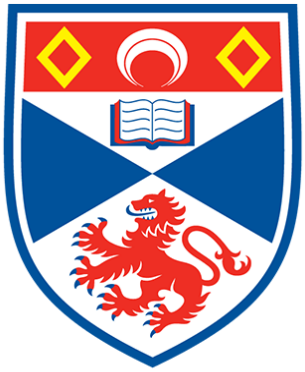
Thinking Energy Ethics with Care –
Citizens' Perspectives on Energy & the Low-Carbon Transition

Caroline Sejer Damgaard



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Abstract

Social science energy research is asking important questions about the social, political, and economic implications of energy transitions, and the consequent changing roles and relationships in the energy system. This has given rise to ethically and politically driven research agendas, for example around energy poverty and justice, as well as emerging conceptions of democracy and citizenship in the energy context. Within this scholarship, there is an increasing focus on the need to better understand how people relate in their daily lives, both to mundane dilemmas around energy use, and to bigger questions around energy systems and energy system change.

This thesis builds on these discussions with a particular focus on the concept of energy citizenship, an increasingly popular concept in both academic and political energy discourse. The thesis explores how a better understanding of citizens' ethical attitudes towards energy might inform theorising of energy citizenship to better reflect everyday engagements with energy and energy transitions. To address this question, I draw on findings from Q-methodological research conducted in Denmark and the UK, and further reflect on the relevance of Q-methodology as a tool for social science energy research.

A Q-methodological study was conducted through interviews with thirty-nine residents in the UK and Denmark, in which participants were asked to consider a range of opinion statements drawn from public debates around energy transitions. Q-methodology was found to be a useful tool for opening up the complexities and ambiguities of the topic of energy transitions, in conversation with people of varying levels of energy knowledge.

The findings indicate that relational understandings of energy systems and a language of dependence, necessity and mutual responsibility are important elements in how people make sense of the energy transition and their place in it. This speaks strongly to recent advances of relational theories of energy systems and transitions, but calls for a recognition not only of inter-connections and relations, but of their ethical significance. To this end, I discuss the relevance of a care ethical framework for enriching our thinking around energy citizenship, and energy ethics more broadly.

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CHAPTER 1

Introduction

Thinking energy with care may sound like an unusual proposition. Care is an unfamiliar term in energy literature – academic and otherwise – and may at first glance seem out of place. But as Maria Puig de la Bellacasa (2017, p. 55) asserts, "exhibiting [matters of care] appears even more necessary when caring seems to be out of place, or not there". In this thesis, I engage care ethics in conversation with energy citizenship, a concept with unfulfilled potential, I contemplate, to address people's complex interactions with energy in transition and to draw attention to both political and ethical aspects of those interactions. Based on exploratory research amongst residents in Denmark and the UK, I argue that a recognition of relationality and (inter)dependence as basic conditions of existence, and as basis for ethical reasoning in everyday engagements with energy in transition, is key to reflecting ways of relating to energy ethicalities in the everyday. A better understanding of how people relate in their daily lives, both to mundane dilemmas around energy use, and to bigger questions around energy systems and energy system change, is necessary for energy and society scholarship to have relevance for, and be able to engage with, public debate and evolving everyday ethicalities around energy.

Crucially, a care ethical approach to these discussions encourages a recognition of diverse perspectives as valid caring concerns. This does not mean that any perspective or any practice is good or caring or that all perspectives or practices are equally appropriate. Rather, it recognises the diversity of forms and expressions of care as well as the non-innocent nature of care and caring. It offers a different, and arguably more productive, basis for debate and engagement than a for/against or us vs. them orientation, or other binaries frequently animating narratives around energy transitions (active/passive, engaged/disengaged, acceptance/opposition). The complexities of an energy system, the magnitude of energy system change, the entanglement of energy processes and practices with all other aspects of

life require nuanced and sensitive understandings of diverse experiences, reasonings and perspectives, rather than black-and-white, oppositional, and alienating discourse. To this end, this thesis begins to 'think energy (ethics) with care' and considers the further potential of care ethics for enriching energy social science scholarship and energy discourse more broadly.

1.1 Research problem & contribution

Existing frameworks, theories and vocabularies advanced by energy social science scholarship are primarily concerned with analysing and describing *how change occurs*, on the one hand, and prescribing what/how change *should* occur, on the other. The recognition of a historically unprecedented project of steering a socially intentional energy transition is leading not to a broad, inclusive debate about where we, collectively, want this transition to lead – what 'pathway' to take, what we value and wish to prioritise in a transformed energy system – but rather has given rise to a managerial science (Köhler *et al.*, 2019). Too often, citizens are viewed not as relevant voices in directing this transition, but chiefly as potential barriers to successful diffusion of innovative technologies, and as users and consumers of energy.

As thinking advances around new roles of individuals in more sustainable energy systems, focus remains on the role of end-user, consumer or prosumer, emphasising the connection between demand and supply and equating the lived experience of energy to the practice of energy consumption. This confines ethicality to decisions around the purchase and use of energy and appliances. But based on interviews conducted in this Q-study, this appears to be an oversimplified view of how individuals relate with energy, negating the possibility that wider political, ecological and social relations may be important aspects of everyday ethicalities in an energy web in transition. In our active (scholarly) engagement with socially intentional energy transitions, it is critical that we remain in touch with how people make sense of energy and energy transitions in their daily lives and in relation to "the kinds of lives, societies, and futures that they deem to be good or valuable" (Smith and High, 2017a, p. 1).

Understanding public views of energy system change as a whole remains an important challenge for energy social science research (Pidgeon *et al.*, 2014; Schönwälder,

2018; Ruostetsaari, 2020). There is much we don't know both about how people interact with energy in the everyday, and how this interacts with the wider organisational and political energy landscape (Schönwälder, 2018). Particularly, Groves et al. (2016, p. 395) emphasise, "it remains … unclear how to approach the study of everyday energy use in ways sensitized to how people make their daily lives meaningful and liveable." Thus, gaps exist at both ends of the spectrum, the systemic and the personal, and in making connections between the two: understanding how people relate to the energy system as a whole, and how energy interacts with everyday judgments about the good life. There appears to be significant scope for advancing ethico-political energy theories to better grasp how people relate in their daily lives, both to mundane dilemmas around energy use, and to bigger questions around energy systems and energy system change.

This thesis contributes to these debates with a particular focus on the theoretical construct of the energy citizen (Devine-Wright, 2007), an increasingly popular concept in both academic and political energy discourse. The focus of this thesis on the concept of energy citizenship is motivated by its (potential) relevance, on the one hand, as a broad ethico-political framing of individuals and their roles within energy systems and, on the other hand, the limited extent to which current applications of the concept fulfil this potential. Narrow framings of energy citizenship have important implications, theoretically, politically and practically. Theoretically, narrow conceptions of energy citizenship shape wider socio-political theorising around energy, with energy citizenship a constitutive element of emerging theorising around energy democracy, for example. Politically, questions arise about 'who counts' as energy citizens and 'what counts' as energy citizenship, with potential implications for policy design and implementation. Finally, narrow framings of energy citizenship may have practical implications for practices of engagement around energy.

In this thesis, I set out to explore how a better understanding of citizens' ethical attitudes towards energy might inform theorising of energy citizenship to better reflect how citizens relate with energy both in the everyday and to wider energy system change. It is in my discussion hereof that I engage care ethics, as elaborated further below.

1.2 Research approach

To explore citizens' ethical attitudes towards energy and low-carbon energy transition, I present a Q-methodological study conducted in Denmark and the UK. This empirical study explored how citizens construct diverse accounts of attitudes, values and priorities around energy from the perspective of their lived reality within a society transitioning to a more sustainable energy system. Q-methodology (Stephenson, 1964; Brown, 1980) is a framework developed for the study of subjectivity and is particularly well-suited to exploring perceptions around complex, contested topics such as this. Fundamentally, Q-methodology seeks to uncover patterns of subjectivity around a given subject. This is based on the sorting by research participants of a set of stimuli (e.g. opinion statements) to construct a representation, based on those stimuli, of their own subjective views on the given topic. This is known as a Q-sort. In my study, the sorting exercise was conducted in face-to-face interviews, with qualitative data collected alongside Q-sorts. Using Q-factor analysis (a specific variation of factor analysis), and drawing on the supporting qualitative data, types of views can then be identified and interpreted.

The decision to use Q-methodology reflects the twists and turns this research project has taken, as elaborated in Chapter 3. This inspires two methodological research questions: 1) To what extent is Q-methodology a useful tool for research on perceptions of and interactions with energy in the everyday? And 2) How do everyday ethicalities around energy and low-carbon transitions differ (or not) across Denmark and the UK, and why? Based on the experience of the present study, I propose Q-method to be a useful tool in opening up the complexities and ambiguities of the topic of energy transitions in conversation with people of varying levels of energy knowledge. I reflect on this and some key lessons and considerations in the Methodology and Conclusion chapters.

Based on my analyses of participants' perceptions around energy in transition, this thesis illustrates how relational understandings of energy systems and a language of dependence, necessity and needs are important elements in how people make sense of the energy transition and their place in it. In light of these findings, it is thought-provoking that our frameworks and vocabulary for discussing matters of energy and energy transitions remain deeply marked by individualism, relying on a language of individual responsibility, rational choice and/or individual rights and justice. Instead, this thesis suggests that a

language of (inter)dependence, necessity and needs appears to better reflect people's own ethical sensibilities. It is on this basis that I, in my discussion (Chapter 6) engage a feminist theory of care and care ethics (Held, 2006; Noddings, 2013; Tronto, 2013; Puig de la Bellacasa, 2017) in a proposition to 'think energy with care'.

1.3 Roadmap

Before proceeding to explore the ideas and debates introduced in this chapter in more detail, I briefly introduce each of the chapters that are to come. In the following chapter, I introduce three ideas, as applied in social science energy literature, central to the argument of this thesis: citizenship, ethics and care. The first two are associated with relatively well-established bodies of energy social science research. The concept of energy citizenship was introduced by Devine Wright (2007) and has since gained traction both as an academic and political concept. Similarly, energy ethics has become a well-established branch of energy social science over the past decade, spearheaded by energy justice theory (McCauley *et al.*, 2013; Jenkins *et al.*, 2016) but with recent anthropological contributions on energy ethics and the everyday deserving attention (Smith and High, 2017a; High and Smith, 2019b). As noted above, care, on the other hand, is a less familiar concept in the energy field, just beginning to emerge in empirical accounts, particularly around smart homes (Hargreaves and Middlemiss, 2020) and energy poverty (Longhurst and Hargreaves, 2019). As a discourse of care begins to emerge in energy social science research, it is critical to learn from the development of and debates around care in other disciplines, in order to address the ethical and political complexities surrounding care, care work and caring responsibilities. To this end, care ethical literature is introduced (Held, 2006; Noddings, 2013; Tronto, 2013; Puig de la Bellacasa, 2017), providing the backdrop for further discussion in Chapter 6.

I then proceed to introduce the methodology and research design in Chapter 3. Here I present the aim, research questions and research philosophy underpinning the research. The overarching aim of the thesis is to contribute to a better understanding of how citizens relate with energy both in the everyday and to wider energy system change. In order to do so, four research questions are set out; two conceptual and two methodological:

1) To what extent does the energy citizenship concept offer a relevant framework for understanding interactions of energy and ethics in the everyday?
2) How can a better understanding of citizens' ethical attitudes towards energy inform theorising of energy citizenship?
3) To what extent is Q-methodology a useful tool for research on perceptions of and interactions with energy in the everyday?
4) How do everyday ethicalities around energy and low-carbon transitions differ (or not) across Denmark and the UK, and why?

Before presenting the research design, a basic introduction to Q-methodology is offered. As Q-methodology remains unfamiliar to many, this is described in some detail (section 3.3), with further information provided in Appendix 1.

The Q-technique consists of three stages. The first stage is the development of the *concourse* and refinement to determine the *Q-set*. Concourse refers to the full range of subjective viewpoints existing around the topic of interest, and the Q-set is a smaller set of representative statements from the concourse, which are presented to participants for sorting. The second stage is the *Q-sort*; the sorting and ranking of the Q-set statements by participants. This can be done in various ways, in one-to-one interviews, multi-participant workshops, or even online. Finally, Q-sorts are analysed and interpreted using *Q-factor analysis* together with qualitative analysis of supporting qualitative data, commonly collected alongside the Q-sort. In the present study, the concourse was developed based on public debates around energy, drawing mainly on online media including newspaper comments and social media, resulting in a concourse of approximately four hundred opinion statements. Based on this, a Q-set of thirty-one statements was derived. Thirty-nine participants participated in face-to-face interviews, in which the Q-sort exercise was the primary focus. During these interviews, participants were encouraged to 'think out loud', and qualitative data was collected in the form of participants' reflections throughout and responses to questions after the sorting exercise.

A brief review of previous applications of Q-methodology in energy research is presented (3.4), before detailing the approach taken in the present study to each of the three stages, including sampling and recruitment of participants (3.5). Participants were recruited from two areas in Denmark and two areas in the UK according to the principle of maximum variation, as recommended for Q-methodological research. The procedures followed for

data collection and data analysis are explained in section 3.6, before reflecting on ethics, validity and limitations of present research (3.7). Finally, I conclude Chapter 3 with some methodological reflections, providing the basis for addressing the third research question on the relevance of Q-methodology for this type of research.

The research contexts are introduced in chapter 4, with a brief outline of the Danish and British energy contexts, respectively (4.1). This is followed by a description of the four specific research settings for this study. Research was conducted in two municipalities in Denmark, with different socio-economic and energy profiles, and similarly in two different local authorities in the UK.

In Chapter 5, I present key findings from the empirical research. Findings from Q-methodological research are based on factors – or viewpoints – identified through Q-factor analysis. Thus, Chapter 5 opens with a brief summary of four perspectives identified through Q-factor analysis of the data from Denmark and the UK combined (5.1). The four perspectives are interpreted as politically oriented, market oriented, community oriented and system critical, respectively. Highlighting the diversity across the four perspectives, I explore how each foregrounds a different type of relation in their various accounts of and engagements with energy. Thus, while the diversity of these perspectives highlights the importance of a plural understanding of the ways in which individuals think about and engage with energy and energy system change, the theme of relationality emerges as a common feature. As explored in section 5.2, this notion of relationality is reflected in the ethical vocabularies with which participants expressed their views, suggesting an ethical reasoning rooted in notions of relationality and (inter)dependence. This was particularly pronounced in discussions of responsibility as shared and dispersed, and in response to notions of rights and fairness as better conceived of in terms of needs and necessity.

Reflecting on these themes, I highlight how viewpoints expressed by participants in this Q-study relate to ideas central to the ethics of care. This leads to a broader discussion, in Chapter 6, of how a relational ethics of care may enrich our theorising of energy citizenship, to better reflect everyday ethicalities around energy and the energy transition. I open the discussion with a contemplation of how energy and care are deeply entangled in complex interdependent webs, in order to introduce a fundamentally relational understanding of energy systems (or energy webs), and the relevance of engaging care ethics in the ensuing conversation. I draw on findings from the empirical Q-methodological

research and care ethical literature to discuss how insights from present research may inform further theorising of the energy citizenship concept. I then conclude the chapter with a broader discussion of the potential for care ethics to enrich energy social science research more broadly (6. 5) and vice versa, how the application of care ethics to the energy context may contribute to further development of care ethical thought (6.6).

Finally, I conclude in Chapter 7 by revisiting the research questions in light the research findings and discussion. Here, I highlight the contribution of this thesis and, more broadly, of the potential contribution of care ethics for the field of energy social science research. I further consider opportunities presented by Q-methodology for energy social science researchers, as well as some key lessons and potential limitations to consider in future Q-methodological (energy) research.

CHAPTER 2

Citizenship, ethics, care: conceptualisations in energy social science research

In this chapter, I introduce three ideas central to the argument of this thesis: citizenship, ethics and care. The chapter is arranged in two parts. Part one includes a review of literature on energy citizenship (2.1) and energy ethics (2.2), respectively, providing the theoretical context for my first two research questions concerned with the relevance of the energy citizenship concept as a theoretical framework for understanding interactions of energy and ethics in the everyday. (The other two research questions are of a more methodological nature and are introduced in the following chapter). The second part of the chapter (2.3), then, provides the backdrop for the discussion presented in Chapter 6.

The first part of the chapter consists of two sections. Section 2.1 offers a review of literature engaging the notion of energy citizenship. I argue that energy citizenship remains under-theorised, and frequently applied narrowly to refer to particular modes of participation around energy. This fails to realise the full potential of the citizenship concept to capture relations between individuals and the wider social and political dynamics in the energy system, and engage with fundamental questions of ethicalities around energy. To this end, in section 2.2, I review energy justice as the most prominent framework for theorising energy ethics, as well as recent anthropological work on energy ethics of the everyday. Bringing these diverse strands of literature into conversation, I ask, then, how a better understanding of citizens' ethical attitudes might inform further theorising of energy citizenship to better reflect how citizens relate with energy both in the everyday and to wider energy system change.

The second part of the chapter introduces a theory largely unfamiliar to the energy context: the theory of care ethics. Notably, as reviewed in section 2.3.1, the notion of care is beginning to emerge within energy social science discourse, with exciting work around energy biographies (Henwood, Groves and Shirani, 2016), smart homes (Hargreaves and Middlemiss, 2020) and energy poverty (Longhurst and Hargreaves, 2019) beginning to raise questions around care and relationships of care in the context of (low-carbon) energy practices. This thesis builds on these early engagements of energy social science literature with care, but proposes a more comprehensive engagement with care ethics to draw attention to the ethical significance of relational existence within energy webs. I thus conclude this review of literature with an introduction to care ethical scholarship and its relevance for energy social science scholarship.

2.1 A critical review of the energy citizenship concept

The term 'energy citizenship' (Devine-Wright, 2007) was introduced to describe the idea that a forthcoming energy transition will involve a new role for individuals and new relations between actors in the energy system. While the concept suggests an association with concepts of political citizenship and environmental/ecological citizenship and a broad socio-political framing of the energy debate, there is a lack of deep engagement with and development of theory around the concept. As argued below, this risks fostering narrow, exclusive conceptions of citizens' roles in relation to energy, and fails to realise the opportunity of the concept of 'energy citizenship' to be a force for inclusion and broader ethico-political engagement with energy transitions.

Energy citizenship has predominantly been employed in the context of community energy and emerging accounts of energy democracy on the one hand, and consumer behaviour on the other. This has led to two prevalent framings of energy citizenship. One bearing close resemblance to the idea of the 'citizen-consumer', reflecting a narrative of individual responsibilization and the fostering of energy citizenship through active consumer engagement, as explored in section 2.1.1. The other characterised by a focus on community energy participation. The following sections explore these two prevalent framings of energy citizenship (2.1.1 and 2.1.2), followed by a consideration of how energy citizenship is both shaped by and contributes to emerging conceptions of energy democracy (2.1.3). As argued below, existing applications of the energy citizenship concept leave considerable room for

broader discussion of what an understanding of people-as-citizens might mean in relation to a low-carbon energy transition.

2.1.1 Energy citizenship framed as material engagement and consumer-citizenship: individualising-privatising engagement

A few definitions exist in the energy literature of 'energy citizenship'. Most commonly referenced is that of Devine-Wright (2007), identifying the energy citizen as actively engaged with energy issues both in the private and public spheres, attentive to energy efficiency in the household, committed to energy organisations or projects, and engaged in political debates (Radtke, 2014). The use of the concept in contemporary writing, however, frequently stresses active engagement in the private sphere, in the consumer-space of the household, and leaves out the latter part of Devine-Wright's definition addressing the public and political sphere.

Van Veelen and van der Horst (2018) argue that energy citizenship – as well as the related notion of energy democracy – tend to theorise public participation in terms of material engagement with energy in the home. Everyday practice is frequently foregrounded as a means for the performance of energy citizenship, mediated through material artefacts as objects of participation and engagement (Marres, 2015; Ryghaug, Skjølsvold and Heidenreich, 2018; Kloppenburg and Boekelo, 2019). Ryghaug et al (2018), for example, examine how interaction with artefacts such as electric cars, smart meters and solar panels fosters participation and energy citizenship, arguing that such forms of material engagement have the potential to produce energy citizenship. This application of the concept is perhaps better reflected in an alternative definition offered by Goulden et al. (2014). Here the consumer and the citizen are distinguished based on their respective 'orientation' to the energy system (passive vs actively engaged), but both are understood as acting within the private consumer space. In this way, energy citizenship is reduced to a limited and constrained domestic and consumer space, with a similarly limited range of associated agencies (Pallett, Chilvers and Hargreaves, 2017).

This framing of energy citizenship closely resembles the notion of 'consumer citizenship', (Mcgregor, 2002; Spaargaren and Martens, 2005; Clarke and Newman, 2007; Johnston, 2008; Spaargaren and Oosterveer, 2010; Wheeler, 2012; Vihalemm and Keller, 2016), reflecting a conflation of 'energy citizenship' with processes of 'democracy through

the wallet' (Maniates, 2001; Scerri, 2013). In environmental literature, this form of 'consumption-as-social-action' has been heavily criticised as being apolitical, insufficient, and encouraging a philosophy of "act, but don't get in the way [of business as usual (ed.)]" (Maniates, 2001, p. 42). Similarly, in the energy context, it has been argued that a consumer framing, prioritising market-based forms of engagement, neglects other social and political forms of engagement with energy (Pallett, Chilvers and Hargreaves, 2017, p. 68).

In the energy context, a further concept has been introduced to reflect developments by which consumers are becoming also producers of energy (for example through the installation of solar panels): the 'prosumer' (Ellsworth-Krebs and Reid, 2016; Ruokamo and Kopsakangas-Savolainen, 2016; Standal, Talevi and Westskog, 2020). And with the rise in energy storage solutions, demand-response programs and time-of-use tariffs, recent work has broadened this term to incorporate also the notion of energy management: the 'prosumager' (Koirala, van Oost and van der Windt, 2018; Gorroño-Albizu, Sperling and Djørup, 2019). While these represent different forms of participation in the energy system beyond mere consumption, they remain strongly associated with market-based forms of engagement, such as the purchase of solar panels and the subsequent payments for energy sold to the grid.

In framings of energy citizenship closely resembling notions of the citizen-consumer, as well as the prosumer or prosumager, and primarily market-based conceptions of participation, energy citizenship is frequently characterised by a narrative of individualist responsibilization, heavily influenced by neoliberal discourse (Lennon *et al.*, 2019). As Lennon et al. (2019) argue, this is a narrative assigning freedom and autonomy to individuals as autonomous, rational consumers acting in accordance with freedom of choice, while simultaneously appealing to individual responsibility-taking. This narrative of energy citizenship fails to fulfil the intention of the concept to reflect diverse forms of engagement with energy beyond consumption. It constrains debate to the market sphere and stresses engagement through decisions around the purchase and use of energy and appliances, and leaves little room for discussion beyond individual preference, as discussed further below.

2.1.2 Participatory conceptions of energy citizenship: (il)legitimising practices

Energy citizenship has also been identified with participation in community energy projects. While breaking out of the individualist consumer narrative, early framings of energy citizenship in terms of community energy participation reflect highly contextualised accounts, based on primarily anecdotal evidence from isolated case studies of successful small-scale energy initiatives (Radtke, 2014). Thus, much empirical research has focused on the 'already-energy-citizen', or in the words of Naus et al. (2015), 'unproblematic' individuals; i.e. individuals already engaged and participating in the energy system through, for example, community energy or energy cooperatives. This has led to a narrow and exclusionary conception of 'the energy citizen' (Walker and Cass, 2007) with a primary focus on the 'niche', on a minority of people as examples of 'good' energy citizens. An energy citizenship acknowledging a minority of the population engaged in community energy and similar initiatives has problematic (if unintended) implications for 'who counts' as (energy) citizens and 'what counts' as energy citizenship.

The framing of energy citizenship around community energy participation follows a longstanding concern within energy social science research with public engagement and participation in energy development. This research has been characterised by an early understanding of social attitudes to renewable energy – especially wind turbines and wind farms – in terms of the NIMBY (not in my back yard) effect, highlighting the barrier to innovation diffusion posed by local opposition. The suggested solution to overcoming this barrier has been to engage local populations in the planning process for renewable energy projects, to manufacture greater acceptance through participation. The key argument is that greater involvement of local people in planning processes for, and/or ownership of energy developments, especially wind farms, is likely to reduce local resistance (e.g. Warren and McFadyen, 2010). With an underlying logic drawn from the 'objection discourse' (Evans, Parks and Theobald, 2011) and the (now widely debunked) NIMBY theory, much of this work implicitly portrays 'the public' as backwards, uninformed and a barrier to development. The result has been a primarily instrumental approach to public engagement aimed at "managing anticipated opposition" (Barnett *et al.*, 2012, p. 47) and generating social acceptance (Schönwälder, 2018).

This logic of participation has been strongly critiqued (Evans, Parks and Theobald, 2011; Cotton and Devine-Wright, 2012; Chilvers and Longhurst, 2016). Notably, Rogers et al. (2008) critique the 'hierarchies of participation', emphasising non-participation as an equally valid choice. Similarly, Batel et al. (2013, p. 2) warn that a continued focus on social acceptance perpetuates a "normative top-down perspective on people's relations with energy infrastructures" and ignores – or illegitimates – "all the other types of responses to those, such as support, or uncertainty, resistance, apathy, among others". Thus, a focus on community energy participation risks producing a narrow conception of energy citizenship – and more broadly, of the types of roles and behaviours considered 'right' and legitimate. As Walker and Cass (2007) argue, it is naïve to assume that everyone is capable of taking up the roles implied with the energy citizenship concept and, just as access to energy is unequal across society, access to energy citizenship (narrowly conceived) will be likewise unequal.

Furthermore, this narrow framing of participation fails to engage with broader discussions around energy transitions, collective imaginaries and ethics. Here, Pallett et al.'s (2017, p. 68) critique is pertinent; that a dominant "vision of energy issues as being primarily about public acceptability of new technology and infrastructures" results in obliviousness to more complex concerns with the directionality of energy transitions and underlying socio-environmental relationships. In response to this critique, an alternative relational account of participation is proposed (Chilvers and Longhurst, 2015, 2016; Chilvers, Pallett and Hargreaves, 2015, 2018; Pallett, Chilvers and Hargreaves, 2017; Chilvers and Pallett, 2018). Much of this work has centred on the analysis of participation and societal engagement in energy transitions (Chilvers, Pallett and Hargreaves, 2015, 2018; Pallett, Chilvers and Hargreaves, 2017), emphasising the multiplicity of participatory collectives (Chilvers and Longhurst, 2016) and the diversity of modes of engagement, beyond previously conceptualised engagement practices. Interestingly, recent work begins to engage this relational perspective on participation in analyses of energy democracy (Chilvers and Pallett, 2018) and of diverse visions of energy futures (Longhurst and Chilvers, 2019). This thesis speaks strongly to these emerging relational accounts of energy systems, taking the argument a step further to consider the ethical significance of relationality from the perspective of citizens.

2.1.3 From narrow framings of energy citizenship to exclusionary discourses of energy democracy

More recently, energy citizenship has been linked to an emerging energy democracy agenda (Angel, 2016b, 2016a; McMurtry and Tarhan, 2016). This framing of energy citizenship along with energy democracy speaks to transformative views of energy transitions, emphasising energy as intrinsically linked to social processes. Thus, any rethinking of energy systems is seen as necessitating a fundamental rethinking of social relations. As Schönwalder (2018) notes, from this perspective, energy citizenship comes to imply something more than a shift from passive consumers to active consumers. Energy citizenship can be seen as constitutive of energy democracy (Mullally, Dunphy and O'Connor, 2018), with energy democracy, in turn, facilitating the redefinition of individual consumers as citizens (Burke and Stephens, 2018, p. 79).

While this begins to link the energy citizenship concept to more political and ethical agendas around energy transitions (Mullally, Dunphy and O'Connor, 2018), there is a strong association of energy democracy with community energy development and a tendency to speak to narrow understandings of citizenship in terms of the 'ideal-typical citizen' (Szulecki, 2018). Energy democracy is widely understood as a form of associative or participatory democracy (van Veelen and van der Horst, 2018), but research has shown that this is frequently limited to economic participation, with less evidence of engagement beyond investment (McMurtry and Tarhan, 2016). As van Veelen and van der Horst (2018, p. 26) argue:

> "Energy democracy … implies a particular form of energy citizenship that is expressed through the leveraging of personal finance, material assets (e.g. roof of your house) and time (committing manual and organisational labour)".

They warn that individualised notions of energy citizenship risks promoting an energy democracy in which "the 'haves' may more easily disregard the needs of the 'have nots'" (van Veelen and van der Horst, 2018, p. 21). Similarly, Robison et al. (2018, p. 13) highlight the danger of an energy citizenship based on financial capability, arguing that the "energy transition is then seen as a luxury instead of a way to solve essential problems". Thus, a narrow, exclusive concept of energy citizenship risks perpetuating existing socio-economic inequality, speaking primarily to the privileged and excluding those without financial means.

As this section has argued, while energy citizenship reflects advances in thinking around new roles of individuals in more sustainable and democratic energy systems, the conceptual focus remains on the role of end-user, consumer or prosumer, emphasising the connection between demand and supply. This equates the lived experience of energy to the practice of energy consumption and confines ethicality to decisions around the purchase and use of energy and appliances. The problem with this framing is that it privileges expressions of individual preference and leaves little room for discussion about collective values, imaginaries and ethicalities. Arguably, encouraging a more ethical evaluative frame is important if energy social science scholarship is to engage more broadly and meaningfully with citizens' views and concerns around energy system change (Pidgeon *et al.*, 2014). In the words of Groves et al. (2017, p. 72):

> "What … makes the ethical attitude distinct from an expression of mere preference, is the implication that what is being said or done is an attempt to give voice or expression to that which is right or good in general. … The key difference between the objects of ethical evaluations and mere preferences is that the rightness or goodness of ethical objects is open to argument and justification, whereas a stated preference takes an assertion of subjective will to be the final word. Ethical evaluation, whether implicit or explicit, holds open a space of reasons for desiring or avoiding something on the basis of its rightness or goodness."

There are multiple possible pathways for a low-carbon energy transition, with the potential to fundamentally change relations in the energy system, between individuals on the one hand and the wider institutional and social relations surrounding them, on the other (Schönwälder, 2018). If we are to credibly invoke ideas of democracy and citizenship in this context, these debates need to be open to deliberation and contestation, as opposed to the definiteness of subjective preference.

I therefore set out to explore how a better understanding of citizens' ethical attitudes towards energy might inform theorising of energy citizenship to better reflect how citizens relate with energy both in the everyday and to wider energy system change. As explored below, energy ethics is a growing area of energy social science research, spearheaded by energy justice theory as the main contemporary framework for understanding ethical issues

pertaining to energy (Frigo, 2017). This, however, presents a primarily institutional ethical framework with less relevance for understanding interactions of energy and ethics in the everyday. The approach taken in this thesis to energy ethics has more in common with an emerging anthropology of energy, taking a bottom-up perspective and understanding energy ethics as arising out of everyday engagements with energy. Notably, a focus on the everyday is not new within energy social science research, so before proceeding to explore literature on energy and ethics (section 2.2), the following section briefly situates this thesis in relation prevalent approaches in energy social science research to the study of energy and the everyday.

2.1.4 Alternative perspectives on everyday engagement with energy

The link between everyday engagement with energy and wider system change has been variously theorised within energy social science research. Behavioural approaches have been particularly influential, gaining significant traction in the world of policy and practice (Hampton and Adams, 2018). Behavioural approaches, however, have been critiqued for their tendency to "exaggerate the autonomy of individual choice" (Spurling et al., 2013). This area of work is characterised by a view of energy as something separate from society or social life, of energy demand as separate from energy supply, and is centrally motivated by an interest in energy consumption and how to bring about behaviour change to reduce energy demand (Shove, 2017; Horta, 2018). An influential critic of behaviour change research and behaviour centred environmental and energy policy, Elizabeth Shove (see for example Wilhite et al., 2000; Shove, 2003; Shove, 2010; Shove, 2015; Shove, 2017), argues that behavioural approaches focus wrongly on 'energy behaviour' and the drivers thereof, and suggests instead a social science of 'energy service consumption', in which the services performed by energy, such as comfort and convenience, take centre-stage, rather than energy per se. It is further argued that the appropriate focus is not on individuals as decision-makers, but rather on the social practices and social conceptions of 'normality' associated with the consumption of energy services.

Providing a strong counter-narrative to behavioural approaches and individualist framings in energy research more generally, such social practice theoretical research has generated important insights around everyday engagements with energy, drawing attention to social drivers of energy consuming practices (Horta, 2018). Taking social practices as the

unit of inquiry, people are viewed as carriers of social practice, rather than individually autonomous behavioural agents. Spaargaren and Oosterveer (2010) claim that "using consumption practices as the basic unit of analysis helps to avoid individualist and privatized accounts of the role of citizen-consumers in environmental change", turning attention instead to the "structuring context of society itself" (Dirks, Eley and Ortner, 1994). Such practice approach to the study of energy transitions throws up fundamental questions of how social and cultural norms manifest in (energy consumption) practices of everyday life, of how certain (energy consumption) practices are normalized through the daily reproduction of lifestyles, and it begins to challenge mainstream understandings of needs and expectations, of comfort, convenience and of 'normality' (Jalas *et al.*, 2017; Roberts and Henwood, 2019).

Social practices are widely understood as constituted by technology (e.g. artefacts), skills (e.g. the know-how and competencies involved) and meaning (understandings, assumptions, values and symbolic meanings, including attitudes and feelings) (Breadsell, Eon and Morrison, 2019). Much practice driven energy research has looked at these elements of everyday practice in domestic settings (Chilvers and Longhurst, 2016; Corsini et al., 2019), with social practice theories applied in studies of, for example demand-side management, energy efficiency and retrofit, peak electricity demand and smart-grids (Strengers, 2012; Goulden *et al.*, 2014; Genus and Jensen, 2017; DellaValle, Bisello and Balest, 2018; Sahakian et al., 2019; Lowe and Chiu, 2020; Palm, 2020; Stelmach et al., 2020), case studies of innovation and experimentation around energy and sustainability (Hargreaves, Longhurst and Seyfang, 2013; Jalas et al., 2017) and studies of transport and mobility (Williams, 2015; Cellina and Morici, 2021). But energy social practices can be conceptualised much broader as making up systems of practice (Breadsell, Eon and Morrison, 2019; Greene and Fahy, 2020), intersecting with wider policies and practices beyond the home and beyond the energy context.

While this thesis is not based on practice driven research, it shares a view of people – and energy practices – as entangled in wider social structures. Proponents of social practice theories call for researchers to look beyond energy per se, beyond energy use as a behaviour or practice in its own right. Similarly, this thesis explores subjectivities, not around energy or energy use per se, but around societal and ethical considerations and dilemmas associated with wider energy system change. Meanwhile, in seeking to understand how the ethical orientations and reasoning of individuals might inform our theorising of energy citizenship,

I take subjectivity, not practice, as my unit of analysis. In asking what it means to be a (energy) citizen in an energy system in transition, I am concerned less with practices and their dynamics, and more with patterns of understanding and reasoning – from the perspective of the everyday, around issues of and beyond the everyday. It is also interesting to note the recognition of meaning and imaginaries as one element of social practice (Breadsell et al., 2019); but where a social practice approach looks at ways in which meaning is bound up in practice (and vice versa), this thesis looks at meaning through the lens of subjectivity to explore how people relate to the wider context of and debates around the energy system and transition.

Moreover, the approach of this thesis differs from both behavioural and social practice approaches to the study of energy and the everyday in that the primary concern is not to understand the nature of energy behaviours or practices and how best to affect change (in behaviour or in social practices) as part of the project to reduce energy use, but rather to understand how people relate to, and perceive their – and other – roles in, the wider project of energy system change. These are not mutually exclusive or contradictory approaches, but rather complementary, with significant potential for cross-fertilisation. It would, for example, be interesting to see more explicit engagement with ethical theory in future practice theoretical energy research, and there is a clear potential for practice approaches to deepen understanding of the myriad ways in which caring concerns are implicated in energy practices. As considered in section 2.3 below, notions of care are emerging in social practice inspired research, with significant potential for insights generated through the focus on subjectivity and ethicality in this thesis to advance and expand on these early practice oriented understandings of care.

This section has critiqued common applications of the concept of energy citizenship, arguing that the concept, to date, has been associated with narrow, individualist framings, limited in their ability to capture ethico-political engagements around energy in the everyday. This thesis considers how our theorising of energy citizenship may be enriched by taking into account ethico-political engagements with energy from the perspective of the everyday. As discussed, other approaches to the study of everyday energy engagement have been influential in shaping understandings of energy consumption. These include behavioural theories and social practice theories, providing divergent understandings of energy consumption, but sharing a concern with how best to affect change – in behaviour

or in social practices. While this thesis has much in common with social practice perspectives, the focus here is distinct in seeking to understand how ethical considerations feature in perspectives on energy system change and exploring energy citizenship as an expression of an ethico-political existence within energy webs.

2.2 Energy ethics: from institutional morality to everyday ethicality

Energy ethics is a growing area of energy social science research, spearheaded by energy justice theory as the main contemporary framework for understanding ethical issues pertaining to energy (Frigo, 2017). This, however, presents a primarily institutional ethical framework with limited relevance for understanding interactions of energy and ethics in the everyday. The approach taken in this thesis to energy ethics has more in common with an emerging anthropology of energy, taking a bottom-up perspective and understanding energy ethics as arising out of everyday engagements with energy. This section presents a brief overview of these different approaches to energy ethics.

Over the past decade, a language of fairness and rights has become established in energy and society literature. Energy is increasingly viewed from a perspective of social justice, giving rise to the concept of 'energy justice' (McCauley *et al.*, 2013; Sovacool, Sidortsov and Jones, 2014), which builds both on the concepts of energy and fuel poverty and the social movements around environmental and climate justice. Energy justice is proposed as a cross-cutting social science research agenda (Jenkins *et al.*, 2016), a conceptual, analytical and decision-making tool for philosophers, researchers, and policymakers (Sovacool and Dworkin, 2015), and a framework for addressing the three (conflicting) dimensions of the energy trilemma (Heffron, McCauley and Sovacool, 2015).

This is a now well-developed body of literature, associated with a clear conceptual framework, which sets out a rights-based understanding of distributional, procedural and recognition justice in the context of (frequently large-scale, centralised) energy development. The three tenets of distributional, recognition and procedural justice embrace considerations of burden/benefit distributions, inclusion, and fair participation, respectively, in energy development. Distributional justice addresses both geographical aspects of energy development, the spatial distribution of burdens and benefits from energy generation and

infrastructure, and the distribution of economic burdens and benefits related to energy generation and consumption throughout society. Recognition justice is centrally concerned with the representation of marginalised populations in energy policy and decision-making. Finally, procedural justice concerns decision-making processes, with fairness in decision-making frequently equated with inclusion, participation and deliberation in decision-making processes (Silveira, 2016).

The procedural element of energy justice is closely aligned with the participation discourse within social science energy scholarship, also characterising conceptions of energy citizenship, as discussed above (section 2.1.2). Similar to critiques of narrow and exclusionary conceptions of citizen engagement, as discussed above, energy justice theory has been critiqued for presenting consensual and universalist understandings of procedural justice. It is argued that energy justice research, similar to much research on community energy, fails to acknowledge the tensions underlying much energy development as well as diverse normative perspectives. Simcock (2016), for example, challenges the consensual assumptions around procedural justice. Based on research of a community wind project in South Yorkshire, the authors highlight how stakeholders held contrasting normative expectations and perceptions of the decision-making processes. Just like Chilvers et al. (2018) stress the importance of recognising diversity of participatory practices (as discussed above), this highlights the importance of recognising diversity in our understandings of energy ethics.

In its rights-based approach, energy justice contrasts with common responsibilizing discourses around energy citizenship (section 2.1.1) and more generally around citizen-consumers, behaviour change and individual responsibility. Instead, the concepts of energy equity and justice are centrally concerned with access to affordable energy and the absence of harm from energy extraction and production activities as basic human rights (Sovacool, Sidortsov and Jones, 2014). Thus, energy justice presents energy users and communities primarily as rights bearers, vis a vis political authorities and corporations as agents and the responsible parties. Sovacool and Dworking (2014, p. 271), for example, identify the principle of responsibility as follows: "nations have a responsibility to protect the natural environment and minimize the production of negative externalities, or energy-related social and environmental costs". While a moral responsibility is also attributed to "current generations" and "humans" (Sovacool and Dworkin, 2014), this remains abstract and insubstantial. A lack of theorising of responsibility in relation to energy justice has been

critiqued (Fuller and Bulkeley, 2013; Damgaard, McCauley and Long, 2017). Damgaard et al. (2017) for example argue that an energy justice concept needs to embrace notions of rights, responsibility and agency as relevant for all actors in, and at all levels of, an energy system; especially if an energy transition will lead to more decentralised energy systems with citizens/consumers as more actively engaged agents.

Meanwhile, energy justice remains a primarily institutional perspective, focusing on high level principles and processes, with little focus on the individual plane of analysis. Hall (2013) critiques the international and national focus of energy justice theory as divorced from consumption practices, their moral motivations, and notions of justice as relating to energy supply chains. This she sees as a consequence of energy justice literature drawing more on environmental justice literature than moral philosophy. This has implications for the framing and development of the concept, with energy justice theory focusing firmly on energy policy from an energy systems perspective and, arguably, less so on energy ethics or the everyday ethicalities around energy. Similarly, Galvin (2019) critiques the lack of engagement with moral philosophy by energy justice scholars, arguing that energy justice scholarship, fails to address the basis on which moral claims can be made and moral obligations can be said to exist. Thus, while energy justice has proven effective as a tool for analysing institutional processes and policy decision-making, and in framing policy discourse around justice concerns, it is less suitable in (and was also not developed for) addressing ethicality at the level of individuals and everyday energy encounters.

Instead, emerging anthropological work on energy ethics deserves greater attention for exploring everyday ethicalities around energy. A growing body of research into the anthropology of energy, presents an alternative account of energy ethics, as documented in two recent special issues of Energy Social Science Research (Smith and High, 2017b) and the Royal Journal of Anthropology (High and Smith, 2019a), respectively. The articles in these special issues explore energy ethics as emerging in everyday energy encounters. Smith and High (2017a, p. 1), for example, define energy ethics as "the ways in which people understand and ethically evaluate energy: how … people judge the ways in which energy can contribute to or imperil the kinds of lives, societies, and futures that they deem to be good or valuable". This is a perspective, which takes people's own ethical sensibilities seriously, "working from the ground up, rather than analyzing social life through pre-defined notions of ethics" (Smith and High, 2017a, p. 1). This approach encourages

consideration of diverse coexisting ethical worlds (Appel, 2019), and opens up discussion over ethical dilemmas around energy, rather than assuming consensus and prescribing top-down moral principles.

A similar understanding of energy ethics as something arising out of everyday engagements with energy and energy transitions underpins the exploratory research questions underpinning this thesis. In asking how a better understanding of ethical attitudes towards energy may inform theorising of energy citizenship, this research takes a bottom-up approach to energy ethics, and opens up for diverse accounts of what it means to be a (energy) citizen in a society transitioning to a low-carbon energy system. This thesis thus contributes to the understanding of energy ethics from the perspective of everyday encounters with energy and energy transitions.

Based on my analysis of research with citizens in the UK and Denmark (Chapter 5), I discuss, in Chapter 6, the relevance of a care ethical framework for enriching our theorising of energy citizenship, and our thinking around energy ethics more broadly. Similar to anthropological work on energy ethics (Smith and High, 2017b; High and Smith, 2019a), a focus on the everyday is central to this ethics of care, understanding ethicality not as predetermined, but as emerging in and through lived experiences. To inform this later discussion, I conclude my literature review with an introduction to the ethics of care.

2.3 Engaging care ethics

In this section, I introduce care ethical literature originating in feminist writing within psychology (Gilligan, 1982), philosophy (Ruddick, 1980; Noddings, 1984; Held, 2006) and political science (Fisher and Tronto, 1990; Tronto, 1993; Robinson, 1997; Sevenhuijsen, 1998, 2000). This work draws attention to the critical role of care work in society, paid and unpaid, formal and informal, and particularly to the gendered and undervalued practices of caring. While much work on care has explored specific instances of care work (e.g. Mol, Moser and Pols, 2010), literature on care has also given rise to broader theorising of care as "a generic doing of ontological significance" (Puig de la Bellacasa, 2017, p. 3) and caring relations as the basis for a comprehensive ethics with social and political implications. It is this broader theorising of an ethics of care, which I engage in my discussion of energy citizenship.

The value of care ethics for my discussion in this thesis lies in particular in its relational ontology, its attention to interdependence and its conception of caring responsibilities. In its relational ontology, care ethics offers an alternative to traditional moral and political theories, challenging the common ontological assumption of the autonomous rights bearing individual at the heart of much contemporary theory (and politics) – including energy justice (2.4.1) and energy citizenship (2.4.2). From a care ethical perspective, dependence, not freedom or autonomy, is the defining (human) condition; dependence on others, dependence on the care of others. In contrast to conventional moral philosophies defining ethicality based on the goodness of an outcome (consequentialism, including Rawlsian and utilitarian perspectives), or based on a set of predefined, universal rules (deontology, including Kantian perspectives), care ethicists understand ethicality as arising out of the lived experience of relatedness and the responsibilities of care implied within these relations. In the words of Nel Noddings (2013, p. 4), "relation [is] taken as ontologically basic and the caring relation as ethically basic".

But before introducing care ethical literature, the following section reviews recent empirical work within energy social science research highlighting accounts of care in the context of smart homes (Hargreaves and Middlemiss, 2020) and energy poverty (Longhurst and Hargreaves, 2019). Thus, the notion of care is beginning to emerge in energy social science research, but this has not yet been coupled to any broader theorising of care or care ethics as this thesis proposes.

2.3.1 Emerging notions of care in energy social science research & neighbouring fields

Early examples of energy social science research engaging a notion of care come from the French context (Garabuau-Moussaoui, 2011; Brugidou and Garabuau-Moussaoui, 2013). Garabuau-Moussaoui introduced the idea of "energy care logics". She identifies energy care as "paying attention to energy" (Garabuau-Moussaoui, 2011, p. 495), and identifies five associated 'logics of action': material comfort; anti-waste; a financial logic; environmental logic; critique of over-consumption; and a regulatory logic. Building on this notion of energy care, Brugidou and Garabuau-Moussaoui (2013) suggest that a new social norm – an "energy care norm" – is emerging. They argue for a greater recognition that households, while not necessarily saving more energy than in the past, are in fact "careful" about energy. Interestingly, the authors distinguish between care as a practice associated with

citizenship and practices of consumption associated with the consumer. The notion of the citizen-consumer, then, is conceived as a negotiation between care and consumption practices (Brugidou and Garabuau-Moussaoui, 2013).

More recent engagements with the notion of care in energy research employ an explicitly relational conception of care, closer to that of care ethics. In their analysis of energy biographies, Henwood et al. (2016), for example, employ notions of relational entanglements, dependency and care to frame practices of energy use and demand reduction within family life. Here, care is explicitly associated with energy practices within the context of family relationships, stressing relations of care between family members. Similarly, in their examination of how social relations influence energy demand, Hargreaves and Middlemiss (2020) locate care within intimate interpersonal relations. They question current discourses targeting people as isolated individuals, and call for the cultivation of new forms of social relations based on multi-directional influence between 'energy citizens', agencies and communities. While thus recognising the complex webs of social relations within which energy practices play out, the notion of care is not explored beyond intimate, inter-personal relations of families and friends. Engaging a feminist ethics of care stresses the importance of considering care as a practice not confined to domestic life or intimate relations.

In the context of energy poverty, Longhurst and Hargreaves (2019) discuss relationships of care as a form of emotional engagement central to understanding the lived experience of energy poverty. Relations of care, and other forms of emotional and subjective experience, should be understood, they argue, not just as consequences of energy poverty but as inherent to both the problem of and solutions to energy poverty. Thus, notions of care emerging in energy social science research is associated with a recognition not only of the social relations within which energy practices are embedded, but also of the significance – and validity – of emotional engagements, challenging the primacy of rationalist framings of behaviour, choice and forms of engagement. Likewise, the theory of care ethics draws attention to emotions and affect as valid – and important – forms of knowledge (Lawson, 2007).

While notions of care are thus beginning to emerge in energy social science research this has yet to engage comprehensively with a theory of care. Meanwhile, the theory of care ethics (further elaborated below) has been explored more comprehensively in related fields, including ethical consumption (Popke, 2006; Cox, 2010; Morgan, 2010; Barnett *et al.*,

2011), Responsible Research and Innovation (Groves, 2009, 2015, 2017; Adam and Groves, 2011; Grinbaum and Groves, 2013), climate change, sustainability and intergenerational ethics (Groves, 2011, 2019; Diprose *et al.*, 2019), and engineering and maintenance and repair studies (Campbell, Yasuhara and Wilson, 2012; Callén and Criado, 2015; Denis and Pontille, 2015, 2020; Vinck, 2019).

In literature on responsible research and innovation (RRI), the notion of care is developed in relation to knowledge production and technological innovation, with direct relevance in the context of the low-carbon transition. Christopher Groves (2009) explores the potential of care ethics for guiding research decisions in the face of increasing uncertainty. With reference to the care ethical notion of responsibility as being about connection rather than separation, he develops a temporally extensive perspective on care ethics. This argument is further developed in relation to intergenerational justice, climate change and sustainability (Groves, 2011, 2019). Furthermore, based on empirical research in the UK and China, Diprose et al. (2019) argue that a more inclusive, spatially and temporally extensive ethics of care is required to foster a sense of responsibility for present and future climate change. This view of intergenerational ethics as 'care' for the future is highly relevant in relation to low-carbon energy transitions, which cannot be understood separately from concerns over climate change and sustainability.

Recent work in maintenance and repair studies offers a different perspective on care, equally relevant for the energy context, where maintenance work is critical for the functioning of energy systems. In particular, Vinck's (2019) discussion of recent contributions from maintenance and repair studies engaging the notion of care, and their implications for engineering studies, could be extended to consider implications for energy engineering. But also beyond engineering, maintenance and repair studies address a much wider range of areas and practices, from repair practices in ICTs and software and information systems, to buildings, large infrastructures, urban settings as well as domestic consumption (Denis and Pontille, 2020). Drawing on Mol and Puig de la Bellacasa, scholars are increasingly conceptualising maintenance and repair practices as care (Callén and Criado, 2015; Denis and Pontille, 2015), drawing attention to the largely unacknowledged vulnerabilities of matter and technology and the often invisible processes of maintenance and repair underpinning the common "taken-for-grantedness" (Denis and Pontille, 2020) by users of devices, technologies and infrastructures. As Denis and Pontille (2020, p. 6)

describe: "As care, maintenance and repair practices … take decay and vulnerability as a starting point. … Everything has, in one way or another, to be taken care of". Understood as such, maintenance and repair work is performed by a range of actors, experts as well as lay persons, and at every scale, from small objects to large technological systems (see Strebel, Bovet and Sormani's (2019) recent collection of ethnographies for empirical examples). These various engagements with care ethics are relevant also in relation to energy transitions, where maintenance work is critical for the functioning of energy systems. These ideas will be discussed further in Chapter 6.

2.3.2 Introducing the ethics of care

As introduced briefly above, the theory of care ethics originates in feminist writing across a range of disciplines. It is centrally concerned with the critical role of care work in society, and the often gendered and undervalued practices of caring. While much feminist work on care has explored specific instances of care work (e.g. Mol et al., 2010), the focus of this thesis is on the broader theorising of an ethics of care. The definition of care adopted in this thesis is that proposed by Tronto and Fisher (1990) upon which Tronto (2013) also builds her account of caring democracy, and Puig de la Bellacasa (2017) bases her speculative exploration of care in more-than-human worlds. Tronto and Fisher (1990, p. 40) define care as:

> "a species activity that includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible. That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web".

Care exists in "everything that we do" to live in the world "as well as possible". Thus, an ethic of care is both sweeping in reach (concerned with "everything that we do") and emergent in character (as possibilities and notions of as-well-as-possible living evolve and change). In considering care ethics in the energy context, it is interesting to consider, further, Maria Puig de la Bellacasa's (2010, 2017) speculative work on care in more-than-human worlds challenging the 'our' and the 'we' in this definition, to move away from an originally anthropocentric ethic of care. Through her exploration of care in permaculture practices, she contemplates the meaning of care ethics within more-than-human soil relations, and

explores care as distributed across manifold agencies, materialities and practicalities. This is of particular interest to a discussion of care in energy transitions, and will be discussed further in Chapter 6 (see in particular sections 6.2 and 6.3.3).

There is an important public dimension to this understanding of care and care ethics. Held (2006, pp. 71–72), for example, describes care as a precondition of social life, arguing that, without care (e.g. the care for children in their early stages of life), there would be no society. Thus, care ethics presents a vision of social life as made up not of rational, autonomous individuals competing in a market, but of relations between interdependent persons, persons 'being-in-common' (Williams, 2017), equal in their dependence on care . As Tronto (2013, p. 27) asserts, "once we recognize the extent of caring as a part of human life, it becomes impossible to think politically about freedom, equality, and justice for all unless we also make provisions for all of the types of caring". Democratic theory, she insists, must deal substantively with the question of "who cares" (Tronto, 2013, p. 26). This gives rise to a personal-collective ethics, one which moves both the ethical and the political beyond the privatised-personalised domain of personal choice, individual rights and responsibilization (Puig de la Bellacasa, 2017, pp. 133–136), as further discussed below.

Tronto (1993) defines four ethical qualities derived from the process of care: attentiveness, responsibility, competence and responsiveness. Each of these are associated with a distinct 'phase of care' (Fisher and Tronto, 1990; Tronto, 2013):

1) caring about: being attentive to the caring needs of others (and self);
2) caring for: the taking of responsibility for meeting those needs by someone or some group;
3) care giving: performing care work with competence; and
4) care receiving: responding to care given, responsively observing such response, evaluating the care process and noting further care needs.

Building on this characterisation of the care process, Selma Sevenhuijsen (1998) and Tronto (2013) develop a political approach to care, placing care within conceptions of democratic citizenship and democratic politics to consider the requirements for and distribution of care in society. In her discussion of caring democracy, Tronto (2013) adds a fifth phase of care, caring with, and the associated ethical quality of solidarity (encompassing Sevenhuijsen's (1998) call for plurality, communication, trust and respect as basis for caring citizenship).

'Caring with' addresses a distinctly collective form of care contrasting the privatised-personalised ethics dominating contemporary politics, which "invites people to retreat into their own families and implicitly suggests that there is no one else to help out, little 'caring with' to be done" (Tronto, 2013, p. 6). This notion of 'caring with' is central to a care ethical notion of citizenship, emphasising a responsibility of citizens to:

> "care enough about caring – both in their own lives and in the lives of their fellow citizens – to accept that they bear the political burden of caring for the future … [which] is not only about oneself and one's family and friends but also about those with whom one disagrees, as well as the natural world and one's place in it" (Tronto, 2013, p. xii).

'Caring with' thus requires a recognition of the lives of others, their need for and practices of care, and, importantly, acknowledges the possibility of disagreement. Thus, a care ethical notion of citizenship is not a prescriptive or universal account of citizenship but, as Sevenhuijsen asserts, one based on plurality, communication, trust and respect for difference. Care ethical notions of citizenship will be explored in greater depth in Chapter 6, for the purpose of rethinking notions of energy citizenship and advancing a relational energy ethics.

Central to this care ethical notion of citizenship – and to care ethics in general – is a relational notion of responsibility, as explored below.

2.3.3 Care ethical notions of responsibility: an alternative moral basis for citizenship

Central to care ethics is a relational notion of responsibility. Starting from an appreciation of mutual dependence, responsibility is understood as a basic condition of existence within relations of care. Within relations, obligations are a given, as Sevenhuijsen (2000, p. 10) writes, a "basic standard against which other things are measured, such as the freedom to act as one wishes". In contrast to the liberal notion of responsibility as a 'bridge' between autonomous rights-bearing individuals, care ethics identifies persons as "always already [living] in a network of relationships, in which s/he has to find balances between different forms of responsibility (for the self, for others and for the relationships between them)" (Sevenhuijsen, 2000, p. 10). Responsibilities, like relations, are "always already" existing, prior to any claims to rights or freedoms. This notion of responsibility is "about connection rather than respecting separation" (Groves, 2009, p. 1). There is a further

distinction between the liberal 'negative' notion of responsibility, i.e. the responsibility to refrain from doing something which might violate the rights of another, and the care ethical 'positive' notion of responsibility, a responsibility to actively tend to relations by "providing what is needed" by the other(s) (Adam and Groves, 2011, p. 22). In the words of Trnka and Trundle (2014, p. 144), "fundamentally, it is a commitment to the welfare of the other – a duty of care". A relational account of responsibility thus presents an important counternarrative to individualistic, neoliberal discourses of citizenship resting on the idea of autonomous, rights-bearing individuals and a notion of self-reliance (Kymlicka and Norman, 1994).

As noted by many, the concept of responsibility has become widely colonized by neoliberalism (Trnka and Trundle, 2014), cultivating a notion of individualised responsibility for the autonomous self. Mutual obligation, as Hage (2000) argues, has become contractual rather than ethical, but with the individual citizen as the primary site of responsibility, overriding notions of reciprocity and mutuality, and of obligations of governments to citizens (Braithwaite, Gatens and Mitchell, 2002). Puig de la Bellacasa (2017) presents a sharp critique, from a care ethical perspective, of neoliberal individualist responsibilization, decrying a depoliticization of social life through the conflation of the political with the ethical and the reduction of both to the private domain of personal everydayness. With reference to Jensen (2009, in Puig de La Bellacasa (2017, p. 133)), she contrasts the "irrelevant" notion of individual responsibility to, for example, take shorter showers, with the "significant political option of shutting down all the coal stations". This form of individual responsibilization does not, she argues, raise individuals to a "higher [ethical] self", instead "they descend into the minor petty matters of maintaining everydayness" (Puig de la Bellacasa, 2017, p. 134).

At the same time, however, Puig de la Bellacasa lends significant importance to personal everyday responsibilities of care, but detaches the notion of the personal from the individual and the private. By thinking of personal everyday practices of care as engaged in the maintenance of the world, these practices come to be appreciated as collective affairs (Puig de la Bellacasa, 2017, p. 160); personal-collective affairs. Thus, a personal-collective ethics of care engages with "the ethicality of everyday doings *within* a politics of care [emphasis added]" (Puig de la Bellacasa, 2017, p. 159) and considers the possibility of personal agency rooted in collective commitments (Puig de la Bellacasa, 2017, p. 140).

Hourdequin (2010, p. 458) makes a similar argument in relation to collective action and individual obligations in the context of climate change. Emphasising the connection between the personal and the social, "the role of individual action in constructing one's moral identity, and the effect of individual action on one's relations with others, and on their actions", she argues that a relational ethics emphasises moral obligation to act both at a personal and political level. Likewise, Tronto (2013) adds a public-political notion of responsibility in her discussion of caring democracy. "[I]n its broadest and most public form", she argues, caring is about how "a society allocates responsibilities" (Tronto, 2013, p. ix). This, the allocation of caring responsibilities, she argues, is at the heart of political life, and a more nuanced discussion around responsibilities is essential for a caring democracy. Thus, personal-collective ethics of care seeks to move both the ethical and the political beyond the privatised-personalised domain of personal choice, individual rights and responsibilization (Puig de la Bellacasa, 2017, pp. 133–136).

2.3.4 Care in a global context

As explored above, in its focus on relational responsibility, care ethics offers an alternative to discourses of individualism and neoliberal responsibilization, on the one hand, and to rights-based ethical frameworks, on the other. Furthermore, as briefly discussed in this section, care ethics offers a contextually sensitive framework, and thus offers an alternative to the universalist discourse represented by the dominant energy ethical theory of energy justice (see section 2.2). While this may be seen as a strength, this has also led to critique and important debate about the relevance of a care ethics in a global context[1].

Given the primacy afforded to 'thick', or near, relations and associated responsibilities, care ethics has been critiqued as inadequate in a global context. This is a key point of contention between proponents of justice theory and care ethicists. Where principles of justice are understood as impartial, universal legal principles, an ethics of care

[1] These debates around the partiality of care ethics tie into a wider debate within Geography, on relational space and geographies of responsibility (Massey, 2004; Darling, 2009; Barnett *et al.*, 2011). Geographers have written extensively on the implications of relational space for geographies of responsibility and "the role which distance might play in the negotiations of ethical demands and obligations" (Darling, 2009), feeding in to geographical engagements with care and care ethics (Smith, 1998; Dyck, 2005; Popke, 2006; Lawson, 2007; McEwan and Goodman, 2010; Milligan and Wiles, 2010).

is inherently partial, it is contextual, embedded, and – arguably, to an extent – geographically (and socially) situated (Darling, 2009). Much debate has focused on the possibility – or impossibility – of care as a guiding principle for an international politics and global (environmental) ethics (Robinson, 1997; MacGregor, 2004; Clark Miller, 2010; Mahon and Robinson, 2011; Miller, 2011). Engster (2015, pp. 2–3) explains the problem of partiality with reference to an "innate disposition to care … for our own":

> "Although our innate dispositions to care for one another provide a natural basis for human society, their parochial character can generate significant obstacles to the creation and maintenance of large-scale political communities. Human beings are naturally disposed to care for our own and those with whom we identify but not all others in society".

This is not, however, grounds for dismissing an ethics of care. Rather, Engster argues that insights from care ethics are essential to "expand our natural but parochial dispositions of care to encompass strangers and distant others" (2015, p. 3), and to "identify the institutions, policies, and practices that will enable our natural caring dispositions to expand and grow" (2015, p. 18). Care ethicists generally acknowledge that geographically close relations of responsibility are likely to take priority over geographically distant responsibilities of care, but argue that this does not exclude the possibility of caring responsibilities across space (Robinson, 1997; Held, 2006; Mahon and Robinson, 2011). As Held (2006, p. 157) posits, "the ethics of care has resources to understand group and cultural ties, and relations between groups sharing histories or colonial domination or interests". In fact, she argues, care ethics may be better suited to address "the realities and values of caring relations and of relational persons in a global context" than "moral theories that assume only individuals pursuing their own interests within the constraints supplied by universal rules" (Held, 2006, p. 157). This is further considered in Chapter 6 in a discussion of the spatiality of an energy care ethics.

2.3.5 Critiques of care ethics

Other points of critique against care ethics are important to be aware of. In particular considering the recent emergence within social science energy research of a notion of care closely tied to the domestic sphere and familial and other intimate interpersonal relations

(see section 2.3.1). Understanding the feminist debates around care and care ethics stresses the importance of a broader conception of care.

Strong criticism has been directed against care ethics by other – in particular liberal – feminist scholars, warning that an ethics of care risks promoting an understanding of care and care work as 'natural' and feminine, and thereby hindering – rather than enabling or advancing – the empowerment of women, allowing for continued exploitation of carers and leaving women in a position of servitude (Card, 1990; Hoagland, 1990; Houston, 1990; Nussbaum, 1997). Many critics have (mis)understood the care ethical argument about the necessity of care as being about valuing women's experiences and women's mentality in essentialist, maternalistic terms based on the metaphor of the caring mother (Lister, 2003).

Such critiques, however, focus largely on early work advancing 'maternalistic' notions of care, including, for example, Sara Ruddick's (1980) seminal essay on mothering and moral thought and Carol Gilligan's (1982) ground-breaking study of how girls develop moral maturity as an alternative perspective for interpreting moral problems. While these early works have been and continue to be important sources of inspiration for research on care and care ethical thinking, the literature has developed significantly, and critiques of early maternalistic, essentialist tendencies have little bearing on later developments in care ethical writing (Noddings, 1990; Held, 2006). In fact, care ethics, as further developed by political theorists (Tronto, 1987; Sevenhuijsen, 1998), emphasises the necessity, if gender equality is to be seriously addressed, of recognising care as a public concern (as opposed to, or in addition to, private), and of de-romanticising care as non-innocent, as entangled in power relations and vice versa. Since Joan Tronto's (1987) call for a theory of care beyond gender difference, in which she questions the relevance of care ethics as a 'women's morality' and calls for feminists to construct a "full-fledged moral and political theory of care", discussion around the non-innocence of care, the possibility of good as well as bad caring and care-lessness, and the necessity of evaluating care and relations (Sevenhuijsen, 1998; Held, 2006; Puig de la Bellacasa, 2010; Tronto, 2013; Murphy, 2015) have become more explicit within care ethical literature.

Debate around care is also embedded in feminist theories of citizenship. Here, care is central to the 'equality-difference' debate (Lister, 2002); a debate about whether 'women's citizenship' should be based on an ideal of equality and sameness with men, (advocated by, for example, Kremer (2005)), or on a recognition of difference, frequently associated with

maternalistic discourses (Lister, 2003, p. 96). Both of these approaches are motivated by a critique of the 'male' model of the citizen-worker and its privileging of paid work as the primary citizen obligation, the primary route to participating in society and thereby earning access to citizenship rights, leaving (women) carers disadvantaged (Lister, 2002, 2003). These debates frequently get stuck at the question of whether and how it is possible to value care without locking women into a private caring role. While Fraser (1994, 1997) explores the possibility of men becoming more like women as a thought experiment, proposing the 'universal caregiver model' as alternative to the citizen-worker model, and Lister similarly proposes the notion of 'citizen-the-worker-carer', these debates over feminist citizenship maintain a strong association of care with women, whether as a burden from which women must be liberated in order to achieve citizenship on par with men, or a privilege which should be recognised and valued in order to avoid disadvantaging the woman-carer.

Joan Tronto's (1987) call for a theory of care beyond gender difference is important for work detaching care from essentialist gender differences. Tronto (1987, p. 657) questions the relevance of care ethics as a 'women's morality' and calls for feminists to construct a "full-fledged moral and political theory of care". Importantly, this is not a denial of the often gendered implications of care in contemporary society, but facilitates a discussion of care beyond its private, domestic, 'feminine' form. This also enables discussions of care beyond anthropocentrism, as in recent work on ecofeminism or feminist ecology (MacGregor, 2017; Bauhardt and Harcourt, 2018) and more-than-human explorations of care (Puig de la Bellacasa, 2010, 2017). Others explore what masculine care might mean (Nelson, 2016; Hultman, 2017). Nelson (2016) makes an interesting point about the need for expanding the notion of care to enable wider identification with its messages, and experimentally introduces the concept of husbandry to highlight how masculine ideals have not always been and are not necessarily divorced from notions of care. This raises interesting questions about the potential implications of the displacement of care onto the traditionally 'masculine' field of energy. At the same time, it becomes important to remain critical of the ways in which an energy care ethics may become narrowly associated with 'feminine' energy practices, and/or may give rise to feminisation of new emerging burdens of energy care in the context of climate change, the transition to low-carbon energy systems and the need for energy conservation and demand reduction.

2.4 Citizenship, ethics, care: furthering the conversation

The idea underpinning the emergence of the energy citizenship concept (Devine-Wright, 2007), that a low-carbon energy transition will involve new roles for individuals and new relations between actors in the energy system, remains pertinent for both academic enquiry as well as policy and business developments around energy. However, as argued in this chapter, applications of the concept of energy citizenship within energy social science literature are frequently characterised by narrow, exclusive conceptions of individuals' roles in relation to energy. Arguably, this fails to realise the potential of the citizenship concept to contribute to a broader socio-political framing of energy debates, leaving considerable room for broader discussion of what an understanding of people-as-citizens might mean in relation to a low-carbon energy transition.

To this end, in this thesis, I ask how a better understanding of citizens' ethical attitudes might inform further theorising of energy citizenship to better reflect how citizens relate with energy both in the everyday and to wider energy system change. Bringing a notion of energy citizenship into conversation with literature on energy ethics, I have argued that the dominant energy ethical theory of energy justice may not be the most appropriate framework for understanding interactions of energy and ethics in the everyday. Instead, this thesis supports recent anthropological accounts of energy ethics as arising out of everyday engagements with energy and energy transitions. It is in my further discussion hereof, based on the findings of exploratory Q-methodological research (as introduced in the following chapter), that I engage notions of relationality and, in particular, care ethics.

In the last part of this chapter, I introduced literature on care ethics; a theory largely unfamiliar in the energy context, although the concept of care has begun to emerge in energy social science discourse, as reviewed in section 2.3.1. This thesis builds on these early engagements of energy social science literature with care, but proposes a more comprehensive engagement with a theory of care ethics to draw attention to the ethical significance of relational existence within energy webs.

Thinking energy with care, as I propose in Chapter 6, is an inherently relational conception of energy systems. Thus, as highlighted previously in this chapter, the argument of this thesis contributes to ongoing advances of relational thinking around energy systems. But a care ethical approach takes this a step beyond existing relational theories of energy

systems and transitions, to call for a recognition not only of inter-connections and relations, but of their ethical significance. This is a consideration which remains largely absent from relational approaches associated with science and technology studies, which focus primarily on tracing routes and networks, seeking to account for inter-connections and relationships (Clive Barnett and David Land, 2007; Puig de la Bellacasa, 2017). Exploring the ethical significance of relationality in energy systems is thus a key contribution of this thesis.

CHAPTER 3

Methodology

This project has developed from an initial research proposal to incorporate attributes pertaining to socio-political aspects of the energy sector in valuation research, by designing and conducting a choice experiment to investigate how such aspects influence attitudes towards renewable energy and energy transitions as a whole. The rationale was twofold: First, with the growing focus on new actors and new arrangements in the energy field and new roles of individuals in their interaction with energy services (whether in the form of demand-side management, smart-metering or 'prosumption'), it appeared important to understand how people respond, not just to specific energy technologies and resources, environmental impacts, CO2 emissions and prices, but also to different roles and relations of actors and arrangements in the energy sector. Secondly, very few valuation studies include attributes relating to organisation and structure in the energy system, despite ongoing debates around, for example, ownership, fair process and trust as important factors. Recent work in environmental economics (Sagebiel, Müller and Rommel, 2014) begins to explore how choice experiment research may incorporate such issues; Sagebiel et al. (2014), for example, investigate preferences amongst members of energy cooperatives for democratic organisational principles, and Longo et al. (2008) assess preferences for various attributes of renewable energy policy, with significant scope for expansion of this line of research to add nuance to environmental economic approaches to energy transitions.

However, given the exploratory nature of these questions, it was quickly determined that further research was required to first explore how socio-political aspects of energy transition factor into public subjectivities around energy. To this end, Q-methodology was explored as an interesting approach to a more open, yet structured, study of the types and 'structures' of opinions around these issues. Through my ongoing review of literature and early engagement with Q-methodology, the value of Q-methodology in

and of itself became increasingly clear, and as the project developed, so too did the aims of the research. The project took a turn away from the initial objective to contribute to the field of environmental economics with a more nuanced approach to the study of preferences, to a focus on the role of ethics in everyday relatings with energy and energy system change.

This chapter proceeds with an introduction of the research questions guiding my research and the underlying rationale (section 3.1), followed by a consideration of research philosophy and design (section 3.2). The Q-technique is introduced in section 3.3, and an overview of previous uses of Q-methodology in energy research, in section 3.4. Section 3.5 describes the Q-study design, which consists of two 'phases': the Q-sample (collection of statements used in Q-sorting interviews) and the P-sample (sampling of research participants). Data collection and analysis are detailed in section 3.6, and section 3.7 considers questions of validity, generalisability and limitations. Further reflections on my experience with Q-methodology as a tool for conducting research on energy and ethics are presented in the conclusion in Chapter 7. Following this methodology chapter, the research settings are introduced in Chapter 4.

3.1 Aim and research questions

This thesis aims to contribute to a better understanding of how citizens relate with energy both in the everyday and to wider energy system change, and to consider the relevance of the energy citizenship concept in light thereof. To address this aim, four research questions are set out; two conceptual and two methodological:

> RQ1: To what extent does the energy citizenship concept offer a relevant framework for understanding interactions of energy and ethics in the everyday?
>
> RQ2: How can a better understanding of citizens' ethical attitudes towards energy inform theorising of energy citizenship?
>
> RQ3: To what extent is Q-methodology useful for understand conceptualisations of energy system change from the everyday perspective of citizens?
>
> RQ4: How do everyday ethicalities around energy and low-carbon transitions differ (or not) across Denmark and the UK, and why?

In addressing these questions, I draw on Q-methodological research conducted in 2018 in the UK and Denmark to understand how ethical concerns and socio-political issues feature in public subjectivities around energy transitions. The Q-study was guided by three working questions:

> WQ1: What factors can be observed amongst participants and how can these be interpreted as everyday perspectives on energy transitions?
>
> WQ2: To what extent do perspectives differ; which topics inspire consensus, and which are contentious, and why?
>
> WQ3: How context dependent is the factor solution; do perspectives differ across Danish and British participants and if so, how?

This research developed in response to the observation that much theorising within energy social science scholarship is explicitly or implicitly animated by narrow views of citizens (not unlike the dominant view in environmental economics of citizens as consumers acting rationally in accordance with choice-preferences), as either energy end-users, prosumers or technology users. Discourses of citizens as being at the heart of a low-carbon energy transition are common, both in academic work on energy citizenship and active consumers, and in political discourses as exemplified most clearly in the context of EU energy policy. Meanwhile, these discourses reflect exclusionary understandings of (energy) citizens, what it means to participate actively in the energy transition, and a lack of engagement of citizens in debates and decisions beyond individual consumption in the home. Increasingly, energy and society scholars are recognising the importance, but also difficulty, of engaging with the public around energy system change as a whole. Thus, this thesis explores how to better reflect, in our theorising of energy citizenship, how citizens relate with energy both in the everyday and to wider energy system change.

3.2 Research philosophy

Rooted in a pragmatist philosophy of research, this study is underpinned by a view of research as social enquiry for the purpose of 'the public good' and the centrality of democratic practice, in research as much as in society. Firstly, the focus on self-referential attitudes, characteristic of Q-methodology (see section 3.3.2), sets this research apart from more researcher-led approaches common in research on energy transitions and valuation,

and from 'socialising' and consensual tendencies in much research addressing public attitudes and behaviour (as discussed in the previous chapter). Secondly, the focus on energy users (citizens), broadly, reflects an aim to move beyond the focus, of much empirical qualitative energy research, on the 'already-energy-citizen', or in the words of Naus et al. (2015), 'unproblematic' individuals (see section 2.1.1).

3.2.1 Ontology & epistemology

Ontologically, this research follows pragmatism's transactional theory of knowledge, which posits that knowledge is at once real and constructed; rather than spectators of a finished universe or an objectively knowable reality, we (humans) are seen as "participants in an ever evolving, unfinished universe" (Biesta, 2010, p. 111). Thus, the purpose of research is not to uncover *a priori* 'truths', but rather to develop 'warranted assertions' (Biesta, 2010) for the ongoing improvement of social judgement (Anderson, 2014). This is particularly pertinent in the study of energy transitions; transitions, unfolding as we are conducting our research and debates, which in turn – we can only hope – may serve to inform decisions in the ongoing shaping of that transition.

From this perspective, methodologies are seen as tools designed to aid efforts at understanding the world, allowing for epistemic plurality in research. Thus, the way in which a researcher may best pursue/produce knowledge or understanding about the world will depend on the types of questions s/he is dealing with, and the types of knowledge sought after. In using Q-methodology (detailed in section 3.3), this research project is characterised by a mixing of qualitative and quantitative techniques in continuous interaction (Ramlo, 2016b), to explore subjectivities around the topic of energy transitions. This mixing of qualitative and quantitative is elaborated in the introduction to Q-methodology in section 3.3.

Q-methodology is, in itself, a comprehensive methodology with strong philosophical underpinnings, as elaborated below. A key characteristic of Q-methodology is its central focus on subjectivity understood as shared conceptualisations, with an aim for in-depth understanding of typologies of perception.

3.2.2 The philosophy of Q methodology

William Stephenson, physicist and psychologist, first introduced Q-methodology in the journal *Nature* in 1935, seeking to advance the scientific study of human subjectivity. This was (and perhaps still is) a controversial project, due to the pervading tension between science (and its connotations of fact and objectivity) and subjectivity. Q-methodologists insist on the possibility of observing and studying subjectivity as having structure and form, referred to as 'operant subjectivity'. Subjectivity, as the object of study, is to be understood "in the empirical sense of subjective communicability … of the world … as it is experienced from my [i.e. the individual participant's *(ed.)*] own point of view" (Brown, 1986, p. 57). In the words of Brown (1986, p. 58), while subjective opinions "are typically unprovable, they can nonetheless be shown to have structure and form, and it is the task of Q technique to render this form manifest for purposes of observation and study".

Brown (1980, p. 1) advocates for the application of Q-methodology to better understand "the political ramblings of the average citizen", acknowledging that "individuals typically have viewpoints on issues of public controversy and, unlike the subject matter of physics, are generally capable of speaking for themselves" (Brown, 1980, p. 3). He questions the predominant focus of social scientists on explaining human behaviour through variables with poor resemblance to individuals' own reasonings: "who would ever say, for example, 'I support Kennedy because I am a black, Catholic, urban-dweller, a registered Democrat […]', or anything remotely similar?" (Brown, 1980, p. 59). Looking beyond those socio-economic categories, which place constraints on individuals' experiences, he emphasises the relevance of studying subjective opinion formation by allowing participants to "engage in the formation of his own opinion" through Q-methodology.

Q-methodology is a particularly interesting approach to the study of values and priorities around complex and contested topics, as it helps researchers to discover areas of particular importance, and understand, in depth, areas of consensus and conflict; this, in turn, may help to develop a common view towards policy-making (Steelman and Maguire, 1999). Barry and Proops (2000, p. 23) emphasise the particular relevance of Q-methodology for "studying those social phenomena around which there is much debate, conflict and contestation, such as the environment or citizenship". They suggest the use of Q-methodology in the development of more democratic and participative forms of policy formation, through more inclusive means of defining both problems and possible solutions.

This supports Q-methodology as being well-suited to the study of citizens' values, priorities and concerns relating to the complex topic of sustainable energy development.

The Q-sort allows participants to "[construct] a representation of their view from the statements provided", in a *self-referential* process based on their own interpretations of the statements (Ramlo and Newman, 2011, p. 178). The concept of self-reference is fundamental to Q-methodology; statements and concepts ["are] not assumed to have a priori meaning apart from and independently of the respondent's [internal frame of reference]" (McKeown and Thomas, 1988, p. 22). Thus, in contrast to other methods of opinion or attitude measurement, in Q, no universal definitions, meanings or scales are predetermined by the researcher. Instead of subjecting participants to measurement using surveys or tests, Q methodological data collection – Q-sorting – sees *participants measure* a set of stimuli, or tests, if you will (Watts and Stenner, 2012, p. 15).

The nature of the Q-sort continuum, elaborated in section 3.2.2, means that all Q-sorts are 'anchored' in the same way, in the point of 'no meaning', and the dispersion of statements around this point depends on individuals' self-references (McKeown and Thomas, 1988, p. 35). *Contextuality* is a central aspect of this self-referential process: differences in viewpoints (factors) must be understood contextually, "as part of a pattern or configuration of meaning", not with reference to the placement of single statements seen in isolation (McKeown and Thomas, 1988, pp. 23–24). In other words, two participants with distinct perspectives might place one statement identically in their respective Q-sorts, while each attaching a different meaning to said statement, as understood self-referentially, contextually, within their distinct worldviews.

3.3 The Q-technique

A Q-study consists of three main stages as illustrated in Figure 1 below: 1) the development of the *concourse* (the full range of subjective viewpoints existing around the topic of interest) and refinement to determine the *Q-set* (a smaller set of representative statements presented to participants for sorting), 2) the *Q-sort* (sorting and ranking of the Q-set statements by participants (referred to as the *P-set*), and 3) *factor analysis* and interpretation. Each stage is explained below.

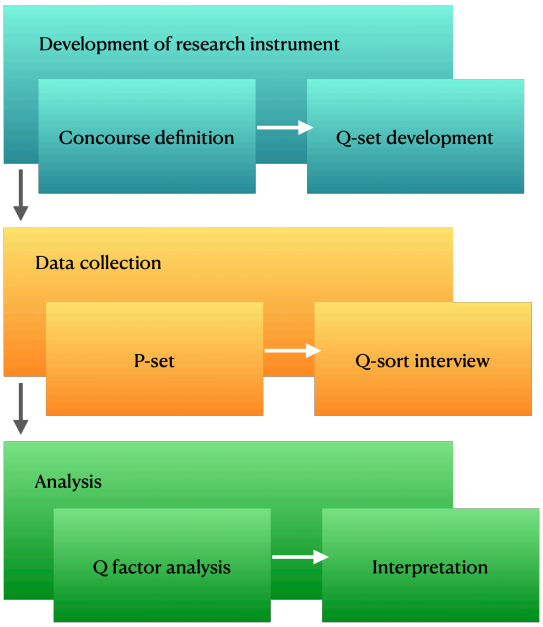


Figure 1. Procedures of Q-methodology

3.3.1 Concourse & Q-set

'Concourse' is a term used, in Q-studies to describe the full range of subjective viewpoints existing around the topic or issue of interest. The researcher may draw on previous research, newspaper articles, social media, and/or interviews with experts and other relevant individuals for the construction of the concourse. A concourse can be developed through a naturalistic or theoretical approach, or a mixed approach drawing on both. A naturalistic approach to concourse development takes statements from 'real' communications (such as from newspapers, social media and/or interviews), while a theoretical approach relies on the researcher to develop statements based on theory and the particular questions and aspects of interest in the study. The concourse – typically consisting of several hundred statements – is then reduced to a Q-set of around thirty to fifty statements (Q-set refinement). The Q-set must be representative of the full concourse, non-repetitive, and balanced. The process of refinement can be either structured or unstructured; a structured, theory-led approach may be favourable, to ensure full coverage of relevant themes or aspects of a topic (in this study, structured refinement was based on Chilvers' and Longhurst's (2015) relational framework of socio-material collectives (see section 3.5.2 below). Through piloting, the Q-set can be further refined to ensure that statements are relevant and comprehensible to participants.

3.3.2 Q-sorting & the P-set

In the process of Q-sorting, participants sort the statements of the Q-set according to their own personal views. Participants are asked to sort the statements onto a fixed distribution, resembling a normal distribution, shown in Figure 2. This serves 1) to ensure that participants make choices about which statements they associate or dissociate *most* strongly with, and 2) to allow comparisons across Q-sorts despite their subjective and self-referential nature, due to the 'anchoring' in and dispersion around a point of neutrality (further elaborated below).

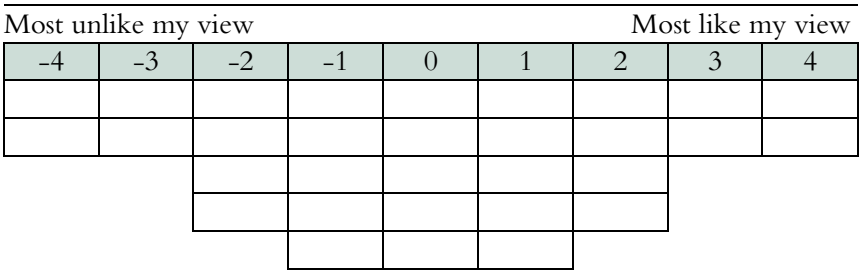


Figure 2. Q-sort grid

Sorting is done in accordance with the study's 'condition of instruction', setting out the scale on which the statements are to be sorted; this could be from 'most agree' to 'most disagree', from 'most important' to 'most unimportant', from 'most like my view' to 'most unlike my view', etc.. Generally, a scale from 'most …' to 'most …' is preferable, as this allows the middle of the spectrum to be interpreted as neutral. One of the oft-repeated strengths of Q-methodology is the ability of participants to relate to statements not merely in terms of 'degrees' of agreement or importance, for example, but to express anything from complete agreement to rejection, as well as oblivion, or 'psychological insignificance' (McKeown and Thomas, 1988, p. 35).

Q-sorts may be conducted face-to-face, either as one-to-one interviews or group workshops, or online. Following the sorting exercise, the researcher conducts a post-sort interview to allow participants to clarify, elaborate on or explain their decisions in the Q-sort. This provides the researcher with qualitative data to support the interpretation of patterns arising from the analysis of Q-sorts. Such qualitative data may alternatively be collected via written comments from the participants at the end of the sorting exercise – this may be relevant for group workshops or online Q-studies.

In Q-methodology, the P-set refers to the participants in the study, typically selected based on purposive sampling. As each individual Q-sort offers a substantial amount of information about the ranking of subjective statements relative to each other, and due to the focus on subjectivities rather than individuals, relatively few respondents are needed; a P-set of thirty to forty respondents is commonly recommended for a Q-study.

Here, the assumption of 'finite diversity' in subjective viewpoints is key; once this diversity is 'revealed' (in the form of factors), the addition of more and more participants will not add new insight but may instead introduce excess 'noise'. Q-researchers would typically aim for four to six respondents loading onto each factor, and would expect a similar number of factors to emerge, meaning that as little as fifteen to twenty-five respondents may be sufficient; however, as the researcher does not know in advance the number of factors, nor which participants will load onto which factors, a strategy of oversampling is typically adopted, with the suggestion of twenty to forty respondents (Previte, Pini and Haslam-McKenzie, 2007; Cairns, 2012).

While many Q-studies include the collection of demographic data about participants, P-sets are typically too small to allow for inferences to the wider population and may not be statistically representative; this is also not the aim of (most) Q-studies. Nonetheless, Q factor analysis may allow the researcher to explore how socio-demographic variables relate to statement rankings and factor loadings, and to consider characteristics of individuals loading on to each factor, to understand 'who' may be associated with the different views identified. This will, however, only be indicative.

3.3.3 Factor analysis

Q-methodology relies on factor analysis to make sense of collected Q-sorts and identify patterns of similarity and difference in how participants have ranked the items of the Q-set. Factor analysis is a method of data reduction, based on correlation statistics[2]. It serves to identify groups of highly correlated variables within a dataset, i.e. variables that

[2] Correlation is a measure of similarity between two sets of variables (in this case between two individuals' Q-sorts), measured on a scale from -1 to +1. A correlation of 0 indicates no relation between the two Q-sorts, a high positive correlation suggests a high degree of similarity in how two individuals have ranked each statement, while a high negative correlation suggests that the statements ranked highly positively by one individual have been ranked highly negatively by the other.

appear to covary – or vary together in a similar way – across the study population. In Q-methodology, a factor reflects an underlying dimension, or in other words, a type of view, with which observed Q-sorts correlate to varying degrees.

While factor analysis is defined as a quantitative method of analysis, the Q-factor analysis provides a richness of description more associated with qualitative than quantitative research (Ramlo and Newman, 2011). Each factor (or type of view) can be represented by an *array*, an arrangement of rankings for the Q-set statements, of the same form as the Q-sort. In this way, types of views emerging from the analysis can be described in detail with reference to each statement included in the study. Based on the results of the factor analysis and, importantly, the additional qualitative data, collected during the Q-sort interview, the researcher is able to further interpret the views represented by each factor.

Below, the three stages of Q-factor analysis – extraction, rotation and interpretation – are described in general terms, with further detail provided in Appendix 1 (see also Brown (1980) for thorough detailed explanations and Watts and Stenner (2012) for very accessible description of the method). Much of this analysis can be done by software packages such as PQMethod (Schmolck, 2014b), but the researcher's judgment remains important throughout, in determining numbers and rotation of factors and the flagging of Q-sorts, as explained below.

Factor extraction

The first step in factor analysis is the extraction of factors. Various methods exist for the extraction of factors, and there are ongoing debates about the best approach. Most used amongst Q-methodologists, and the method used in the present study, is the centroid method. While this is not the most mathematically precise technique available to factor analysists, centroid factor analysis is preferred by many Q-methodologists due to its theoretical and conceptual consistency with the philosophical underpinnings of Q-methodology (this is further elaborated in Appendix 1). Notably, the results of different factor analytic approaches have been found to differ very little (Zabala, 2014).

The number of factors extracted determines the number of viewpoints identified and analysed. Unlike many statistical methods, factor analysis does not provide a single, definite solution; there could be many different ways of extracting and *rotating* factors to present an acceptable solution. *Any* factor solution (number and rotation of factors) presents

a *possible* definition of underlying dimensions of the data. Q factor analysis typically follows an inductive (exploratory) approach to determining the most appropriate factor solution, "[letting the] data take the lead" (Watts and Stenner, 2012, p. 95) and staying true to the Q methodological principle of *self-referential* subjectivity (section 3.2).

Several (mainly statistical) criteria exist to determine the most appropriate number of factors; common criteria are detailed in Box 1 below. As both Brown (1980) and Watts and Stenner (2012) show, the choice of decision criteria can make a big difference for the number of factors to be retained in the analysis. It is thus worth exploring various criteria to get an indication of the range of appropriate factor solutions.

Box 1. Common criteria for determining number of factors to extract

Eigenvalues & the Kaiser-Guttman criterion
Eigenvalues are the most commonly used criteria for selecting the number of factors to retain in quantitative factor analysis. Eigenvalues are indicative of a factor's statistical strength; the higher the value, the stronger the factor's explanatory power. The Kaiser-Guttman criterion states that a factor should be included in the final factor solution if EV is higher than 1. However, as an eigenvalue lower than one simply suggests that the factor explains less than what a single Q-sort explains, this is likely to lead to the extraction of far more factors than is relevant (Watts and Stenner, 2012, pp. 106, 110).

Factor variance
Like EV, *factor variance* offers a measure of the strength and potential explanatory power of an extracted factor (Watts and Stenner, 2012, p. 105). A factor's variance is defined as the percent of total study variance accounted for by the factor. A solution accounting for 35% or more of total study variance can generally be accepted (Kline (1994) in Watts and Stenner, 2012).

Humphrey's rule
Humphrey's rule posits that a factor is significant if the cross-product of the two highest loadings on the factor (regardless of sign) is greater than two times the standard error (an estimate of how far the sample mean is likely to be from the population mean). The same rule can be applied less strictly, so that a factor is accepted if the cross-product of the two highest loadings (regardless of sign) is greater than the standard error.

Significant loadings
A factor may be retained if it has two or more Q-sorts loading on the factor with loadings that are statistically significant. Statistical significance is a measure of the probability of a given deviation from the sample mean occurring by chance. A deviation is commonly accepted as statistically significant if it has less than a 5 % probability ($p < 0.05$) or, for a stricter criterion, less than a 1 % probability ($p < 0.01$) of occurring by chance. Ultimately, it is up to the researcher to define the level of significance to apply.

Further criteria can be added; for example, a factor may be retained only if 2 or more Q-sorts load significantly *and purely* onto the factor. A *pure* loading then needs to be defined, for example that the Q-sort does not load significantly on any other factor, at the 0.05 level (or some other researcher defined level).

The magic number 7
Brown (1980, p. 223) advocates for a non-statistical approach, "the magic number 7", based on his extensive experience with Q-methodological research. He recommends extracting seven factors as a good starting point, noting that irrelevant factors can simply be discarded further down the line (Brown, 1980, p. 223; Watts and Stenner, 2012, p. 110).

This indicative exercise should not, however, overrule the role of theoretical reasoning or knowledge of the data in determining an appropriate factor solution, and the final factor solution should always be determined with reference to the qualitative data collected alongside the Q-sorts. Thus, factor extraction is a highly iterative process, in which multiple factor solutions are explored and evaluated based on the extent to which each can be explained with reference to the qualitative data.

Factor rotation

After factor extraction, factors are *rotated.* This is a process of adjusting the angles from which the Q-sorts are viewed and interpreted. It is these viewing angles, in relation to which the Q-sorts are interpreted, which are described as factors. To illustrate, one can imagine a multi-dimensional space (with as many dimensions as there are factors extracted) onto which each Q-sort is plotted. This space can be represented in a diagram with as many axes as there are factors, and each axis is described as a factor. These axes could be positioned in an infinite number of ways within the multi-dimensional factor space. Thus, factor *rotation* refers to the process of rotating (repositioning) the axes within the factor space. Importantly, this process of rotation does not alter the data in any way. The prior act of factor extraction serves to fix the positions of all the Q-sorts within the factor space. The relative positionings of all the Q-sorts are absolutely and permanently fixed, and these positionings are "fixed by the viewpoints of the respective participants" (Watts and Stenner, 2012, p. 129). Thus, the form of the data (the relative positions of all the Q-sorts in the factor space) is given by the initial process of factor extraction, and rotation is a tool for observing that form from various viewing angles. The goal of factor rotation is ultimately to determine the most appropriate 'placements', or compositions of the factors to facilitate analysis and interpretation of said factors.

Factor arrays & interpretation

Finally, for each factor, a *factor array* is produced, showing what an average (or idealized) Q-sort would look like for each factor. Thus, a factor can be described as representing a type of viewpoint on the topic under study, and the factor array describes what opinions characterise this viewpoint, based on the Q-set statements. In other words, based on the factor arrays, each unique viewpoint can be described with reference to the placement of statements onto the Q-sort grid. The scores assigned to each statement in a factor array are calculated as weighted averages of the scores assigned in each Q-sort loading

onto that factor, with higher loading Q-sorts weighted higher than Q-sorts with a smaller factor loading. To facilitate these calculations 'flagging' is required to conclude the factor rotation. Flagging is a process of marking those Q-sorts which are to be used in the calculation of factor arrays.

Once factor arrays have been generated for each factor, Watts and Stenner (2012) recommend setting up 'crib sheets' to facilitate the further analysis. In crib sheets, the researcher sets out the statements given the highest ranking(s) and the lowest ranking(s) by a given factor, as well as statements ranked higher by that factor than by any other factor, and those ranked lower than by any other factor. This helps to organise the process of analysis and interpretation, which requires detailed, holistic exploration of factor arrays together with the qualitative data collected, and helps to ensure broad-based interpretation. Throughout the analytic process, the qualitative data from the debriefing questions provides the researcher with important insights to facilitate the interpretation and explanation of emerging viewpoints.

3.4 Q-methodology and energy research

Although originating in psychology, the Q-technique has been applied in a wide range of disciplines and research contexts. As mentioned above, Q-methodology has been argued to offer a valuable addition to the toolbox for policy relevant research. Its application has been growing in the field of environmental policy, and several social science energy scholars have applied the technique to energy related studies. Table 1 shows an overview of energy related Q-studies and the researchers' approaches to the stages of the Q-method.

The majority of these studies focus on perspectives of 'key actors', including representatives from different levels of government, energy companies, industry, sector organisations, academia, NGO's, and the media (Fisher and Brown, 2009; Cuppen *et al.*, 2010, 2016; Setiawana and Cuppen, 2013; Olazabalab and Pascual, 2015) and, to a lesser extent, specific community groups (Olazabalab and Pascual, 2015; Byrne *et al.*, 2017). In a study of public acceptance of a wind farm proposal in Northern Ireland, participants included objectors and supporters, who had been identified in the public debate around the proposal (Ellis, Barry and Robinson, 2006, 2007). Sampling is not detailed, but according to the research project website, the aim was to include proposers of the Tunes Plateau development,

the British Wind Energy Association, key environmental NGOs, local authorities, residents, local businesses, opposition groups, and political parties. Similar to Ellis et al.'s inclusion of residents, other Q-studies include a limited number of participants representing 'affected residents' (Cotton and Devine-Wright, 2011) and 'affected and unaffected citizen stakeholders' (Cotton, 2015). Sampling procedures, however, are generally not discussed beyond the identification of 'key actor' groups and 'key stakeholders'. Interestingly, in their study, using Q-technique for the selection of participants in stakeholder dialogue on bioenergy in the Netherlands, Cuppen et al. (2010) conclude that 'actor groups', although frequently used in studies aiming to represent stakeholder perspectives, are in fact poor proxies for perspectives. Similar findings are reported by Steelman and Maguire (1999) in a Q-study of national forest management. Alternative approaches to sampling may thus be relevant, as exemplified in the present study (see section 3.5.2).

Few studies specifically investigate citizen perspectives around energy, and these are highly focused on specific phenomena, such as home energy renovations (Kerr, Gouldson and Barrett, 2018) and public participation (Díaz, Adler and Patt, 2017). In order to understand motivations, expectations and experiences around home energy renovation, Kerr et al. (2018) conducted a Q-study amongst home owner occupiers, who had recently undertaken home renovation. Recruitment was done via snow-balling and collaboration with local renovation groups, while ensuring coverage of diverse demographic and property characteristics. Diaz et al. (2017) likewise focused on participants with direct experience with a recent decision making process to construct a small hydropower plant. A wider sampling frame is employed by Pelenur (2018) in a combined Q-method and survey study exploring the views of householders towards energy use in the home. Recruitment of participants in this study was based on initial identification of 'typical' neighbourhoods in Manchester and Cardiff based on census data, followed by distribution of leaflets and door canvassing.

The majority of energy related Q-studies have been single-country case studies, although a few authors have undertaken cross-national studies. Wolsink and Breukers (2010), for example, conduct a comparison of stakeholder perspectives on wind power implementation in the Netherlands, North-Rhine Westphalia and England. The authors apply a theoretical – as opposed to naturalistic – approach to concourse development; they *produced* statements based on seven factors identified for comparison together with the

framework of cultural theory on decision-making processes. Statements were produced to be generalizable across cases, and the same statements were presented to participants in all cases. This study shows similarities across the three countries in the patterns of conflicting perspectives, albeit with distinctions between those perspectives most prominent and those more marginal in different places. They explain these differences based on differing national experiences of successful wind power implementation. In a study comparing European and African stakeholder perspectives on energy drivers in Africa, Matinga et al. (2014) also find similarities in perspectives across geographical background. However, in contrast to Wolsink and Breuker's (2010) trans-national Q-study (comparing perspectives of stakeholders towards each their own national context), Matinga's et al. (2014) study addresses perspectives on one context (energy drivers in Africa), across stakeholders with varying geographical background, but all engaged in the African energy access debate.

Building on this small but growing body of Q-methodological energy research, this thesis adds methodological novelty in a number of ways. Existing Q-methodological energy research demonstrates the relevance of Q-methodology as a tool, primarily, for stakeholder analysis to aid stakeholder management in energy projects. This thesis explores the further potential of Q-methodology to understand conceptualisations of energy system change from the everyday perspective of citizens. Furthermore, the use of Q-methodology for trans-national energy research remains relatively unexplored. In presenting a multi-national Q-methodological research project, this thesis addresses a growing interest in the energy social science research community in the multiplicity of transitions (Köhler *et al.*, 2019). Understanding the multiplicity of transitions is important not only with respect to the multiplicity of innovation projects and transition processes, but also, as is the focus of present research, with respect to the ethicalities of transitions.

Table 1. Energy related Q-studies

Author	Topic & Thematic Framework	Location	Concourse	Q-set	P-set	Factor rotation	Findings
(Kerr, Gouldson and Barrett, 2018)	Domestic energy retrofits	UK – North of England	Naturalistic based on interviews with homeowners with experience of home renovation, compared with grey and academic literature to ensure comprehensive coverage	49 statements developed based on categorisation of the concourse into groups of statements with similar meaning, with similar statements refined to a single representative statement.	24 home owner-occupiers that had been through home renovation process, selected to cover various demographic and property categories. Recruitment based on snow-balling, public advertisements and collaboration with local renovation groups.	PCA with Varimax rotation	Four narratives identified: 1) Organised and seeking greater comfort; 2) Settled and performing a functional upgrade; 3) Growing and needing a family home; 4) A lot to do and no time like the present. Two narratives (2 and 4) are identified as associated with energy renovation, and two (1 and 3) as focused on amenity renovation.
(Dairon, Parkins and Sherren, 2018)	Energy development	Canada: Two communities in southwestern Alberta		Parkins' et al. (2015) Q-set of 48 statements used.	Residents and business people with direct interests or experiences with energy production	PCA with Varimax rotation	Four factors identified, two identified as "minority discourses" (less commonly held amongst participants in the study and in related literature); one around overconsumption of energy not motivated by global concerns over climate change but rather with local concerns over unsustainable energy development and industrialisation of landscapes. The other characterised by power inequities and unjust distribution of responsibilities, costs and benefits around energy.
(Byrne *et al.*, 2017)	Motivations and barriers to decarbonisation for communities	Ireland	Naturalistic based on interviews with activists	64 statements	32 respondents (original 18 interviewees from concourse development + 14 community group members and activists (mix of in-person and online)	No info	Four discourses: 1) Community as partner in transition 2) Step by step community change 3) Urgent action on climate change 4) top-down sceptic. – Discourse 1 dominating. Findings challenge common assumption of individuals' economic motivation driving. Q-method successful in identifying both diversity and common motivational factors driving action
(Díaz, Adler and Patt, 2017)	Stakeholder perspectives on hydropower	Switzerland	Based on interviews with stakeholders as well as secondary sources.	34 statements selected based on analytical framework defined by themes emerging from the concourse and determinants of public acceptance as found in academic literature.	26 participants directly involved in the decision process of a small hydropower plant; recruited using snow-balling.	CFA with Varimax rotation	Four stakeholder perspectives identified (one of which is left out of analysis due to its complexity and bipolarity requiring further investigation). Consensus is observed around a preference for democratic decision-making, but

(Cuppen *et al.*, 2016)	Stakeholder engagement in large-scale energy infrastructure projects Governance of risk; integrating public engagement & project management literature	Netherlands: shale gas exploration areas: Boxtel and Haaren villages	Statements from media sources and internal reports from companies involved in the project	49 statements selected based on 7 identified categories in the concourse.	19 participants; 8 internal and 11 external stakeholders from industry, research institutes, government, companies, community and NGO's. Recruitment through snow-balling and media.	PCA with Varimax rotation	Demonstrates the use of Q methodology for stakeholder analysis as the first step in external stakeholder management processes, arguing that the use of Q-methodology as integrated part of project management could have contributed to better stakeholder management. Six stakeholder perspectives identified, three supportive of, three in opposition to shale gas.
(Olazabalab and Pascual, 2015)	Urban sustainability transitions; how intermediary actors perceive the opportunity	Bilbao	Based on previous study by same authors (2013) – Naturalistic based on expert interviews + local media sources	32 statements	32 respondents; online Q-sort questionnaire	Varimax	Four discourses: 1) follower, 2) visionary, 3) pragmatist, 4) sceptic
(Parkins *et al.*, 2015)	Energy discourses Sustainability discourses and energy futures	Canada; three regions of intense energy related debate.	Range of secondary sources, grouped into eight conceptual themes based on factorial design	48 statements developed by clustering statements with similar meaning or content to create single aggregate statement and rephrasing statements to make them applicable.	58 participants from a range of backgrounds but all with interest and knowledge of energy issues.	PCA with Varimax rotation	Five discourses identified and discussed with reference to energy debates in Canada. No significant regional variation observed. It is suggested that the strongest tensions arise between concerns over environmental collapse and notions of science and technology and the optimism of ecological modernization.
(Cotton, 2015)	Shale gas fracking & environmental discourses	UK	Quasi-naturalistic (interview data from previous study and a range of secondary sources).	Unstructured based on thematic analysis of the concourse => 40 statements	28 participants recruited based on purposive sampling (oil & gas industry bodies, protest organisations, scientific institutions, regulators, environmental management professionals, statutory bodies, affected and unaffected citizen stakeholders.	PCA with Varimax rotation	3 factors identified: A. Don't trust the industry; B. Shale gas is a bridge fuel; C. Place-protective action. Five areas of consensus identified and seven points of disagreement, primarily between A and C in agreement, and B in opposition. Only disagreement between A and C regards role of citizens in decision-making, with A supportive of citizen control and C advocating technocratic solutions.
(Matinga *et al.*, 2014)	Energy drivers in Africa energy access, efficiency, renewables, financing and targeting of solutions	European and African stakeholders			700 emails sent with Excel workbook format of Q-survey =>34 completed sorts. Mostly members of AFRETEP	Varimax rotation	4 factors. Geographical background did not influence perspectives. (but then these were all engaged in (int'l) energy work/politics?
(Setiawana and Cuppen, 2013)	Stakeholder perspectives on CCS	Indonesia	250 statements from scientific articles, online news, reports, websites etc.,	45 statements selected based on categorisation around e.g. value-chains, policy and regulation and merging of similar statements	30 respondents; Snowball sampling of stakeholders with different affiliations (national government, energy companies, academia, NGOs, international actors, media)	CFA with Varimax	Four perspectives; two contrasting (pro / con CCS); two more nuanced

(Cotton and Devine-Wright, 2011)	Energy infrastructure development	UK - SW England, Somerset	Quasi-naturalistic (interviews, secondary sources and academic literature)	structured theoretical sampling (no details) => 60 statements	25 participants from 4 communities: affected residents, stakeholders, NG representatives	not mentioned	Consensus: early public engagement in decision-making; no worry about impracticalities of participation; rights, ethical, legal considerations; satisfied with existing down-stream engagement. Dissensus: trust in engagement process, lack of info results in lack of meaningful participation, lack of trust in National Grid, place and landscape change, technology options
(Wolsink and Breukers, 2010)	stakeholder views on wind energy Institutional capacity in land allocation for wind energy	Geographical comparison of Netherlands, North-Rhine Wetphalia and England	Theoretical structured	60 statements covering spatial planning, economic considerations, environment, and each of the cultural theory factors	structured samples: key actors active in the realm of all 3 dimensions of socio-political acceptance based on Wustenhagen + all levels of governance => 56	orthogonal hand-rotation	4 factors; all 4 present in all cases, implying similarities in patterns of conflicting perspectives among international cases. *Distinctions: some more prominent in some places, marginal elsewhere; down to differing national experiences of (successful) wind power implementation
(Cuppen *et al.*, 2010)	bio energy, stakeholder dialogue Q for selection of participants in dialogue	Netherlands	Naturalistic: transcripts from stakeholder dialogue 1 year previously + public debates, secondary sources. (easy, range of ideas and opinions relatively well articulated due to substantial public debate	62 statements based on categorization of concourse statements; reduced to 60 after piloting	75 respondents recruited via newspapers/sites to identify stakeholders + earlier contacts + snowballing: academia, energy companies, sector organisations, small/medium enterprises in energy, NGOs, nat'l, reg'l, local government	CFA with Varimax rotation chosen after exploring different ways of factor extraction and rotation.	6 factors. "Actor groups" not a good proxy for perspectives (although often assumed so in studies aiming to represent stakeholder perspectives).
(Fisher and Brown, 2009)	Support and opposition to windfarm developments	Isle of Lewis	Reports, planning submissions, press releases, media articles	32 statements; mixed of factual and normative, grouped by subject area	20 respondents from relevant organisations and snowballing		Five discourses: 1) Pro local wind; economic benefits, 2) Opposite to 1; 3) Anti local wind, local environment, energy conservation; 4) Neutral, pro local decision making, pro smaller community owned projects; 5) Anti local wind, concern for tourism and environment
(Ellis, Barry and Robinson, 2007)	Public acceptance of wind farm proposals	Northern Ireland; case of offshore windfarm proposal	Naturalistic (interviews and press cuttings)	50 statements selected based on a matrix, drawing on Dryzek & Berejikian '93	71 participants (- 13 not adequately completed). Sampling not specified.	not mentioned	4 discourses: A=Anti-wind, local resister, B=Wind-supporter, siting issue, C= Anti-developer, local pragmatist, D=Economic sceptic, siting compromiser

3.5 Q-study design

There are two sampling phases to a Q-study design: the sampling of statements (Q-sample) and the sampling of participants (P-sample). The approach to each sampling phase adopted in present research is described below, after which I present my approach to data collection and analysis.

3.5.1 Q-set

A mixed approach to concourse development was pursued, drawing on both naturalistic and theory-driven collection of statements. Statements were collected from Danish and British (online) newspapers, (particularly debate sections and user comments), and social media (specifically posts and comments from relevant Facebook groups), supplemented by statements identified based on pilot interviews and a review of previous research (a list of sources used in the development of the concourse is available in Appendix 2). Approximately four hundred statements were collected and managed in the software package NVivo. An initial thematic analysis was carried out to identify themes represented in the concourse (see Appendix 3). Based on these emerging themes, Chilvers' and Longhurst's (2015) four dimensional framework was found to usefully describe the 'field of subjectivity', and was used to further categorize statements in the concourse for subsequent Q-set sampling. Chilvers and Longhurst (2015) represent energy systems as socio-material collectives made up of four interacting dimensions, including *doings*, *knowings, meanings*, and *organisings,* as elaborated below:

- *Doings* are the material aspects of a socio-technical system, including practices and actions as well as technologies.
- *Knowings* refers to knowledges, cognitive resources, competencies, and forms of appraisal. "The production of knowledge about the system and other collectives can be formal or informal, explicit or tacit and includes lay/public knowledge as well as expert analytic".
- *Meanings* consist of normative framings of issues, problematisations and visions establishing coherence within and bounding socio-technical materialities; "the formation of issues and matters of concern".

- *Organisings* concerns the "making of social order", the way systems are organised and governed. Here, logics of governance are distinguished from technologies of governance, referring to policy instruments such as regulation or economic based approaches, technologies and practices of democracy and forms of engagement.

With the sub-categorisation of 'doings' into practices and technologies, and of 'organisings' into logics and technologies of governance, respectively, six categories were used to group statements of the concourse. Highly similar statements were then refined to a single representative statement. In keeping with Q-methodological principles of full coverage, balance and non-repetition, the concourse was sampled with a conscious aim to ensure that each theme was represented. The resultant Q-set is presented in Table 2, below. Of course, the categorisation of statements according to this framework is no black-and-white exercise, and some statements could be defined with reference to multiple categories. This is inconsequential as the categorisation serves not as an analytical framework, but as an initial guide to ensure full coverage in the research instrument (the Q-set) of relevant forms of expressions.

The Q-set was reviewed by an expert in energy social science research to ensure theoretical relevance, and piloted with a small number of individuals both in Denmark and the UK, to ensure relevance and comprehension, and to assess whether any key aspects appeared to have been missed. Pilots were conducted with non-energy-expert men and women of various ages and backgrounds, to resemble likely participants in the study. Over two rounds of piloting, eight statements were dropped, and several statements were simplified to make them clearer and easier to understand.

Table 2. Q-set statements

Knowings	I would like to receive more reliable information about climate change.	1
	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	2
	I don't really think about my energy use; I have so many other things to deal with.	5
	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	25
	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	8
Doings /practice	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	3
	Reducing carbon emissions is not a personal responsibility.	4
	Climate and energy politics greatly influence who I vote for.	6
	I would definitely participate in public consultations about local energy development.	7
	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	21
	It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	14
Doings /tech	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	13
	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	11
	Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	9
	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	10
Organisings /logics	Locally owned renewable energy is good for local communities.	28
	Energy should be produced locally for local consumption.	12
	I want my local politicians to take responsibility for acting on climate change.	27
	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	29
	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	30
	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	31
Organisings /tech	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	22
	The government should provide less subsidies for renewable energy and invest that money more appropriately.	23
	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	24
	Local people should have more influence on energy planning and decisions.	20
Meanings	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	19
	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	15
	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	18
	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	26
	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	16
	No household should be unable to afford a basic level of energy use to cover their needs.	17

3.5.2 P-set

Since the Q-set (the statements) is the primary concern in Q-methodology, participant sampling and recruitment is less explicitly discussed by Q researchers, who frequently limit the description of the employed sampling strategy as based on 'purposive sampling', 'convenience sampling' and/or 'snowball sampling'. For this study, sampling was based on the principle of maximum variation. Participants were recruited from municipalities with differing socio-economic and energy profiles, and from diverse areas within each municipality (see section 4.3). Based on ethnographic principles of observation (following Davies (2008)) a mixture of demographic characteristics in the sample was pursued[3].

As this research did not aim to investigate perceptions amongst any well-delineated group, a strategy of leafletting and door-knocking was pursued. Recruitment of participants outside specified circles presents a significant challenge due the diffuse nature of the target group (Wheeler, 2012). Nonetheless, this has been demonstrated successfully in previous research (Davies, 2011; Wheeler, 2012). In a study of Fairtrade consumption, Wheeler emphasises the value of a less targeted approach to recruitment, enabling her to access 'non-participants'. This, she argues, offered valuable insight into the views of an otherwise assumed outsider status of passivity. Her observation that ethical consumption research views non-participants as passive, 'blank sheets', "to be imprinted with principles and practices of consumer-citizenship" (Wheeler, 2012, p. 10)is equally relevant in the context of energy research. Thus, while sampling of a more diffuse group presents a challenge, this is important in order to investigate views and engagements with energy beyond groups of 'ideal-typical energy citizens'.

Door knocking as a method of recruitment has been expertly documented in previous qualitative research (Davies, 2011; Hazel and Clark, 2013; Hillier *et al.*, 2014). For research not targeting particular groups, Davies (2008) suggests door knocking as a particularly appropriate method: "Where there is no bounded area or group of people to whom you want access, or where you are not interested in recruiting people from hard to

[3] Research has shown gender, age, education and income to have explanatory power in relation to attitudes towards energy and the environment (e.g. Elnakat, Gomez and Booth, 2016; Mortensen, Heiselberg and Knudstrup, 2016; Sovacool *et al.*, 2018).

reach social groups or with very specific experiences, it can be more productive (and appropriate) to contact people directly rather than through a third party". She emphasises the possibility of combining door knocking with a theoretical sampling strategy "as long as [this is] not too specific" (Davies, 2008).

Following Davies' approach, leaflets (see Appendix 4) were distributed in selected residential areas, to inform residents that I would be coming by the following week, and to provide the option to request not to be visited or to request further information. Street and house selection for distribution of leaflets was based on observations made during bicycle rides or walks around selected areas (selection of these locales is discussed in section 4.3). A few participants responded to the leaflet by SMS or email to confirm their wish to take part in the research, but most participants were recruited during a personal visit to follow up on the previously delivered leaflet. Approximately two hundred leaflets were distributed, with a total of thirty-nine participants, giving a response-rate of roughly one in five. The characteristics of the final P-set are shown in Figures 3-5. Figure 3 presents socio-demographic characteristics including gender, age, education, work status, and type of housing tenure[4]. Figures 4 and 5 show household income across participants from the UK and Denmark, respectively. Both graphs show total household income as well as household income normalised by the number of people living in the home. Some reflections on the P-set composition are included in section 3.7 in this chapter.

[4] It is likely that the way people relate with matters pertaining to energy from an everyday perspective is influenced by their housing situation, with home owners more likely to consider issues around energy efficiency and home improvements and opportunities for energy generation (e.g. solar panels), for example, than people living in rented accommodation. While recruitment was carried out with a particular view to targeting areas with high levels of rental properties to include such perspectives in the research, the vast majority of participants are home owners. This is reflected on in section 3.7 in this chapter.

Figure 3. Sociodemographic structure of the P-set

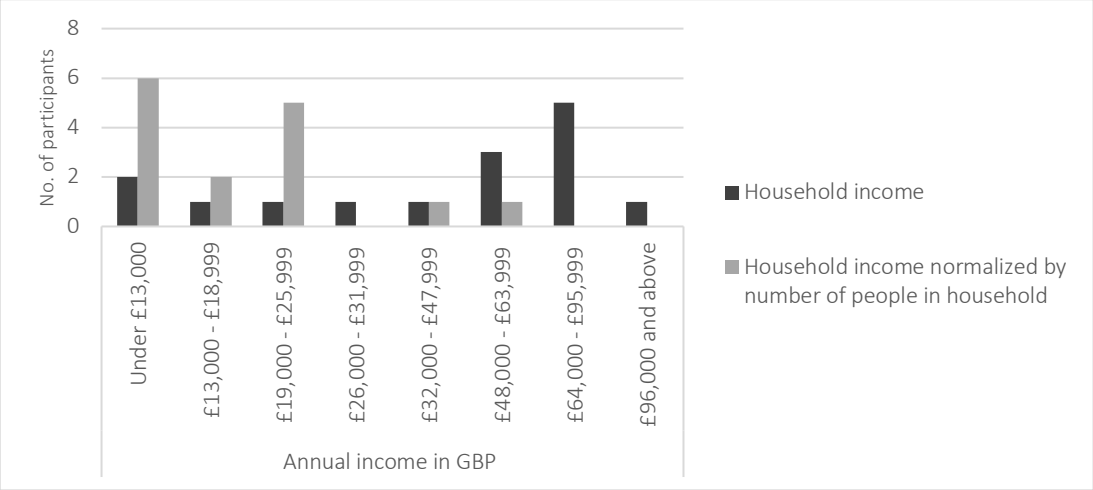


Figure 4. UK P-set: household income

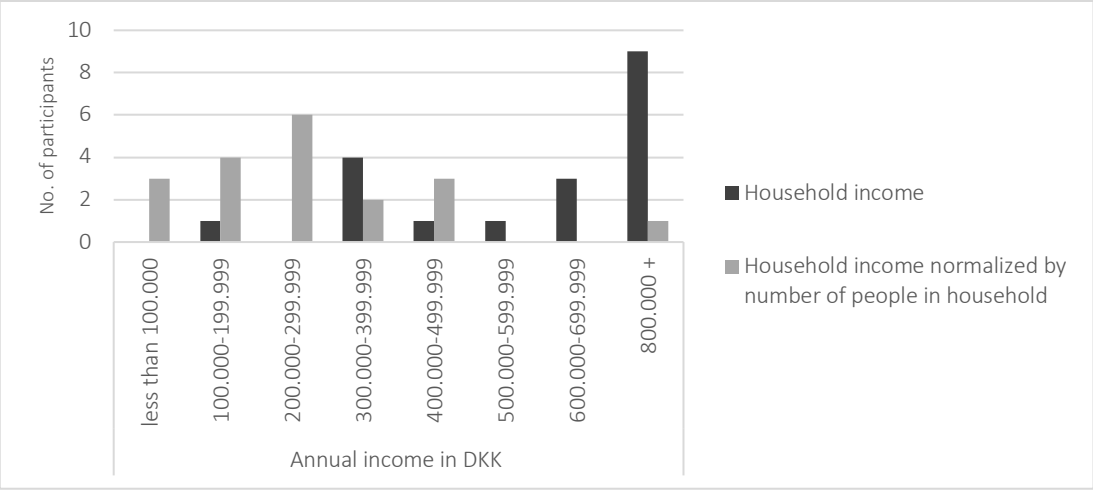


Figure 5. DK P-set: household income

3.6 Data collection & analysis

3.6.1 Data collection: Q-sorting

Q-sorts were administered face-to-face in individual interviews[5]. The sorting exercise was conducted on a tablet, using the software package *HtmlQ* (Aproxima, 2015), and consisted of five steps. First, participants were asked to complete an initial sorting exercise: participants were presented with one statement at a time, and asked to drag the statement into one of three boxes ("like my view", "neutral" or "unlike my view"). They were then asked to work their way through the three 'piles', placing statements onto the grid according to the condition of instruction (from most characteristic of my view, to most uncharacteristic of my view). Once all statements had been placed on the grid, the participant had the option to examine the structure they had created and shuffle statements around, until they were happy with the structure. After completing the Q-sort exercise, participants were asked to elaborate on their interpretation of those statements they placed at either extreme of the grid (+4, +3, -3 and -4), and to elaborate on their reasoning. Finally, participants were asked to complete a brief demographic survey.

Throughout the process, participants were encouraged to 'think aloud' and raise any questions or comments that occurred to them as they went through the sorting exercise. This allowed for the collection of rich qualitative data alongside the Q-sorts by providing opportunity for participants to reflect and comment on the statements as well as associations and considerations these inspired, and on their thought process throughout. Detailed notes on these comments as well as answers to the debriefing questions were recorded by hand in a fieldwork notebook, providing rich, qualitative data to aid the subsequent analysis and interpretation of results. Qualitative data from the Q-sort interviews was entered into NVivo and coded, first by participant, and subsequently, following factor analysis, coded by factor, so that comments from participants were coded under the factor(s) on which that participant's Q-sort loaded.

[5] Interviews and Q-sorts were conducted in Danish with Danish speaking participants, and in English with English speaking participants.

3.6.2 Data analysis

Analysis was conducted in the software package PQMethod (Schmolck, 2014b). This has been the go-to software for Q methodologists, and remains a trusted tool. While a package capable of facilitating Q-methodological factor analysis has been developed for R, this only supports PCA. Due to the conscious decision to conduct the analysis using CFA (for reasons highlighted in section 3.3.3), PQMethod was deemed the most appropriate software for the analysis. Data entry and manual calculations were managed in Microsoft Excel. Ranking data (coded to ensure anonymity) was entered in a table listing all individuals' rankings of each statement, (from -4 to 4). Demographic data was entered in a separate table. Analysis was performed on the full dataset of Danish and British participants, followed by country-level analysis to explore potential national particularities. For each analysis, the structure of the study was entered into PQ Method[6]. Rankings were then entered for each participant's Q-sort.

Centroid factor extractions were run (QCENT procedure in PQMethod) using both Brown's method for communality estimates and Horst's centroid method[7], for purposes of triangulation. Horst's method of centroid extraction was added to PQMethod to address irregularities experienced occasionally when running Brown's centroid factor extraction. As similar irregularities were observed with present dataset (when extracting more than four factors, the order of factors became random (for example, factor five explained more of the variance in the data than factor four)), analysis proceeded with Horst's method, which avoids such irregularities.

Initial statistical indicators

As explained in section 3.3.3 above, several statistical tests exist to determine the most (statistically) appropriate number of factors to extract. While present analyses were not driven by assumptions of statistical 'correctness', these tests served as a starting point for exploring the data. Although the various tests indicated differing numbers of factors to

[6] The structure of Q-study was entered into PQMethod: 31 statements, sorting grid values from -4 to 4, with a distribution as shown in Figure 2 (section 3.2.2).

[7] "Horst's Centroid method uses a somewhat more refined approach in the way the diagonal entries in the correlation matrix are estimated… [T]he final communalities are iteratively entered as diagonal entries in the initial correlation matrix" (Schmolck, 2014a).

extract (viewpoints to analyse), they all suggested that several distinct viewpoints were represented in the data. Based on these tests, the initial expectation was that a suitable factor solution would consist of between two and five factors; or in other words, that the participants in the study represented between two and five distinct viewpoints.

According to the Kaiser-Guttmann criterion, factors with an eigenvalue larger than one (EV > 1) should be extracted. Table 3 shows outputs from PCA and Horst's centroid factor extraction, respectively (unrotated). Ten components extracted by PCA, and seven factors extracted by means of Horst's centroid factor extraction passed this criterion[8]. However, this is likely an inflated estimate, as the Kaiser-Guttmann criterion typically indicates a higher number of factors than is likely to be appropriate (see section 3.3.3).

Table 3. Eigenvalues and variance of PCA and CPA solutions

	PCA (unrotated components)											Horst's centroid (unrotated factors)							
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	F1	F2	F3	F4	F5	F6	F7	F8
Eigenvalue	**17.0**	**3.7**	**2.7**	**2.2**	**1.8**	**1.3**	**1.2**	**1.1**	**1.1**	**1.0**	0.9	**16.8**	**3.4**	**2.3**	**1.9**	**1.5**	**1.0**	**1.0**	0.8
% variance explained	44	9	7	6	5	3	3	3	3	3	2	43	9	6	5	4	3	3	2

Alternatively, Horst's criterion states that factor extraction should end when the average squared residual correlation is less than one divided by the number of statements in the Q-set ($\bar{r}^2 < 1/N$). For present study, 1/N = 1/31 = 0.032. This threshold was reached already with the second extracted factor (extracted by Horst's centroid method), resulting in an $\bar{r}^2 = 0.02$[9]. Thus, based on Horst's criterion, a two-factor solution would be recommended.

Based on Humphrey's rule, a factor should be retained if the cross-product of the two highest loading Q-sorts on that factor exceeds two times the standard error. The same rule can be applied less strictly by using just the standard error. With a standard error of 0.180, one factor (F1) passed Humphrey's rule, and four factors (F1, F2, F3, F4) passed the

[8] When CFA was performed using Brown's method of extraction, just five factors pass the Kaiser-Guttmann criterion

[9] In PQMethod, Horst's centroid factor extraction can be run using either a self-selected number of factors to extract, or allowing the program to determine when to stop extracting factors according to Horst's criterion.

less strict threshold of two times the standard error ($2 \cdot 0.18 = 0.36$), as shown in the first row of Table 4.

Table 4. Humphrey's rule & significant loadings

		F1	F2	F3	F4	F5	F6
Cross-product of the 2 highest loadings		**0.771** > 0.36	**0.351** > 0.18	**-0.193** > 0.18	**0.235** > 0.18	0.164	0.118
No. of significant loadings at the 0.1 and 0.5 level	0.01	33	5	-	2	-	-
(factors with 2+ significant loadings to be retained)	0.05	37	10	6	3	3	1

Another strategy for determining number of factors to retain is to look at the number of significantly loading Q-sorts. Generally, a factor may be retained if two or more Q-sorts load significantly on that factor. For the present study, a Q-sort loading onto a factor with a loading of 0.35 or 0.46 and above, indicates that the Q-sort is significantly associated with that factor at the 0.05 or 0.01 level, respectively. As Table 4 shows (rows two and three), this would indicate the extraction of between three and five factors.

Exploring factor solutions

Based on the initial statistical investigations presented above, the initial expectation was that a suitable factor solution would consist of between two and five factors; or in other words, that the participants in the study represented between two and five distinct viewpoints. To determine which of these indicated solutions would be most relevant and best supported, CFA was run with two, three, four and five factors, respectively, and each solution varimax rotated. The rotated factor matrices were examined, and crib-sheets filled out for each. To consider the qualitative soundness of a solution, each solution was also explored with reference to the qualitative data from the Q-sort interviews.

A two-factor solution was ruled out based on a qualitative assessment, as the two factors did not satisfactorily reflect the variation observed in the data. Based on an initial 'eyeball' comparison (Watts and Stenner, 2012, p. 198) of three-, four- and five-factor solutions, these all appeared viable. An eyeball comparison looks at the total number of Q-sorts accounted for by a given factor solution (i.e. loading purely on a factor), the number of confounded Q-sorts (i.e. Q-sorts loading significantly on more than one factor), and the number on non-significant Q-sorts (not loading significantly on any factor). Table 5 shows this comparison, a break-down of loading 'behaviour' for a three-, four-, and five-factor

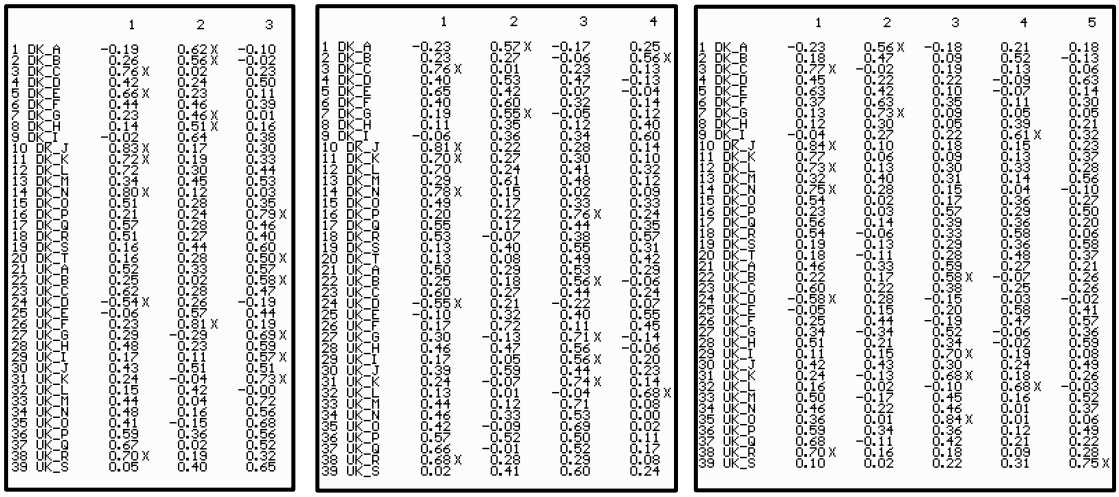
solution, respectively. All three solutions accounted for a respectable 29-30 out of 39 Q sorts, with eight mixed cases (confounded Q sorts), and one to two Q-sorts not captured by any of the factors (non-significant Q sorts).

Table 5. Eye-ball comparison of 3- 4- and 5-factor solutions

		3 factor solution	4 factor solution	5 factor solution
Number of Q sorts accounted for (purely loading Q-sorts)		**29**	**30**	**30**
Confounded	Total	**8**	**8**	**8**
	Q sort ID's	17, 21, 23, 28, 30, 34, 36, 37	4, 13, 18, 21, 28, 34, 36, 37	2, 16, 18, 21, 26, 28, 33, 36
Non-significant	Total	**2**	**1**	**1**
	Q sort ID's	4, 32	8	8

Meanwhile, adopting a stricter definition of a 'pure loading' brought the relevance of factor five, in the five-factor solution, into question, (this can be seen in Figure 6, below). Figure 6 shows the varimax rotated three, four and five-factor solutions with purely loading sorts flagged[10]. With only one significantly loading Q-sort on factor five, a five-factor solution was ruled out, but only after further qualitative scrutiny of the factor. Based on the qualitative assessment, factor five appeared to be better understood as a 'mixed viewpoint', rather than as a unique viewpoint in its own.

[10] A pure loading was here defined as a q sort loading significantly (at the 0.01 level) on a factor, with no significant loadings (at the 0.05 level) on any other factor. Thus, a purely loading Q-sort would have a loading higher than 0.46 on one factor, with loadings on all other factors below 0.35.



	1	2	3
1 DK_A	-0.19	0.62 X	-0.10
2 DK_B	0.26	0.56 X	-0.02
3 DK_C	0.76 X	0.02	0.23
4 DK_D	0.42	0.24	0.50
5 DK_E	0.66 X	0.23	0.11
6 DK_F	0.44	0.46	0.39
7 DK_G	0.23	0.46 X	0.01
8 DK_H	0.14	0.51 X	0.16
9 DK_I	-0.02	0.64	0.38
10 DR_J	0.83 X	0.17	0.30
11 DK_K	0.72 X	0.19	0.33
12 DK_L	0.72	0.30	0.44
13 DK_M	0.34	0.45	0.53
14 DK_N	0.80 X	0.12	0.03
15 DK_O	0.51	0.28	0.36
16 DK_P	0.21	0.24	0.79 X
17 DK_Q	0.57	0.28	0.46
18 DK_R	0.51	0.27	0.40
19 DK_S	0.16	0.44	0.60
20 DK_T	0.16	0.28	0.50 X
21 UK_A	0.52	0.33	0.57
22 UK_B	0.25	0.02	0.59 X
23 UK_C	0.62	0.28	0.42
24 UK_D	-0.54 X	0.26	-0.19
25 UK_E	-0.06	0.57	0.44
26 UK_F	0.23	0.81 X	0.19
27 UK_G	0.29	-0.29	0.69 X
28 UK_H	0.48	0.23	0.59
29 UK_I	0.17	0.11	0.57 X
30 UK_J	0.43	0.51	0.51
31 UK_K	0.24	-0.04	0.73 X
32 UK_L	0.15	0.42	-0.00
33 UK_M	0.44	0.04	0.72
34 UK_N	0.48	0.16	0.56
35 UK_O	0.41	-0.15	0.68
36 UK_P	0.59	0.36	0.56
37 UK_Q	0.67	0.02	0.52
38 UK_R	0.70 X	0.19	0.32
39 UK_S	0.05	0.40	0.65

	1	2	3	4
1 DK_A	-0.23	0.57 X	-0.17	0.25
2 DK_B	0.23	0.27	-0.06	0.56 X
3 DK_C	0.76 X	0.01	0.23	0.13
4 DK_D	0.40	0.53	0.47	-0.13
5 DK_E	0.65	0.42	0.07	-0.04
6 DK_F	0.40	0.60	0.32	0.14
7 DK_G	0.19	0.55 X	-0.05	0.12
8 DK_H	0.11	0.36	0.12	0.40
9 DK_I	-0.06	0.36	0.34	0.60
10 DR_J	0.81 X	0.22	0.28	0.14
11 DK_K	0.70 X	0.27	0.30	0.10
12 DK_L	0.70	0.24	0.41	0.32
13 DK_M	0.29	0.61	0.48	0.12
14 DK_N	0.78 X	0.15	0.02	0.09
15 DK_O	0.49	0.17	0.33	0.33
16 DK_P	0.20	0.22	0.76 X	0.24
17 DK_Q	0.55	0.17	0.44	0.35
18 DK_R	0.53	-0.07	0.38	0.57
19 DK_S	0.13	0.40	0.55	0.31
20 DK_T	0.13	0.08	0.49	0.42
21 UK_A	0.50	0.29	0.53	0.29
22 UK_B	0.25	0.18	0.56 X	-0.06
23 UK_C	0.60	0.27	0.44	0.24
24 UK_D	-0.55 X	0.21	-0.22	0.07
25 UK_E	-0.10	0.32	0.40	0.55
26 UK_F	0.17	0.72	0.11	0.45
27 UK_G	0.30	-0.13	0.21 X	-0.14
28 UK_H	0.46	0.47	0.56	-0.06
29 UK_I	0.17	0.05	0.56 X	0.20
30 UK_J	0.39	0.59	0.44	0.23
31 UK_K	0.24	-0.07	0.74 X	0.14
32 UK_L	0.13	0.01	-0.04	0.68 X
33 UK_M	0.44	0.12	0.71	0.08
34 UK_N	0.46	0.33	0.53	0.00
35 UK_O	0.42	-0.09	0.69	0.02
36 UK_P	0.57	0.52	0.50	0.11
37 UK_Q	0.66	-0.01	0.52	0.17
38 UK_R	0.68 X	0.28	0.29	0.08
39 UK_S	0.02	0.41	0.60	0.24

	1	2	3	4	5
1 DK_A	-0.23	0.56 X	-0.18	0.21	0.18
2 DK_B	0.18	0.47	0.09	0.52	-0.13
3 DK_C	0.77 X	-0.02	0.19	0.13	0.06
4 DK_D	0.45	0.22	0.22	-0.09	0.63
5 DK_E	0.63	0.42	0.10	-0.07	0.14
6 DK_F	0.37	0.63	0.35	0.11	0.30
7 DK_G	0.13	0.73 X	0.09	0.05	0.05
8 DK_H	0.12	0.30	0.05	0.39	0.21
9 DK_I	-0.04	0.27	0.22	0.61 X	0.32
10 DR_J	0.84 X	0.10	0.18	0.15	0.23
11 DK_K	0.77	0.06	0.09	0.13	0.37
12 DK_L	0.73 X	0.13	0.30	0.33	0.26
13 DK_M	0.32	0.40	0.31	0.14	0.56
14 DK_N	0.75 X	0.28	0.15	0.04	-0.10
15 DK_O	0.54	0.02	0.17	0.36	0.27
16 DK_P	0.23	0.03	0.57	0.29	0.50
17 DK_Q	0.56	0.14	0.39	0.36	0.20
18 DK_R	0.54	-0.06	0.33	0.58	0.06
19 DK_S	0.19	0.13	0.29	0.36	0.58
20 DK_T	0.18	-0.11	0.28	0.48	0.37
21 UK_A	0.46	0.33	0.53	0.27	0.21
22 UK_B	0.22	0.17	0.58 X	-0.07	0.26
23 UK_C	0.60	0.22	0.38	0.25	0.26
24 UK_D	-0.58 X	0.28	-0.15	0.03	-0.02
25 UK_E	-0.05	0.15	0.20	0.58	0.41
26 UK_F	0.25	0.44	-0.19	0.47	0.57
27 UK_G	0.34	-0.34	0.52	-0.06	0.36
28 UK_H	0.51	0.21	0.34	-0.02	0.59
29 UK_I	0.11	0.15	0.70 X	0.19	0.08
30 UK_J	0.42	0.43	0.30	0.24	0.49
31 UK_K	0.24	-0.13	0.68 X	0.18	0.26
32 UK_L	0.16	0.02	-0.10	0.68 X	-0.03
33 UK_M	0.50	-0.17	0.45	0.16	0.52
34 UK_N	0.46	0.22	0.46	0.01	0.37
35 UK_O	0.36	0.01	0.04 X	0.01	0.06
36 UK_P	0.59	0.34	0.36	0.12	0.48
37 UK_Q	0.68	-0.11	0.42	0.21	0.22
38 UK_R	0.70 X	0.16	0.18	0.09	0.28
39 UK_S	0.10	0.02	0.22	0.31	0.75 X

Figure 6. Excerpts from PQMethod for 3, 4 and 5-factor solutions (varimax rotated). Left: 3-factor solution. Centre: 4-factor solution. Right: 5-factor solution. Pure loadings flagged with an 'x'.

While the fourth factor has just two pure loadings, a qualitative examination of the factor suggested it captures relevant nuance in the data, otherwise lost in a three-factor solution. This is further elaborated in chapter 5. Correlations between factor scores were checked, as a measure of overlap between factors, and thus the extent to which factors represent actually distinct viewpoints. As shown in Table 6, a three-factor solution produces high correlations between Factors 1 and 2 as well as factors 1 and 3. While these can both be explained and justified qualitatively, the overall lower correlations associated with the four-factor solution is a strength of this constellation, particularly when viewed together with the explanatory power of factor four. The correlations between factor scores in the four-factor solution are generally acceptable, with the exception of a high correlation between factor 1 and factor 3. As discussed further in Chapter 5, while these two factors were found, with reference to crib sheets and qualitative data, to exhibit some overlap, they were nonetheless found to be qualitatively different, and a full qualitative analysis was able to both explain the high correlation and justify the inclusion of both as distinct viewpoints.

Table 6. Correlations between factor scores (left: 3-factor solution; right: 4-factor solution)

	F1	F2	F3	F1	F2	F3	F4
F1	1	0.3519	0.5121	1	0.0448	0.5161	0.2674
F2	0.3519	1	0.1812	0.0448	1	-0.052	0.26
F3	0.5121	0.1812	1	0.5161	-0.052	1	0.1239
F4				0.2674	0.26	0.1239	1

Finally, four factors were extracted and Varimax rotated. No further manual rotation was found necessary or relevant,[11] as all four Varimax rotated factors were interpretable and appeared to reflect the data well, and no improvements nor significant changes were achieved as result of additional manual rotation. Flagging was done based on a strict definition of a pure loading[10;12]. The final factor matrix with significant loadings (at the 0.01 level) indicated by a star (★), and flags indicated by an "x" is shown in Table 7, and the images shown in Figure 7, extracted from PQMethod, shows each of the factors plotted against each of the others, showing their relative position in the factor space. It can be seen, in Table 7, that one Q-sort (Q-sort number 8) does not load significantly onto any of the factors, indicating that this person's perspective is not well described by any of the viewpoints identified. Thirty individuals load purely on a factor, suggesting that the four factors do well in describing the views of a large majority of the participants. Eight individuals load onto more than one factor; seven loading onto two factors and one loading onto three factors. These eight individuals can be described as having more complex or mixed views, but nonetheless having significant elements in common with the types of views represented by the four factors.

Notably, factor 1 is (moderately) bipolar. As is evident from the factor loadings matrix in Table 7, Q-sort 24 loads negatively on Factor 1, with a loading of -0.55 (significant at the 0.01 level). This means that Q-sort 24 tends towards the mirror image of the factor array for F1; in other words, the individual who sorted Q-sort 24 tended to disagree strongly with statements with which individuals positively loading on Factor 1 strongly agreed, and agreed strongly with statements with which Factor 1 strongly disagreed. Meanwhile, it is important to recognise the 'negative' manifestation of a factor as a viewpoint in and of itself, not simply the negation of the 'positive' factor. Thus, a common process to facilitate interpretation of a bipolar factor is to split the factor into two distinct factors, such that only the positive loadings contribute to the calculation of the 'positive' version of the factor, and

[11] Any rotational adjustments had little impact on the structure of the factor solution, and produced higher correlations between factors, higher standard errors and lower reliability of factors.

[12] A strict flagging strategy results in more clearly distinct factors than if Q-sorts displaying more mixed loadings were also flagged (e.g. Q-sorts loading significantly (at the 0.01 level) on a factor, with no other significant loadings (at the 0.01 level). Importantly, this does not mean that non-flagged Q-sorts are disregarded, these feed into the qualitative analysis of identified factors.

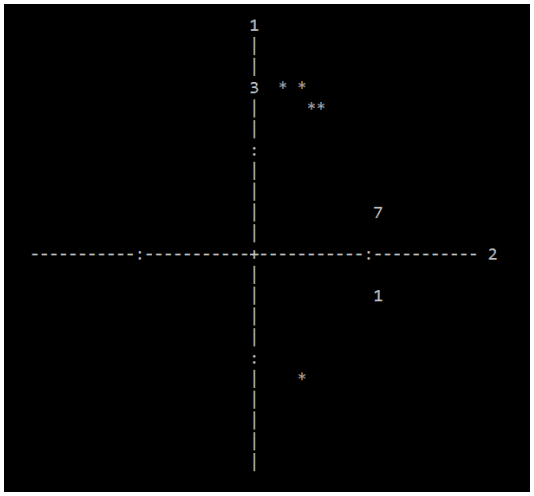
only the negative loadings contribute to the calculation of the 'negative' version of the factor[13]. However, this is commonly done only where several Q-sorts load significantly negatively on the factor (Brown, 2018). In the present study, only one Q-sort is negatively associated with Factor 1; thus, the original Q-sort 24 was analysed directly, but as a singular case will not be a central focus of the analysis and subsequent discussion. It is possible that a larger P-sample would have yielded more Q-sorts sharing this negative manifestation of Factor 1 or, alternatively, would have allowed an entirely different fifth factor to emerge.

Table 7. Final 4-factor solution. Significant loadings (at the 0.01 level) indicated by a star (*), and flagged Q-sorts (pure loadings) indicated by an "x".

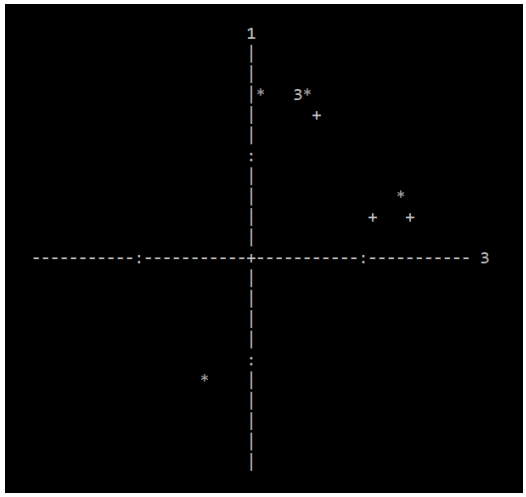
Q-sort #	Factor 1	Factor 2	Factor 3	Factor 4
1	- 0.2308	0.5732* X	- 0.1679	0.2483
2	0.2269	0.2677	- 0.0643	0.5563* X
3	0.7553* X	0.0062	0.2261	0.1281
4	0.3962	0.5263*	0.4733*	- 0.1310
5	0.6450*	0.4154	0.0678	- 0.0371
6	0.4028	0.6030*	0.3188	0.1441
7	0.1915	0.5519 *X	- 0.0537	0.1154
8	0.1077	0.3504	0.1163	0.3989
9	- 0.0646	0.3579	0.3358	0.6010*
10	0.8132* X	0.2172	0.2817	0.1390
11	0.6980 *X	0.2746	0.3043	0.1012
12	0.6998*	0.2366	0.4064	0.3158
13	0.2923	0.6096*	0.4800*	0.1238
14	0.7835 *X	0.1506	0.0233	0.0929
15	0.4930*	0.1658	0.3284	0.3316
16	0.1960	0.2243	0.7554 *X	0.2370
17	0.5537*	0.1696	0.4366	0.3528
18	0.5254*	- 0.0661	0.3809	0.5681*
19	0.1322	0.3970	0.5493*	0.3131
20	0.1293	0.0848	0.4921*	0.4171
21	0.4965*	0.2949	0.5325*	0.2880
22	0.2450	0.1844	0.5611 *X	- 0.0616
23	0.6007*	0.2726	0.4368	0.2449
24	- 0.5528 *X	0.2100	- 0.2177	0.0665
25	- 0.0995	0.3185	0.3965	0.5455*
26	0.1687	0.7170*	0.1058	0.4479
27	0.3036	- 0.1313	0.7055 *X	- 0.1391
28	0.4596	0.4747*	0.5593*	- 0.0614
29	0.1661	0.0549	0.5587 *X	0.2009
30	0.3933	0.5904*	0.4411	0.2335
31	0.2424	- 0.0667	0.7423 *X	0.1408
32	0.1309	0.0109	- 0.0378	0.6756 *X
33	0.4379	0.1187	0.7100*	0.0842
34	0.4604*	0.3310	0.5319*	0.0013
35	0.4159	- 0.0864	0.6933*	0.0177
36	0.5700*	0.5204*	0.5008*	0.1073
37	0.6611*	- 0.0071	0.5187*	0.1732
38	0.6773* X	0.2849	0.2871	0.0831
39	0.0220	0.4070	0.6001*	0.2359
% explained variance	21	12	20	9

[13] In this process, the 'negative' version of the factor is inverted, such that those originally negative loadings become positive, ensuring direct (positive) interpretability of this manifestation of the factor.

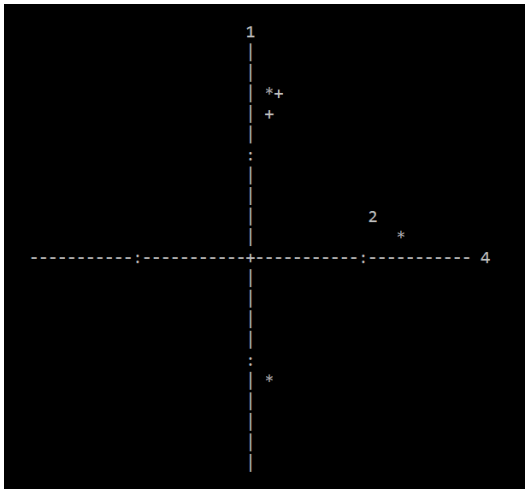
Figure 7. Factor plots for final four factor solution. Extracted from PQMethod. Each figure shows two of the factors plotted relative to one another.



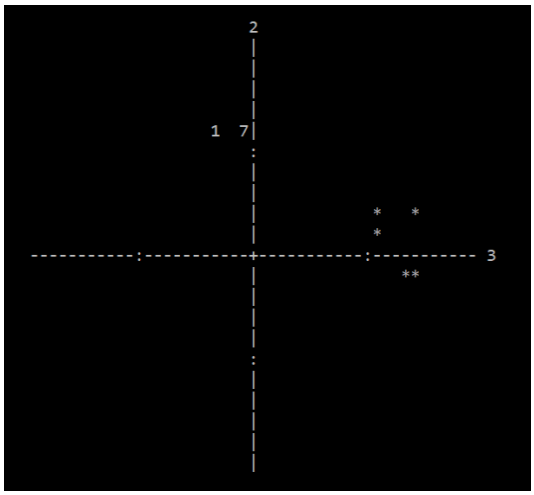
A: Factor 1 plotted against Factor 2



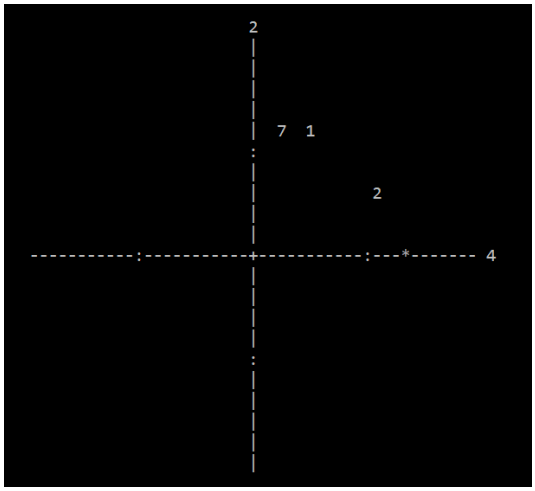
B: Factor 1 plotted against Factor 3



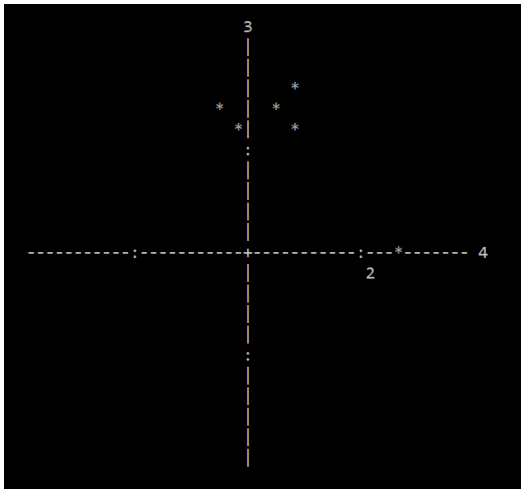
C: Factor 1 plotted against Factor 4



D: Factor 2 plotted against Factor 3



E: Factor 2 plotted against Factor 4



F: Factor 3 plotted against Factor 4

3.6.3 Factor interpretation

The qualitative data recorded during the interviews (in the form of notes taken by hand) was entered into the software package NVivo. This allowed the use of NVivo's coding and search functionality in the process of assessing the suitability of factor solutions and in the final interpretation of factors. A simple coding structure was adopted, coding individual interviews under the factor on which the corresponding Q-sort loaded, and coding mixed cases where an individual's Q-sort loaded on more than one factor. This allowed easy extraction of quotes and comments relevant for the interpretation of each factor.

3.7 Ethics, validity and limitations

3.7.1 Ethical considerations

Full ethics approval (Appendix 5) was obtained prior to data collection. Participants were informed of the nature and aims of the research project and written consent was obtained from every participant. Leaflets and letters, information sheets, consent forms as well as the Q-sorting materials were produced in Danish as well as English, and interviews were conducted in Danish and English with Danish-speaking and English-speaking participants, respectively. All participants were informed that they were free to withdraw at any time without giving reason. Anonymity of participants was ensured through coding of the data to separate all personal identifiers[14].

Previous research suggests that Q-methodology is experienced, by participants, as an engaging and empowering process (Riley, Schouten and Cahill, 2003; Burke, 2015). My experiences from the present study support this claim. Participants generally found the process interesting and engaging. Many stated their appreciation of the process as thought-provoking, and felt that they learned something, or gained a new awareness, as a result of participating. The most powerful example of this was expressed by Tina, a participant from Fredensborg Municipality in Denmark. Tina commented both during the sorting exercise and in her feedback on the method after the interview, that "this is a bit of a kick in the bum for me". While she thought of herself as environmentally conscious and trying to live

[14] A 'key' to the coded data was retained (kept confidential to the researcher and supervisors), allowing individual participants to be reconnected with their data.

sustainably, she had never considered energy as an important part of a sustainable lifestyle. Participating in this project, however, was a "kick in the bum" to start thinking about her and her family's energy use and seek out information about sustainable energy. Other participants' reflections were less action oriented, but nonetheless reflected positive experiences of participating and an effect of Q-methodology as thought-provoking and stimulating.

In terms of ethical evaluation of the research, the topic itself was not considered to be of sensitive nature, and no ethical issues were expected to arise for participants. However, upon arrival in Jutland (the location for my first round of data collection), it became clear through conversations with locals, prior to commencing recruitment and data collection, that the topic of energy is in fact a very socially sensitive topic in that region (and many others), where renewable energy development (in this case, wind energy development in particular) is the source of significant social and political conflict as well as personal stress and anxiety for some residents. This was an important (if not altogether surprising) awareness to take with me in my encounters with (potential) participants. One encounter, in particular, highlighted the sensitivity of the topic; a potential participant hesitated to commit to an interview, but agreed tentatively, on the condition that he might cancel at short notice due to the emotional stress the topic had recently – and still – caused him and his wife. That the interview went ahead was to my great appreciation; it provided valuable insights into an important and highly nuanced perspective on energy transitions. But moreover, the feedback from the participant after the interview suggested that it had also been an interesting encounter for him and had offered a safe space and a new perspective from which to revisit some of the questions and issues he and his wife had been dealing with.

3.7.2 Limitations

The choice of conducting Q-sorts on a tablet was partly motivated by logistical considerations, and consideration of convenience for participants. While Q-sorting done 'physically' with a grid printed or drawn on a physical sheet, poster or mat, and with statements printed on physical cards may be more accessible for people not used to handling a tablet, this also requires substantial amount of space (e.g. a cleared table). The use of a tablet allowed for greater flexibility to respond to the space available. This proved beneficial on numerous occasions. While there was certainly a trade-off in terms of a steeper learning

curve, for some participants, in becoming familiar with the technology, participants quickly adapted and generally expressed a positive experience and fascination with the software.

One key limitation of Q-methodology is the cognitive burden associated with reading and sorting a large number of statements around a, possibly complex, topic. A small number of participants in this study found it complicated and difficult to engage with so many statements, one of whom (confounded by frustrations using the tablet) chose to withdraw from the study. The participant provided the reason that they had had a long and tiring day and simply was not in a state of mind to focus, highlighting the concentration and cognitive demands of Q-methodology as a key limitation. However, it is my clear impression that this incident was a consequence of attempting to conduct two Q-sorts in parallel, as two individuals from the same household were interested in participating, and requested doing the Q-sort simultaneously (in the evening, after work). I proceeded with the two Q-sorts in parallel based on the awareness that Q-studies are frequently conducted in workshops with numerous participants sorting the Q-set at the same time, or online with no researcher supervision, and combinations of face-to-face and online Q-sorts within the same study are also common. In this particular case, however, the splitting of researcher attention was detrimental to the engagement of one of the two participants. For the purpose of the present study all other Q-sort interviews were conducted in strictly individual one-to-one interviews[15]. While Q-studies have been successfully conducted in other formats (e.g. workshop and online), experience from this study suggests that one-to-one engagement with Q-sorters is beneficial, both for participant experience, and for data quality. This will be of particular relevance to researchers wishing to amplify the qualitative potential of the method.

Another potential limitation of Q-methodology is the nature of the Q-sort grid requiring participants to sort statements onto a forced distribution. Several participants commented on the frustration associated with having to prioritise a limited number of statements to place at the extremes of the grid. This is a well-known phenomenon in Q-methodological research, and it is common practice to advise participants, if they, for

[15] Of the participants who completed the Q-sort, two were from the same household. They had suggested conducting the Q-sort in parallel but, on my recommendation (based on the previous unsuccessful attempt at conducting two Q-sorts in parallel), agreed to proceed individually.

example, want to place three statements in a column with only two spaces, not to worry too much about which one to move to the next column, as it is the general pattern that will be looked at, rather than the exact placement of one statement in isolation. Thus, such frustrations were anticipated, and participants were advised in accordance with common Q-methodological guidance. It was not felt that this presented an actual problem in any of the interviews, however in future research, an alternative structure could be considered for the Q-sort grid, to have more spaces at the extremes. As the Q-sorts were conducted in a qualitative interview setting, with the researcher noting and engaging with participants' thoughts ('thinking out loud'), questions and comments throughout the sorting process, such frustrations rather became a topic for further reflection by the participant. In all interviews, participants were satisfied that such reflections were documented qualitatively and would feed into the subsequent analysis. Notably, this reflects the significant qualitative dimension to the present study, and this limitation may be more significant for other formats of Q-studies (e.g. online studies and Q-sorts administered to large groups of people simultaneously, e.g. in a workshop, with limited researcher engagement and where qualitative data is limited to post-sort debriefing questions).

3.7.3 Validity & generalisability

The validity of knowledge claims, following a transactional theory of knowledge (see section 3.2.1), can be judged in terms of their relevance as warranted assertions resulting from problem-responsive social inquiry. As with much social science research, validity is closely tied to the researcher and the craftsmanship with which research is designed and conducted (Kvale, 2002). In Q-studies, validity is primarily a product of the approach to concourse- and Q-set development and the rigour of analysis.

In the present study, statements were collected for the concourse from a wide variety of sources until a point of saturation was reached (i.e. further research did not produce new themes or opinions not already captured in some form in the concourse). The Q-set was then developed to ensure representation of all major themes identified in a thematic analysis of the concourse, as well as all dimensions of an energy system from a

whole-systems perspective (section 3.5.1). Validity of the Q-set was confirmed repeatedly in participant feedback on the method and their experience of participating[16].

Three notable critiques were raised by participants in this research. One participant suggested that there were too many statements concerned with local contexts and local concerns; a critique reflecting their view of energy as a primarily national governmental issue. This was countered by another, who found statements pertaining to national government to be irrelevant. This suggests that the inclusion of both ends of the spectrum was appropriate (and notably the nature of the Q-sort does allow participants to express both indifference and complete disagreement with statements that do not reflect their view). Another participant found that the statements represented too many different themes, making it difficult to prioritise between them. This was a conscious choice in the design of the study, in order to understand how participants negotiated a wide range of issues pertaining to low-carbon energy transition. However, for the most part, participants reported that the statements reflected good coverage of relevant themes and issues, and that they found them both interesting and relevant, and were able to relate to all or most statements, in either a positive or negative fashion.

In the process of factor analysis, the researcher also makes judgements, determining the number and 'rotations' of resultant factors. Importantly, the qualitative data supplementing the q-sort data provides the researcher with participants' commentary to aid in this analysis, enabling the researcher to qualitatively check validity of the factor analysis results. Some Q-studies have included a second phase engagement with participants, presenting the researcher's analysis and interpretation of factors (viewpoints) and allowing participants to comment on and discuss these. While this is a useful way to maintain participant input throughout the process, this was beyond the scope of present research project due to time and resource restrictions. Such follow-up engagement may be particularly relevant where the purpose of a Q-study is to identify viewpoints or profiles to be used as the basis for further research or activities, as seen for example in Cuppen et al.'s

[16] After each interview, I asked the participant about their experience of the method. Feedback was not recorded word-by-word, as this was after close of the interview. Instead, I summarised a participant's reflections on the experience and the method when reviewing my interview notes upon my return from the participant's home.

use of Q-methodology for selection of participants for stakeholder dialogue (2010) and as a tool for stakeholder management (2016).

In its focus on "attitudes as attitudes rather than their demographic correlates" (Coke and Brown, 1976), Q-methodology generally does not allow generalizability of demographic relationships, nor any identification of how prevalent each factor (or viewpoint) is in the wider population. Notably, this is also not the aim. Rather, the aim is to understand the substantive patterns of subjectivities, and to identify aspects of an issue or theme likely to offer common ground across diverse viewpoints, on the one hand, and those aspects likely to generate disagreement or conflict, on the other. Where generalisability is sought, these substantive insights gained from a Q-study can be used to inform further quantitative research, to pursue more generalizable findings. For example, quantitative valuation studies in energy research could benefit from a better understanding of subjective viewpoints, or more substantive understandings of subjective values and preferences around energy development. In order to facilitate quantitative insights, valuation research must simplify the problem under study, greatly reducing complexity and nuances. Empirically grounded principles to guide this reduction is important to ensure relevance of such survey design.

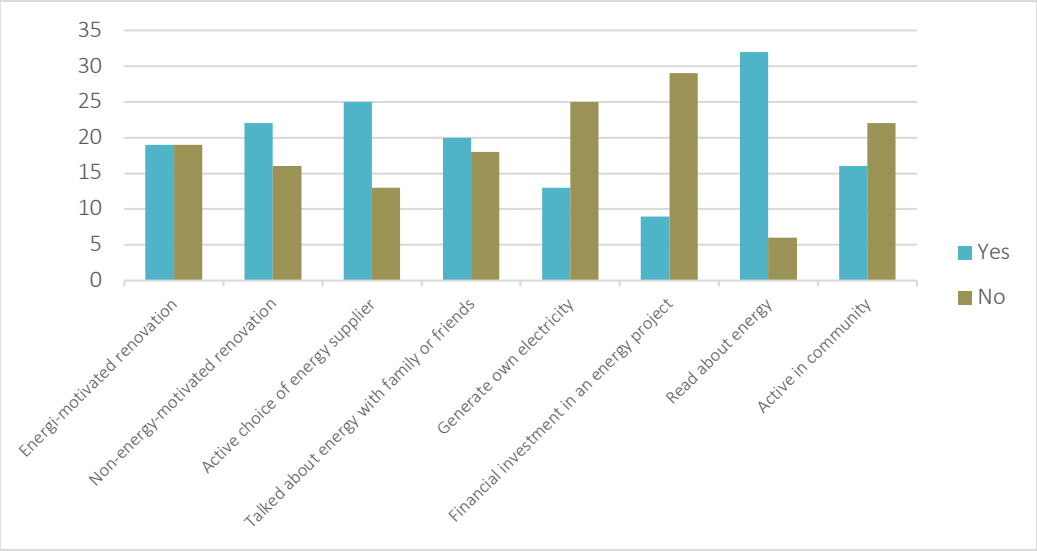
In section 3.5 and 3.6 above, I described sampling and recruitment strategies. While inclusion of participants representing various socio-demographic categories was sought, representation of different categories in the sample, as presented in Figures 3-5 (section 3.5.2), was not equal. The majority of participants were owner occupiers. This could be a reflection of a greater interest in and/or awareness of energy on the part of home owners compared to tenants (Trotta, 2018; Jansma, Gosselt and de Jong, 2020), and/or a greater prevalence of owner-occupied homes in the sampled neighbourhoods (some areas with high levels of rented properties were target specifically, but this was based on aggregated statistics, and thus there is no way of knowing what proportion of leafletted homes was rented accommodation). The dominance of participants aged 45 and above could be related to the former point. Almost all participants were parents, which could have implications for their views on climate change and, by extension, energy issues (Mortensen, Heiselberg and Knudstrup, 2016; Lawson *et al.*, 2019). Participants represent diverse educational backgrounds, albeit with a majority of participants university educated. This may be

indicative of self-selection bias suggesting that academically educated individuals were more interested in and/or felt more capable of taking part in this research project.

Here, the cognitive burden associated with Q-methodology, on the one hand, and the complexity and, for many, relative unfamiliarity with the topic, on the other, are important to note. With regards to the former, the implication for participant recruitment of the method's cognitive burden was illustrated by an encounter with an individual interested in the topic and the research project, but feeling unable to engage with the method. This individual expressed an interest in taking part, but was concerned about the requirement to read a number of statements. Upon my offer to read the statements aloud, he hesitated further and explained that he had difficulty concentrating, and ultimately declined to take part. With regards to the latter, it is likely that the sample reflects a self-selection bias based on interest in and familiarity with the topic of (renewable) energy. However, the door-to-door recruitment method proved useful in reducing this effect. A lack of knowledge of energy and being unable to 'help' with my research was a common theme encountered at the point of 'doorstep engagement'. But upon my explanation that I was particularly interested in speaking also with people with limited knowledge of energy, and upon further elaboration of the study and the method, several individuals changed their mind and agreed to take part. Similar benefits of door-knocking as a method of recruitment have been documented by Davies (2011).

The bias in the sample have implications for the generalisability of the results, however, as previously emphasised, generalisability is not the purpose of this research (or indeed of Q-methodological research in general). While variability in the sample was sought, in line with Q-methodological emphasis on maximum variation sampling, this study is not representative of the wider population, and may reflect an element of self-selection bias leading to an overrepresentation of individuals with some pre-existing interest in energy, sustainability and/or climate change. Nonetheless, this study successfully engaged individuals with varying levels of prior engagement with energy, as illustrated in Figure 8, presenting participants' responses to a set of questions included at the end of the Q-study.

Figure 8. Participants' energy engagements (full P-set)



3.8 Chapter summary

This chapter has focused on Q-methodology, its philosophical underpinnings, the procedures involved and its prior applications in energy social science research. I have elaborated on the design of the Q-study underpinning this thesis, and discussed key strengths and limitations of the method. These methodological reflections provide the basis for addressing my third research question, concerning the relevance of Q-methodology for understanding conceptualisations of energy system change from the everyday perspective of citizens. I address this question specifically in the concluding chapter (Chapter 7).

Before proceeding to present the results of the Q-study (Chapter 5), the next chapter briefly introduces the research settings. I first outline the Danish and British energy contexts, with a focus on their respective transitions to a low-carbon energy system and diverse historical developments. I then describe the selection of two localities in Denmark and two localities in the UK in which the empirical research was conducted.

CHAPTER 4

National energy contexts & field sites

Research was conducted in Denmark and the UK, to gain insight into citizens' perspectives within different national contexts of energy transitions within Europe. Both Denmark and the UK are working towards targets for carbon emission reductions and increasing renewable energy production, and the implications for and engagement of individuals in this process are, in various ways, high on their respective agendas. But while both nations have declared their commitment to fight climate change and transition to a low-carbon energy system, they are at different stages of transition, and historical developments of the energy systems differ substantially, both in technological and social respects. Below, each national context is briefly introduced, paying particular attention to roles of and implications for energy users/citizens.

Within each country, two different fieldwork sites were selected with different socio-economic profiles and energy experiences, to maximise the likelihood of including varied types of viewpoints in the Q-study. The two fieldwork sites in Denmark reflect regional, cultural and socio-economic differences between East and West and contrasting experiences of (wind) energy development. In the UK, the two fieldwork sites reflect cultural and political variations between England and Scotland, distinct socio-economic profiles, and varying extents of renewable energy development. After a brief introduction of the national energy contexts, each fieldwork site is introduced as well as my engagement with places on the ground.

4.1 Overview of the Danish and British energy contexts

According to the International Energy Agency (2017b), Danish energy policy centres on sustained political support for energy efficiency and renewable energy, holistic energy planning and broad stakeholder engagement. Pathways to a low-carbon future is a

major topic of public debate, with key themes including the role of biomass, electrification of heating, transport and other sectors and closer inter-sector integration; and the role of taxation in directing the energy sector development. By 2050, Denmark aims to be a low-emission society, independent of fossil fuels and with zero greenhouse-gas emissions (Energi- Forsynings- og Klimaministeriet, 2018). Medium-term targets include increasing renewable energy generation to meet 30% of total energy demand by 2020, and 50% by 2030, and reducing carbon emissions by 70% from 1990 levels by 2030 (Energistyrelsen, 2019). The country is on track to exceed the 2020 target, with renewables providing 35.8% of final energy consumption as of the end of 2016 (REN21, 2019).

Denmark is well-known for its high share of wind power in the energy mix, with wind power making up over 40% of electricity both generated (48% in 2018) and consumed (40.8% in 2018) (International Energy Agency, 2017b; REN21, 2019). Onshore wind dominates with over 3800 MW installed capacity in 2015, compared to 1270 MW from offshore wind, but the current Energy Agreement aims to shift the balance, aiming to reduce the number of onshore turbines by more than half by 2030 (from the approximately 4300 existing turbines to a maximum of 1850), and build three new offshore wind parks by 2030 (Energi- Forsynings- og Klimaministeriet, 2018).

District heating is the most important heating source in the residential and commercial sectors, providing almost half the total heat supply in buildings (International Energy Agency, 2017b), and supplying 64 % of Danish households (Dansk Fjernvarme, 2020). District heating systems are increasingly moving away from fossil fuels, with 52% of district heating now based on renewable energy, including solar, wind, biomass and geothermal (Dansk Fjernvarme, 2020). In 2015, 31% of final heat demand in Denmark was met by renewable district heating (REN21, 2019).

In stark contrast to the Danish context, gas central heating is the most significant source of heating in the UK, with 85% of households served by gas central heating (in 2016), and less than 2% by district heating. Heat decarbonisation is thus a key challenge for the UK in meeting its climate targets. In 2019, the UK government set a target to become carbon neutral by 2050. To achieve this long term goal, the Climate Change Act 2008 requires the Government to set five-yearly carbon budgets, twelve years in advance, from 2008 to 2050 (Priestley, 2019), identifying legally-binding targets for national carbon emission reductions. The fifth carbon budget commits the UK to a 57% reduction from 1990 levels by 2030.

According to Committee on Climate Change[17] (CCC), while the UK is set to out-perform the target of a 37% reduction by 2020, set out in the third (and current) carbon budget, the country is not on track to meet its targets for 2025, 2030 and, ultimately, the 100% emission reduction target for 2050. Emission reductions have been driven in large part by changes in electricity generation (Department for Business Energy & Industrial Strategy, 2018), in particular the shift from coal to gas and renewables, as several coal-fired power plants have come to the end of their life (Damgaard, 2019). The CCC (2019) notes that, despite consistent emission reductions from the power sector in the past decade, sustaining this progress will require more challenging measures, with the "diminishing potential to reduce emissions further by phasing out coal generation"

Furthermore, under the EU Renewable Energy Directive, the UK had committed to increasing renewable energy production to meet 15% of total energy demand by 2020 but, following Brexit, is released from this obligation. The UK government states that the climate ambitions set out in domestic law "are more stretching than our current obligations under EU law and will be maintained after we leave the EU" (Department for Business Energy & Industrial Strategy, 2019). Yet with renewable energy accounting for just 10.2% of final energy consumption in 2017 (Department for Business Energy & Industrial Strategy, 2018), major increases in renewable energy generation will be required to meet these ambitions. In line with this requirement for renewable energy development, the UK increased investment in renewable energy by 23% in 2018, making the country the largest investor in renewables in Europe (REN21, 2019).

While small-scale wind development had been growing, this started decreasing in 2017, and new investment was mainly associated with the financing of two offshore windfarms. The government aims to sustain investment in offshore wind, and expects the installation of 10 GW offshore wind capacity by 2030, more than doubling current offshore capacity.

In contrast to the focus of Danish public debate on pathways to a low-carbon future, the respective implications of biomass and electrification, and the role of taxation in directing

[17] Independent, statutory body established under the Climate Change Act 2008 to advise the government on emissions targets.

the energy sector development, the IEA (2019) identify competitiveness and rising consumer bills as top of the political agenda of the United Kingdom.

4.1.1 Transmission & Distribution

In Denmark, the national transmission networks for electricity and gas are owned and operated by the independent, government owned company, Energinet.dk, responsible for the national gas and electricity grids. There is a total of approximately 465 distribution companies across the electricity, gas, oil and district heating sectors, responsible for the distribution infrastructures. In the gas sector, four distribution companies own and operate distribution networks. Three of these (Aalborg Forsyning, HMN Gasnet and NGF Nature Energi Distribution) are municipally owned, while Dansk Gas Distribution is owned by Energinet.dk (government owned). The electricity distribution network is divided between approximately fifty-five distribution network companies (a reduction of around one third since 2005, due to mergers and acquisitions), with natural monopolies over the local distribution infrastructure. The majority of these are customer owned cooperatives, and a consistently decreasing minority are municipally owned (Moesgaard, 2012). The size of these companies varies significantly, from large consortiums servicing millions of customers, to small, local distribution networks with connection customers in the hundreds (Ministry of Energy Utilities and Climate, 2015). The recent acquisition of Radius (previously owned by Ørsted) by the consumer-owned consortium SEAS-NVE makes this the largest distribution network company, serving 2.8 million electricity customers and responsible for approximately 40% of all distributed electricity in Denmark (SEAS-NVE, 2020).

In contrast to the dominance of public and consumer ownership of the Danish transmission and distribution infrastructure for both electricity and gas, the British electricity and gas infrastructures are owned by private companies, many of which are multinationals. In the UK, the electricity transmission network is operated by National Grid (a private British multinational electricity and gas utility company), who also owns the transmission infrastructure in England and Wales. Ownership of the transmission systems in Scotland is split between the British owned SSE and Spanish owned SP Energy Networks. In contrast, the transmission infrastructure in Northern Ireland is 95 % state owned. The UK is divided into fourteen electricity distribution network regions, managed by six Distribution Network Operators (DNOs).

4.1.2 Energy supply

In the UK, forty energy supply companies (as of the end of 2015) operate in the competitive energy supply market, regulated by Ofgem, the independent National Regulatory Authority. Many of these companies supply both electricity and gas. The market is dominated by "The Big Six", the six largest energy supply companies, four of which are owned by non-British parent companies. The Big Six have a combined market share of 87% and 86% for electricity and gas, respectively (Ofgem, 2016). This market share has, however, been falling. Six 'other' suppliers have individual market shares of over 1%, (including First Utility, OVO, Utility Warehouse, Extra Energy, Co-operative Energy and Utilita). Between April 2015 and March 2016, fourteen new independent suppliers entered the domestic energy and gas market. New entrants follow a variety of business models and service strategies. Two companies are, for example, owned by local authorities, one is set up as a 'not-for-dividend' organisation, reinvesting profits, and some focus on offering low tariffs and easy switching, while others focus on renewable energy supply or smart technology and demand flexibility (Ofgem, 2016).

While the modern British energy sector is the result of privatisations initiated in the 1980s, liberalisation of the Danish electricity market is a more recent trend. Since 2003, in response to the 1996 EU liberalisation directive, Danish energy companies have been required by law to separate distribution activities from supply activities, to ensure regulation of monopoly ownership of distribution networks, while increasing competition in the supply sector. Denmark has opted for a functional separation rather than a full ownership unbundling; i.e. the separation of supply and distribution activities applies only to operation and financial management, not company ownership, leading to a complicated setup in the electricity sector (De Frie Energiselskaber, 2017). The current picture is one of consolidated companies, comprising of a parent company owning numerous child- or sister companies, engaged in activities across the supply chain, and frequently across the electricity and gas sector, as well as water supply and broadband. With a recent reform, the *Engros Model*, which entered into force in 2016, further separation is required in the form of name and logo separation.

Approximately fifty electricity supply companies operate in Denmark, in a competitive market. Customers can freely choose electricity supplier, and in recent years, an increasing number (although still small) have chosen to switch supplier. Until the *Engros*

Model reform, households and businesses were automatically supplied by the local supply company, unless they actively chose a different company. With the reform, this changes so that a local supply company is required to supply electricity to a household, *only if* the customer requests it. The aim is to encourage greater consumer engagement and active selection, and thus competition in the market.

4.1.3 Consumer ownership & community energy

The prevalence of cooperatives is an oft-cited characteristic of the Danish energy sector. Historically, the Danish distribution network has been characterized by local residents setting up cooperatives to develop the local electricity network, and as mentioned, customer owned cooperatives still constitute the majority of distribution network companies. However, a trend of consolidation has led to fewer, larger network companies (Ministry of Energy Utilities and Climate, 2015). Many of the existing energy consortiums are made up of a customer owned electricity network company (owned by the residents, who are served by the local distribution infrastructure), which in turn owns a child limited company offering electricity supply to customers locally and beyond. Interestingly, a study carried out by Userneeds (Dansk Energi, 2016) reports that, while 60 % of Danes prefer a customer ownership model for electricity network companies, only 18 % of Danes believe that this is currently the most common form of electricity network company in Denmark, despite the fact that most electricity network companies are, in fact, customer owned cooperatives. As electricity network companies serve all electricity consumers in an area (regardless of electricity supplier), that means that, in most areas of the country, all local residents are, in effect, part owners of their local electricity network company. The organisation Dansk Energi (the sector organisation for electricity network companies) has published various campaigning materials to help spread awareness of this fact and encourage customer engagement (Dansk Energi, 2014).

The *Engros Model* reform is changing the framework for communications between these companies and electricity customers. Before 2017, electricity customers received separate bills from their network company and their electricity supply company, respectively. After the implementation of the reform, however, customers now receive just one bill, from the electricity supplier, who in turn deals with the network companies. Thus, going forward, network companies will have no direct interaction with customers. What

this will mean for the future of consumer ownership and engagement in the Danish electricity sector is an open question. While the intention with the reform is to benefit customers through improved competition, this could lead to questions about the model for customer engagement, as customers no longer will be dealing directly with their local network company (Committee for the inspection of electricity regulation, 2014). Furthermore, while consumer influence is embedded in energy regulations, this has weakened over the past decade. In 1999, regulation required that the majority of board members in a network company was elected by consumers, while the current requirement is that a minimum of just two board members be elected by consumers (Larsen, Nielsen and Rieper, 2005; Ministry of Energy Utilities and Climate, 2015).

Consumer ownership also occurs at the level of energy generation, particularly in the context of renewable energy generation. In contrast to customer ownership of distribution networks, unique to Denmark, this is the case in both Denmark and the UK. Wind turbine cooperatives (vindmøllelaug) were important for the growth of wind energy in Denmark in the 1970s and 1980s. Political developments over the past two to three decades have, however, increasingly favoured commercial actors at the expense of cooperatives (Mey and Diesendorf, 2018). Mey and Diesendorf (2018) point to three policy developments with negative implications for community ownership in the Danish wind energy sector. First, the introduction, in the 1990s, of planning zones for wind energy development meant an increasingly top-down planning process with high upfront costs and was associated with a desire to cluster wind turbines, making it difficult for small actors to participate. Secondly, the repower scheme introduced by the Danish government in 2001 created favourable conditions for commercial actors, who could make attractive offers to cooperatives and take over ownership of wind turbines, causing a fall in the number of cooperatives active in the wind energy sector. Finally, Mey and Diesendorf (2018) stress the effect of neoliberal renewable energy policies in Denmark in the late 1990s and early 2000s together with EU obligations to deregulate the sector as detrimental to community wind ownership. Particularly, the increasing emphasis on support structures targeting individual financial participation in energy generation is argued to undermine collective forms of engagement such as cooperative or community ownership (Mey and Diesendorf, 2018; Gorroño-Albizu, Sperling and Djørup, 2019).

In the UK, renewable energy development has been a primarily top-down process from the beginning. Here, wind energy development, in particular, has sparked significant public debate, frequently characterized by public opposition. While this has previously been explained with reference to NIMBYism, it is increasingly understood to be a consequence of poor public engagement. More generally speaking, the top-down nature of many (wind) energy projects and the primarily corporate and foreign ownership model may be an additional explanatory factor of public opposition. However, bottom-up models of renewable energy development are increasingly being encouraged by the British governments (especially the Scottish government)(Bauwens, Gotchev and Holstenkamp, 2016; International Energy Agency, 2019). Community energy has thus made it onto the political agenda and is increasingly presented as an important factor in the low-carbon energy transition. Yet, community energy still makes up only a small fraction of the British energy sector, which remains characterized by high levels of concentration in the hands of 'the big six' energy companies.

4.2 Renewables and geographical disparities

The density of onshore wind turbines in Denmark has increased significantly over the past four decades. Increased numbers of turbines means more people living in the vicinity of wind turbines, and in addition, the increased size of modern high-capacity turbines means that turbines are visible (and audible) across greater distances[18]. Modern wind turbines are of significantly higher capacity than in the early days of Danish wind energy development, and correspondingly, of larger size – and greater capital investment requirements. This is evident in Figure 9, which documents the developments in wind energy project capacity from 1990 (when the wind energy landscape was made up primarily of installations of less than 500 kW capacity) to 2015 (when projects of greater than 2000 kW capacity dominate).

[18] Denmark has the second largest average turbine size in the EU, with an average capacity of 3.8 MW, only second to the UK with an average capacity of 4 MW; in the UK, this is due particularly to the large proportion of offshore wind turbines (REN21, 2019).

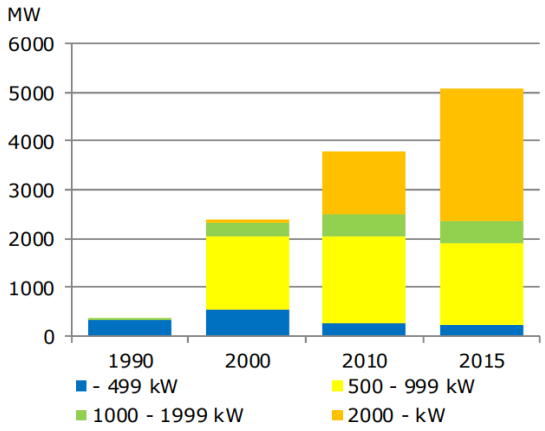


Figure 9. Developments in Danish wind energy project capacity(from Energistyrelsen, 2018c).

Notably, while most of the country has experienced these developments, wind turbines remain largely absent in the north-eastern part of Zealand, as shown in Figure 10. A study conducted by EnergiWatch (Johansen, 2017) reports on the unequal spread of wind turbines across Danish municipalities (measuring number of "wind turbine neighbours" – households living within a distance of eight times the height of a wind turbine – relative to the number of households in the municipality), with all except one of the top twenty municipalities located in Jutland.

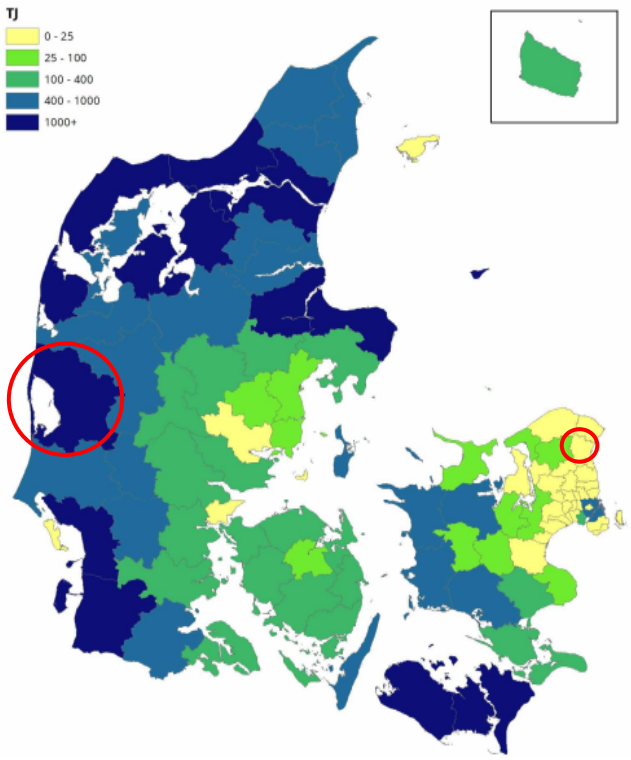


Figure 10. Wind energy generation in Denmark by municipality (adapted from Energistyrelsen, 2018c). Red rings indicate field sites.

There are multiple possible explanations for these disparities. Firstly, the wind speeds are higher in the western parts of the country than the East. Secondly, the western parts of Denmark are less densely populated than the municipalities in and around Copenhagen. As regulations require wind turbines to be located at a distance of at least four times the height of the turbine from the nearest residential neighbours, the municipality of Hørsholm in Northern Zealand, for example, explains that the absence of any land allocated for wind energy development within the municipality is down to a lack of land area fulfilling this regulatory requirement (Johansen, 2017). Yet, it is worth also noting similarities between socio-economic geographies and the distribution of wind turbines. This can be seen in Table 8, which brings together socio-economic statistics and previously mentioned ranking of turbine-neighbour ratios for some of the highest and lowest ranking municipalities in Denmark.

Table 8. Highest and lowest ranking municipalities for wind turbine neighbours and socio-demographics. (Sources: Damm and Østerman, 2017; Johansen, 2017)

	Wind turbine neighbours pr 1000 households	Employment rate (%)	Income support (%)	Education (yrs beyond 9th grade)	Average disposable income (DKK1000)
Langeland	*66.3	**69.5	*32.2	**3.0	**231
Ringkøbing-Skjern	*36.7	79.6	22.5	3.4	265
Morsø	*33.2	75.8	26.8	3.0	243
Lemvig	*29.1	78.9	22.6	**3.4	**272
Vesthimmerland	*13.8	76.1	23.9	**3.2	**245
Egedal	**0.4	*85.2	**13.6	4.3	*318
Solrød	**0.3	*82.5	14.9	4.1	*328
Greve	**0.3	80.7	17.4	3.9	304
Hørsholm	**0.0	80.5	**12.6	*5.2	*439
Fredensborg	**0.0	78.3	17.2	4.5	*315
*Amongst the 10 highest ranking municipalities in Denmark **Amongst the 10 lowest ranking municipalities in Denmark					

In the UK, the take-off of wind energy development is more recent, and has followed a different trajectory than that in Denmark. a mostly top-down approach has led to more concentrated wind energy development in the UK, with a primary focus of contemporary wind energy development on off-shore wind farms (REN21, 2019). The sector has faced substantial public opposition in the UK (West, Bailey and Winter, 2010). Compared to the geographical disparity in wind turbine density in Denmark, the UK presents a less divided picture – partly due to the overall lower density. Nonetheless, different extents of wind energy development can be observed here too. As the map in Figure 11

shows, major wind energy developments cluster in Scotland, particularly across central and southern Scotland. In contrast, the south east and west Midlands of England have seen very little wind energy development.

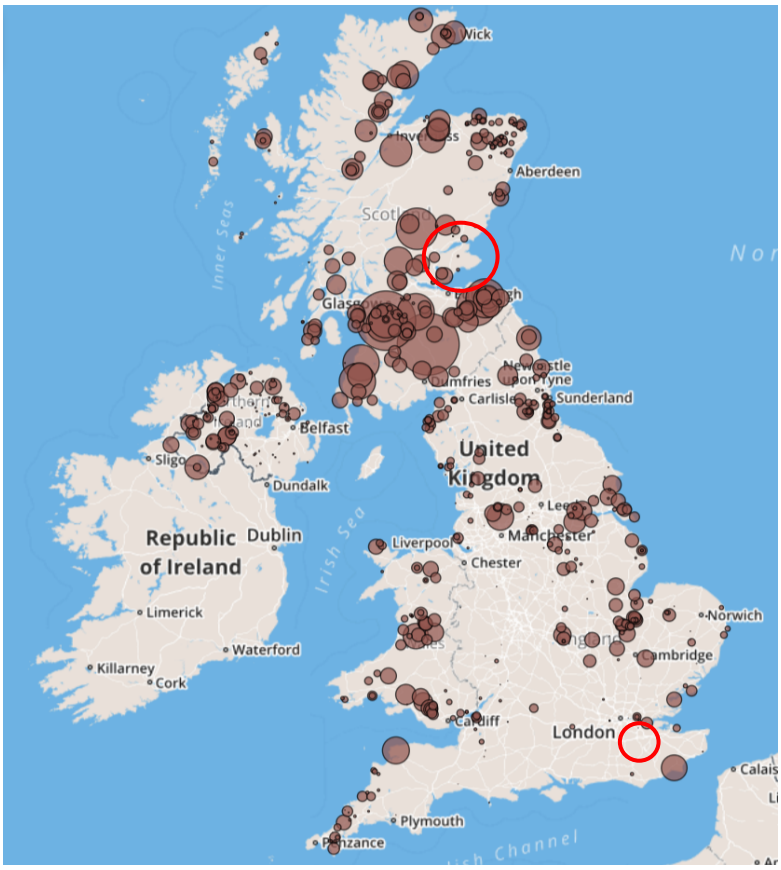


Figure 11. Locations of wind farms in the UK(adapted from Trimble, 2014 - data from DECC 2014). Red rings indicate field sites.

4.3 Fieldwork sites

Fieldwork sites were selected based on the aim of recruiting participants with varied views on the energy transition. Locations were chosen to maximise the likelihood of recruiting participants with varied socio-economic characteristics and different experiences relating to the energy system (as discussed in the previous chapter, section 3.5.2). This process involved an initial selection of two municipalities in Denmark and two councils in the UK, largely based on a review of national statistics. In Denmark, Ringkøbing-Skjern municipality on the west coast of Jutland and Fredensborg Municipality in northern Zealand were selected for their varying levels of wind energy development and diverse socio-economic profiles. In the UK, Fife on the east coast of Scotland and Tunbridge Wells in the

south east of England were selected similarly for their diverse socio-economic profiles and experiences of energy development.

The same motivation of maximum variation guided the actual process of door-to-door recruitment within each municipality/council, guided initially by micro-level statistics and based on my own engagement with local places and observations on the ground. These observations were made while cycling and walking around urban and rural neighbourhoods, paying attention to visual hints such as levels of affluence (e.g. type of car, location, type, size and appearance of home), presence/absence of energy generation technologies (necessarily limited to visible technologies such as installed solar panels or vicinity to wind turbines) and other signs of energy awareness (e.g. electric vehicle, newly renovated windows/roof), signs of age and gender (e.g. lacy curtains in the windows and other decorations), and the presence/absence of children (e.g. toys or children's bicycles in the front yard). These observations were of course a superficial and imprecise guide to enhancing variation in sampled households, but they served effectively to guide the distribution of flyers and subsequent in-person follow-ups. Below I introduce each study area in more details.

4.3.1 Field sites in Denmark

Northern Zealand: Fredensborg Municipality

Northern Zealand, the area north of Copenhagen, is the wealthiest part of Denmark. Fredensborg Municipality lies in Northern Zealand and ranks amongst the top ten municipalities in the country for average income, with an average annual income of DKK 274,358, well above the national average of DKK 229,900 (Engmann, 2019). On the other hand, the municipality also has the eighth highest rate of economic inequality, measured by the gini coefficient (Hjarsbech and Meyer, 2016), and a relatively high proportion of people living in economic poverty (KL, 2014). Fredensborg Municipality consists of four main towns and a number of rural villages and has a population of ca. 40,800.

Fredensborg Municipality is amongst the many municipalities recognised as a "climate municipality"[19], and one of a select number of municipalities recognised as "climate municipality plus"[20], with an ambitious climate change and CO2 reduction Strategy. Fredensborg Municipality gained the "climate municipality plus" status for its efforts under the Global Covenant of Mayors, to which it is signatory, and its initiatives for energy efficiency improvements in residential and commercial buildings in the municipality. Energy efficiency initiatives include an offer of free home energy advisor visits to all residents in the municipality, but uptake has been limited (Bossen, 2016). Fredensborg is meeting its obligations for emission reductions, with an average reduction of 5.6% per year since the commencement of the agreement in 2008.

Yet, the proportion of total energy consumption met by renewable energy remains low in Fredensborg Municipality. 5.4% of total energy consumption is met by renewable sources, primarily biomass (84.4%), with solar energy accounting for 15.6% of renewable energy used (Energistyrelsen, 2018a).

As for the whole of Northern Zealand (as described above), Fredensborg Municipality has seen very little wind energy development. While land has been allocated for potential future wind development, the municipality has no (registered) wind turbines. No land is allocated in the most recent local plan for large wind turbines, and while small household turbines may be allowed, the majority of the municipality is characterised by zones where household turbines are not permitted or will most likely not be permitted (Fredensborg Kommune, 2017). Moreover, the waste-to-energy plant supplying the district heating networks in Fredensborg Municipality is located in the neighbouring municipality.

[19] "Climate municipality" refers to an agreement between a municipality and the Danish Society for Nature Conservation, in which a municipality commits to reducing carbon emissions from municipal buildings and activities by a at least 2% per year, creating a CO_2 reduction strategy, and annual emissions monitoring and reporting. In 2018, 71 of Denmark's 98 municipalities were recognised as climate municipalities.

[20] Similar to the "climate municipality" agreement, "climate municipality plus" refers to an agreement between a municipality and the Danish Society for Nature Conservation, in which a municipality commits to ambitious climate initiatives beyond emission reduction targets for municipal activities, targeting also residents and companies in the municipality, and including a range of climate initiatives beyond emission reductions.

As Figures 12 and 13 indicate, Northern Zealand has also seen relatively little solar energy development, both at domestic and commercial scale, compared with the rest of the country.

Figure 12. Number of installed domestic solar panels in Denmark by municipality (adapted from Hansen, 2012). Red rings indicate field sites.

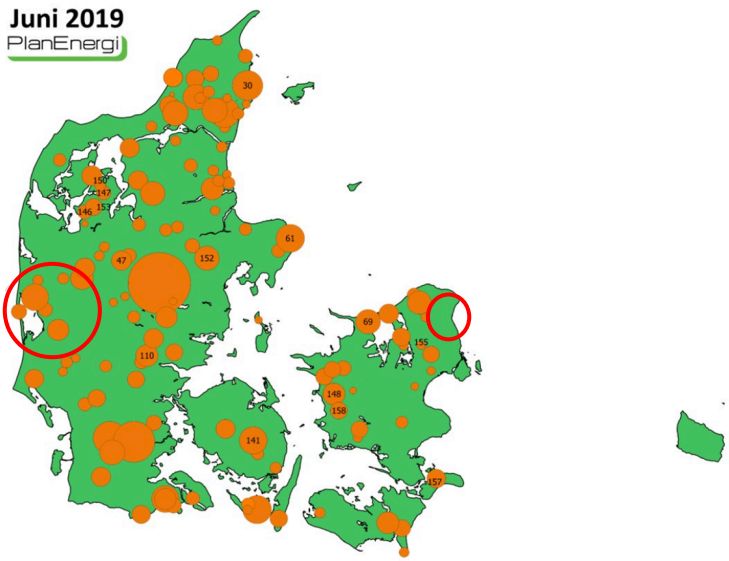


Figure 13. Commercial scale solar generation for district heating (adapted from PlanEnergi, 2019). Orange spots indicate location and capacity of solar installations; red rings indicated field sites.

In addition to energy efficiency of the building stock, Fredensborg Municipality is focused on decarbonising heat supply, with the aim that all fossil-fuel based heating systems (gas and oil central heating) will be replaced with district heating or heat pumps by the end of 2020 (Fredensborg Kommune, 2019). District heating accounts for the biggest part of heating needs, covering 46.6% of heat consumption in the municipality (Energistyrelsen, 2018a). Together with four neighbouring municipalities, Fredensborg is co-owner of the municipally owned waste management and energy supply company, Norfors, supplying district heating to two of the four towns in the municipality, with plans to expand the district heating networks to cover the two remaining towns (Fredensborg Kommune, 2017). Approximately 20% of heat demand is located in rural areas, where individual solutions such as heat pumps are being promoted to replace existing individual heating solutions (65% of which is oil based (Fredensborg Kommune, 2017)).

For the purpose of participant recruitment, a mix of rural and urban areas were targeted. Leaflets were distributed in two rural villages as well as homes in the surrounding countryside, and in four town locations (three in central Kokkedal and an affluent area on the outskirts of Kokkedal on the coast). Flyers were distributed in areas characterised by different forms of heat supply, as identified based on Fredensborg Municipality's interactive map service (Fredensborg Kommune, no date), and by different socio-demographic characteristics, based on a previously publicly available small-unit mapping service from Geomatics (now-discontinued).

Western Jutland: Ringkøbing-Skjern Municipality

Jutland, particularly the west coast, represents a different story of wind energy development to that of northern Zealand, as discussed above. On the west coast of Jutland lies Ringkøbing-Skjern Municipality, the geographically largest municipality in Denmark, with a population of roughly 57,000. Approximately half of the population live in the urban areas of the five main towns, and the other half in villages and in the countryside. On average, residents in Ringkøbing-Skjern Municipality have a lower educational attainment compared to the rest of the country, with an average of 3.4 years of further education past 9th grade (Damm and Østerman, 2017). With an average disposable income of DKK 218,399 per year, Ringkøbing-Skjern Municipality lies below the national average of DKK 229,900 (Engmann, 2019).

While Ringkøbing-Skjern is not a 'climate municipality', it is signed up to the Covenant of Mayors and has an ambitious energy and climate strategy under its programme "Nature's Realm" (Naturens Rige) (Ringkøbing-Skjern Kommune, 2019c). In 2008, the Municipality introduced the Energy2020 strategy, committing to becoming 100% self-sufficient with renewable energy by 2020, and 100% fossil fuel free by 2040. The Energy2020 strategy set out six focus areas (Ringkøbing-Skjern Kommune, 2019a):

1. Efficiency: aiming for 20% reduction in heat demand through home energy checks in 1000 households, energy renovations in public buildings, phasing out of oil burners by 2030, efficiency improvements in industry.
2. Electrification: aiming for the local consumption of clean electricity from wind and solar energy and electrifying the 12 district heating networks.
3. storage and smart energy: focusing on innovation and research to improve storage and thereby maximise local renewable energy sources.
4. green transport: focusing on new transport models, the roll-out of EV charging points and conversion of public vehicle fleets to run entirely on renewable energy by 2025.
5. efficient bio-energy: aiming to become self-sufficient with biogas
6. Energy laboratory: focusing on continued innovation and the inclusion of residents and businesses

Ringkøbing-Skjern is already more than 100% self-sufficient with electricity from renewable resources (Ringkøbing-Skjern Kommune, 2019b). In 2017, 54.8% of total energy consumption was met by renewable energy, primarily from wind (85.1%) (Energistyrelsen, 2018b).

Ringkøbing-Skjern is the municipality with the second highest rate of wind turbine neighbours in Denmark, relative to number of households, with 36.66 households per 1000 (out of 25,584 households in total) living near one or more wind turbines (Johansen, 2017). Likewise, Ringkøbing-Skjern Municipality has the sixth highest number of solar panels of all municipalities in Denmark (2169 solar panels) (energinet.dk in Christensen, 2020). Of course, it has to be taken into account that Ringkøbing-Skjern is Denmark's largest municipality in size and has the fourth lowest population density, and therefore more space for renewable energy developments. As shown in Figures 12 and 13 above, the prevalence of both large-scale and domestic solar installations is higher in Ringkøbing-Skjern Municipality than in Fredensborg Municipality.

As in Fredensborg Municipality, district heating is the most important source of heating, followed by natural gas (Energistyrelsen, 2018b). The municipality aims to electrify

the district heating network to run on renewably sourced electricity, with little focus on expansion of the networks. Instead, the aim is to convert the 23.9% of heating supplied by natural gas to be based on bioenergy.

Ringkøbing-Skjern has the highest energy consumption of all municipalities in Denmark, with three times the consumption per capita as compared to Fredensborg Municipality (energinet.dk in GreenMatch, 2019). Notably, however, the public and business sectors account for the vast majority of energy consumption in Ringkøbing-Skjern municipality compared to domestic energy use (more than double), while in Fredensborg Municipality, domestic energy use dominates (approximately double the energy consumption of the public and business sectors), resulting in similar levels of domestic energy consumption per capita, between161 kWh/person and 183 kWh/person for Fredensborg and Ringkøbing-Skjern municipalities respectively.

In Ringkøbing-Skjern Municipality, participants were recruited from a mix of urban and rural locations with varied socio-demographic profiles. Selection of locations was guided by socio-demographic spatial statistics obtained from Ringkøbing-Skjern Municipality's (2016) mapping service, as well as a socio-geographic indicators obtained from a public health survey (Larsen *et al.*, 2018), which defines and maps four socio-geographic categories across the Municipality, based on education, employment status and income. Flyers were distributed in five urban locations in the town of Ringkøbing, including one area consisting of blocks of flats, and four rural area. Some rural locations were targeted specifically for their location near wind farms.

4.3.2 Field sites in the UK

South East England: Borough of Tunbridge Wells

The south east of England is amongst the most prosperous regions in the UK, home to eight of the ten top ranking local authorities on the Legatum Prosperity Index (Legatum Institute, 2016; Maltby, 2016). The Borough of Tunbridge Wells is a local council area in Kent in south East England with a population of 116,100. The majority of the population live in the urban area of Tunbridge Wells and Southborough, with approximately 43% living in rural towns and villages (Tunbridge Wells Council website). The Borough of Tunbridge Wells does not contain any of the most deprived neighbourhoods in England, ranks amongst

the 50 overall least deprived local authorities in England (Department for Communities and Local Government, 2015), and ranks 17 on the Legatum Prosperity Index.

In July 2019, Tunbridge Wells Borough Council declared a climate emergency and pledged to become carbon neutral by 2030. This has yet, however, to be reflected in local plans and strategies. While a Renewable Energy Supplementary Planning Document from 2007 sets out the expectation for all large new-builds and conversions to incorporate renewable energy technologies to off-set a minimum of 10% of expected carbon emissions (Tunbridge Wells Borough Council, 2007), the existing five year plan 2017-2022 (Tunbridge Wells Borough Council, 2017) makes no mention of climate change or energy. A new local plan is under development, with a draft (Tunbridge Wells Borough Council, 2019a) proposing an increase of the 10% requirement from 2007 to 15% of expected emissions from large newbuilds to be offset by onsite renewable energy generation. Additionally, the new draft local plan emphasises sustainable design principles for new-builds focusing on energy efficiency, and the extension of the gas network to connect the 38.6% of households in Tunbridge Wells Borough Council currently not connected.

Households not connected to the gas network in Tunbridge Wells borough rely primarily on oil, with significantly larger carbon emissions than gas. Thus, converting these homes to gas supply presents an opportunity for emission reductions. This is also driven significantly by concerns over energy poverty, as homes off the gas grid are associated with higher levels of energy poverty, partly due to fuel needs, partly due to a correlation with low levels of energy efficiency (Tunbridge Wells Borough Council, 2019b).

The domestic sector accounts for the largest proportion of energy consumption (45% compared to 31% in the transport sector and 24% in the industry and commercial sector) as well as carbon emissions, with gas dominating (64% of consumption compared to electricity 25%; and petroleum products, manufactured fuels, and coal making up the remaining 11%). Low energy efficiency is the norm across the Borough, with the majority of buildings rated D or below according to the EPC rating. While the draft plan states support for retrofit to improve efficiency in existing buildings, no concrete initiatives are proposed.

As discussed above, the southeast of England has seen relatively little wind energy development. Likewise, when examining the distribution of solar generation, developments in the southeast appear sparse (Figure 14). Thus, Tunbridge Wells as a field site represents

an area with relatively little presence of energy generation. Significant solar potential has, however, been identified, and Tunbridge Wells Borough does have three installed solar farms near Paddock Wood and Five Oak Green (collectively 30MW). Existing solar and wind energy development in the South East is dominated by large-scale projects (80% of solar and 99% of wind, of which the 91% are offshore) (Tunbridge Wells Borough Council, 2019b).

Figure 14. Solar generation sites in the UK over 0.01 MW (adapted from Trimble, 2014 - data from DECC 2014). Red rings indicate field sites.

In the Borough of Tunbridge wells, participants were recruited from a mix of urban and rural areas with varying socio-demographic profiles. Flyers were distributed in three urban locations in the town of Tunbridge Wells, two town locations in Paddock Wood (with some areas targeted specifically for their proximity to the nearby solar farm) and three rural areas.

South East Scotland: Fife

The local council area of Fife lies in the south east of Scotland, with a population of roughly 370,000. Fife consists of three major towns (Kirkcaldy, Glenrothes and Dunfermline), five mid-sized towns and a number of small towns and villages, with a rural region in the northern part and a semi-industrial region in the southern part of the council area. Fife has the third highest national share of most deprived areas in Scotland (Aberdeenshire Council, 2017), with 95 data zones falling into the most deprived quintile (Scottish Government, 2016).

Fife has long been engaged with sustainable energy, building on a history of energy expertise, first as one of Scotland's main coal mining areas, and later through involvement with the North Sea oil and gas industry. Interestingly, Fife Council was home to the last coal fire power plant in Scotland, Longannet Power Station, which was closed in 2016. This powerplant did not feature in Fife Council's carbon calculations "due to its national significance as a power generator and carbon emitter" (Fife Council, 2012, p. 4). Today, Fife Council is recognised as an energy leader in the UK for engagement with the energy transition (Tingey, Webb and Hawkey, 2017), it is home to several 'low carbon firsts', and operates numerous energy research and pilot projects. The existing planning framework documents Fife Council's diverse approach to low-carbon energy development, with significant focus on both onshore and offshore wind, biomass and district heating and a range of micro-generation technologies (Fife Council, 2012; Payne *et al.*, 2020).

Yet, meeting renewable energy targets remains a challenge. Fife is one of Scotland's three largest energy consuming local authorities, with the majority of energy consumption accounted for by the industrial and commercial sector (57%, compared to 25% in the domestic sector based on consumption data for 2013 (DECC, 2015)). Natural gas is the most important source of energy, meeting 46.5% of energy consumption, followed by oil (27.1%) and electricity (16.2%). In 2012, renewable sources were set to meet 38% of total electricity consumption (based on 2012 data including projects under construction and those with planning permission), meeting almost 100% of household electricity consumption in the council (Fife Council, 2012). Of this, the vast majority is based on biomass and wind (Fife Council, 2013).

Fife Council has made both national and international commitments to fighting climate change. Most recently, in September 2019, Fife Council declared a climate

emergency, and committed to decarbonise in line with the Scottish Government target of net-zero greenhouse gas emissions by 2045 (Payne *et al.*, 2020). Since 2007, Fife Council has been signed up to Scotland's Climate Change Declaration (Fife Council, 2019), committing to work with other councils and national government to achieve Scotland's climate targets, a commitment reaffirmed in 2018. In 2018, the Council also became a signatory to the Global Covenant of Mayors. Additionally, both the Scottish government and Fife council state their support for community energy, with Fife council having pioneered a project on community energy planning in the town of Burntisland, empowering residents to collaboratively develop a plan to reduce carbon footprint by 80% (Fife Council, 2017; Steen *et al.*, 2017).

Notably, energy is not an uncontroversial topic in Fife. In the past, controversies have, for example, emerged over wind turbine siting, and the Mossmorran Natural Gas Liquid and Ethylene plant receives regular criticism from local residents. Following the council's declaration of a climate emergency, activities not aligned with this position and with existing national climate targets, including the existing Mosmorran plant, as well as recent plans for new gas fired power plants, are coming under pressure (e.g. Robertson, 2020; Stark, 2020; Warrender, 2020).

Regarding participant recruitment, a mix of urban and rural areas were targeted across the northern and southern parts of the council, with varied socio-demographic profiles. Flyers were distributed in three urban areas in the town of Cowdenbeath, a number of villages and surrounding countryside. Based on spatial analysis of census data (National Records of Scotland, 2016), areas were targeted with varied levels of income and education, and different rates of fuel poor as well as owner-occupied households. Due to low response rates, even after in-person follow-ups, recruitment was expanded in a second round to include Dunfermline and surrounding countryside, as well as villages and countryside in the south-east of Fife.

4.4 Chapter summary

This chapter has given a high-level overview of the British and Danish energy contexts and their respective transitions towards more low-carbon energy systems. Differences have been highlighted with regards to ownership structures, processes of

liberalisation of the energy market and the histories of renewable energy development. Notably, recent developments in the Danish context have seen a trend of consolidation of consumer owned cooperatives (frequently cited as a unique characteristic of the Danish energy sector) into fewer, larger consortiums, with low levels of awareness amongst citizens of the cooperative nature of these companies. Likewise, renewable energy development is increasingly characterised by large-scale developments, with recent policy developments favouring large commercial actors over small-scale cooperative energy projects. Conversely, in the UK, community energy is receiving increasing attention as a supplement to historically top-down energy developments.

As demonstrated in this chapter, both countries are characterised by geographically uneven renewable energy development. This, together with socio-economic factors drove the selection of two local authorities in each country for participant recruitment. In Denmark, research was conducted in Fredensborg Municipality in Northern Zealand (an area of relatively high levels of income and education with no wind energy development or large-scale solar energy generation) and Ringkøbing-Skjern Municipality (an area with high density of wind energy development as well as large-scale solar, and with average income and level of education below the national average). In the UK, research was conducted in the Borough of Tunbridge Wells in the south east of England (a relatively prosperous area where large scale renewable energy generation is largely absent) and in Fife in the south east of Scotland (an area with a high proportion of deprivation, where energy generation has played a significant role, with a history of coal mining and an increasing focus, today, on renewable energy generation).

The rationale underpinning site selection was to engage participants with varying socio-economic backgrounds as well as diverse experiences of energy and the low-carbon transition (as discussed in section 3.5.2 in the previous chapter). Having thus introduced the research context and field sites in which the Q-study was conducted, the next chapter presents key findings of the research.

CHAPTER 5

Findings: citizens' perspectives on energy transitions

In this chapter, I present my analyses of the Q-study conducted with participants in the UK and Denmark. These analyses are based on factors identified through Q-factor analysis, as explained in Chapter 3. I thus begin the chapter by outlining four 'meta-factors' ('meta-perspectives') identified through Q-factor analysis of Q-sorts from Denmark and the UK, combined. The perspectives represented by these four meta-factors are labelled *politically oriented* (F1), *market-oriented* (F2), *community oriented* (F3) and *system critical* (F4), respectively. These perspectives provide the basis for further analysis and interpretation in section 5.2. Finally, in section 5.3, I present key points from country level Q-factor analyses.

Throughout this chapter, relationality features as a central theme emerging across viewpoints, both as a social condition, characterising existence within the energy system, and as a basis for ethical reasoning. Both differences and commonalities across the four perspectives are analysed with reference to this theme of relationality. In section 5.1, I show how the four perspectives foreground embeddedness in different relations, illustrated with reference to diverse perceptions of and judgements about appropriate actions and solutions expressed from each of the four perspectives. In section 5.2, I then explore how relationality features as a common theme reflected in the ethical vocabularies with which participants expressed their views. Participants' discussions are shown to be characterised by an ethical reasoning rooted in notions of relationality and (inter)dependence. This was particularly pronounced in discussions of responsibility as shared and dispersed, and in response to notions of rights and fairness as better conceived of in terms of needs and necessity, as elaborated below. These themes provide the starting point for my discussion in Chapter 6 and motivate the engagement of care ethics in rethinking 'energy citizenship' and energy ethics more broadly based in a relational ontology.

Finally, in section 5.3, I provide a country-level analysis to explore to what extent the meta-factors reflect the types of views found in Denmark and the UK respectively and whether and how such comparative analysis brings to light contextual manifestations of energy citizenships.

5.1 Four factors, four relational perspectives on energy

As explained in Chapter 3 (section 3.3), each factor in a Q-study can be described with reference to its factor array[21]. The factor arrays for each of the four identified meta-factors are presented in Table 9. These factor arrays represent 'idealised' q-sorts defining each factor, showing how each Q-set statement is scored by each factor. Based on these scores, crib sheets were completed for each factor, and comprehensive analyses of factors was conducted with reference to the qualitative data from the Q-sort interviews. summaries are presented below, while factor arrays and crib sheets are provided in Appendix 6.

Based on these analyses, the perspectives represented by the four factors are described as politically oriented (Factor 1), market-oriented (Factor 2), community oriented (Factor 3) and system critical (Factor 4), respectively. To show how my interpretation of each perspective relates to its factor array, references to key statements and their rankings by the respective factors are given in parenthesis throughout the summaries. For example, the observation that Factor 1 sees voting as the most important form of individual engagement refers to statement 6, which was ranked +3 by Factor 1, indicated in parenthesis like this: (#6 +3). Throughout this chapter, illustrative participant quotes are presented to illustrate or support interpretations. Participants are referred to by pseudonyms, together with descriptors to indicate gender (m/f[22]), country of residence (DK/UK) and factors with which their Q-sort most closely relates. For participants associated with more than one factor (mixed cases), factors are listed in the order of the strength of the association. For example, Fiona is a female participant from the UK, whose Q-sort loads most strongly on Factor 2, but also loads significantly on Factor 4, indicated in parenthesis as: (Fiona: f, UK, F2 F4).

[21] An arrangement of scores for the Q-set statements, of the same form as the Q-sort, calculated as weighted averages of Q-sorts 'loading' onto the factor

[22] All participants in this research identified as either male or female.

Table 9. Statement scores for four factors

Statement scores for each factor		F1	F2	F3	F4
1	I would like to receive more reliable information about climate change.	1	-1	0	1
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	-2	2	-1	-3
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	-1	1	-2	-2
4	Reducing carbon emissions is not a personal responsibility.	-2	-4	-4	-1
5	I don't really think about my energy use; I have so many other things to deal with.	-2	-2	-2	-4
6	Climate and energy politics greatly influence who I vote for.	3	-3	-1	-2
7	I would definitely participate in public consultations about local energy development.	1	-3	1	0
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	-3	2	-3	2
9	Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	2	2	2	4
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	-4	-2	-3	-4
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	-1	-2	1	0
12	Energy should be produced locally for local consumption.	-1	-2	2	-4
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	-2	1	0	-2
14	It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	-1	-1	-4	1
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	-1	-2	0	3
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	-4	0	-1	-1
17	No household should be unable to afford a basic level of energy use to cover their needs.	1	0	4	2
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	0	2	-2	0
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	2	2	-2	2
20	Local people should have more influence on energy planning and decisions.	0	-2	0	1
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	0	0	3	0
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	3	1	1	-1
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	-3	3	-1	3
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	2	4	0	-1
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	0	4	2	3
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	4	0	4	2
27	I want my local politicians to take responsibility for acting on climate change.	1	1	1	0
28	Locally owned renewable energy is good for local communities.	1	-1	3	-2
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	4	1	-1	1
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	0	0	1	-1
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	2	-4	2	1

5.1.1 Factor 1: Politically oriented (embedded in socio-political relations)

The view represented by factor one can be described as politically oriented. Tackling climate change is viewed as a matter of societal priority (#26 +4) and matters of energy and carbon emissions are seen as primarily collective political issues requiring political and government action. Responsibility for change in the energy system is seen as lying first and foremost with government (#29 +4), and government action – for example via provision of subsidies for renewable energy development (#23 -3) and regulation on energy efficiency (#22 +3) – is given foremost importance. This was emphasised by all participants associated with the politically oriented perspective, including several 'mixed cases'. The following quotes are good examples of this, highlighting an emphasis on legislation rather than voluntary action:

> "… legislation for change [is the only way], rather than expecting individuals or industry to do it voluntarily". *(Colin: m, UK, F1 F3)*

> "[The greatest responsibility] has to be [with government], they have to take the lead. … With energy and climate change, politicians need to make the difficult, thorny statements and decisions, even if it's not popular". *(Chris: m, UK, F1 F3)*

From the politically oriented perspective, the nature and scale of the challenge requires governments to assume primary responsibility for enacting change, providing guidelines and regulation, and for making the difficult and "thorny" statements and decisions, which may prove to be unpopular but no less necessary.

The primary role of the individual is then seen in relation to government, with voting as the most important form of individual engagement with the energy transition (#6 +3). The importance of voting was, by most participants associated with this perspective, accompanied by comments about a need for the (political) system to change in order to make low-carbon energy a reality. This comment by Jesper, about energy and climate change influencing who he votes for, is illustrative:

> "This is the absolute most important thing for me! There is a need for new thinking and a seriousness around these issues in our political system" *(Jesper: m, DK, F1)*

With the emphasis on the individual as, first and foremost, citizen in a (democratic) society, the individuals' role of energy user or consumer is considered of secondary importance. This gives rise to an ambivalent attitude towards personal responsibility (#4 -2). Personal responsibility is not dismissed, but many participants emphasised the greater responsibility of other actors, as Niels' and Colin's comments illustrate:

> "[The responsibility is] not only mine, [the need to reduce CO2 emissions] mandates some form of regulation; it's a collective issue… in need of steering from the top". *(Niels: m, DK, F1)*

> "Yes and no. That is, we all need to do as much as we can; that said, the biggest polluters are the top 40 companies, they are mainly responsible. We do need to do our share, but our share is tiny! Shifting the focus to personal responsibility is wrong". *(Colin: m, UK, F1 F3)*

A similarly ambivalent attitude is expressed around the importance of individual action and awareness of energy in the every-day. Participants associated with the politically oriented perspective disagree only slightly with the argument that making an individual effort is pointless (#14 -1), which can also be seen as a reflection of cautious or hesitant agreement (Watts and Stenner, 2012). The following quotes are representative of participants associated with the politically oriented perspective:

> "There is some truth to that. … but then again, you do have to think about it". *(Claus: m, DK, F1)*

> "Sometimes, on bad days, I agree; what is the point!? But I do come from a perspective of 'every little helps'". *(Rose: f, UK, F1)*

Thus, there is a tendency, from this perspective, to agree that a personal effort seems pointless in the grand scheme of things, and while this is not considered a justification for not making an effort, this can be seen to manifest in the level of awareness around energy in the everyday (#5 -2), as the following comments on statement # 5 (I don't really think about my energy use…) illustrate:

> "That is sadly true [laughing]… But… I do think about it to some extent…". *(Rose: f, UK, F1)*

> "I must admit, not much in the day-to-day. I am generally aware that it [my energy consumption] is too high, but I don't know what to do about it". *(Kasper: m, DK, F1)*

While disagreeing, moderately, with the statement "I don't really think about my energy use…" (#5 -2), these comments from Rose and Kasper are representative of participants associated with this perspective. Thus, while the importance of individual responsibility and behaviour is not dismissed, political and collective forms of responsibility and action appear to be valued higher, a key distinction between the politically oriented and community oriented perspective, introduced below (5.1.3).

5.1.2 Factor 2: Market oriented (embedded in market relations)

Factor 2 can be described as a market oriented perspective, representing a view of market forces and market relations as central to the energy transition. An energy transition driven by economic interests is embraced (#18 +2) (#8 +2), and the one policy instrument endorsed is energy taxation, seen to ensure that the consumer pays for the costs of their consumption of energy (#24 +4). The following comment, made in response to statement #31 on the vision of a more democratic energy system (# 31 -4), is illustrative:

> "It's an issue of expenses and revenues not fairness or equality. Everyone pays for what they get, it shouldn't be a collective thing". *(Anders: m, DK, F1)*

This view of energy as a commodity was expressed in various ways by all participants associated with this perspective, frequently emphasising price and financial incentives as the primary driver of behaviour and action (#8 ranked +3).

The market orientation of this perspective manifests in a preference for voluntary forms of action, both with regards to individual consumers, energy companies and nations. With regards to individual consumers, there is a broadly shared sentiment, amongst participants associated with the market oriented perspective, that assuming responsibility for reducing one's own energy use and carbon emissions is a valid consumer choice, but, for the most part, participants associated with this perspective do not feel compelled to do so themselves. Consider for example Mads' comment on the pointlessness of purchasing green electricity (#3 +1):

> "I understand the argument… I guess it is more a question of expressing one's opinion in relation to the energy system, expressing one's support for a green way of thinking. But I can't be bothered myself, and I don't know enough about what the money actually goes to". *(Mads: m, DK, F2 F1)*

This is also reflected in a low level of awareness around energy in the everyday. Although indicating a slight disagreement with the statement "I don't really think about my energy use…" (#5 -1), the market oriented perspective ranks this statement close to neutral, the lowest level of disagreement of all the factors. Similar to Mads' expression of being "not bothered", Gustaf's comment on everyday awareness of energy use is illustrative:

> "I try to think about it, but I won't change my lifestyle". *(Gustaf: m, DK, F2)*

It is interesting to consider these attitudes towards individual action in relation to the simultaneous emphasis, from this perspective, on personal responsibility for reducing carbon emissions (#4 -4). This seeming discrepancy can be understood as an interpretation of responsibility influenced by market-based principles of individual preference and freedom of choice, as further discussed in the next chapter (section 6.3.1).

A similar perception is reflected in the market oriented view of energy companies and their role in energy transitions. Making money is acknowledged as the fundamental objective of any company (#18 +2). Socially and environmentally responsible behaviour, on the part of energy companies, is considered commendable, but ultimately voluntary, as captured clearly in the following two comments:

> "In itself, the purpose of any company is to make money, but they should do it ethically". *(Jack: m, UK, F2 F3 F1)*

> "It has to be a private initiative. This means two things: on the one hand, industry has to take responsibility, and on the other hand, that has to happen without political interference". *(Anders: m, DK, F2)*

Finally, this emphasis on voluntary action applies internationally as well. On the one hand, this perspective sees no need to take the lead as a nation in the global fight against climate change, except to the extent that this benefits the country itself (#16 0). On the

other hand, with regards to international energy trade, responsibility for any associated risks and damages are firmly located with the exporting country or community (#19 +2):

> "It is the responsibility of the exporting party, but I guess we could take a stance". *(Felix: m, DK, F1)*

> "They could just export wind instead". *(Eva: f, DK, F2 F1)*

From the market oriented perspective, energy is seen primarily as a matter of technological development. The disagreement with the notion that there is no need to worry about climate change, as long as we develop and adopt technological solutions (#10 -2 (least disagreement across all factors)) reflects a view that development and adoption of technological solutions should happen not just gradually but needs to be accelerated and pushed. This is also reflected in a support for large-scale energy development (#11 -2). Eva's comments on technological development and about small-scale vs. large-scale energy development are particularly illustrative:

> "We have to develop technology like crazy … it really needs to be pushed and put into action" *(Eva: f, DK, F2 F1)*

> "Concentrated wind rather than small 'destructions' all over the place; better to put it all in few concentrated zones. … We need volume; it's not enough with small feel-good projects". *(Eva: f, DK, F2 F1)*

Likewise, while local opposition to the siting of large-scale renewable energy generation is considered understandable, this is seen as a question of necessity over and above concerns of fairness (#15 ; -2). These points are considered further below (5.1.5 and 5.2.2).

In line with the view of energy as a technological matter, this perspective sees energy as a matter for experts (#2 +2), not for public deliberation or democratic processes (#31 -4) (#20 -2) (#7 -3) (#6 -3), a key distinction between the market oriented perspective and the system critical perspective summarised below (5.1.4). Generally speaking, the market-oriented perspective opposes the mixing of energy issues with politics:

> "Energy should not be mixed with politics. This already dominates the political debate excessively". *(Anders: m, DK, F2)*

It follows that engagement with energy through political actions, such as voting (#6 -3) and participation in public consolations (#7 -3) are dismissed.

5.1.3 Factor 3: Community oriented (embedded in community relations)

Factor 3 reflects a locally, community oriented perspective. Similar to the politically oriented perspective, action on climate change is considered to be of utmost importance (#26 +4), but the locally oriented perspective differs in its views on how and by whom this should be achieved.

From the community oriented perspective, social wellbeing takes centre-stage, with great importance attached to the issue of affordability of energy (#17 +4). This is based on a perception of energy as a fundamental necessity and right, which also underpins a view that energy systems ought to be underpinned by democratic values and practices (#31 +2), in order to ensure equal and affordable access to energy. Consider, for example, Bill's comment on affordability, and Ian's and Max' interpretations of a democratic energy system:

> "This is an important point; it's a fundamental right, we can't have people unable to afford energy!" *(Bill: m, UK, F3)*

> "People living on this earth all have the same entitlements; that is something that needs much more attention". *(Ian: m, UK, F3)*

> "For me, a democratic energy system is necessary to [ensure] that no one should be without energy". *(Max: m, UK, F3 F1)*

Alongside this perception of a right or entitlement to energy, the community oriented perspective also stresses personal responsibility as critical in transitioning to a more sustainable energy system. Reducing carbon emissions is emphasised as a decidedly personal responsibility (#4 -4), as opposed to government responsibility (#29 -1), and the importance of individual action is stressed (#14 -4). This was emphatically expressed by all participants associated with the community oriented perspective, as the following comments illustrate:

> *"Wow; yes! It has to be a personal responsibility". (Bill: m, UK, F3)*

> *"Absolutely; everything we do has an impact. We need to control that". (Kevin: m, UK, F3)*

> *"We each have to do what we individually can". (Pia: f, DK, F3)*

This emphasis on personal responsibility and action needs to be seen in light of the community orientation of this perspective. Thus while personal responsibility and individual forms of action are prioritised, this is rooted in a local context and accompanied by collective

forms of engagement. This is evident in the uniquely positive view of local energy development (#12 +2) (#28 +3) and enthusiasm for active involvement in local energy initiatives (#21 +3).

This is in particular contrasted by the fourth – and final – perspective, as summarised below. Whereas the community oriented perspective is wholly supportive and optimistic about locally based energy developments, seeing local wellbeing and local energy development as going hand in hand, a system critical perspective presents a highly critical view of the impact of energy development on local communities.

5.1.4 Factor 4: System critical (breakdown of relations)

Factor 4 represents a critical view of current energy practices and authorities; a system critical perspective. This perspective does not immediately appear to be associated with or favouring any particular type of relation. Instead, this perspective draws attention to the imperfections or even failures or breakdowns of relations in the energy system, leading to a position of critique and distrust.

The system critical perspective is highly sceptical of expert knowledge driving decisions in the energy sector at the expense of democratic values and public participation (#2 -3). This does not, however, result in support for government regulation (#22 -1) (#24 -1) (#6 -2) (#23 +3), a political interest in energy (#6 -2) (#7 0) nor enthusiasm around local involvement in energy decision making (#20 +1) (#27 0), all of which are seen as more technocratic than democratic institutions, as discussed further below (5.1.5 and 5.2).

From this perspective, the importance of ethical considerations in energy development is centre stage (#9 +4), and fairness around location of energy generation (#15 +3) is a key concern. The system critical perspective distinguishes itself from the other three in its strong emphasis on the injustice of the disproportionately rural burden of renewable energy development. Notably, this is not a simple objection to renewable energy projects, but reflects a concern with a lack of debate around alternative solutions and the ethical aspects of siting decisions. Consider Brian's comment:

> "You can force it on people, but you cannot expect them not to raise objections." *(Brian: m, DK, F4)*

Generally, Brian accepted that energy development is a fact of modern society, and may have to be forced upon people, but emphasised the right of people to challenge these decisions and voice their concerns. Similar sentiments were voiced by other participants associated with the system critical perspective. Several participants spoke about the negative image of opponents to local energy projects, equating opposition with anti-environmentalism and the lack of nuance in these debates. These points are considered further below (see section 5.2.2).

In line with the above, the system critical perspective is highly critical of the impact of energy development on local communities (#15 +3) (#28 -2) (#12 ; -4). In contrast to the community oriented perspective, in particular, the system critical perspective represents a view that renewable energy – even if locally owned – is not (necessarily) good for local communities. Most important is a concern over potential negative implications for a community:

> "It creates severe divisions in the local community between supporters and opponents." *(Brian: m, DK, F4)*

Furthermore, all participants associated with this perspective questioned the meaning of local ownership and the motivations behind 'locally owned' projects. There are many different ways that an energy project can be claimed to be locally owned. This is often only partial local ownership, for example with an external investor and/or project manager coupled with an offer for local individuals to purchase shares in a project, or perhaps owned locally but not collectively, (e.g. by a single or select group of farmers). There is a further critical view of the motivations for these types of 'locally owned' energy projects, as expressed most comprehensively by Brian:

> "The project management is keen to have a project locally rooted, [not for the sake of the community, but] in order to avoid opposition." *(Brian: m, DK, F4)*

Ultimately, the system critical perspective is sceptical of incentives for local communities, seen as insincere bribes and empty promises:

> "it usually comes with promises of jobs and other good things, which never materialise." *(Lisa: f, UK, F4)*

The scepticism from this perspective towards the existing system and institutions manifests in a general scepticism around the relevance of government regulation for energy transitions (#22 -1) (#24 -1) (#6 -2), and in particular in a sceptical view of subsidies as motivating profiteering behaviour in the renewable energy sector (#23 +3), as further discussed below.

5.1.5 Insights on diverse forms of engagement

In this section I bring together insights from the four perspectives, introduced above, to highlight diverse forms of engagement – and disengagement – around energy. I explore further how material artefacts give rise to diverse forms of material engagement, couched in diverse ethical and political views of 'prosumption', material forms of engagement and small-scale energy development more generally.

First, based on the analysis of the four perspectives, it appears that disengagement (of one type) does not thwart engagement (of another type), and likewise, engagement (of one sort) does not predict engagement in other ways. The politically oriented and community oriented perspectives, for example, both appear to represent high levels of engagement, but differ in their prioritised modes of engagement. As shown above (5.1.1), the politically oriented perspective champions political forms of participation to hold politicians and government accountable. This manifests in a strong support for government policies around energy and climate change, but does not manifest in high levels of personal engagement with energy in the everyday. Indeed, from the politically oriented perspective, personal responsibility and individual action to reduce carbon emissions are not considered the most important principles for making the low-carbon transition a reality. Meanwhile, the community oriented perspective reflects low levels of political engagement, dismissing the role of politicians and governments, as exemplified by the following excerpts:

> "Government doesn't have particular responsibility; certainly not the greatest". *(Ian: m, UK, F3)*

> "Government may be a key driver, sure, but the problem is, they say one thing, but do something else once they're in power, plus, governments change. Besides, governments aren't elected purely on a green energy mandate… No, the greatest responsibility is with humans". (*Bill: m, UK, F3)*

Instead, as shown in the summary above (5.1.3), the community-oriented perspective attaches great importance to personal, domestic and community forms of engagement.

In contrast to both the politically and community oriented perspectives, the market oriented perspective may appear 'disengaged' due to a disinterest in or unwillingness to engage with energy transitions either in political or private practices. In addition to the disengaged attitude to energy consumption, illustrated in the summary of this perspective (5.1.2), the market-oriented perspective reflects not only a disinterest in, but a fundamental disagreement with the appropriateness of political forms of engagement around energy. Consider for example the following comments on the role of experts vs democratic principles of participation:

> "We need experts rather than majoritarian democracy when it comes to technical matters". *(Gustaf: m, DK, F2)*

And on political forms of participation, including voting and public consultations:

> "Energy should not be mixed with politics. This already dominates the political debate excessively". *(Anders: m, DK, F2).*

Yet, this perspective attaches significance to a principle of individual responsibility and emphasises voluntary action both by individual consumers and energy companies, as shown in the factor summary (5.1.2).

In turn, the 'disengagement' displayed by the system critical perspective can be interpreted as a disenchantment with current procedures and institutions in the energy system, as illustrated in section 5.1.4 above. Notably, this does not reflect a disengagement with energy per se; in fact, as shown above, participants associated with the system critical perspective express high levels of awareness and engagement in the everyday.

It is interesting to note, further, how the different perspectives manifest in attitudes towards concrete material forms of engagement and interactions with material artifacts. Reflections on material forms of engagement emerged in response to various statements, and centred particularly on solar panels, electric vehicles and debates about subsidies for renewable energy technologies. The four perspectives reflect diverse motivations and perceptions of engagement, couched in ethical and political considerations around prosumption and community energy. In the following I identify three narratives around

material engagement 1) material artifacts as a source for community engagement 2) material engagement as a means for taking individual responsibility 3) small-scale energy solutions as an unrealistic, utopian view of the energy transition. Finally, two further narratives address a problematic conflation of finance and engagement, one – characteristic of the system critical perspective – highlights subsidies for small-scale energy development as a problematic enabler of profiteering behaviour, and another reflecting on the dilemma that various forms of engagement are only available to those with the financial means to invest.

From the community oriented perspective, solar panels were frequently referred to as an attractive source of engagement with energy, on the one hand, and as something around which the community could come together, on the other. George (m, UK, F3), for example, started out talking about solar panels in relation to his own personal engagement with energy through the installation of solar panels on his roof, and proceeded to reflect on how collective generation of solar power could be an attractive way to get involved in the local community, as a focal point around which to engage with his neighbours. Similarly, Ian (m, UK, F3) reflected on the positive opportunities solar generation could offer as a way for the community to come together; opportunities regrettably missed, according to Ian, in the context of an existing, privately developed, solar farm in his local area. Other participants associated with the community-oriented view also emphasised community energy projects as attractive ways of creating local buy-in in the energy transition and encouraging local responsibility. Thus, from a community-oriented perspective, material artifacts can be understood not only as artifacts for personal engagement with energy, but as focal points for the enactment of community relations. The importance of this understanding of material artefacts is highlighted in reflections by a participant associated with the politically oriented perspective. Considering the appeal of participating in a community energy project, Rose stressed the importance of social dynamics:

> "It depends entirely on what the group is like … Such a big part of participating in anything comes down to the social dynamic". *(Rose: f, UK, F1)*

Thus, in understanding engagement in community energy projects, community relations and social dynamics may be at least as important as – if not more than – an interest in and willingness to engage with the energy project itself.

From the politically oriented perspective, material forms of engagement centre on private investment in energy technologies such as solar panels, heat pumps, electric vehicles as well as energy efficiency improvements. These are seen as easy ways to engage, given appropriate incentives from government and/or energy companies. Following a government incentive scheme for EVs and guidance around heat pumps from the local council, Niels (m, DK, F1) for example planned to purchase an EV and install a ground source heat pump, and emphasised these as ways in which he could assume personal responsibility. Similarly, Amy (f, UK, F3 F1) highlighted her purchase of an electric vehicle as a decision partially motivated by a financial incentive from an energy provider for EV charging solutions. This illustrates an understanding of material engagement as a way of engaging individually, while expecting bigger players and government to take the big steps and incentivise those smaller actions by individuals. This will be further discussed below with reference to a relational interpretation of responsibility (5.2.1).

The third 'narrative' around material engagement is perhaps more of a lack of narrative. In contrast to both the community and politically oriented perspectives, the market oriented perspective reflects a more indifferent approach to material engagement. Few comments are made relating to material artefacts of any kind. The focus from this perspective is instead directed at the need for large-scale technological solutions (as illustrated in the factor summary above (5.1.2)). Small-scale, distributed solutions, whether community energy projects or domestic solar panels, are seen as an unrealistic basis for a low-carbon energy transition.

Finally, two narratives centre on the conflation of engagement with access to finance. First, the system critical perspective represents a strong critique of subsidies as encouraging profiteering behaviour. Brian explains this sentiment:

> "There are major subsidy schemes which skew things badly in large projects." *(Brian: m, DK, F4)*

He continued to describe the ways in which government subsidy schemes create financial incentives for project developers to set up renewable energy projects at all costs, with little or no consideration of local people or communities. Furthermore, the management of subsidy schemes is critiqued:

> "The money [given through government subsidy schemes] isn't well spent; there's no real control with it, promises are made but not kept… It's not managed at all. Giving subsidies without managing what they're used for is a problem". *(Lisa: f, UK, F4)*

Similarly, Rasmus acknowledges the need for subsidy schemes and other regulations, emphasising that willing the end means willing the means. However, he argues that such schemes should be underpinned by a different logic, facilitating more decentralised solutions:

> "…but subsidies should be given differently. They shouldn't only prioritise large-scale projects; the government is scared of allowing small, decentralised solutions". *(Rasmus: m, DK, F4 F1)*

Second is a view not attributable to any particular perspective, drawing attention to a problematic conflation of engagement/responsibility and personal finance. For example, one participant reflected on the unfairness of her being able to take advantage of her pension and subsidies for pensioners to install solar panels on her roof. She emphasised that not everyone has those means, and that existing subsidy schemes may not accurately reflect need or achieve broad inclusion in energy transitions.

> "I have solar panels because I got a lumpsum of money at retirement which allowed me to make that investment and I now get cheaper electricity. And that's wrong; those who are able to invest get the cheapest electricity!" *(Rose: f, UK, F1)*

Other participants expressed similar concerns about the dependence of engagement on personal financial circumstances. For example, Bill considered the idea of locally generated energy attractive enough to be willing to pay more for locally generated electricity, but reflected on the dilemma that not everyone has the financial means to make that kind of prioritisation regardless of price:

> "I would buy energy if it was produced locally for local consumption; I would buy into that. I would even be happy to pay more … but then, I'm fortunate enough that I could do that; but what if others can't afford it…?" *(Bill: m, UK, F3)*

This consideration surfaced also in relation to energy efficiency improvements. One participant's initial reaction to a suggestion of more strict energy efficiency regulation was to wholeheartedly agree, ranking the associated Q-set statement towards the extreme end of the Q-sort grid. However, upon further reflection he moved this to the neutral column based on a recognition that not everyone is able to afford substantial home energy renovations:

> "Of course! … But then on the other hand, not everyone will be able to afford to implement it [energy efficiency improvements]… So I think I will call that one neutral, as in I both agree and disagree". *(Anders: m, DK, F2)*

> "It is easy to guide consumption through pricing, but that means that the affluent have smaller incentive than those less affluent. *(Colin: m, UK, F1 F3)*

This reflects an ambivalent attitude expressed in various contexts by other participants; an ambivalent position of both agreeing with the need for action and an acceptance that sustainable choices and actions may come at a price, while simultaneously problematising the dependence on financial resources.

These last two narratives are particularly important to consider for a more inclusive theorising of energy citizenship, as discussed further in the following chapter. An energy citizenship speaking primarily to the privileged would drastically undermine the sweeping scale at which energy transitions will/must play out. Any theory of energy citizenship must be about the plurality of forms of energy citizenship enacted by – and available to – all kinds of citizens.

More generally, these insights on the diverse modes of engagement, reflected across the four perspectives, suggest that the ways in which people engage with – and don't engage with – energy are influenced by the types of relations they most strongly associate energy with, and based on which they perceive their own roles and responsibilities in the energy system. These diverse relationalities highlight the need for a plural and relational understanding of energy citizenship; we might consider, rather than a single definition of 'the energy citizen', a tapestry of 'energy citizenships', and rather than individualistic notions

of the citizen as isolated and autonomous, understand citizens as (variously) embedded in relations.

5.2 A shared sense of relationality

Having explored diversities across the four perspectives, I turn now to a consideration of shared meaning in participants' perspectives on energy and low-carbon transition. In exploring commonalities across the four viewpoints, I draw attention to a sense of relationality present across the four perspectives. This appears both as a social condition, characterising our being within the energy system (as illustrated above, while foregrounding diverse forms of relations, they can all be interpreted as relationally embedded), and as a basis for ethical reasoning. This motivates a relational, rather than individualist, understanding of energy citizenships.

In addition to relationality as a condition of existence, participants' discussions were characterised by an ethical reasoning rooted in notions of relationality and (inter)dependence. As elaborated below, this was particularly pronounced in discussions of responsibility as shared and dispersed (5.2.1), and in response to notions of rights and fairness as better conceived of in terms of needs and necessity (5.2.2). This notion of relationality as a basis for ethical reasoning is fundamental to the subsequent discussion of care ethics in Chapter 6. This is reflected in the ethical vocabularies with which participants expressed their views.

5.2.1 Relational interpretations of responsibility

Reflections on the notion of responsibility in relation to climate change and energy transitions were extensive and nuanced. While the different types of relational viewpoints emphasise responsibilities of different actors, as shown in the summaries of the four perspectives above (5.1.1-5.1.4), there was a common sense also of responsibility, itself, as a relational notion; as shared and dispersed. It was repeatedly pointed out that responsibility for acting on climate change and reducing energy use and carbon emissions lies with everyone, collectively; from individuals responsible for their own actions to governments responsible for establishing greener frameworks and regulations. And these different levels of responsibility are related.

For example, an emphasis on government responsibility for enacting change was frequently qualified by the need for a political and regulatory framework enabling (and dependent on) other actors to act on *their* responsibilities. While particularly characteristic of the politically oriented perspective (as illustrated in section 5.1.1), this is also a key factor in explaining a number of 'mixed cases' (Q-sorts associated with more than one factor). This suggests a prevalence of this framing of responsibility also by people not otherwise associated with the politically oriented perspective. The following examples are representative of participants' framings of this relation between government and personal responsibility. First is the notion that personal responsibility is one piece of the puzzle, but that this will not be effective without government taking the big steps:

> "Personal responsibility can slowly impact the situation. Government however can take the big steps – even if it's unpopular". *(Daniel: m, DK, F2 F3 F1)*

Second is a view of government responsibility for supporting and enabling action at an individual level:

> "The government needs to legislate to create opportunities rather than limitations" *(Felix: m, DK, F2 F1)*

> "Government needs to create the frameworks; supporting steps in the right direction – that has to be regulated" *(Chris: m, UK, F1 F3)*

This speaks to a relational conception of responsibility more in tune with the origins of the term and its association with notions of responsiveness[23] than the meaning it is afforded under individualistic framings of citizenship as unidirectional individual accountability.

Moreover, this relational notion of responsibility was particularly pronounced in participants' discussions of action and responsibility in an international context. 'Leading by example', 'pioneering change', 'being a window', were some of the phrases used by

[23] Etymologically, the work "responsible" stems from the Latin "to respond". Similar the Danish equivalent: "ansvar" is made up of the two parts an (towards) and svar (answer); See Helbak (2008) for a critical discussion (in Danish) of contemporary usage of the notion of "ansvar" in contrast to its original/semantic implications.

participants to express their disagreement that their country (Denmark/the UK) does not need to take the lead in the global fight against climate change:

> "Denmark has the technological ability, we need to spread and share that, we should be a 'window'." *(Eva: f, DK, F1 F3)*
>
> "We do need to lead; the UK is one of the countries that can pioneer change!" *(Nigel: m, UK, F3 F1)*
>
> "One shouldn't underestimate the importance of one of the richest and most developed countries; Denmark is looked up to all over the world." *(Kasper: m, DK, F1)*
>
> "It's the classic dilemma of collective action; there are two ways to break that dilemma: 1) with an overarching authority (and that doesn't exist!), or 2) someone has to take the lead!" *(Colin: m, UK, F1 F3)*
>
> "Sure, in the big picture we're just a speck, we'd be going up against Trump, Russia and China. But … we can lead by example". *(Chris: m, UK, F1 F3)*
>
> "We need to show that it is possible, then even the Americans must surely start to think…" *(Rasmus: m, DK, F4 F1)*

As these quotes illustrate, an acceptance of responsibility for taking the lead – for acting despite not being the major contributor in the grand scheme of things (whether as a nation or individual) – was frequently qualified by the assumption that others will follow – will respond. Here, again, we see a conception of responsibility based in notions of relatedness and responsiveness.

In more concrete terms, a relational conception of responsibility was expressed around practices of local decision making and public consultation. On the one hand, this implies responsibilities of authorities to conduct public consultations in ways that enable effective participation and to then honour the outcome of this process. On the other hand, this implies responsibilities of local people to engage in these processes.

For some participants, in particular participants associated with the system critical perspective, these discussions were seen in light of previous experiences of local people being unable to influence decisions, or of being heard once, only for a compromise to be

overturned behind the scenes, further down the line. One participant explained how the local council had held public consultations on planning documents (as required by law), including planning regulations and zoning for future renewable energy development. Consultation responses were taken into account and the planning documents revised accordingly. But the whole process was effectively invalidated when, to suit the needs of a particular energy project "they just make supplementary planning guidelines [not subject to public consultation] to overcome the limitations set out in the earlier, publicly approved plans". Other participants mentioned similar experiences. For example, a public consultation on a wind energy development had resulted in a reduction of the number of turbines to be built, based on an assessment, at the time, of the maximum capacity of the area. The sense of a successful public consultation process leading to an acceptable compromise was, however, overshadowed by subsequent reassessments of said capacity leading to approvals of several later applications to expand on the initial number of turbines. These experiences manifest themselves in the system critical perspective as a deep distrust in the system and its institutions, and in a perception of authorities not living up to their responsibility to facilitate local involvement in energy decisions.

Meanwhile, it is also noted, both from the system critical perspective and others, that responsibility for ensuring that local people get to influence local decisions lies not only with the authorities or project developers. In the words of two participants, commenting on statement 20:

> "Yes, [local people should have more influence], but the problem is that a lot of people couldn't care less". *(Lisa: f, UK, F4)*

> "I am often disappointed by the lack of engagement. One may not be particularly keen, but one damn well has to [take part]". *(Rasmus: m, DK, F4 F1)*

In short, local engagement in energy decision-making depends on all actors living up to their respective responsibilities; from ensuring and enforcing proper procedures and ensuring that participation is accessible (both regarding written information materials and 'live' debates), to local residents taking an interest and actively taking part.

5.2.2 Need, necessity and dependence: an ethical vocabulary

As well as shared and dispersed, responsibility was frequently discussed in terms of necessity, as an ethical obligation rooted in the simple fact that society and/or the planet depends on it. A sense of responsibility associated with a need is particularly pronounced from the politically and community oriented perspectives. The question is not whether individuals are responsible for carbon emission reductions, or whether it is right or fair to expect Denmark/the UK to take responsibility and lead in the transition to low-carbon energy systems, it is a matter of *necessity* that all actors (from individual people to national governments) act.

> "We have this planet on loan, and we must not burn it up." *(Karin: f, DK, F1 F3 F4)*

> "Everyone needs to understand we're using way more energy than the planet can deal with, so we drastically need to minimise energy use" *(Colin: m, UK, F1 F3)*

> This world is going down the pan. People don't realise what's happening for the sake of satisfying people's greed. Something must be done". *(Amy: f, UK, F3 F1)*

> "For future generations, we can't just say we couldn't afford to act". *(Pauline: f, UK, F1 F2 F3)*

> "If we don't do anything about climate change, we'll be in big trouble". *(Hellen: f, UK, F3 F2 F1)*

> "We have to get people to understand that, regardless of technology, there are choices to be made. We have to discuss supposed truths such as growth. We need new ways of thinking … We have an ethical obligation to act." *(Eva: f, DK, F1 F2)*

> "Doing nothing is just not an option; we need to get our priorities right. for mankind; it's a global issue." *(Kevin: m, UK, F3)*

Thus, responsibility is not a negotiable question, it is a matter of recognising the necessity of action and stepping up. This is an understanding of responsibility arising not from a higher

moral order but out of our collective dependence on action – on the taking of responsibility – for ensuring a liveable environment and climate.

Across the different perspectives, this sense of (inter)dependence gives rise to ethical sensibilities not rooted in moral truisms but in the fact of our relational existence. This was reflected in participants' discussions of ethical considerations relying more on notions of needs and necessity than established principles of rights and fairness. This suggests that a language of rights and justice may not resonate closely with ethicalities of energy in transition as understood and experienced by citizens on the ground. From questions of siting to issues of affordability and participation, participants gave expression to ethical considerations not well captured by rights-based theories of justice. As explored below, discrepancies appear in relation to the very language of rights and fairness and to the individualism inherent to such theories.

Out of all thirty-nine participants, just three invoked a language of 'rights': one considered energy to be "almost a basic human right", another emphasised the services to which energy are put – heating, lighting, cooking – as basic human rights. Yet for most participants, the notions of needs, necessity and dependence were central to discussions emerging around affordability and access to energy. On the one hand, energy was stressed, by many, as a "basic need", a service upon which everyone in modern society depends and therefore should be able to afford.

> "Absolutely. Guaranteed supply is absolutely vital. I can't imagine what it would be like otherwise". *(Fiona: f, UK, F2 F4)*
>
> "Everything in our daily lives requires energy; not to mention hospitals, industry and workplaces". *(Pauline: f, UK, F1 F2 F3)*
>
> "We need energy twenty-four hours, seven days a week". *(Jack: m, UK, F2 F3 F1)*
>
> "In our society, we are dependent on access to energy, so we have to ensure that everyone is able to afford it". *(Pia: f, DK, F3)*
>
> "goes without saying - it's a basic need, rich or poor." *(Emma: f, UK, F4 F3)*

On the other hand, the notion of 'need' as giving rise to a right to energy was repeatedly problematised, as exemplified in the quotes below:

> "That depends how big the need is, what does 'need' even mean?" *(Eva: f, DK, F1 F2)*

> "What are 'basic needs'? We have an absurd view of 'needs' [in today's society]". *(Jesper: m, DK, F1)*

> "What is 'basic' and what are 'needs'? Then we'll have to start discussing what that means." *(Lisa: f, UK, F4)*

> "Most people understand 'basic needs' as more than what I would" *(Mads: m, DK, F2 F3)*

This questioning of the meaning of 'needs' raises important questions about the appropriateness of a universalist rights-based ethical vocabulary, as further discussed in the following chapter.

Moreover, this readiness to question the notion of needs was linked by many participants to a discussion over the extent to which energy security should be the foremost priority for energy development. In particular from the politically oriented perspective, security of supply is not seen as a key priority, not because it is not considered important for the functioning of society, but because this does not have to be the primary goal of an energy transition:

> "It is important, but not necessarily the highest priority". *(Oskar: m, UK, F1 F2 F3)*

> "I do think it's critical, but I think we could adapt; we take it for granted, and don't necessarily need to". *(Rose: f, UK, F1)*

> "It is possible to deal with blackouts, but it would require big changes. I used to live in a village on the west coast, where there were frequent winter blackouts; the community had adapted to that in a place like that, but of course, many places are not currently prepared for something like that". *(Colin: m, UK, F1 F3)*

As these comments indicate, while acknowledging security of supply as an absolute necessity in society as we know it, some participants consider that in the context of a low-carbon energy transition, we may need to adapt, to rethink 'supposed truths' and existing ways of prioritising.

In addition to discussions over needs and rights, an appreciation of necessity motivated critical discussions of the appropriateness of fairness as a principle for judging energy practices and developments. Fairness was discussed, in particular, in the context of the siting of renewable energy generation. Questions of fairness/unfairness with regards to siting decisions were, from the perspectives of factors 1 and 2, not considered relevant questions for debate due to the simple necessity of their location somewhere. "It may be inconvenient, but it is necessary" was heard in various formulations; "it's probably something we just have to live with". The green transition "requires compromise", as one person associated with the politically oriented perspective stated, "one has to see the bigger picture". This does not appear as a general rejection of debate about energy decisions – including siting – and the ethicalities involved. Rather, a sense that such debates need to be broader and more nuanced, as most clearly expressed by persons associated with the system critical perspective (or a combination of the politically oriented and system critical perspectives).

Based on comments from participants in this study, questions of fairness are rife with contradictions. Is it unfair that rural communities often bear the burden of (renewable) energy generation? Maybe it is. But it may also be the most efficient (or even the only) option available. The question can also be flipped: is it fair that rural communities block developments which are in the (national/global) public interest? There is an acknowledged tension between energy generation as simultaneously experienced as an unjust burden and recognised as a 'necessary evil'; a tension which cannot be resolved with reference to fairness. Here, I contemplate, the language of care could provide a more useful way of talking about the burdens and benefits of energy generation and siting decisions. This can be illustrated with reference to Brian's experiences with a local wind energy project, as discussed below.

One way of looking at renewable energy siting controversies is, as described above, that energy generation 'has to go somewhere', and arguments against local energy projects are unreasonable and unrealistic. Consider for example the following participant comments:

> "That's an unrealistic argument. For example, in order to expand [various] forms of clean energy, they have to go somewhere". *(Anders: m, DK, F1)*
>
> "I need to think about this… it depends how you think about 'burdens'… But coastal communities, for example, have more wind… I guess that's just how it has to be". *(Helen: f, UK, F3 F2 F1)*
>
> "It's probably something we just have to live with". *(Felix, m, DK, F2 F1)*

However, as Brian's discussions, in particular, illustrate, there are other possible ways of approaching dilemmas around energy generation and siting.

Specifically, Brian argued for greater context sensitivity and qualitative assessment in the planning of wind farms and in compensation arrangements, based on local circumstances and local realities. For example, rather than basing compensation allocation on fixed distances (as in Brian's experience, where someone living within 1000 metres of a windfarm was compensated by a given amount, while someone living 1005 metres away received no compensation at all), he argued that, often, the direction of the windfarm relative to a house may be a more appropriate consideration, with reference to things such as wind direction (and hence audibility), gardens (and hence visibility, and visibility from where), location relative to existing major roads, and other such contextual factors. In this way, a different kind of debate could be fostered if ethical assessment of a wind energy project, for example, is rooted in an ethics sensitive to the particular context in question. Care ethics offers one such context sensitive ethical framework, taking account of the embeddedness of energy projects within particular local (material/geographical as well as social) relations.

Moreover, Oskar's (m, DK, F1 F3 F4) experience of public consultation processes and associated public debates highlight a need for more nuanced framings of siting controversies. Reflecting on the significant emotional impacts for him and his wife of previous public consultations around several local energy projects, he expressed a disappointment with local and wider public debate as taking a simplistic, black-and-white view of local opposition to energy projects, equating any such opposition to a general opposition to renewable energy and climate change denial. In their case, they, and fellow

citizens joining in opposing the expansion of a local wind farm, had been the target of such arguments, labelled as examples of NIMBYism, despite living in an area already surrounded by wind farms. Here, again, an ethical framework taking seriously the local context and the subjective and emotional experience of local people could contribute to a more sensitive, and possibly more productive, local and public debate.

Notably, an ethics of care, as discussed in the following chapter, does not erase the various tensions arising around energy, including siting of infrastructure; on the contrary, it draws attention to them. In the words of Nel Noddings (2013, p. 155), "[some] conflicts cannot be resolved but only lived awarely and sensitively"; an ethics of care is particularly attentive to the reality of dilemmas and ethical contradictions.

5.3 National manifestations

Viewpoints were also explored at the national level, with analyses conducted on the data from Denmark and the UK separately, following similar procedures as detailed in Chapter 3, section 3.6 (details presented in Appendix 7). Three factors were identified for each country, with significant similarity between the two sets of factor solutions.

Relating the country-level factors to the four factors from the analysis of the full dataset shows that viewpoints identified in each country are well-represented by the 'meta'-factors (see correlation matrix in Table 10). $F1_{DK}$ and $F3_{UK}$ both correlate highly with the politically oriented perspective (F1 summarised in 5.1.1 above). The viewpoint represented by $F2_{DK}$ corresponds highly with the market-oriented perspective (F2 summarised in 5.1.2), while the closest corresponding British factor ($F2_{UK}$) exhibits a lower correlation of 0.53, suggesting a degree of distinction. Finally, $F1_{UK}$ and $F3_{DK}$ both closely resemble the community oriented perspective (F3 summarised in 5.1.3). It is evident from Table 10 that the fourth factor from the 'meta'-analysis, the system critical perspective, is not a representation of any identified country-level factor (highest correlation = 0.41). This is to be expected, as the system critical perspective is defined by one purely loading Q-sort from each country. It is plausible that, with larger sample sizes for each individual country, a similar fourth factor would emerge at the country-level.

Table 10. Correlations between meta-factors and national factors

		Meta-factors			
		Politically oriented (F1)	Market oriented (F2)	Community oriented (F3)	System critical (F4)
DK Factors	DK_F1	0.96	0.01	0.51	0.23
	DK_F2	0.01	0.99	0.00	0.28
	DK_F3	0.51	-0.04	0.74	0.36
UK Factors	UK_F1	0.35	-0.04	0.89	0.17
	UK_F2	0.28	0.53	0.16	0.41
	UK_F3	0.85	-0.01	0.68	0.24

Based on crib-sheets for each country-level factor (Appendix 7), each country-specific perspective was analysed in further detail. Here, rather than detailed descriptions of each national factor, this section explores significant particularities in the national-level analyses, with reference to the meta-factors outlined in section 5.1.

5.3.1 Political-collective or political-individualist

$F1_{DK}$ and $F3_{UK}$ represent very similar views of energy transitions as a high priority national and political issue, emphasising government responsibility and regulatory solutions. These two national factors can be seen as national manifestations of the politically oriented perspective (meta Factor 1, summarised in section 5.1.1).

A key difference, however, lies in the importance attached to individual action; the UK politically oriented perspective ($F3_{UK}$) emphasises personal responsibility and the relevance of individual efforts more strongly than its Danish counterpart. The Danish politically oriented perspective ($F1_{DK}$) instead attaches higher priority to government measures such as renewable energy subsidies and energy taxes, and stresses the importance of climate and energy politics for voting choice. The UK political perspective places less emphasis on voting as a means of engagement – perhaps a reflection of not experiencing political discourse as significantly engaged with the energy topic.

A concern with fuel poverty is, furthermore, a priority in the British manifestation (+2), while the Danish manifestation reflects a neutral stance (0). This is unsurprising as energy poverty, while prominent in British public discourse around energy, remains absent from public and political energy discourses in Denmark.

5.3.2 Energy security and market solutions or energy security and affordability

The market oriented perspective (meta Factor 2, described in section 5.1.2) is most closely aligned with $F2_{DK}$, while $F2_{UK}$ represents a distinct version of this perspective. Both the Danish and the British manifestations reflect a view of energy security as the foremost priority of energy development, a support for large-scale energy developments, and a view of energy as a matter for experts rather than political or public deliberation. In keeping with the market-oriented meta-perspective, neither the Danish nor British manifestation reflects a personal interest in direct engagement whether of a political or private form.

A key difference, however, between the Danish and the British market oriented perspectives is their allocation of primary responsibility. The Danish manifestation stresses personal responsibility as an important principle, while the British perspective highlights government responsibility more strongly, taking a neutral stance on personal responsibility for reducing carbon emissions. Notably, the emphasis on government responsibility from

this British perspective should be seen in light of a general understanding that there are other greater political priorities than the energy transition, as expressed by all participants associated with $F2_{UK}$.

This helps to explain that, while responsibility in the context of transitioning to a sustainable energy system is seen as lying more with government than with individuals, this is not accompanied by strong views on government action, political solutions or political forms of engagement, as is the case in the politically-oriented perspectives.

In contrast to the British perspective's neutrality around political solutions and engagement, the Danish perspective actively opposes political approaches to the energy transition (e.g. a more democratic energy system, public consultations, voting, and government support via subsidies). Instead, the Danish market-oriented perspective reflects a primarily economic logic (reflected in a strong approval of profit seeking in the energy sector and financial incentives to drive action). Meanwhile, the British perspective remains neutral on the topic of financial incentives and profits as driving the energy transition. Instead, the British perspective gives priority to concerns over affordability and cost of energy for households.

Thus, the distinction of the British perspective from both the meta-factor and the Danish factor may be a reflection that affordability and cost of energy represents a key topic of debate in relation to energy markets in the UK, more so than in Danish public debate. The Danish market-oriented perspective instead reflects a more ideological debate about energy as a private, as opposed to public, matter. This may be understood in light of the fact that privatisation of energy generation and provision has a long history in the UK, whereas this is a more recent and ongoing phenomenon in Denmark.

Furthermore, it is interesting to note that a number of participants associated with $F2_{UK}$ were identified as 'mixed cases' in the meta-analysis, suggesting the $F2_{UK}$ embraces aspects of market-oriented, system critical and community oriented perspectives from the meta-analysis.

5.3.3 People and planet – in principle or action

$F3_{DK}$ and $F1_{UK}$ both align with the community oriented perspective (F3, summarised in 5.1.3) with a focus on societal priorities, social and environmental wellbeing and ethical

considerations. Notably, the British version of this viewpoint strongly rejects the idea that government has the greatest responsibility, and instead attaches importance to various forms of individual and community actions, from an emphasis on personal responsibility to a preference for local energy production, community ownership, active involvement in local initiatives, participation in public consultations, and the relevance (if only moderately) of climate and energy politics for voting choice. The Danish community-oriented perspective, in contrast, remains more neutral when it comes to allocating responsibilities, whether to individuals or governments. This Danish perspective reflects a focus on big ideas, with less clarity when it comes to positions on concrete actions or solutions. With a preference for small energy projects, moderately positive attitude to locally owned and generated energy, and a wish for local politicians to take responsibility, the Danish factor aligns with a general preference for keeping energy transitions small and local. The key distinction of the British community-oriented perspective, then, is its active interest in direct local engagement.

I reflect further on these country-level analyses in Chapter 7, in response to my fourth research question, concerning the ways in which everyday ethicalities around energy and low-carbon transitions differ (or not) across Denmark and the UK.

5.4 Chapter summary

This chapter has presented key findings from exploratory Q-methodological research amongst residents in Denmark and the UK. A 'meta-analysis' based on Q-factor analysis of the combined data from Denmark and the UK presents the main focus for my discussion in the coming chapter. Four 'meta-factors' were identified, and the perspectives represented by these factors were interpreted as politically oriented, market oriented, community oriented and system critical, respectively. While these were found to be largely representative of viewpoints emerging from country-level analyses, some notable national particularities were identified, further reflected on in the conclusion in Chapter 7.

The four types of perspectives, identified in the meta-analysis, show how the privileging of particular types of relations has implications for how people perceive and engage with energy transitions. What emerges is something like a tapestry of 'energy citizenships', made up of a multitude of values, priorities and ideas about one's role in relation to energy in transition. Thus, rather than theorising energy citizenship as a discrete

identity, we need to understand the ways in which energy citizenship may be variously understood and enacted, and rooted in diverse ethical concerns and priorities, as further considered in the following chapter.

While the diversity reflected in the four types of accounts highlights the importance of recognising and understanding difference, a common theme of relationality was also identified across the four viewpoints. This was illustrated with reference to participants' comments and considerations, in particular around notions of responsibility and in response to considerations of rights and fairness. Finding notions of relationality, dependence and mutual responsibility central to participants' accounts of their views and engagements with energy and the energy transition, I argue that care ethics – with its emphasis on responsibility and understanding of (human) existence as relational and dependent – offers an interesting perspective from which to understand and further discuss the viewpoints represented by participants in this study, as discussed in the following chapter.

CHAPTER 6

Discussion: (Re)thinking 'citizenships' in energy webs

Having explored, in the previous chapter, how ethical and political aspects of energy transitions are perceived from the vantage point of citizens in the UK and Denmark, this chapter discusses key insights from these analyses to contemplate how a better understanding of citizens' ethical attitudes towards energy might inform further theorising of energy citizenship. To this end, I engage feminist thinking on care ethics, as introduced in Chapter 2, to further discuss the findings and to open up a broader discussion around the ethicalities at stake in energy transitions. The notion of care and care ethics, I propose, has the potential to enrich debates around energy citizenship and energy ethics and offers an alternative ethical vocabulary better able to give expression to relational, ambiguous experience.

This chapter begins with a general reflection on how energy and care may be seen not as strange bedfellows but in fact intimately and mutually entangled (6.1), before proceeding to the main discussion. Based on the findings presented in the previous chapter, I discuss what it might mean to rethink energy citizenship and responsibility relationally, and draw on care ethics to inform this discussion (sections 6.2 to 6.4). I conclude with some further reflections, 'thinking energy with care' more broadly (6.5). This includes a discussion of the potential of a more-than-human energy care ethics, and an exploration of time and space for care in relation to energy. Finally, I conclude with some thoughts about how engaging with the energy context might also enrich feminist scholarship on care (6.6).

6.1 Entanglements of energy & care

The relational ontology underpinning care ethics has implications for the way we imagine energy systems. While various versions of 'systems thinking' are commonplace

within energy and society research (see section 2.1), this remains largely within either techno-managerial or descriptive boundaries. Whole-systems thinking, as advanced for example by socio-technical transitions scholars (Geels, 2018; Köhler *et al.*, 2019; McMeekin, Geels and Hodson, 2019) and energy justice scholars (Jenkins *et al.*, 2016; Sovacool *et al.*, 2019) is characterised by life-cycle analyses and tracing connections through value-chains. STS and geographically inspired relational approaches tend to focus on describing and explaining cultural, socio-material and spatial relations within socio-technical systems, for example in the study of energy practices (Shove, 2004, 2010), public participation (Chilvers, Pallett and Hargreaves, 2015, 2018; Pallett, Chilvers and Hargreaves, 2017) and energy geographies (Broto and Baker, 2018). Despite this burgeoning whole-systems and 'relational' turn in energy and society research, relationality is rarely followed through to its ontological foundation to probe its ethical and political implications. A care ethical perspective implies a depth and breadth of relationality beyond existing 'systems thinking'.

In the following discussion, I refer to energy webs, rather than energy systems – a term loaded with techno-economic connotations – to amplify the depth and breadth of relationality in my understanding of energy and energy ethics. Everything in the field of energy is related, connected, inter-dependent – physically and/or socially. From the human dependence on energy for survival (Fu *et al.*, 2019; Kondongwe, 2019; United Nations, 2019), the reliance on physical infrastructures of generation and distribution and on market 'infrastructures' facilitating the selling and buying of said energy (Hvelplund, 2006; Cotton and Devine-Wright, 2011; Blum and Legey, 2012), to energy practices shaped by and shaping energy technologies (Strengers, 2012; Goulden *et al.*, 2014). Energy practices shape human interactions and social relations (Walker and Day, 2016). Powerful political relations are bound up with the trade and use of energy resources, nationally, sub-nationally and trans-nationally (Calvert, 2015). The energy system, in all its component parts, is related to the natural environment, both in its dependence on natural resources (whether depletable fossil fuels or renewable resources) and in its impact on ecosystems (through extractive practices, physical infrastructure and water and air pollution) and the climate system (through greenhouse gas emissions), upon which humans – and non-humans – in turn, depend. It is this range of manifold complex and interdependent relations I refer to as the energy web. And energy webs, I propose, can be seen to comprise myriad relations of care – and vice versa.

While a language of care may be unfamiliar in the energy context, energy is deeply entangled in caring practices, and vice versa. Most obviously, energy is a necessity for much 'traditional' care work. Hospitals, for example, depend on the availability of reliable energy supply to keep machines running (for vital life support and many services on which doctors and nurses depend in their daily care work), to keep heating and cooling systems running (for patient comfort and temperature control in laboratories and cold rooms), and at the most basic, to keep the lights on. The fight against energy poverty is implicitly linked to a concern with caring for the vulnerable, with much focus directed at those particularly dependent on access to energy for their survival, due to age or health conditions. Care work performed in homes as part of everyday life – from cleaning, maintaining a safe and healthy environment and personal hygiene, to feeding the family – are closely tied to the availability of energy (Walker and Day, 2016; Ellsworth-Krebs, Reid and Hunter, 2019). And this entanglement of energy and care is evident not only in the necessity of energy for care work, but also, if less apparently, in the care work required to maintain energy systems and, ultimately, a sustainable energy web. From the maintenance work required to care for the physical infrastructure of energy generation and distribution, to the actions and decisions, large and small, of energy users, impacting the dynamics between energy demand and supply. In the following, I explore some concrete entanglements of energy and care; first the way energy may facilitate care work, and then how care work is involved in maintaining energy systems/webs.

6.1.1 Energy for care work

Health care is a key aspect of the dependence of care work on energy. This was reflected in several interviews in this Q-study, in particular in relation to the topic of energy security as expressed, for example, by Pauline, a British participant in this Q-study: "everything in our daily lives requires energy; not to mention hospitals". Even where our everyday dependence on, or taking for granted of, energy is questioned, and constant unlimited energy supply not considered a top priority, this crucial connection between energy and healthcare becomes a central argument for energy security, as expressed by another, Danish, participant "Constant unlimited supply should not be the first priority in our personal everyday, but for hospitals and that sort of thing it really *is* critical" (Louise: f, DK, F1 F3).

This link between energy and health is well-documented in literatures on energy poverty and international energy development. International energy development is centrally concerned with the negative health impacts of reliance on traditional energy sources as a motivation for improving access to clean, modern forms of energy. Much-cited adverse health impacts of the burning of traditional fuels includes poor indoor air quality, estimated to cause 2.8 million premature deaths each year (International Energy Agency, 2017a), and the physical toll, disproportionately affecting women and children, of collecting firewood. To alleviate these negative health impacts, technologies such as improved cookstoves and domestic biogas are promoted as alternatives to cooking over traditional sources of fuel. In the European context, energy/fuel poverty literature pays particular attention to the increased energy vulnerability of people in poor health, and increasingly to the negative health impacts of living in cold homes.

But while these areas of research explore a variety of health impacts relating to energy deprivation and the use of traditional fuels, there is significant scope for more research exploring the interlinkages of energy and healthcare (Suhlrie *et al.*, 2018; Jem Porcaro, 2019; Keim *et al.*, 2019). An energy care ethics could offer an interesting lens from which to consider potential synergies and inconsistencies between energy and healthcare systems in the context of low-carbon transitions.

In general, energy poverty and international energy development are perhaps the areas of energy research most closely related to care, also beyond topics around health. Even if the notion of care is not explicitly invoked, it is implicit in much energy research in developing country contexts. The pervasive discourse ties the energy development agenda firmly to everyday caring practices of cooking and heating and the education potential associated with improved access to lighting. The critical role of energy for the maintenance of everyday living is also recognised in 'Western' energy contexts, in particular in literature on energy poverty (Bouzarovski, Petrova and Tirado-Herrero, 2014) as well as social practice theory (Shove and Walker, 2014). This role of energy for the maintenance of everyday living in modern societies was reiterated by participants in this study (as illustrated in a language of energy as necessity (see 5.2)). We rely on energy for mundane caring practices in the home such as heating and cooking; participants talked about energy as "basic necessity", a "precondition for living", and the necessity of energy to "boil a kettle for a cup of tea" or to have a shower. Here, again, a care ethical framework provides an interesting

lens through which to explore the entanglement of energy with everyday mundane care practices, and this entanglement as being at the heart of everyday energy encounters.

6.1.2 Care for energy webs

But this reliance on energy for everyday practices of care sits in tension with a need to care for the energy web in which these energy-dependent practices are embedded/entangled. There is a tension between the simultaneous need to reduce energy consumption (caring for the planet/climate/energy web) and the need to meet energy dependent caring responsibilities. The call for what we may term care-full energy practices are everywhere. In calls for consumers to reduce energy consumption through more conscious energy behaviours, as championed by the behaviour change literature. In calls for homeowners to improve energy efficiency, through home energy improvements and energy efficient appliances, and install solar panels to become 'prosumers'. And in a general call for individuals to become more proactive participants (read, consumers) in the energy system. Here, an energy care ethics offers an alternative to the narrative on individual responsibilization dominating existing narratives around active consumption and participation (see Chapter 2) by conceiving of care as a matter of personal-collective responsibility and as spread to the whole of a situation rather than centred on a single subject (discussed further in section 6.3.2).

Everyday care for energy webs can also be explored in terms of the energy-education nexus. Where the 'energy for everyday care' narrative of international energy development, as mentioned above, emphasises the role of electrification for improved education (by providing lighting and access to electronic equipment), thus highlighting a link between energy and care in the dependence on energy for education, this can also be turned around to emphasise the role of education in caring for energy webs. This connection was made by several participants in the present study, between energy and education. One participant emphasised sustainable energy practices in the home as being primarily of educational value; joking about driving his family crazy with his insistence on turning lights off in the home, he emphasised that, while switching lights off may have a negligible impact in the big picture of global energy consumption and climate change, it serves to educate the children, teach them to be aware that things consume energy (Mads: m, DK, F2 F3). Another participant emphasised that, while making a personal effort to reduce energy

consumption may seem pointless, "it is part of raising one's kids, and hopefully that way it will spread" (Eva: f, DK, F1 F2). This supports the findings of a previous study, which shows parents to be more enthusiastic about energy conservation, when viewed as part of the education of their children (Fell and Chiu, 2014). In this way energy becomes entangled in the caring practices of raising and educating children to, in turn, learn to care for sustainable living within energy webs.

Integrating the raising and education of – the care for – children with care for sustainable energy webs in this way, challenges common assumptions around energy use in family homes and the parent-child dynamics at play. Rather than parents responsibility for "[protecting] their children's well-being and opportunities in life by accepting unrestricted energy use" (Schmidt *et al.*, 2014), we may view a parental responsibility of care for their children to involve facilitating their development as care-full individuals – care-full energy citizens – teaching and encouraging care-full energy practices. This challenges previous research documenting the belief of parents that their children's energy use should not be restricted (Schmidt *et al.*, 2014; Bossen, 2016), and their unwillingness to initiate discussions about energy habits due to a desire to avoid conflict (Gram-Hanssen, 2007; Fell and Chiu, 2014). Notably, research has also shown how environmental education in schools can reverse this parent-child dynamic, as children become more aware and become the teachers, teaching their parents about sustainable energy practices (Garabuau-Moussaoui, 2011). Thus, children may just as well become the 'carer' or the facilitator of their parents' development into care-full individuals. In this way, bringing into focus the development of care-full individuals situates this practice of care, and the respective responsibilities of parents and children within wider multi-directional relations of responsibilities in energy webs.

Materially, energy webs are dependent for their functioning on ongoing maintenance work as a critical form of care for energy webs. Who carries out this form of care work varies across diverse energy contexts. For example, while a domestic biogas user in Nepal, owning their own biogas digester, is uniquely aware of the cleaning and maintenance work required – of them – to keep the digester producing gas (Damgaard, McCauley and Long, 2017), individual consumers in energy webs based on large-scale, centralised energy generation are more detached from this form of care work. Nonetheless, energy generation and distribution infrastructures require regular maintenance and repair as do appliances. Care in the form of maintenance and repair within energy webs also features

in relation to buildings and energy efficiency. In this, energy scholars may draw on recent work in maintenance and repair studies (see section 2.3.1) to further theorise the processes of care involved in the maintenance of socio-material relations within energy webs.

Thinking about care for energy webs may also raise important questions about what is being cared for and why. In the context of energy transitions, we may ask what kind of energy web is being (re)created through various practices of care – or carelessness – why, and for what or whom. This encourages a move beyond tracing entanglements and inter-connections, to foreground the ethicality inherent in relations of care in energy webs.

Thus, while care, and care ethics in particular, remain relatively unfamiliar concepts in the energy context, there appears to be a wealth of opportunities for bringing care ethics into conversation with energy social sciences. Indeed, in my engagement of care ethics with the findings from this study, I have found its significance and transformative potential illuminating. Thinking energy with care allows us to speak to (and from) lived experiences of everyday relating within energy webs. By drawing attention to connections, dependencies and responsibilities as significant dimensions of lived experience, the ethics of care allows us to engage speculatively with ethical dilemmas as matters of personal-collective, private-public importance. In the following sections, I draw on these ideas to reflect on the concept of energy citizenship and unpack notions of responsibility at the heart of care-full citizenships.

6.2 A tapestry of energy citizenships

The patterns identified in the Q factor analyses point to diverse ways of perceiving, valuing and engaging with energy in transition. This may come as no surprise, yet it is not well reflected in emerging ethico-political theories around energy citizenship and energy democracy nor 'energy ethical' theorisation, primarily represented by energy justice work. While this study is not exhaustive, and other patterns of views could almost certainly be identified amongst larger or different study populations, these findings nonetheless indicate that a limited idealised account of 'energy citizenship' misses out some – if not most –of the various ways in which people think about and relate to (with/within) the energy system. Instead the observed viewpoints reflect four types of perspectives on, or ways of enacting, 'energy citizenships'.

What emerges is something like a tapestry of 'energy citizenships', made up of a multitude of values, priorities and ideas about one's role in relation to energy in transition. Thus, rather than theorising energy citizenship as a discrete identity, we need to understand the ways in which energy citizenship may be variously enacted. This supports emergent accounts of diverse modes of engagement with energy, advanced by Chilvers et al.'s (2018) as 'ecologies of participation'. They stress that prescriptive assumptions guiding much energy and society research fails to account for and understand numerous collectives of participation which deviate from established (legitimised) definitions of what it means to participate. While their analyses focus on collectives of participation and their interaction with wider system dynamics, this recognition of plurality is equally important at the individual plane of analysis, as these findings illustrate. However, a shared sense of relationality, both as a social condition, characterising our being within the energy system, and as a basis for ethical reasoning, leads me beyond the approach, pioneered by these recent 'relational' contributions, of mapping diversity (Chilvers, Pallett and Hargreaves, 2018; Longhurst and Chilvers, 2019; Pallett, Chilvers and Hargreaves, 2019), as explored below.

A care ethical approach contributes to notions of citizenship with an emphasis on plurality, diversity and respect for difference, as developed by Selma Sevenhuijsen (1998, 2000) in her work on care and citizenship. This moves away from the notion of the 'ideal-typical citizen' (Szulecki, 2018) and individualistic framings of individuals and responsibility advanced by much contemporary Energy and Society literature, as well as political energy discourses.

How, then, can energy citizenship be understood, if it is not about adhering to predefined behaviours and practices? Based on the theme of relationality identified in the analyses (Chapter 5), energy citizenships may instead be understood in terms of relational existence within the energy web. A being in relations, which carries notions of reciprocal collective and political responsibilities. This provides an important alternative account of citizenship to the individualistic duty-based definitions common both in energy scholarship, around the citizen-consumer or prosumer, and in green political thought around cosmopolitan environmental or ecological citizenship (Dobson, 2003). Instead, a relational conception of energy citizenship is intimately linked to the notion of shared and mutual responsibility, as expressed by participants in the Q-study (see section 5.3). Care ethical

notions of responsibility as interdependent and personal-collective can help frame this relational perspective on responsibility, as considered below.

6.3 Responsibilities for care in energy webs

A key contribution of care ethics to a discussion of energy citizenships, and of the ethicalities of energy transitions more broadly, is its conception of responsibility. As discussed in the previous chapter (section 5.2), the views expressed by participants in this study reflect a common sense of responsibility as a matter of recognising and meeting a *need* for action. The care ethical notion of responsibility rooted in mutual interdependence as the basic condition of existence shares this understanding of responsibility as relational, shared and arising out of the necessity of care.

6.3.1 Responsibility on the basis of interdependence in relational energy webs

A relational notion of responsibility provides an important counter-narrative to neoliberal individualist responsibilization characterising contemporary political discourse, in general, and energy transition discourses specifically (Lennon *et al.*, 2019). Individualised responsibility is evident whether considering the context of reducing energy use and carbon emissions[24], or the context of meeting basic energy needs[25]. In contrast, frameworks such as energy justice (McCauley *et al.*, 2013; Sovacool, Sidortsov and Jones, 2014) and energy democracy (Kunze and Becker, 2014; Becker, Angel and Naumann, 2019) direct attention away from individual responsibility, and focus instead on individual rights and institutional responsibilities. But while neoliberal responsibilization will not achieve the kind of deep and rapid – not to mention just – transition necessary, we also cannot talk about transition *without* talking comprehensively about responsibility. Care ethics allows us to redeploy the notion of responsibility, unpack the multitude of caring responsibilities enacted within the

[24] As evident in discourses of behaviour change, ethical consumption and 'democracy through the wallet', encouraging domestic energy saving behaviour and 'green' energy consumer choices, discussed in Chapter 2.

[25] Energy and fuel poverty discourses, for example, frequently emphasise solutions based on individual responsibility, from learning to read and understand energy bills, to adopting energy saving behaviours (Middlemiss *et al.*, 2019).

energy web, and reframe responsibilities as personal-collective, shared and inherently political (see also section 2.3.3).

In rights-based discourses such as energy justice (see section 2.2) – centrally concerned with the realisation and protection of rights and freedoms – obligation features as the respect for the rights of others (Trnka and Trundle, 2014). In contrast, an energy care ethics takes it starting point in the lived experience of dependence and relation in energy webs, and the commitments and responsibilities arising therefrom. The care ethical notion of responsibility rooted in mutual interdependence as the basic condition of existence echoes the sense, shared by participants in this study, of responsibility as a matter of recognising and meeting a need.

While this supports needs-based framings of energy, it goes beyond recent conceptualisations of 'energy as a need' (Demski *et al.*, 2019), to consider how energy related activities interact with, fulfil, but also potentially violate diverse needs and dependencies throughout energy webs. From a care ethical perspective, needs, necessity, dependence, is not only attached to human dependence on energy, but is also the driving force behind energy transitions as the source of responsibility for and commitment to the creation of more sustainable energy webs (this is further discussed below in relation to the potential of a more-than-human energy care ethics (section 6.5.2)).

For participants in this study, as illustrated in section 5.2, there is a common sense of necessity as the basis on which claims about responsibility are made. The notion of responsibility in – and for – energy transitions is about recognising the necessity of action. On account of a simultaneous dependence and impact on energy webs, responsibility is a matter of responding to that need. Views on the most appropriate form of action and the most appropriate actors to take responsibility for it differ (see section 5.1), however. From the politically and community oriented perspectives, as illustrated, necessity is tied to personal and government responsibility to address the need for action on climate change. In the market-oriented perspective, necessity features most strongly in a view of a necessity of large-scale energy generation in order to realise a low-carbon energy transition.

Meanwhile, a notion of responsibility rooted in interdependence challenges the perception associated with the market-oriented perspective identified in this research (section 5.1.2) and with neoliberal individualism more generally, of individual responsibility

based on voluntarism and choice. As Kremer (2005) argues in the context of the labour market and welfare state, a care ethical account of citizenship requires a redefinition of participation and independence. While some feminist scholars draw on a notion of care-full citizenship to argue for freedom from moral pressure and forced altruism, this is a distinctly liberal individualist approach to citizenship and care, following a liberal feminist theory of citizenship, idealising the (male) model of the worker-citizen and viewing care as a burden. A relational care ethical perspective instead insists on care as a fact of life, which cannot be reduced to one possible choice of lifeplan amongst many, but must be embraced as a moral requirement to be embraced within all various lifecourse patterns (Kershaw, 2006).

Thus, from a care ethical perspective caring responsibilities are not seen as a matter of personal choice, as this simply masks a re-allocation of care work to others (who may not be in a position to choose). In the energy web, those 'others' may be a myriad of human and non-human others, who/which are then required to absorb the carbon emissions resulting from a high-carbon lifestyle, or to take action to balance the electricity grid, or to care for those suffering due to air pollution or pollution from extractive activities to supply that high-carbon lifestyle. While care is thus highly dispersed throughout energy webs, the emphasis on bringing to light the dependence on care, the consequences of our decisions about how to care (or not) for whom, what and how, and engaging in debate about the allocation of responsibilities is all the more relevant.

6.3.2 Personal-collective responsibility

While participants in this Q-study generally agreed with the sentiment that a personal commitment to reduce energy use in the home seems negligible in the big picture and somewhat pointless, this was not accepted as justification *not* to make a personal effort, or as grounds for dismissing personal responsibility. Instead, making a personal effort was afforded meaning as motivated by a commitment to a collective purpose, and personal responsibility was widely accepted as *part* of the picture. This view echoed through my interviews with people in both Denmark and the UK, in participants' internal deliberations about responsibility as lying "not only" with individuals, or "also" with individuals, with "everybody", about government having responsibility "but not the *greatest*", in back-and-forth discussions with themselves about the allocation of responsibilities ("yes … and no…").

Similarly, Partridge et al. (2017) report an awareness amongst participants in the UK and the US of their own implication in energy systems, combined with criticism of a perceived lack of shared responsibility and political will. An energy transition discourse needs to be able to speak to this sense of shared responsibility, to embrace a sense of personal responsibility while also acknowledging the limitations thereof and the absurdity of putting the onus solely on individual consumers and households. As Tronto (2013, p. 42) argues, "the problem with personal responsibility is when it seems to be the only form of responsibility that is important in democratic life".

Care ethics moves both the ethical and the political beyond the privatised-personalised domain of personal choice, individual rights and responsibilization (Puig de la Bellacasa, 2017, pp. 133–136), and offers a relational, personal-collective account of caring commitments. A relational ethics of care defines care as happening always in the in-between, spread to the whole of a situation (Puig de la Bellacasa, 2017, p. 166). It follows, that ethicality cannot be located with individual subjects or actors or encompassed in isolated acts or behaviours. In this way, a care ethical notion of responsibility supports the relational notion of responsibility shared by participants in this study, as explored in Chapter 5. For example, the findings indicate a view of government and personal responsibility as interlinked. Participants repeatedly stressed that personal responsibility, while *also* important, will not be possible without government creating the frameworks to enable and support private action, and will not be effective without government taking the big steps. Similarly, participants repeatedly emphasised the need for 'everyone' to take responsibility. In care ethical terms we might say that the care required to realise a low-carbon energy transition lies in-between individuals, and in-between individuals and governments.

The realisation of a care-full energy transition can never be achieved through tweaks in ethical consumption and behaviour change, but likewise, a care-full energy transition can never be achieved by government or industry alone and without citizens' responsiveness. In the following, I consider how the emerging concepts of energy citizenship and energy democracy may be reconceptualised from a care ethical perspective to embrace this personal-collective, shared and inter-dependent notion of responsibility. In considering care as a personal-collective, ethico-political matter, I engage, in particular, Joan Tronto's (2013) And Selma Sevenhuijsen's (1998) discussions of the political meaning of care in relation to democracy and citizenship.

6.4 (Re)thinking 'energy citizenship': caring with and for

For Tronto (2013, p. 13), caring democratically is about citizens caring *with* their fellow citizens. 'Caring with' addresses a distinctly collective form of care contrasting the privatised-personalised ethics dominating contemporary politics, which "invites people to retreat into their own families and implicitly suggests that there is no one else to help out, little "caring with" to be done" (Tronto, 2013, p. 6). 'Caring with' implies a responsibility of everyone to care about and for the energy web in which they are entangled. (Energy) citizens must:

> "care enough about caring – both in their own lives and in the lives of their fellow citizens – to accept that they bear the political burden of caring for the future … [which] is not only about oneself and one's family and friends but also about those with whom one disagrees, as well as the natural world and one's place in it" (Tronto, 2013, p. xii).

A care ethical notion of energy citizenship is about more than a private responsibility to manage one's own energy consumption. It is about taking seriously our responsibility to care, with each other, about and for the creation and maintenance of sustainable energy webs; producing the kinds of values, practices and institutions (Tronto, 2013, p. 44) that will facilitate a transition to a care-full, democratic and sustainable energy web. For example, a sense of 'caring with' was reflected across viewpoints in this study, in an insistence that "we all … do our bit". Furthermore, participants' discussions of a responsibility to engage in opportunities for participation in local decision-making around energy (see section 5.2.2) offer a particularly good example of this notion of 'caring with'. Many participants felt ambivalent about involvement by local people in local energy decisions and planning, and about ideas of democratic principles to underpin energy development, considering that people do not care enough to take part (see section 5.2.1). The question, then, is whether to move away from such principles and processes, or whether, as several participants argued, we need to encourage a culture of meaningful engagement, of 'caring with'. And here, the argument about reciprocity is critical: in order to encourage engagement – 'caring with' – processes and institutions for engagement must be experienced as accessible, enabling meaningful interaction, and leading to meaningful outcomes, that are respected and upheld.

And the notion of reciprocity extends beyond direct interactions; crucially, caring citizenships and practices of 'caring with' rest on relations of mutual responsibility between citizens and the democratic state and society. Citizens in caring democracies, Tronto (2013, p. 44) asserts, "should be able to expect more from the state and civil society in guaranteeing that their caring needs, and those of their loved ones, will be met". There are two elements to this: 1) the meeting of needs, and 2) expectations to the role of the state and civil society, both of which were recurring themes across participants' discussions.

With regards to the former, the importance of meeting needs is illustrated in numerous discussions by participants stressing a need for public welfare to take priority over financial profits in the energy sector, and more generally in a language of needs as previously discussed. Moreover, this is attached to expectations of government and energy companies to ensure that those needs are met, or at least not deprioritised. In the context of energy transitions, that expectation of governments goes beyond responsibility to meet the care needs of (human) citizens, and includes also a responsibility for the transition to more sustainable energy webs; a responsibility for meeting a wide range of human *and* more-than-human needs in the energy web.

And with regards to the latter participants repeatedly emphasised responsibility for the energy transition, the reduction of energy use and carbon emissions, as lying *also* with governments and energy companies, and called for regulation to create the *framework* for individual enactment of their corresponding responsibilities. Similarly, in the context of environmental politics, Dobson and Saiz (2005) stress that citizenship depends on government action to enable the exercise of citizenship. Without such mutuality, any notion of energy citizenships remains one-sided, if not meaningless.

6.5 Contemplating wider applications of care ethics

In this penultimate section, I discuss some broader opportunities for engaging care in energy and society scholarship. First, closely linked to a care ethical conception of energy citizenships, I consider what a care ethical understanding of energy democracy might mean. I then contemplate the potential of a more-than-human energy care ethics for transformative thinking around energy, all the while maintaining the awareness of the citizens' perspective emphasised throughout this thesis. Finally, I explore what thinking energy with care might

mean in terms of time and space, based on my analysis of Q-sorts and reflections on the meaning of care in the energy context.

6.5.1 (Re)thinking energy democracy

In the energy system, just as in Tronto's caring democracy, the question is not whether care occurs, or whether caring responsibilities are allocated, but *how* responsibilities are allocated and what is cared for – and not. Arguably, current practices are primarily concerned with caring for the economy and, more broadly, care matters pertaining to the economic dimension of sustainability. Several participants expressed concern that economic growth and economic sustainability is prioritised over and above environmental and social dimensions of sustainability. Democratic caring in energy webs is, first and foremost, about a collective, democratic process for negotiating such care priorities and responsibilities in the energy web. A collective discussion about what is to be cared for and "who has the responsibility to care for what, when, where and how". Notably, it is not the objective for any energy care ethical theory or framework to specify allocations of responsibilities. The objective is to *draw attention to* these questions as the central questions for a democratic energy transition to grapple with.

These questions go beyond current energy democracy literature (Kunze and Becker, 2014; Angel, 2016a; Becker and Naumann, 2017; Szulecki, 2018), which tends to focus on democratic forms of ownership of energy generation and infrastructure, and the 'democratic potential' of certain technologies (e.g. distributed wind or solar) or structures (e.g. community energy) (McMurtry and Tarhan, 2016; Burke and Stephens, 2018).

Moving away from a focus on technologies or structures in the energy system, I propose three principles of a caring energy democracy, derived from my analysis of views expressed by participants in this Q-study. Sensitized to the values of citizens, energy democracy must be about:

1) valuing care (over profit)
2) meeting energy needs
3) democratic procedures and institutions rooted in mutual respect, trust and responsiveness.

The first principle, I derive from numerous discussions by participants associating a democratic energy system with a need for public welfare to take priority over financial profits in the energy sector. This first principle also addresses the concern of many about the lack of priority currently afforded to environmental wellbeing. Thus, affording value and importance to care, and (re)considering how we care for whom/what in energy webs, must be central to a notion of energy democracy. This is also a central message of a feminist ethics of care, which has a long history of arguing for greater recognition of the value of care. There is significant scope for further research to consider the caring implications of existing (and alternative) structures, institutions and policies in different countries, including, for example, subsidy schemes, pricing structures, taxation and regulations both directly and indirectly relating to energy.

The second principle is derived from many participants' association of democratic energy systems with the possibility for everyone to meet their basic energy needs. Thus, energy democracy is not only about the valuing of and allocation of responsibilities for care, but is also substantively about the provision for those in need of care, through the provision of basic energy services on the basis of a recognition of their necessity. This echoes the care ethical emphasis on relations of dependence and care.

Finally, energy democracy must be based on democratic procedures and institutions rooted in mutual respect, trust and responsiveness. Responsiveness here is key, as several discussions by participants illustrated with reference to public participation in energy decision-making. On the one hand, participation processes must be anticipatively responsive (e.g. in terms of levels of prior knowledge assumed and time required for reading and research to be able to participate competently), must be responsive in the situation (i.e. promoting dialogue rather than one-way information provision), and must be subsequently responsive (e.g. honouring agreements and compromises reached). On the other, a need for responsiveness applies equally to citizens, as noted by several participants, public engagement and democratic processes are meaningless, if citizens do not care and respond. This means, at its most basic, showing up and taking part, and it means engaging openly and responsively, avoiding the democratic encounter being captured by individual interests or going off on irrelevant tangents. This, again, echoes care ethical ideas around relationality and responsiveness to needs, also embedded in Joan Tronto's theory of caring democracy.

6.5.2 More-than-human energy ethics

In bringing care ethics to bear on the ethicalities of energy transitions, I find inspiration in recent work by Maria Puig de la Bellacasa, exploring the meaning and ethics of care in more-than-human worlds. A more-than-human energy ethics acknowledges the more-than-human interdependencies and agencies at play in an energy system, and the ethicalities arising from them. In this, Puig de la Bellacasa's discussion of more-than-human worlds – drawing on insights from actor network theory and assemblage theory – is equally relevant for unpacking the more-than-human relations and ethicalities making up energy webs. Actor Network Theory and assemblage theory contribute to an understanding of agency as distributed, moving away from traditional humanist normative perspectives. This approach is represented in energy and society scholarship (to a limited extent), for example in Strengers' et al. (2016, p. 761) conception of energy consumers as assemblages of human and non-human actants, including "babies, pets, pests and pool-pumps" as performers of or materials in practices. But while this problematises in important and interesting ways the assumption that energy consumption is a practice involving only autonomous, detached individuals making choices as rational consumers, it stops short of considering citizens, or 'adult actants', as ethical subjects with specific obligations as "human carers".

Puig de la Bellacasa (2017, p. 166) builds on the notion of distributed agency but takes a further step to contemplate the implications for ethicality as "spread to the whole of a situation". Similarly, a more-than-human energy care ethics redirects attention from singular (human) subjects of ethical acts, but moves beyond tracing networks or describing assemblages to consider the ways in which an ethos of care may be fostered through relatings and doings throughout energy webs, including numerous agencies, materialities and practicalities, and to acts of care happening always 'in-between'.

It is critical, here, to reiterate the argument by Science and Technology Studies scholar Lucy Suchman (2007, p. 285 quoted in de la Bellacasa (2017, p. 16,142)): that the price of recognising distributed agencies "need not be the denial of our own", and to recognise that "there are specific obligations for those engaged within them *[webs of interdependent care – for our purposes here; within energy webs*] as human carers" (Puig de la Bellacasa, 2017, p. 220). This is an important consideration in the discussion of care-full energy citizenship (as discussed above, section 6.3) within more-than-human energy webs.

As with Puig de la Bellacasa's (2017) exploration of care in permaculture and soil relations, considering care in the context of energy webs requires a departure from the original anthropocentrism characterising care ethics (Held, 2006). Energy ethics, likewise, has been dominated by anthropocentrism (Frigo and Giovanni, 2018; Pellegrini-Masini, Pirni and Maran, 2020). While work on energy transitions is centrally concerned with sustainability and climate change, these are not framed as ethical questions addressed by energy ethical literature, where focus centres primarily on human rights, equality, and justice (Gillard, Snell and Bevan, 2017; McCauley and Heffron, 2018; Pellegrini-Masini, Pirni and Maran, 2020; Wood and Roelich, 2020). The consequent liberal notion of obligation as the respecting of others' rights (Held, 2006) leaves non-rights-bearing others beyond the ethical. Thus, similar to discussions in environmental ethics (Nash, 1989; Boyle, 2007), the question with regards to the environment becomes (if at all discussed) whether nature should have rights, and if so how to enforce them.

From a care ethical perspective, the question is not "whose rights must I respect", but rather "what relations require my care". This opens up a potential for a more-than-human energy ethic, where both human and environmental wellbeing have ethical importance. As Groves (2019) argues, care "allows the otherness of nature … into the sphere of concern as necessary ingredients of any concernful engagement with the world". A sense of the ethical around energy transitions as being about more-than-human ethicality was recurring in interviews with participants in this Q-study. As discussed in section 5.1, participants perceived ethical issues around energy transitions as being primarily about situating the energy debate within the bigger picture of climate change, the environment and care for "the planet", as the following participant comments exemplify:

> "Caring for the planet and for the environment, that is the primary ethical issue." *(Kasper: m, DK, F1)*
>
> "Ethically, it has to do with the planet." *(Oskar: m, DK, F1 F3 F4)*
>
> "We have this planet on loan, and we must not burn it up." *(Karin: f, DK, F1 F3 F4)*
>
> "Everyone needs to understand we're using way more energy than the planet can deal with, so we drastically need to minimise energy use" *(Colin: m, UK, F1 F3)*

There is clear resonance between the ways in which participants spoke about the ethics of energy transitions and a more-than-human energy care ethics. A more-than-human energy care ethics offers a language with which to question and discuss conventional, as one participant put it, "supposed truths", and provides a language for "new ways of thinking", as he called for. I have previously noted the persistence of a neo-liberal capitalist logic across all interviews, yet with frequent expressions of regret over the pervasiveness of that logic (see Chapter 5). A more-than-human energy care ethics disrupts that conventional logic of self-interest, autonomy and choice by introducing a vocabulary rooted in relationality and inter-dependence through which to express and deliberate notions of care, needs and commitment within more-than-human energy webs.

Crucially, the potential synergy between low-carbon transition and a more-than-human energy care ethics does not mean, that a low-carbon energy web will necessarily be 'care-full', nor that care does not circulate in the energy web as we know it. The care needed to foster caring relations – caring societies – does not occur effortlessly or innocently, and indeed the notion of care is present even in the absence of care, manifesting in the effects of neglect, of carelessness (Puig de la Bellacasa, 2017, p. 70). As care ethicists have emphasised, in response to critiques of romantic notions of caring, care is not by definition good, easy or unproblematic, care must be evaluated (Held, 2006). Care can take many forms and does not harbour any inherent desirable qualities; this is an important consideration for energy transitions, in which different technologies and different organisational arrangements carry both positive and negative implications and potentialities for caring.

Just as Puig de la Bellacasa considers in the context of agricultural production, we may question a productionist frame for energy generation as promoting "a form of exploitative and instrumentally regimented care" (Puig de la Bellacasa, 2017, p. 186). In this way we may view a privileging of energy security (at all costs) for care of 'the economy' as an exploitative and instrumental form of care pursued under the extractivist techno-economic logic of conventional fossil fuel based energy systems. But a similarly exploitative and instrumental care regime is possible as an underpinning objective of an energy transition. Just as scholars increasingly point out that renewable energy is not by default more just or democratic, renewable energy is not by default caring. What and who is cared for (or not), how and by whom/what "does and undoes relation". For example, whether a wind energy project is motivated primarily by private financial interests, with compensation offered to

the local community primarily to shut down objection, or rather by a collective desire to establish a local sustainable energy project, with constructive engagement and inclusion of the community, will likely shape the kinds of relations emerging around the wind energy project and impact relations in the wider community. And vice versa; different relations "foster care for some things rather or more than for others" (Puig de la Bellacasa, 2017, p. 166). Thus, we might expect the relation between external project developer and community to lead to a different kind of energy project rooted in a different set of concerns than the relation between mutually committed community members; or we might expect company-shareholder relations to foster quite different priorities than relations between an energy cooperative and its consumer owners.

Additionally, questions of where and when highlight care as having implications in space and time. Below I offer some initial reflections on how care may inform our understandings of spatiality and temporality in energy transitions.

6.5.3 Geographies of an energy care ethics

Energy offers a unique platform for thinking through ethical questions in relation to space and time, as anthropologist Hannah Appel (2019) suggests in her discussion of energy and ethics in a recent special issue of the Journal of the Royal Anthropological Institute:

> "Energy offers a particularly useful empirical terrain on which to think through the questions posed by ethical worlds. Ethical worlds gesture both to the supra-individual, supra-present contexts in which we all craft quotidian ethics, and to the expansive geographies and timescapes in which the effects of our ethical practices ramify." (Appel, 2019)

Care ethicists have argued in various contexts for the extension of care to global others (albeit with primacy given to near relations). The energy context, if anything, makes that distant relatedness more apparent, and in some ways more tangible, through physical, material resource relations and dependencies, and makes it clear that the global dimension of relatedness, care and thus of responsibility cannot be ignored. Similarly, I suggest that the context of the energy web renders also temporal relations 'thicker' and more tangible, through the physical, measurable depletion of resources on the one hand, and lasting infrastructures, on the other, which will determine the structure and functioning of an

energy system into the future. In the following, I briefly consider temporal and spatial dimensions of energy transitions from a care ethical perspective, and discuss how care illuminates further alternative timescapes of sustainable energy webs.

As discussed in Chapter 2, one of the limitations of care ethics is argued to be its seeming prioritisation of geographically near relations of care. But while care ethics is characterised by a partiality, recognising ethical commitments within particular relations, in contrast to the universality of justice theory, for example, the ethics of care has been convincingly extended to distant/global relations of care (see section 2.3.4). Thus while an ethics of care acknowledges that near relations and associated responsibilities are typically 'thicker' than distant ones, this does not imply that distant relations and responsibilities of care do not exist or do not matter, nor that the thickness of relations are necessarily defined in relation to geographical distance; other ways can be imagined of evaluating the 'closeness' and the strength of experienced relations and responsibilities (Milligan and Wiles, 2010).

Caring responsibilities circulate in global energy webs, crossing borders and scales. From the use of electricity at one point in the energy web, relations extend through distribution and transmission infrastructures to points of electricity generation, to the extraction of energy sources and/or materials for the manufacturing and construction of these infrastructures, to the institutions enabling these activities, the (human) communities touched, and the ecosystems impacted, to the climate system altered by the emissions at all stages of energy generation and use, and to those (including more-than-humans) impacted, globally, by the changing climate resulting from those emissions. Responsibilities for care are distributed throughout this expansive and complex web.

An energy care ethics global in premise recognises the potential for caring – as well as the implications of care-lessness – through globally expansive energy webs. Within this global energy web, human individuals are, as previously established (section 6.2.3), imbued with unique responsibilities of care to act consciously and with awareness of the (potentially global) consequences of our personal-collective energy practices. Thus, energy citizenships must also be explicitly global in premise and avoid the trap of promoting a partial energy citizenship inconsistent at the global level. Literature on environmental citizenship problematises the outsourcing of responsibilities by "the green citizen-consumer of the Global North", practicing a far-removed, indirect and, tokenistic form of 'citizenship', to the "citizenship-stewards" of the (typically) Global South, "enlisted as guardians of the global

commons" to confront environmental degradation head-on in their own locales (de Castro, 2012)[26]. This notion of the citizen-consumer outsourcing responsibility to distant others, "citizen-stewards" on the frontline, so to speak, was reflected in several participants' discussion over global responsibilities. For example, one participant argued that the taking of responsibility for harms caused by energy activities "would have to come from potentially affected communities". A theory of caring energy citizenship challenges this sentiment; while stressing embeddedness in relations, this must not be divorced from spatially distant relations, processes of extraction and production and the caring responsibilities these entail.

As mentioned, this notion of an energy citizenship guided by a global ethics of care is not well represented in the views observed in this Q-study. 'Outsourcing' of burdens was seen by most participants as justified based on the perceived reality of capitalism governing global society, the fact of unequal distribution of resources, and a perception that any potential burdens are a willingly accepted by-product of a lucrative income opportunity. Consider for example the following participant comments regarding burdens of energy generation and international responsibilities:

> "Wow, well, haha... that's capitalism". (*Bill: m, UK, F3)*
>
> "This is an interesting topic; on the surface seems true... but we have to accept that it's a reality; the distribution of fossil fuels is variable, just like other commodities". *(Ian: m, UK, F3)*
>
> "That's how it is; we did have North Sea oil and gas, did have coal; but it's no longer economical". *(Jack: m, UK, F2 F3 F1)*
>
> "Well, they could just sell wind instead". *(Eva: f, DK, F1 F2)*
>
> "That's a silly argument; it's a matter of buying and selling at the end of the day; we buy it, and then you just have to hope that the price is set appropriately to make up for the costs". *(Mads: DK, F2 F3)*

[26] Baldwin and Meltzer (2012) present an example of the paradoxes of forest conservation and oil and gas exploration and extraction in the Peruvian Amazon, where indigenous people are "required on the one hand to step aside and allow forest destruction for fossil fuel extraction, [and] are exhorted on the other hand to become custodians of those same forests in order to preserve and accumulate valuable carbon stocks" (Baldwin and Meltzer 2012, 34).

Yet there was a preparedness to consider a notion of corporate responsibility for undertaking extractive activities carefully, with consideration for those impacted, and a realisation that prices may not accurately reflect the real costs involved. Mads, for example, followed up his initial comment with a consideration that prices, unfortunately, often do not reflect actual costs, including externalities, recognising the problems this cause for trusting the market. Others emphasised that it is up to companies to recognise their commitments in the locations, in which they work, and act responsibly.

An energy care ethics offers a basis on which to expand such arguments and question the assumption that global inequality and global harms caused by extractivist and exploitative relations within capitalist energy webs are a given, an indisputable fact of an indisputably capitalist (energy) world order. An energy care ethics challenges us to think about – to care about and for – the quality of relations in which we are entangled through our energy practices and dependencies, and a global energy care ethics emphasises the global character of (many of) those relations.

But an energy care ethics is not solely global in character, and must not imagine that care or citizenship is solely, or even primarily, enacted on the basis of a global ethos of care. Findings from this research suggest that citizens prioritising local community relations express a more active engagement around energy in their everyday, while those lending relatively greater importance to the nature of national and global relations (characteristic of the politically and market oriented perspectives) expressed less awareness of and engagement with energy in their everyday. Thus, promoting a wholly global vision of citizenship appears counterproductive. Energy citizenship, while global in premise, must relate to the very material and spatial contexts of energy provision and consumption, providing local context for implementation. Only then, paradoxically, can its global premise be fulfilled.

6.5.4 Caring timescapes for sustainable energy webs

A temporal dimension has been implied within the concept of sustainability since its establishment in international politics with the Brundtland Report (United Nations, 1987). And the notion of intergenerational justice is receiving significant attention in the climate debate and, increasingly in energy justice scholarship (Healy and Barry, 2017; Pellegrini-Masini, Corvino and Löfquist, 2020). Similar to the debate around the ability of care ethics to acknowledge spatially distant relations and responsibilities for care, the same

questions have been posed in relation to intergenerational justice and temporally distant relations and responsibilities (Groves, 2011, 2019; Diprose *et al.*, 2019). Indeed, an energy care ethics must extend to distant relations, temporally as well as spatially. And, similar to the argument above regarding spatial distance, I suggest that the context of the energy web, if anything, makes also the temporally distant relationality even more tangible through the physical, visible/measurable depletion of resources on the one hand, and lasting infrastructures which will determine the structure and functioning of an energy system into the future.

But care-for-the-future is only one dimension of a care-full energy timescape. An energy care ethics also draws attention to a more inherent temporality. With the transition to more renewables-based energy webs, changing temporality of energy production is a key challenge, as increasing proportions of energy generation comes from variable and unschedulable sources such as the wind and sun. Due to the need for electricity grids to maintain a precise balance between energy generated and used at any point in time, this will have profound implications for our understanding of time and temporality in the energy web. Solutions are being developed to enable and encourage the management of energy use to respond to the needs of the grid. Demand side response and flexibility services are transforming the use of energy from an automatic, unresponsive, unconscious process, to a responsive practice capable of reacting to the balancing needs of the grid. Implicit in this changing temporality of energy use is an element of care (even if this is not reflected in the common terminology); a caring for the grid by responding to grid requirements, shifting energy practices to different times, turning demand on or off, up or down. This form of care work will become increasingly necessary to maintain the functioning of the kind of energy system, which can make as-well-as-possible living possible within the energy web, namely a system based on renewable sources of energy.

Furthermore, the notion of care implies something about continuity and persistence, contrasting the temporal delimitation implied by public participation and energy justice. Public participation tends to centre on unique moments of participation, and 'justice' is frequently associated with compensations for an injustice, for a burden accepted, allowing for temporal delimitation of a solution (captured neatly in the phrase "justice has been done"). Care ethics, meanwhile, is concerned with the sustained work required to maintain (good/caring) relations. A relation does not cease to exist upon the conclusion of public

consultation or the exchange of compensation. It may improve or degrade over time, can be maintained or broken. A participant in this research project raised an illustrative example; in Denmark, there is an institutional requirement for twenty percent of shares in a wind farm to be offered to local residents, and other similar initiatives exist in Denmark, the UK and elsewhere, through regulation or voluntary corporate responsibility projects, where, for example, a portion of the profits from an energy project is directed to a community fund. However, as said participant noted, critically; local shareholders in Danish windfarms are increasingly selling their shares off to German companies, who are willing and able to buy shares in wind farms from local residents at very attractive prices. An initial attempt to buy the goodwill of local residents by promoting a project as partially 'locally owned', establishes – at least monetarily or on paper – a mutually beneficial relation between residents and energy project. But what happens to this relation over time is an important – but so far neglected – part of the story.

A part of the story, which a relational, care ethical perspective helps bring to light. When locally held shares are sold off to foreign companies, what does that mean for local relations around a supposedly 'locally owned' energy project? This is not an argument for relations to remain static and unchanged; relations are always dynamic and evolving. But what an energy care ethics stresses is that relations must be cared for, respected – potentially (re)-negotiated – over time, and especially in events of change. Take, for example, the Danish repowering scheme; with many Danish wind turbines reaching the end of their lives, a repowering programme was introduced to replace old turbines with new, frequently larger, more powerful (and often more controversial) turbines. To maintain relations of as well-as-possible living in these local nodes of the energy web, care has to be an ongoing process.

6.6 Contemplating care in new terrains

Just as care ethics remains notably absent in energy social science scholarship, consideration of 'energy' remains largely absent from the by now well-established – across a wide range of disciplines – care ethical literature. This mutual disengagement is noteworthy, considering their shared concern with the fundamental conditions for human existence and the maintenance of societies. Central to care ethics is the concern with 'maintenance of life' and care as a precondition for human existence, and in energy research, the notions of energy

as "the lifeblood of modern societies" (Holt, 1999; Goldthau and Sovacool, 2012) and as a "basic necessity" (Walker and Day, 2016; Demski *et al.*, 2019) are commonplace.

Their mutual disengagement may come as no surprise considering the oppositely gendered notions of care and caring, on the one hand, and energy, technology and engineering on the other. Caring is strongly associated with femininity; as Joan Tronto (2013, p. 68) notes, "care is seen as women's work" (see Chapter 3 in Tronto (2013) for a thorough discussion of the gendered nature of caring). In contrast, energy is typically seen as a technological and, so to speak, masculine field.

Yet, as highlighted in section 6.1, energy is also deeply entangled in 'feminine', so to speak, everyday practices of care in the home, and the largely female burdens associated with the use of traditional sources of energy such as wood. Thus, different dimensions of the energy web are differently gendered; speculatively, we may see energy-as-technology as well as energy-as-production as 'masculine' dimensions, and energy-as-a-practice as 'feminine'. In displacing care onto the energy terrain, we are thus challenged to think of care as entangled both in the 'masculine' energy-as-technology-and-production and the 'feminine' energy-as-practice. A common critique of care ethics, for example, contests a perceived valorisation of the historically female burden of caring, as discussed in section 2.3.5. Contemplating how care is distributed in energy webs may encourage more inclusive, de-romanticised framings of care, supporting Nelson's (2018) call for an expanded notion of care to enable wider identification with its messages. An energy care ethics has the potential to move care beyond gender binaries, while opening the myriad of caring practices with which energy is entangled to critical gender analysis. A more-than-human energy care ethics, furthermore, moves care beyond anthropocentric assumptions, while foregrounding the responsibilities associated with existence as human carers in more-than-human webs of interdependence.

Extending care into the energy domain also exposes new areas of tension and draws renewed attention to care as potentially contested, discordant and non-innocent. For example, the energy transition exposes a tension between caring-in-the-present and caring-for-the-future. While the relevance of care ethics for addressing questions of intergenerational justice has, as previously noted, been explored in relation to climate change and sustainable development (Healy and Barry, 2017; Pellegrini-Masini, Corvino and Löfquist, 2020), this literature approaches future oriented care in isolation. Meanwhile, in

the ethical encounter with energy through everyday life, such care-for-the-future may sit in tension with contemporary care responsibilities. Only in acknowledging such contradictions and dilemmas and allowing debate over these, will care ethics be "sensitized" to the lived experience.

CHAPTER 7

Conclusion

This thesis has sought to contribute to a better understanding of how citizens relate with energy both in the everyday and to wider energy system change. To this end, I have argued, that energy social science scholarship will benefit from a greater recognition of the interdependent relationalities inherent to energy systems, the care required to maintain (and transform) them, and the ethicalities emerging out of our relational experience within interdependent energy webs. Based on research amongst residents in the UK and Denmark, I have shown how notions of relationality and interdependence are central to how people make sense of the energy transition and their place in it. I have argued, further, that existing frameworks, theories and vocabularies characterising energy social science scholarship are limited in their ability to capture these ways of thinking and relating with energy in the everyday. Drawing instead on an ethics of care (Sevenhuijsen, 1998; Held, 2006; Tronto, 2013; Puig de la Bellacasa, 2017), this thesis has presented a rethinking, based in a relational ontology, of the notion of energy citizenship and energy ethics more broadly.

In this final chapter, I revisit the four questions guiding the thesis, present key conclusions of the research, and reflect on the contribution of this work to the field of energy social science research. The research questions were set out as follows:

> RQ1: To what extent does the energy citizenship concept offer a relevant framework for understanding interactions of energy and ethics in the everyday.
>
> RQ2: How can a better understanding of citizens' ethical attitudes towards energy inform theorising of energy citizenship?

> RQ3: To what extent is Q-methodology useful for understand conceptualisations of energy system change from the everyday perspective of citizens?
>
> RQ4: How do everyday ethicalities around energy and low-carbon transitions differ (or not) across Denmark and the UK, and why?

I first address the two conceptual research questions, reflecting on the concept of energy citizenship in light the research findings and discussion presented in the previous two chapters. I then proceed to address the fourth research question, considering the country-specific analyses presented in Chapter 5. Finally, I address the third research question, drawing on methodological reflections presented in Chapter 3. Here I consider the opportunities presented by Q-methodology for energy social science researchers, as well as some key lessons and potential limitations to consider in future Q-methodological (energy) research. I conclude this chapter with a consideration of the potential contribution of care ethics to the field of energy social science research.

7.1 Careful energy citizenships

'Energy citizenship' (Devine-Wright, 2007; Goulden *et al.*, 2014), as critically reviewed in Chapter 2, remains an abstract, loosely defined concept, frequently employed in narrow and exclusionary ways (Walker and Cass, 2007) with little empirical underpinning beyond select groups of 'ideal' energy citizens (Radtke, 2014; Szulecki, 2018). Findings from this study lend empirical weight to a critique of such narrow, individualistic conceptualisations of energy citizenship[27] (Lennon *et al.*, 2019).

In this thesis, based on a critical review of energy citizenship literature and empirical research with citizens in Denmark and the UK, I have argued that, in its present manifestations, the concept of energy citizenship has limited relevance for understanding interactions of energy and ethics in the everyday. I have argued that narrow conceptions of

[27] Or the consumer, consumer-citizen (Spaargaren and Oosterveer, 2010; Vihalemm and Keller, 2016), prosumer (Ellsworth-Krebs and Reid, 2016; Ruokamo and Kopsakangas-Savolainen, 2016; Standal, Talevi and Westskog, 2020), prosumager (Koirala, van Oost and van der Windt, 2018; Gorroño-Albizu, Sperling and Djørup, 2019), or other innovative terms to denote the entangled person in the energy web.

energy citizenship have problematic implications for how individuals and their roles in the energy system are framed, and are both shaped by and, in turn, shape how individuals are framed in wider social science energy research, in particular in emerging accounts of energy democracy. This has implications for how we perceive relations between (energy) citizens, and relations between citizens and other actors in the energy web, including energy companies and political authorities.

While the energy citizen concept was introduced to capture advances in thinking around new roles of individuals in more sustainable energy systems, focus remains heavily on the role of end-user, consumer or prosumer, emphasising the connection between demand and supply and equating the lived experience of energy to the practice of energy consumption. Such a notion of energy citizenship, rooted in narrow, individualist conceptions of citizens, their roles and modes of engaging around energy, confines ethicality to decisions around the purchase and use of energy and appliances. Departing from this consumer conception, an alternative framing of energy citizenship is more closely associated with narratives of participation and community energy engagement. However, as discussed in Chapter 2, this framing has been critiqued for its limited conception of participation and selective focus on niche innovations such as community energy and energy cooperatives, leading to exclusive conceptions of who counts as energy citizens and what counts as energy citizenship. Thus, I have argued, common framings of energy citizenship risk being a force for exclusion rather than inclusion, and fail to fulfil the potential of the citizenship concept to contribute to broader ethico-political framings of energy debates and discussions over changing roles, priorities and ethicalities to guide the transition to a low-carbon society.

Meanwhile, based on analysis of citizens' ethical attitudes towards energy, I have also shown how the concept may be retheorised to better reflect how citizens relate in diverse ways with energy and the ethics of energy transitions. Based on findings from empirical Q-methodological research, presented in Chapter 5, I have discussed two central themes: plurality and relationality. First, the diversity observed across the four identified perspectives, highlight the need for a plural understanding of energy citizenship or, rather, energy citizenships. Secondly, across these different perspectives, relational understandings of energy systems and a language of interconnectedness, of dependence, necessity and needs have been shown to better reflect people's ethical sensibilities around energy and the low-carbon transition, than for example a language of justice and rights. Thus, I have argued, for

the energy citizenship concept to provide a relevant framework for understanding everyday perceptions of and engagements with energy and low-carbon transitions, it needs to better reflect these lived ethicalities around energy.

Based on these research findings, I have discussed how a relational ethics of care may enrich our theorising of energy citizenships, to better reflect everyday ethicalities around energy and the energy transition. I have argued for a plural, care ethical account of energy citizenships to move away from the notion of the 'ideal-typical citizen' (Szulecki, 2018), advanced by much contemporary energy social science literature, as well as political energy discourses. From a care ethical perspective, I propose, 'energy citizenship' is not about adhering to predefined behaviours and practices, it is a declaration about relational existence within the energy web. And it is out of this relational existence that ethicality arises. Here, I have argued, responsibility takes centre stage in a relational theory of energy citizenships; a mutual, shared form of responsibility arising out of interdependent relations of care within energy webs.

Notably, in suggesting care ethics as resonating with lived ethicalities around energy, I do not, however, imply that a fully-fledged ethic of care is to be found in the viewpoints observed in this Q-study. Nonetheless, these perspectives exemplify key elements of, and indicate an openness to the sort of ethical engagement enabled and encouraged by – and required for – an ethos of care; an ethical engagement and sense of personal-collective commitment rooted in interdependence within a complex energy web made up of myriad (caring) relations.

7.2 Insights from cross-national research

In order to address the question of how and why everyday ethicalities around energy and low-carbon transitions may differ (or not) across Denmark and the UK, this thesis has considered insights from Q-methodological research with residents in Denmark and the UK. Q-factor analysis was conducted with the combined data from all participants, and separately with data from Danish and British participants, respectively. Based on the findings and interpretations across these three rounds of analyses, I was able to identify both similarities and some notable national particularities between the ethicalities emerging in the Danish

and British contexts. I reflect on these below, but before doing so, I would like to point to a key limitation of the research in relation to this research question.

In responding to this research question, I consider that an alternative research design may have enabled a more comprehensive response. While the findings from the three rounds of analyses enabled response to the first part of the question (*how* perspectives differ (or not) across Denmark and the UK), the second part of the question (*why)* would have benefited from further engagement with participants to discuss the results of the Q-factor analyses. Alternatively, this could have been achieved through a second round of data collection with new participants, drawing on findings from the first study. This would have had the added benefit of validating the identified perspectives with a different group of people. Re-engaging the same group of participants, meanwhile, would align with the Q-methodological principle of self-reference, by providing for participants to feed in to, or confirm or challenge, the interpretation of results. It is also possible, that more practical experience of conducting Q-methodological research with a substantial qualitative element, would lead to improved outcomes from the first round of data collection, through greater awareness of how to get the most out of the combined Q-sort exercise and accompanying interview.

Nonetheless, the country-level analysis did facilitate reflection on similarities and differences in the ethical attitudes amongst Danish and British participants. As illustrated in Chapter 5, perspectives identified from the 'meta-analysis' represented country-specific perspectives relatively well, suggesting that there are significant commonalities between the Danish and British contexts with regards to how citizens perceive and relate with energy and a low-carbon transition.

Meanwhile, some notable differences were observed between Danish and British perspectives. The differences between country-specific perspectives may be explained with reference to national public discourses around energy, suggesting that public and political discourse impact on everyday relations with energy. This is not surprising, but shows that public and political discourse around energy and the energy transition matters for how people perceive and engage with energy and ethics in the everyday.

Most notably, some important differences were identified between a British and a Danish manifestation of the market-oriented perspective. A greater emphasis on an

economic logic and private responsibility in the Danish perspective may be indicative of a public debate characterised by an ideological division between socialist and liberal visions of the energy transition. Meanwhile, a focus in the British manifestation of a market-oriented perspective on affordability of energy and government responsibility may reflect a public discourse around the energy market, in the UK, more concerned with the affordability of energy for consumers.

Moreover, a concern with the affordability of energy represents a more general distinction between Danish and British perspectives on the energy transition, representing a key distinction also between the Danish and British manifestations of a politically oriented perspective. This is likely a reflection of the prevalence of energy poverty considerations in public and political discourse in the UK, a discussion largely absent in the Danish context. It could also reflect a material difference between Denmark and the UK, with Danish homes generally characterised by better energy efficiency than the housing stock in the UK, resulting in (a perception of) low levels of vulnerability to energy poverty in Denmark.

A key distinction between the Danish and British manifestations of a community-oriented perspective was found in the extent to which this reflected an interest in direct personal engagement with local energy initiatives. This could be a reflection of the diverse histories of energy development in the two countries. Thus, in the UK, where community energy is a relatively recent phenomenon receiving attention and support as part of a decentralised energy agenda, a community-oriented perspective reflects an enthusiasm for such opportunities for engagement. In contrast, local cooperative energy development has a long history in Denmark. However, this has been replaced, over recent decades, by more centralised, large-scale developments, consolidations of cooperatives into large consortiums, and increasing local controversies over energy projects, which are seen increasingly as driven by financial motives rather than social or community objectives. This could help to explain the low level of interest in this form of engagement with energy amongst Danish participants in this study.

These observations draw attention to a context-specificity of everyday ethicalities around energy and energy transitions. Here, a care ethical perspective offers an interesting alternative to the universalism of a justice-based framework, for understanding how ethics arises in particular relational contexts. Notably, this research did not originate in a care ethical approach (the care ethical perspective emerged through reflections on the research

findings); further research, taking care ethics as a starting point, is needed to further explore the meanings and relations of care in and across particular contexts.

7.3 Reflections on the applicability of Q-methodology

Finally, this thesis has considered the relevance of Q-methodology for investigating engagements with energy and ethics in the everyday. Based on the experience of the present study, Q-methodology was found to be a useful tool in opening up the complexities and ambiguities of the topic of energy transitions in conversation with people of varying levels of energy knowledge. Importantly, Q-methodology was experienced by participants as interesting, engaging and thought-provoking, and allowed discussion of a wide range of complex debates in what was experienced as a thought-provoking but non-confrontational setting. My experiences from the present study support previous claims (Riley, Schouten and Cahill, 2003; Burke, 2015) that Q-methodology offers an engaging and empowering experience for research participants. Participants generally found the process interesting and engaging. Many stated their appreciation of the process as thought-provoking, and felt that they learned something, or gained a new awareness, as a result of participating.

The more structured nature of a Q-study as compared with traditional qualitative interview methods was found to be a strength, particularly in enabling participants to engage in a conversation about complex and, for many, unfamiliar issues. At the same time, the Q-study offers a less fixed structure than quantitative surveys or valuation methods. The more accommodating and flexible nature of Q-methodology offers participants greater control and room for interpretation than would be the case under traditional quantitative research methods. While an extent of structure remains, which some participants expressed frustration over, the decision, in the present study, to conduct data collection through one-to-one interviews provided additional scope for participants to qualify their decisions in the Q-sort process and ensure that their reflections throughout were recorded for analysis. This highlights Q-methodology as an interesting option for energy social science research, where the negotiation of reduction and articulation of complexity has been identified as one of the main methodological frontiers (Köhler *et al.*, 2019).

In contrast to common quantitative methods, Q-methodology generally does not allow generalizability of demographic relationships, nor any identification of how prevalent

each viewpoint is in the wider population. Notably, this is also not the aim. Rather, the aim is to understand the structure and patterns of subjective views on a topic. Where generalisability is sought, these substantive insights gained from a Q-study can be used to inform further quantitative research, to pursue more generalizable findings. For example, quantitative valuation studies in energy research could benefit from a better understanding of subjective viewpoints, or more substantive understandings of subjective values and preferences around energy development. In order to facilitate quantitative insights, valuation research must simplify the problem under study, greatly reducing complexity and nuances. Empirically grounded principles to guide this reduction are important to ensure relevance of such survey design. Here, Q-methodology could play an important role, as a method enabling nuanced analyses and interpretation while maintaining a degree of structure.

Interestingly, several participants reflected on the experience of relating to subjective statements originating largely from public debate, as an interesting, stimulating way of engaging with debates in a non-confrontational way[28]. Thus, while other methods exist to encourage deliberation over a question or topic, and while Q-methodology is not a method for facilitating deliberation amongst participants (although Q-methodology could form part of a more actively deliberative process), Q-methodology was seen as a way to privately deliberate, so to speak. Participants frequently stopped, when faced with a statement they strongly disagreed with or found irrelevant, to consider what the other side of the argument might look like; sometimes changing their mind in this process of reflection. The emphasis by several participants on their appreciation of the non-confrontational nature of the method – one of whom contrasted this experience with a previous experience of participating in a focus group – highlights that more deliberative methods are not by default a positive – or constructive, emancipatory – process, but can become confrontational and intimidating to some participants. In this respect, Q-methodology may be seen as an alternative method for facilitating reflection on divergent viewpoints, including critical self-reflection, while avoiding confrontation. Enabling such reflection is an important objective for energy social science research (Jasanoff, 2018), and with a need for and interest in new methods to help

[28] Moreover, one participant commented on the fact that the Q-set statements were sourced from public debates rather than being formulated by the researcher, making her feel more free and confident to respond honestly, without needing or wishing to answer 'correctly' or please or impress the researcher.

facilitate this (Robison *et al.*, 2018), Q-methodology could be an interesting addition to the methodological toolbox.

A key limitation of Q-methodology is the cognitive burden associated with reading and sorting a large number of statements around a, possibly complex, topic. The one-to-one interview setting in which Q-sorts were administered in the present study was found to ease the process. While Q-studies have been successfully conducted in other formats (e.g. workshop and online), experience from the present study suggests that one-to-one engagement with Q-sorters is beneficial, both for participant experience, and for data quality. Notably, this will be of particular relevance to researchers wishing to amplify the qualitative potential of the method.

One aspect complicating the process for some participants was the limitations imposed by the structure of the Q-sort grid, allowing – in the present study – the ranking of just four statements at either extreme. While it was not felt that this presented an actual problem in any of the interviews, future research could consider an alternative structure for the Q-sort grid, to have more spaces at the extremes. This will depend on the particular topic and purpose of any given study, but for open-ended, exploratory research covering a wide topic area, this may be a particularly relevant considerations.

From a researcher perspective, Q-methodology offers an interesting tool around which to engage participants, in particular, I suggest, if views are sought around a complex topic from participants with varied levels of expertise on the topic. Thus, I suggest, Q-methodology may be a relevant instrument for research seeking insight into broader values around energy and energy transitions (Pidgeon *et al.*, 2014). Moreover, using Q-methodology as a tool in face-to-face interviews was found to generate rich and nuanced data, in addition to the Q-sorts themselves. This was found to be of great value, but also presented a challenge for the process of analysis. Based on the experience of using Q-methodology in this research project, a key recommendation is to target the process of analysis according to the purpose of the research. This may sound self-evident, but in the process of Q-factor analysis, it is easy to get carried away in the analysis and interpretation of factors, and with a rich set of qualitative data accompanying the Q-sorts, this can become a very elaborate and time-consuming exercise. While this may be valuable for a given research project concerned with understanding the specific patterns of particular perspectives, if the purpose of using Q-methodology is more as tool for opening up a complex topic – as

I propose may be an interesting use of the method – a balance needs to be struck between Q-factor analysis and further qualitative analysis.

7.4 Research limitations

Above, I have discussed limitations in the research design for providing a comprehensive response to my fourth research question. Additionally, as discussed in Chapter 3, the findings of the research need to be seen in light of sampling limitations. In particular, it is likely that the participant sample reflects an element of self-selection bias, with possible implications for the types of perspectives identified in the study. In other words, people with a prior interest in the topic of energy, or more broadly of climate change and sustainability, may have been more likely to accept the invitation to take part in the research. This could mean that the study has missed out potentially more sceptical or disengaged perspectives on energy and energy transitions. The method of recruitment sought to mitigate this and, as discussed in Chapter 3, did achieve the inclusion of participants with varying extents of prior engagements with energy (e.g. home renovation, reading or talking about energy, investment in energy technologies), and some participants, who explicitly claimed little or no knowledge and/or opinion on the topic, although this was a minority.

A further sampling limitation was the unequal representation of different socio-demographic categories. Thus, an important question for further research is how care ethics resonates differently, or may not resonate, with the ethical experiences of those groups underrepresented in this study; this could include, for example, more younger people, people living in rented accommodation, and more people with lower income and educational attainment. It should be noted, in general, however, that this research, as is the case for most Q-methodological research, is not generalisable to the wider population; neither was this the aim of the study.

7.5 Avenues for further research

Having proposed a care ethical conception of energy citizenships, this thesis has also raised a number of questions about the further potential of a care ethical approach to energy social science research more broadly. Below, I highlight three areas where further research would be particularly interesting: 1) energy democracy, 2) constraints and 3) timescapes.

First, rethinking energy citizenships with care raises questions about the implications hereof, and of care ethical thinking in general, for theorising of energy democracy. As considered in Chapter 2, these two concepts are closely related and are subject, in their current manifestation, to many of the same critiques around narrow individualism and exclusive framings of participation. Thus, further to my discussion in Chapter 6, one interesting avenue for future research would be to extend a care ethical analysis to the concept of energy democracy. This could build on the three principles of a care ethical account of energy democracy, proposed in this thesis (section 6.5.1): 1) valuing care in energy webs 2) meeting needs, and 3) institutions/procedures rooted in mutual respect and responsiveness.

Second, the concept of constraints (Stengers in Puig de la Bellacasa, 2017, p. 152) offers an interesting focus for further research, relating to discussions in this thesis around dilemmas and tensions as important elements of everyday engagements with energy and ethics. This builds on discussions, in Chapters 5 and 6, around energy generation and siting, monetary forms of engagement, tensions between different caring responsibilities, future care vs. caring in the present, and the controversial topic of rights and needs and how these may (or may not) be defined. Can an ethics of care serve as a framework to navigate these dilemmas? Or at least to open up and frame more nuanced discussions, both at an individual and societal level? And how might an energy care ethics reframe the questions and debates around these topics?

Finally, it would be interesting to explore further the notion of timescapes of energy and care, as briefly considered in the Discussion (section 6.5.4). This could take various forms. For example, intriguing questions emerged from this research around relations of care in local energy projects, the temporality of relations in the energy web, and their evolution over time. A better understanding of the continuity of care and relations in the energy web, and how they may improve, deteriorate or break down over time, would add much needed nuance to debates of public and community engagement, understanding of the dynamics of acceptance and opposition, and the continuously unfolding ethicalities around energy. Future research could also look at the changing temporalities emerging around flexible, responsive energy consumption (and generation), and how care ethical notions of relationality, shared responsibility and responsiveness may be useful in understanding and framing these practices.

7.6 Thinking energy with care

I conclude this chapter with some broader reflections on the contribution of the thesis, and on the potential and timeliness of a care ethical energy scholarship.

In light of findings from this study, and other previous and recent advances of relational thinking around energy systems, it is thought-provoking that our frameworks and vocabulary for discussing matters of energy and energy transitions remain significantly marked by individualism, whether in the form of individual responsibilization or individual rights. As this thesis has argued, energy social science research needs to develop a new register to address normative demands, capable of giving expression to relational notions of responsibility, interdependence and necessity.

To this end, I have argued that an ethics of care has the potential to enrich our thinking around energy citizenships and ethical interactions around energy in the everyday. Moreover, having explored some further implications of a care ethical approach, in particular with regards to notions of energy democracy, the possibility of a more-than-human energy care ethics, as well as spatial and temporal implications, I propose a wider engagement of energy social science scholarship with a more-than-human care ethics. This has the potential to enrich debates around energy transitions in ways sensitized to lived realities of energy in the everyday as well as the collective, relational existence within energy webs.

This complements a recent surge in relational approaches to the study of energy systems and transitions, but moves beyond an analytical focus on interconnection as a property of energy systems, to consider relationality as an underlying condition, on the basis of which ethical sensibilities arise. This thesis has illustrated how a sense of relationality underpins people's sense of responsibility, and ethical sensibilities more broadly. Not in the sense of systemic interconnections, through which our actions and behaviours are (causally) linked to actions and events elsewhere, but in the sense of complex interdependencies, giving rise to notions of responsibility as shared and emerging in response to necessity, but also as ambiguous and contradictory. A more-than-human energy care ethics offers a framework and alternative ethical vocabulary better able to give expression to relational, ambiguous experience around energy in transition.

A care ethical perspective on energy systems and transitions also has significant practical implications. Concretely, a care ethical approach could foster more effective modes

and formats for engagement. As discussed in the previous chapter, a care ethical approach to participation would stress mutual respect and responsive engagement, stressing responsibility of both participants and 'facilitators' for enabling effective processes of engagement. Another significant implication of a care ethical approach in the energy field lies in drawing attention to the importance of relations, of fostering as well as maintaining relations. This could have implications for community energy initiatives, by stressing the importance of the social, relational context and role of the initiative alongside substantive energy/sustainability objectives. For energy project development and management, a particularly interesting implication of a care ethical approach is its emphasis on the importance of continued negotiation of relations as an energy project evolves, expands, changes ownership, and as the context in which it is embedded evolves and changes.

At a higher level, a more-than-human energy care ethics has the power to change narratives. A care ethical perspective challenges the narrative, dominant in industry and policy worlds, of the autonomous, rational consumer, and the narrow, exclusive framings in academic and policy discourses around energy citizenship. It creates an alternative narrative of (inter)dependent persons embedded in complex, more-than-human relations of care and replaces notions of individual responsibilisation (and rights) with notions of mutual, distributed responsibilities, dependencies, reciprocity and responsiveness, changing the focus from individual consumption and responsibilities to the responsibilities of – and between – a whole range of (interdependent) actors. Such shift in narrative as well as new ethical vocabulary could change communication strategies and messaging from all actors in the energy space, including political messaging, communications to householders from energy suppliers and service providers, and messaging and campaigns by environmental movements. An energy care ethics could also help to nuance an often polarised public debate by shifting focus from binary notions of us versus them, support vs opposition, good versus bad, right against wrong, to a recognition of, respect for, but also critical reflection on the diverse and nuanced experiences, perceptions and caring concerns associated with being within energy webs in transition.

There is, perhaps, no better time to draw attention to care as a practice of ontological and ethical significance, also in the energy context. As societies across the world continue to address the challenges posed by the global coronavirus pandemic, societal priorities are turned upside-down, conventional 'truths' are being questioned and the

indispensability of diverse practices of care is being highlighted. From healthcare workers to workers at every stage of the food supply chain, from farmers to supermarket staff to delivery drivers, and to energy workers, the value of 'critical workers' for providing the care necessary to maintain as-well-as-possible living is being recognised to an unprecedented degree. There is significant opportunity for further research to explore the (changing) meanings and practices of both energy and care as a consequence of this ongoing pandemic, and to consider the implications hereof for a care-full transition to net-zero.

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Appendix 1: Principles & procedures of Q factor analysis

Principles of Q factor analysis

Q-methodology relies on factor analysis to make sense of collected Q-sorts and identify patterns of similarity and difference in how participants have ranked the items of the Q-set. Factor analysis is a method of data reduction, based on correlation statistics[29]. It serves to identify groups of highly correlated variables within a dataset, i.e. variables that appear to covary – or vary together in a similar way – across the study population. The basic premise is, that a group of covarying observed variables may indicate the existence of a single underlying, unobserved or latent *factor,* which may help to explain the ways participants have sorted the statements in the Q-set.

As opposed to the traditional Spearman's factor analysis, where focus is on correlations between variables such as attributes, traits, abilities, etc. characterising the study observations (e.g. participants), in Q factor analysis, participants – the Q-sorters – are the variables, while the statements from the Q-set make up the observations. In other words, a Q-study uses by-person factor analysis, as opposed to the traditional by-variable factor analysis. To illustrate, Spearman's factor analysis would look at correlations by column, as shown in Table 11 (e.g. (how) does income vary with level of education), while a Q factor analysis would look at correlations by row, as shown in Table 12. What is of interest in the Q factor analysis is thus correlations between individuals' whole Q-sorts – i.e. each participant's ranking of all the statements relative to other participants' ranking of all the statements.

[29] Correlation is a measure of similarity between two sets of variables (in this case between two individuals' Q-sorts), measured on a scale from -1 to +1. A correlation of 0 indicates no relation between the two Q-sorts, a high positive correlation suggests a high degree of similarity in how two individuals have ranked each statement, while a high negative correlation suggests that the statements ranked highly positively by one individual have been ranked highly negatively by the other.

The factors resulting from a traditional by-variable factor analysis describe "associations and difference *between variables* mapped at the population level" (Watts and Stenner, 2012, p. 11), whereas factors resulting from a Q factor analysis "map out the field into groups of persons who resemble one another with respect to whole aspects of their personality" (Stephenson, 1936, p.278 in Watts & Stenner 2012, p.14). Q factor analysis thus aims to identify *'types'* – types of people, types of viewpoint – across different life domains or contexts (Watts and Stenner, 2012, p. 14).

Table 11. Structure of Spearman's factor analysis

	Characteristic 1 (e.g. education)	Characteristic 2 (e.g. income)	…	Characteristic N
Individual A				
Individual B				
…				
Individual n				

Table 12. Structure of Q factor analysis

	Statement 1	Statement 2	…	Statement *N*
Individual A				
Individual B				
…				
Individual *n*				

Unlike many statistical methods, factor analysis does not provide a single, definite solution. Watts and Stenner (2012, p. 95) illustrate this with a cake analogy; if we think of a Q dataset as a "big cake of mixed-up meaning", and a *factor* as a slice of the cake, then:

> "[t]he infinite solutions issue … makes itself manifest as soon as we ask ourselves: *How many slices does the cake possess?* … Any cake can legitimately be sliced in a huge variety of different ways, none of which could ever be thought of as universally correct or definitive, but very many of which could prove *acceptable*".

Similarly, in factor analysis, there could be many different ways of extracting and *rotating* factors to present an acceptable solution. In Q-methodology, a factor reflects an underlying dimension, with which observed Q-sorts correlate to varying degrees. The number of factors extracted thus determines the number of dimensions (or viewpoints) identified. *Any* factor solution (number and rotation of factors) presents a *possible* definition of underlying dimensions of the data. Determining a 'best' factor solution can be based on either a

deductive or inductive approach, commonly known as confirmatory factor analysis (CFA) and exploratory factor analysis (EFA), respectively. Q factor analysis typically follows an inductive (exploratory) approach, "[letting the] data take the lead" (Watts and Stenner, 2012, p. 95) and staying true to the Q methodological principle of *self-referential* subjectivity (section 3.2).

Centroid Factor Analysis vs. Principal Components Analysis

Various methods exist for the extraction of factors, and there are ongoing debates about the best approach. Most used amongst Q-methodologists is the centroid method. This is not, however, the most mathematically precise technique available to factor analysists and, indeed, in the quantitative factor analytic community is generally dismissed as an outdated technique. The principally cited strength of the centroid factor analysis (CFA) is its computational simplicity, but with the aid of computers, other techniques, such as principal components analysis (PCA), have become widely preferred for their ability to offer more exact and, importantly, mathematically conclusive results. Nonetheless, many Q-methodologists continue to practice centroid factor extraction, for a number of conceptual and theoretical reasons, and this is also the method chosen in this study, due to its theoretical and conceptual consistency with the philosophical underpinnings of Q-methodology.

Conceptually speaking, CFA can be described as a method for the development of theory about the observed data (in the case of Q-methodology, about observed worldviews) (Ramlo, 2016a), whereas PCA is a statistical procedure for reducing a number of variables to a smaller number of principal components reflecting observed mathematical relationships, which may or may not have theoretical or real-world relevance. This is because the conceptual and mathematical underpinnings of CFA and PCA differ fundamentally (Figure 15). In PCA, components are extracted, which are actual linear combinations of observed variables; a component is expressed as a linear function of observed variables. In CFA, variables are expressed as linear functions of factors. In other words, in PCA, components are *defined and explained by the variables* they are made up of, while, in CFA, factors are *theoretical constructs* which help explain observed variables:

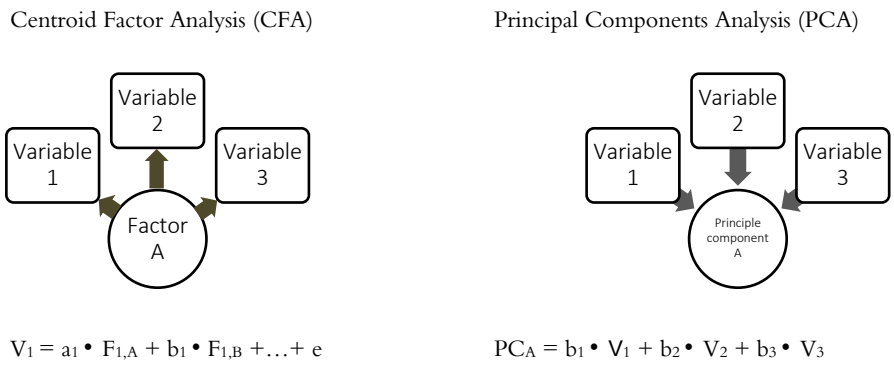

Figure 15. Conceptual overview of CFA and PCA

Thus, conceptually speaking, CFA can be described as a method for the development of theory about the observed data (in the case of Q-methodology, about observed worldviews) (Ramlo, 2016a), whereas PCA is a statistical procedure for reducing a number of variables to a smaller number of principal components reflecting observed mathematical relationships, which may or may not have theoretical or real-world relevance.

Furthermore, the indeterminacy of factor solutions reached by CFA is in keeping with the Q-methodological philosophy of exploration and discovery. Conversely, the idea of a single statistically correct answer, characteristic of PCA, is inconsistent with Q-methodology, where theoretical relevance may be of greater importance than statistically calculated significance. Finally, whereas PCA takes its starting point in total variance, centroid factor extraction takes into account error and unique variance, so that factors are extracted only based on common variance (further elaborated below).

Notably, the results of different factor analytic approaches have been found to differ very little (Zabala, 2014). Due to its theoretical and conceptual consistency with the philosophical underpinnings of Q-methodology, as outlined above, this study employs the centroid method. The procedures involved in factor extraction are outlined below (for detailed explanations, see Brown (1980), see Watts and Stenner (2012) for very accessible description).

Procedures & statistical underpinnings

Correlation statistics

Factor extraction is based on a correlation matrix for all Q-sorts. The equation[30] for the correlation between two Q-sorts is given by:

$$r_{1,2} = 1 - \frac{{d_{1,2}}^2}{2Ns^2} \quad (1)$$

$r_{1,2}$ is the correlation coefficient between Q-sorts 1 and 2
$d_{1,2}^2$ is the sum of squared differences between Q-sorts 1 and 2, between the pairwise scores assigned to each statement
N is the size of the Q-set (31)
s^2 is the variance.

This is a simplified version of the standard equation for Pearson's r, applicable to data where means and standard deviations are the same for all variables, as is the case in Q-studies where all Q-sorts follow the same forced distribution (see Brown (1980, pp. 264–275)). For example, in the present study, all participants were asked to sort 31 statements onto a forced distribution from -4 to +4 with scores and frequencies as shown in Table 13.

Table 13. Structure of present Q-study

										Sum
Scores (X)	4	3	2	1	0	-1	-2	-3	-4	0
Frequencies (f) (i.e. number of statements)	2	2	4	5	5	5	4	2	2	31
f*X^2	32	18	16	5	0	5	16	18	32	142

Based on Table 13, measures of variability for all Q-sorts in present Q-study are given by:

$$s^2 = \frac{\sum fX^2}{N} = \frac{142}{31} = 4.58$$
$$s = \sqrt{s^2} = \sqrt{4.58} = 2.14 \quad (2)$$

s is the standard deviation
s^2 is the variance
X is a score on the Q-sort scale
f is the frequency with which a score occurs
N is the number of statements in the Q-set (in this case N = 31).

[30] This is a simplified version of the standard equation for Pearson's r, applicable to data where means and standard deviations are the same for all variables, as in a Q-study where all Q-sorts follow the same forced distribution (see Brown (1980, pp. 264–275)).

The diagonals in the correlation matrix marks a key distinction between CFA and CPA. A standard correlation matrix uses ones (1s) in the matrix diagonal, and this is the basis for principal component extraction in PCA. This indicates that any individual variable is 100% correlated with itself (also known as the 'closed model'), and thus presumes no error variance. In a Q-study, however, it is unrealistic to expect an individual's Q-sort to be free from some amount of uncertainty (error variance); in other words, it is unlikely that a person would sort a set of statements in exactly the same way on two separate occasions. While empirically measured self-correlation – test-retest correlation – would be the ideal entries for the matrix diagonals, such measure is usually not available (Brown, 1980)[31]. Instead, a measure of *communality* – how much one Q-sort has in common with the other Q-sorts in the study – is used. In this way, factors are extracted on the basis of shared meaning; based on portions of meaning, or views, held in common across multiple individuals. A Q-sort's communality (h^2) is calculated as the sum of that Q-sort's loadings on all factors (the sum of squared loadings):

$$h_1{}^2 = f_{1,A}{}^2 + f_{1,B}{}^2 + \cdots + f_{1,N}{}^2 \quad (3)$$

$\boldsymbol{h_1^2}$ is the communality for Q-sort 1
$\boldsymbol{f_{1,A}}$ is the loading of Q-sort 1 on factor A
$\boldsymbol{N}$ is the number of factors extracted.

Factor extraction

The process of factor extraction is then an iterative process aiming to maximise the sum of the squared loadings of all Q-sorts on a factor[32]. The extraction of the first factor involves the calculation of factor loadings (f) for each Q-sort:

$$f = \frac{t}{\sqrt{T}} \quad (4)$$

$\boldsymbol{f}$ is the factor loading
$\boldsymbol{t}$ is the column total (the sum of a Q-sort's correlations with all Q-sorts in the study, including self-correlation)
$\boldsymbol{T}$ is the total sum of the correlation matrix.

[31] For most studies it would be impractical, if not impossible, to repeat the Q-sort on several occasion with each participant to obtain such measure.

[32] This is another key distinction between PCA and CFA; PCA seeks to maximise the amount of variance explained

In order to obtain t and T, the entries of the matrix diagonals (i.e. communalities) have to be included. As communality is defined by the final loadings, an *initial estimate* of communality is used. Brown (1980) uses the average correlation ($\bar{r}$) of a column as the initial diagonal entry for said column, emphasizing that the choice of initial estimate is unimportant, as the process of iteration will lead to a closer and closer approximation of the actual measure of communality. The resultant factor loadings (f) are accepted if, for each Q-sort, $f^2 \approx \bar{r}$, to a precision of ± 0.02. If this is not the case the iterative process continues to a second round. All $\bar{r}$ in the diagonals are then replaced with the initial estimated factor loadings, squared (f_1^2), resulting in new column and matrix totals (t_2 *and* T_2). Second estimates of factor loadings (f_2) are calculated in accordance with equation 4, and compared to the f_1 estimates in the matrix diagonals; the process is ended if, for all Q-sorts, $f_1^2 \approx f_2^2$, to a precision of ± 0.02, otherwise the process continues with a third iteration, and so on, until estimates of factor loadings are accepted for the first factor.

Factor extraction is a step-by-step process; for each extracted factor, a portion of shared meaning is, so to speak, extracted from the initial correlation matrix. The first extracted factor will account for the largest portion of study variance. The extraction of subsequent factors is based on *residual correlations*, i.e. the associations between Q-sorts disregarding the influence (or common variance) described by the previously extracted factor. By removing the effect of the first factor from the correlation matrix, a *table of first residuals* is computed. The residual correlation between two Q-sorts after the extraction of factor A ($r_{1,2 \cdot A}$), is given by:

$$r_{1,2 \cdot A} = r_{1,2} - f_{1,A} \cdot f_{2,A} \qquad (5)$$

$r_{1,2}$ is the original correlation between Q-sorts 1 and 2

$f_{1,A}$ ***and*** $f_{2,A}$ are the loadings of Q-sorts 1 and 2, respectively, on factor A.

This is done for all pairs of Q-sorts, creating a table similar to the initial correlation matrix. A second factor (factor B) can then be extracted through a similar iterative process as that for factor A, but based on the table of first residuals, instead of the correlation matrix. The effect of factor B is then removed from the table of first residuals, in accordance with Equation 5, to produce a table of *second residuals*, from which a third factor can be extracted, and so on. This process could go on to extract many more factors than would be relevant; the question is when to stop; how many factors to extract.

How many factors?

Several 'rules' exist to determine the appropriate number of factors. Eigenvalues are the most commonly used criteria for selecting the number of factors to retain in quantitative factor analysis. Eigenvalues (EV) are a similar measure to that of communality, but for factors rather than for variables (Q-sorts). Thus, where a Q-sort's communality indicates how much of that Q-sort's variability is accounted for by all factors, a factor's Eigenvalue indicates how much of the total study variance is accounted for by that factor. EV is calculated as the sum of squared loadings of all Q-sorts on a factor:

$$EV_A = {f_{1,A}}^2 + {f_{2,A}}^2 + \ldots + {f_{N,A}}^2 \quad (6)$$

$\boldsymbol{EV_A}$ is the eigenvalue of factor A

$\boldsymbol{f_{1,A}}$ is the loading of Q-sort 1 on factor A

$\boldsymbol{f_{2,A}}$ is the loading of Q-sort 2 on factor A

$\boldsymbol{N}$ is the number of Q-sorts in the study.

Eigenvalues are indicative of a factor's statistical strength; the higher the value, the stronger the factor's explanatory power. The Kaiser-Guttman criterion states that a factor should be included in the final factor solution if EV > 1. This is likely, however, to lead to the extraction of far more factors than is relevant (Watts and Stenner, 2012, pp. 106, 110), as an eigenvalue lower than one simply suggests that the factor explains less than what a single Q-sort explains.

Like EV, *factor variance* offers a measure of the strength and potential explanatory power of an extracted factor (Watts and Stenner, 2012, p. 105). A factor's variance is defined as the percent of total study variance accounted for by the factor, and is derived from its eigenvalue:

$$Variance_A = 100\frac{EV_A}{N} \quad (7)$$

A solution accounting for 35% - 40% or more of total study variance can generally be accepted (Kline (1994) in Watts and Stenner, 2012).

A third approach, *Humphrey's rule,* posits that a factor is significant if the cross-product of the two highest loadings on the factor (regardless of sign) is greater than two

times the standard error[33]. The same rule can be applied less strictly, so that a factor is accepted if the cross-product of the two highest loadings (regardless of sign) is greater than the standard error.

$$SE = 1 \div \left(\sqrt{N_{Qset}}\right) = 1 \div \sqrt{31} = 0.18$$
$$2 \cdot SE = 2 \cdot 0.18 \ = 0.36 \qquad (8)$$

Another alternative is to retain a factor if it has two or more significant factor loadings; i.e. two or more Q-sorts load on the factor with loadings that are statistically significant. Statistical significance is a measure of the probability of a given deviation from the sample mean occurring by chance. A deviation is commonly accepted as statistically significant if it has less than a 5 % probability ($p < 0.05$) or, for a stricter criterion, less than a 1 % probability ($p < 0.01$) of occurring by chance. Ultimately, it is up to the researcher to define the level of significance to apply. Further criteria can be added; for example, a factor may be retained only if 2 or more Q-sorts load significantly *and purely* onto the factor. A *pure* loading then needs to be defined, for example that the Q-sort does not load significantly on any other factor, at the 0.05 level (or some other researcher defined level).

For the present study, the levels of statistical significance (at significance level 0.01 and 0.05) were calculated, in order to identify Q-sorts loading significantly onto each factor.

$p < 0.01$ significance level:

$$2.58 \times \frac{1}{\sqrt{N}} = 2.58 \times \frac{1}{\sqrt{31}} = \ 0.4634 \qquad (9)$$

$p < 0.05$ significance level:

$$1.96 \times \frac{1}{\sqrt{N}} = 1.96 \times \frac{1}{\sqrt{31}} = \ 0.3520$$

Thus, in the present study, a Q-sort loading onto a factor with a loading of 0.35 or 0.46 and above, indicates that the Q-sort is significantly associated with that factor at the 0.05 or 0.01 level, respectively.

[33] The Standard Error (SE) is an estimate of how far the sample mean is likely to be from the population mean.

As both Brown (1980) and Watts and Stenner (2012) show, the choice of decision criteria can make a big difference for the number of factors to be retained in the analysis. It is thus worth exploring various statistical criteria, without letting these overrule a potential solution based on theoretical reasoning or knowledge of the data.

Finally, Brown (1980, p. 223) advocates for a different, non-statistical approach: "the magic number 7", which he bases on experience with Q-methodological research. It is generally advised to extract more factors than is indicated by various statistical tests; "[n]othing at all can be lost … by extracting them, rotating them and having a good look, since they can always be discarded further down the line" (Watts and Stenner, 2012, p. 110). Brown (1980, p. 223) suggests that retention of insignificant factors may actually be beneficial, as these "frequently contain small amounts of systematic variance that can help in improving the loadings on a major factor … After rotation, insignificant residual factors are merely discarded".

Factor rotation

After factor extraction, factors are *rotated.* This is a process of adjusting the angles from which the Q-sorts are viewed and interpreted. It is these viewing angles, in relation to which the Q-sorts are interpreted, which are described as factors. To illustrate, one can imagine a multi-dimensional space (with as many dimensions as there are factors extracted) onto which each Q-sort is plotted. This space can be represented in a diagram with as many axes as there are factors, and each axis is described as a factor. These axes could be positioned in an infinite number of ways within the multi-dimensional factor space. Thus, factor *rotation* refers to the process of rotating (repositioning) the axes within the factor space. Importantly, this process of rotation does not alter the data in any way. The prior act of factor extraction serves to fix the positions of all the Q-sorts within the factor space. The relative positionings of all the Q-sorts are absolutely and permanently fixed, and these positionings are "fixed by the viewpoints of the respective participants". Thus, the form of the data (the relative positions of all the Q-sorts in the factor space) is given by the initial process of factor extraction, and rotation is a tool for observing that form from various viewing 'angles'. The goal of factor rotation is ultimately to determine the most appropriate 'placements', or compositions of the factors to facilitate analysis and interpretation of said factors.

Different strategies of rotation (centroid, judgemental or varimax) can be applied to explore patterns of shared viewpoints (factors) emerging from the data. The most commonly used amongst Q-methodologists are varimax rotation (employed in all reviewed energy related Q-studies set out in Table 1 in Chapter 3) and manual rotation. Manual rotation is particularly used where the researcher wishes to test theoretical or other assumptions, or where the researcher wishes to explore how the patterns of subjectivity around a particular perspective.

Factor interpretation

Finally, for each factor, a *factor array* is produced, showing what an average (or idealized) Q-sort would look like for each factor. Thus, a factor can be described as representing a type of viewpoint on the topic under study, and the factor array describes what opinions characterise this viewpoint. In other words, based on the factor arrays, each unique viewpoint can be described with reference to the placement of statements onto the Q-sort grid.

The scores assigned to each statement in a factor array is calculated as weighted averages of the scores assigned in each Q-sort loading onto that factor, with higher loading Q-sorts weighted higher than Q-sorts with a smaller factor loading. To facilitate these calculations 'flagging' is required to conclude the factor rotation. Flagging is the process of marking those Q-sorts which are to be used in the calculation of factor arrays. Here, again, considerations around significance come into the picture.

Distinguishing and consensus statements can be identified across different factors, to show on which matters distinct viewpoints differ or converge. Consensus- and conflict statements indicate which aspects of the topic are associated with broad agreement across diverse perspectives, and which aspects differentiate perspectives. This can be particularly relevant in terms of policy making as well as public engagement, where establishing common ground and understanding areas of and motivations behind disagreements may improve processes of deliberation and decision-making. Finally, the qualitative data from the debriefing questions help the interpretation and explanation of emerging viewpoints

Appendix 2: Concourse sources

	UK	Denmark
Media (articles and reader comments)	The Telegraph The Guardian The Independent The Sun Daily Mail Mirror	Berlingske Tidende Ingeniøren Dagbladet Information Ekstrabladet Adresseavisen Syddjurs Arbejderen Altinget ScienceNordic Modkraft Energy Supply DK EnergiWatch
Grey Literature	Citizens Advice Consumer Focus Energy Democracy Greater Manchester Energy Futures Lab Global Justice Now Platform London Public and Commercial Services Union Ofgem Ecotricity	Dansk Energi KL NOAH WWF Denmark Kooperationen Modstrøm Demokrati I Europa Oplysningsforbundet Center for Fremtidsforskning Naturstyrelsen
Social Media	Sky News Green Party of England and Wales Home Energy Team (CSE) Tunbridge Wells Climate Action Mossmorran Action Group Fife Communities Climate Action Network	Politiken VedvarendeEnergi Energi og Klima I Fredensborg Kommune
Academic Sources	Foulds and Robison 2017 Rogers et al 2008 Yildiz et al 2015 Cotton and Devine-Wright 2011 Miller 2014	Dioni 2015 Lykkeberg 2012 Rasmussen et al 2009

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Appendix 3: Concourse themes

Knowings	Discourse & societal values (statements #25 #8) Individual knowledge & information (statements #1 #5) Valid knowledges (statement #2)
Do/practice	Individual lifestyle/behaviour (statements #4 #14) Market practice / choice (statement #3) Citizenship (statements #6 #7) Community (statements #21)
Do/tech	Technological solutions, implementation & implications (statements #9 #10 #11) Technology and behaviour (statement #13)
Meanings	Needs / rights (statement #17) Private vs public good (statements #18 #26) Fairness / distribution (statement #15) Global (statements #19 #16)
Organisings/logic	Ownership & supply (statements #28 #30 #12) Responsibility (statements #27 #29) Democracy (statement #31)
Organisings/tech	Energy efficiency regulation (statement #22) Subsidies (statement #23) Taxes (statement #24) Public engagement (statement #20)

Appendix 4: Recruitment Leaflet (English)

How will the research be used?

Publications

Findings will be included in my PhD thesis and published in various forms, including articles, reports and presentations. They will be of interest to academics and to others who are interested in public opinion on energy development.

Ethical practice

This project has received ethical clearance by the University Teaching and Research Ethics Committee. Any information you give me will be held securely and treated in strict confidence. Real names will not be used in publications and reports.

Possible outcomes

Not many academics have talked to people about societal issues and priorities around energy development in this way before, so I hope that this study will help to pave the way for new and exciting ways of thinking about energy development.

Further information

I (Caroline) am a PhD researcher at the University of St Andrews. My project is funded by the university, and runs from October 2016 to October 2019. My research involves interviews with energy consumers in the UK and Denmark.

For more information about the research, please feel free to contact me:

Caroline Sejer Damgaard, PhD student
Mobile phone: 077 6868 6707
Email: csd3@st-andrews.ac.uk

Geography & Sustainable Development
Irvine Building, University of St Andrews
North Street, St Andrews, KY16 9AL
Fife, Scotland, UK

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Tel: 01334 462894

University of St Andrews

What is your take on energy?

Invitation to take part in a research project

Energy is a big part of our everyday lives and of our social worlds.

- What does it mean to you?

I would like to talk to you about the values and concerns you think need to be taken into account when we talk about energy development.

Climate change and renewable energy are challenging our basic understanding of what energy means for our everyday lives:

Should we reduce the amount of energy we use?

Where should energy be produced and by whom?

Who should have a say?

Taking part

I am interviewing around 50 people from different places and of different ages and backgrounds about their perceptions of what the most pressing societal issues are, relating to energy development.

What will the interviews involve?

The interview will take half an hour to an hour, max, and will consist of a simple sorting exercise and an informal chat about your thoughts during the exercise.

You will be given 30 cards with opinion statements, which you will be asked to arrange from those best representing your views to those most different from your views.

How to take part

If you think you would like to take part, you can e-mail, message or phone me (my contact details are on the back page of this leaflet). I will then contact you to arrange a convenient time for the interview which can take place at your home or at another location if you would prefer.

Please feel free to contact me if you have any questions about the research. If you decide to become involved, you are still free to withdraw from the research at any time and without giving a reason.

Appendix 5: Ethical Approval Letter

University of St Andrews

University Teaching and Research Ethics Committee

School Of Geography And Sustainable Development

2nd March 2018
Caroline Sejer Damgaard
Geography and Sustainable Development

Ethics Reference No: *Please quote this ref on all correspondence*	**GG13340**
Project Title:	Societal issues surrounding energy development and transitions – assessing social values and preferences
Researchers Name(s):	Caroline Sejer Damgaard
Supervisor(s):	Dr Darren McCauley & Dr Tobias Borger

Thank you for submitting your application which was considered by the Geography and Geosciences School Ethics Committee on the date specified below. The following documents were reviewed:

1. Ethical Application Form — 26th February 2018
2. Participant Information Sheet — 26th February 2018
3. Consent Form — 26th February 2018
4. Other (Leaflet and letter) — 26th February 2018

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years. Projects, which have not commenced within two years of original approval, must be re-submitted to your School Ethics Committee.

You must inform your School Ethics Committee when the research has been completed. If you are unable to complete your research within the 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely,

Dr. Kim McKee
Convenor of the School Ethics Committee

UTREC School of Geography and Sustainable Development Convenor, Irvine Building, North Street, St Andrews, KY16 9AL
Email: ggethics@st-andrews.ac.uk Tel: 01334 463897

Appendix 6: Factor Arrays & Crib Sheets

Figure 16: Factor array for Factor 1 (Politically oriented)

-4	-3	-2	-1	0	1	2	3	4
16: The UK does not need to take the lead … first and foremost, we need policies that work for us.	8: Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	2: Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	14: It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	18: It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	28: Locally owned renewable energy is good for local communities.	9: Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	6: Climate and energy politics greatly influence who I vote for.	29: The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.
10: If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	23: The government should provide less subsidies for renewable energy and invest that money more appropriately.	4: Reducing carbon emissions is not a personal responsibility.	3: There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	21: I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	1: I would like to receive more reliable information about climate change.	19: When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	22: There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	26: Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.
		13: A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	12: Energy should be produced locally for local consumption.	25: Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	7: I would definitely participate in public consultations about local energy development.	24: Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.		
		5: I don't really think about my energy use; I have so many other things to deal with.	11: I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	30: I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	17: No household should be unable to afford a basic level of energy use to cover their needs.	31: The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.		
			15: It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	20: Local people should have more influence on energy planning and decisions.	27: I want my local politicians to take responsibility for acting on climate change.			

Table 14: Crib sheet for Factor 1 (Politically oriented)

RANKED + 4		
26	Making the necessary investments in the fight against climate change is not a question of affordability, but of our priorities as a society.	
29	The government has the greatest responsibility. The big changes have to come from national government….	
RANKED + 3		
6	Climate and energy politics greatly influence who I vote for.	
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	
RANKING HIGHEST OF ALL		
6	Climate and energy politics greatly influence who I vote for.	*3*
7	I would definitely participate in public consultations about local energy development.	*1*
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	*3*
26	Making the necessary investments in the fight against climate change is not a question of affordability, but of our priorities as a society.	*4*
29	The government has the greatest responsibility. The big changes have to come from national government…	*4*
31	The green transition should lead to a more democratic energy system….	*2*
RANKING LOWEST OF ALL		
8	Honestly, there has to be a financial benefit; at the end of the day it's mostly about money.	*-3*
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	*-4*
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer….	*-2*
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	*-4*
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	*-3*
25	Security of supply is critical. We are dependent on constant access to electricity.	*0*
RANKED -3		
8	Honestly, there has to be a financial benefit; at the end of end of the day….	
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	
RANKED -4		
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	
16	The UK does not need to take the lead on climate change; first and foremost we need policies that work for us.	

Figure 17: Factor array for Factor 2 (Market oriented)

-4	-3	-2	-1	0	1	2	3	4
4: Reducing carbon emissions is not a personal responsibility.	6: Climate and energy politics greatly influence who I vote for.	15: It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy	12: Energy should be produced locally for local consumption.	16: The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	3: There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	2: Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	8: Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	24: Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.
31: The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits	7: I would definitely participate in public consultations about local energy development.	11: I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	5: don't really think about my energy use; I have so many other things to deal with.	26: Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	27: I want my local politicians to take responsibility for acting on climate change.	9: Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	23: The government should provide less subsidies for renewable energy and invest that money more appropriately.	25: Security of supply is critical. We are dependent on constant access to energy in our everyday lives.
		10: If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	14: It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	30: I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	29: The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	18: It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.		
		20: Local people should have more influence on energy planning and decisions.	1: I would like to receive more reliable information about climate change.	21: I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	22: There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	19: When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.		
			28: Locally owned renewable energy is good for local communities.	17: No household should be unable to afford a basic level of energy use to cover their needs.	13: A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.			

Table 15: Crib sheet for Factor 2 (Market oriented)

RANKED + 4		
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	*4*
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	*4*
RANKED + 3		
23	The government should provide less subsidies for renewable energy and invests that money more appropriately.	*3*
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	*2*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*2*
RANKING HIGHEST OF ALL		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	*2*
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*1*
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	*2*
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	*-2*
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	*1*
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	*0*
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	*2*
23	The government should provide less subsidies for renewable energy and invests that money more appropriately.	*3*
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	*4*
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	*4*
RANKING LOWEST OF ALL		
1	I would like to receive more reliable information about climate change.	*-1*
4	Reducing carbon emissions is not a personal responsibility.	*-4*
6	Climate and energy politics greatly influence who I vote for.	*-3*
7	I would definitely participate in public consultations about local energy development.	*-3*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large/scale projects are too imposing.	*-2*
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	*-2*
20	Local people should have more influence on energy planning and decisions.	*-2*
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	*0*
28	Locally owned renewable energy is good for local communities.	*-1*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*-4*
RANKED - 3		
6	Climate and energy politics greatly influence who I vote for	
7	I would definitely participate in public consultations about	
RANKED - 4		
4	Reducing carbon emissions is not a personal responsibility.	
31	The green transition should lead to a more democratic energy	

Figure 18: Factor array for Factor 3 (Community oriented)

-4	-3	-2	-1	0	1	2	3	4
4: Reducing carbon emissions is not a personal responsibility.	10: If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	18: It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	16: The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	13: A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	22: There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	9: Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	21: I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	17: No household should be unable to afford a basic level of energy use to cover their needs.
14: It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	8: Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	5: don't really think about my energy use; I have so many other things to deal with.	29: The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	24: Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	11: I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	25: Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	28: Locally owned renewable energy is good for local communities.	26: Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.
		19: When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	23: The government should provide less subsidies for renewable energy and invest that money more appropriately.	20: Local people should have more influence on energy planning and decisions.	27: I want my local politicians to take responsibility for acting on climate change.	31: The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits		
		3: There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	2: Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	1: I would like to receive more reliable information about climate change.	7: I would definitely participate in public consultations about local energy development.	12: Energy should be produced locally for local consumption.		
			6: Climate and energy politics greatly influence who I vote for.	15: It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy	30: I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.			

Table 16: Crib sheet for Factor 3 (Community oriented)

RANKED + 4		
17	No household should be unable to afford a basic level of energy use to cover their basic needs.	
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	
RANKED + 3		
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use or using local renewable energy.	
28	Locally owned renewable energy is good for local communities.	
RANKING HIGHEST OF ALL		
7	I would definitely participate in public consultations about local energy development.	*1*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	*1*
12	Energy should be produced locally for local consumption.	*2*
17	No household should be unable to afford a basic level of energy use to cover their basic needs.	*4*
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use or using local renewable energy.	*3*
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	*4*
28	Locally owned renewable energy is good for local communities.	*3*
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	*1*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*2*
RANKING LOWEST OF ALL		
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*-2*
4	Reducing carbon emissions is not a personal responsibility.	*-4*
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	*-3*
14	It seems pointless for me in the UK/Denmark to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	*-4*
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	*-2*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*-2*
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	*-1*
RANKED – 3		
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	
RANKED – 4		
4	Reducing carbon emissions is not a personal responsibility.	
14	It seems pointless for me in the UK/Denmark to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	

Figure 19: Factor array for Factor 4 (System-critical)

-4	-3	-2	-1	0	1	2	3	4
12: Energy should be produced locally for local consumption.	10: If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	6: Climate and energy politics greatly influence who I vote for.	22: There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	27: I want my local politicians to take responsibility for acting on climate change.	31: The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits	17: No household should be unable to afford a basic level of energy use to cover their needs.	25: Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	15: It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy
5: don't really think about my energy use; I have so many other things to deal with.	2: Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	28: Locally owned renewable energy is good for local communities.	30: I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	21: I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	1: I would like to receive more reliable information about climate change.	26: Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	23: The government should provide less subsidies for renewable energy and invest that money more appropriately.	9: Energy is not just a technological issue; there are also difficult ethical issues we have to consider.
		13: A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	4: Reducing carbon emissions is not a personal responsibility.	11: I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	29: The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	8: Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.		
		3: There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	16: The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	18: It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	20: Local people should have more influence on energy planning and decisions.	19: When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.		
			24: Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	7: I would definitely participate in public consultations about local energy development.	14: It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.			

Table 17: Crib sheet for Factor 4 (System-critical)

RANKED + 4		
9	Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	**4**
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	**3**
RANKED + 3		
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	**3**
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	3
RANKING HIGHEST OF ALL		
1	I would like to receive more reliable information about climate change.	**1**
4	Reducing carbon emissions is not a personal responsibility.	**-1**
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	**2**
9	Energy is not just a technological issue; there are also difficult ethical issues we have to consider.	**4**
14	It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	**1**
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	**3**
20	Local people should have more influence on energy planning and decisions.	**1**
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	**3**
RANKING LOWEST OF ALL		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	-3
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	-2
5	I don't really think about my energy use; I have so many other things to deal with.	-4
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	-4
12	Energy should be produced locally for local consumption.	-4
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	-2
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	-1
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	-1
28	Locally owned renewable energy is good for local communities.	
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	-1
RANKED – 3		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	-3
5	I don't really think about my energy use; I have so many other things to deal with.	-4
RANKED - 4		
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	-4
12	Energy should be produced locally for local consumption.	-4

Appendix 7: Country-level factor analyses

Denmark

To explore the structure of the data, different numbers of factors (from two to four) were extracted and rotated. The data was found to best support a three-factor solution. Due to the exploratory nature of the study, without predetermined theoretical expectations to justify judgemental rotation, varimax rotation was applied. While additional hand rotation was explored, no substantial changes to the resultant factors were observed.

Initial statistical indicators

Table 18 shows outputs from centroid factor extraction, three factors pass the Kaiser-Guttmann criterion (EV > 1). The unrotated factor matrix shows two factors satisfying the criterion of two or more significantly loading Q-sorts, both at the 0.05 and the 0.01 significance levels (Table 19). As shown in the bottom row in Table 19, two factors satisfy Humphreys rule: that a factor is significant if the cross-product of the two highest loadings is larger than twice the standard error. Relaxing Humphrey's rule and using the one times then standard error indicates the extraction of three factors.

Table 18. Eigenvalues and explained variance for four Danish factors

	F1	F2	F3	F4
Eigenvalues	**8.37**	**2.00**	**1.57**	0.97
% explained variance	42	10	8	5

Table 19. Humphrey's rule & significant loadings for four Danish factors

		F1	F2	F3	F4
Number of significant loadings (factors with 2 or more significant loadings to be retained)	0.01	16	2	3	1
	0.05	19	5	4	1
Cross-product of the 2 highest loadings		**0.724** > 0.36	**0.410** > 0.36	**| -0.313 |** > 0.18	0.202

A three factor solution with varimax rotation is shown in Table 20, with factor loadings and percent explained variance for each factor. Purely loading Q-sorts are indicated with a star (★).

Table 20. Factor loadings for three factor solution (Denmark). Pure loadings marked with star (*)

Q SORTS	F1	F2	F3
1 DK_A	-0.2358	*0.7211	0.0189
2 DK_B	0.2244	0.3467	0.2599
3 DK_C	*0.7795	-0.0498	0.1614
4 DK_D	*0.5371	0.3105	0.2588
5 DK_E	0.7382	0.4784	-0.1085
6 DK_F	0.4592	*0.6462	0.2715
7 DK_G	0.161	*0.7039	0.0798
8 DK_H	0.1503	0.2033	0.4367
9 DK_I	-0.0884	0.5246	0.6834
10 DK_J	*0.8216	0.0186	0.3874
11 DK_K	*0.7817	0.0699	0.3265
12 DK_L	0.7786	0.1502	0.5042
13 DK_M	0.4545	0.4347	0.4382
14 DK_N	*0.7669	0.0984	0.1089
15 DK_O	0.5572	0.0659	0.3947
16 DK_P	0.3259	0.1349	*0.6733
17 DK_Q	0.5342	0.1508	0.5393
18 DK_R	0.4884	-0.0597	0.6427
19 DK_S	0.2966	0.2927	*0.5157
20 DK_T	0.1225	-0.0386	*0.7491
% Explained Variance	28	13	19

Three Danish perspectives

The three retained factors were analysed with reference to crib sheets (presented in tables 21-24 below) and qualitative data. As discussed in Chapter 5 (section 5.3), the viewpoints represented by these three Danish factors (i.e. based on data from Q-sorts conducted with Danish participants) closely resemble three of the meta-factors presented in Chapter 5 (section 5.1).

Table 21: Crib sheet for Danish manifestation of politically oriented perspective ($F1_{DK}$)

RANKED + 4		
26	Making the necessary investments in the fight against climate change is not a question of affordability, but of our priorities as a society.	
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	
RANKED + 3		
6	Climate and energy politics greatly influence who I vote for.	
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	
RANKING HIGHEST OF ALL		
6	Climate and energy politics greatly influence who I vote for.	*3*
7	I would definitely participate in public consultations about local energy development.	*1*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*2*
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	*2*
26	Making the necessary investments in the fight against climate change is not a question of affordability, but of our priorities as a society.	*4*
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	*4*
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	*1*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*2*
RANKING LOWEST OF ALL		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	*-2*
8	Honestly, there has to be a financial benefit; at the end of the day it's mostly about money.	*-3*
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	*-1*
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	*-4*
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	*-4*
25	Security of supply is critical. We are dependent on constant access to electricity.	*1*
RANKED -3		
8	Honestly, there has to be a financial benefit; at the end of the day it's mostly about money.	
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	
RANKED -4		
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	
16	The UK does not need to take the lead on climate change; first and foremost we need policies that work for us.	

Table 22: Crib sheet for Danish manifestation of market oriented perspective ($F2_{DK}$)

RANKED + 4		
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	*4*
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	*4*
RANKED + 3		
23	The government should provide less subsidies for renewable energy and invests that money more appropriately.	*3*
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	*2*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*2*
RANKING HIGHEST OF ALL		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	*2*
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*1*
8	Honestly, there has to be a financial benefit; at the end of the day, price is the main concern.	*2*
10	If we just gradually make use of new technologies as they are being developed, then there is no need to worry about climate change.	*-2*
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	*1*
14	It seems pointless for me in Denmark to make a big effort to…	*-1*
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	*0*
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	*2*
23	The government should provide less subsidies for renewable energy and invests that money more appropriately.	*3*
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	*4*
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	*4*
RANKING LOWEST OF ALL		
4	Reducing carbon emissions is not a personal responsibility.	*-4*
6	Climate and energy politics greatly influence who I vote for.	*-3*
7	I would definitely participate in public consultations about local energy development.	*-3*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large/scale projects are too imposing.	*-2*
12	Energy should be produced locally for local consumption.	*-2*
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	*-2*
20	Local people should have more influence on energy planning and decisions.	*-2*
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	*0*
28	Locally owned renewable energy is good for local communities.	*-1*
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	*1*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*-4*
RANKED - 3		
6	Climate and energy politics greatly influence who I vote for.	
7	I would definitely participate in public consultations about local energy development.	
RANKED - 4		
4	Reducing carbon emissions is not a personal responsibility.	
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	

Table 23: Crib sheet for Danish manifestation of community oriented perspective ($F3_{DK}$)

RANKED + 4		
17	No household should be unable to afford a basic level of energy use to cover their basic needs.	
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	
RANKED + 3		
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	
15	It is unfair to expect...	
RANKING HIGHEST OF ALL		
4	Reducing carbon emissions is not a personal responsibility.	*0*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	*2*
12	Energy should be produced locally for local consumption.	*1*
15	It is unfair to expect rural communities	*3*
17	No household should be unable to afford a basic level of energy use to cover their basic needs.	*4*
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	*4*
27	I want my local politicians to take responsibility.	*2*
28	Locally owned renewable energy is good for local communities.	*1*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*2*
RANKING LOWEST OF ALL		
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*-2*
10	If we just gradually make use of new technologies as they.	*-4*
14	It seems pointless for me in the UK/Denmark to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	*-4*
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	*-3*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*0*
21	I would want to be involved in a sustainable energy project	*-1*
22	There should be a requirement for all buildings	*0*
24	Energy taxes are reasonable, they make sustainable energy	*0*
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	*1*
RANKED - 3		
18	It is fine that energy companies .	
23	The government should provide less subsidies for renewable.	
RANKED – 4		
10	If we just gradually make use of new technologies as they	
14	It seems pointless for me in the UK/Denmark to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	

UK

Initial statistical indicators

To explore the structure of the data, different numbers of factors (from two to four) were extracted and rotated. Tables 24 and 25 show results of some of the initial statistical analyses. Based on this and further qualitative exploration of factors, the data was found to best support a three-factor solution. While additional hand rotation was explored, no substantial changes to the resultant factors were observed.

Table 24 shows outputs from centroid factor extraction. Two factors pass the Kaiser-Guttmann criterion (EV > 1). Based on the unrotated factor matrix, two or three factors satisfy the criterion of two or more significantly loading Q-sorts, at the 0.01 and 0.05 significance levels, respectively, as indicated in Table 25. As shown in the bottom row of Table 25, two factors satisfy Humphreys rule: that a factor is significant if the cross-product of the two highest loadings is larger than twice the standard error. Relaxing Humphrey's rule indicates the extraction of three factors.

Table 24. Eigenvalues and variance for three UK factors

	F1	F2	F3
Eigenvalues	**8.79**	**1.80**	0.87
% explained variance	46	9	5

Table 25. Significant loadings & Humphrey's rule for three UK factors

		F1	F2	F3
Number of significant loadings (factors with 2 or more significant loadings to be retained)	0.01	**17**	**2**	0
	0.05	**18**	**3**	**2**
Cross-product of the 2 highest loadings		**0.724** > 0.36	**0.410** > 0.36	**| -0.313 |** > 0.18

A three factor solution with varimax rotation produced the factor loadings and variances reported in table 26. Table 26 also shows flagged Q-sorts, as well as confounded and non-loading Q-sorts. Purely loading Q-sorts are indicated with a star (★).

Table 26. Factor loadings for three factor solution (UK). Pure loadings marked with star (*)

Q SORTS	F1	F2	F3
UK_A	0.5649	0.3549	0.5014
UK_B	*0.6069	0.2019	0.2766
UK_C	0.3179	0.4544	*0.5733
UK_D	-0.1108	0.115	*-0.6235
UK_E	0.1862	*0.6328	0.0527
UK_F	-0.2252	*0.9460	0.233
UK_G	0.3864	-0.0248	*0.5386
UK_H	0.2388	0.4195	*0.6638
UK_I	*0.6914	0.1861	0.105
UK_J	0.3055	*0.6336	0.4512
UK_K	*0.6946	0.1734	0.3538
UK_L	0.0988	0.3283	-0.0486
UK_M	0.3488	0.3871	*0.6634
UK_N	0.4881	0.3885	0.4447
UK_O	*0.7924	0.0424	0.4188
UK_P	0.411	0.4867	0.5722
UK_Q	0.4788	0.0809	0.7368
UK_R	0.2123	0.3607	*0.6530
UK_S	0.3338	*0.5595	0.2403
% Explained Variance	19	18	23

Three UK perspectives

Table 27: Crib sheet for UK manifestation of community oriented perspective ($F1_{UK}$)

RANKED + 4		
17	No household should be unable to afford a basic level of energy use to cover their basic needs.	
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	
RANKED + 3		
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	
RANKING HIGHEST OF ALL		
6	Climate and energy have a big impact on who I vote for.	*0*
7	I would definitely participate in public consultations about local energy development.	*2*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	*-1*
12	Energy should be produced locally for local consumption.	*1*
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	*0*
17	No household should be unable to afford a basic level of energy use to cover their basic needs.	*4*
20	Local people should have more influence on energy planning and decisions.	*0*
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	*3*
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	*4*
28	Locally owned renewable energy is good for local communities.	*2*
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	*3*
RANKING LOWEST OF ALL		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	*-1*
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*-2*
4	Reducing carbon emissions is not a personal responsibility	*-4*
5	I don't really think about my energy use; I have so many other things to deal with.	*-4*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*-1*
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	*-3*
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	*-1*
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	*-3*
RANKED - 3		
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	
23	The government should provide less subsidies for renewable energy and invest that money more appropriately.	
RANKED – 4		
4	Reducing carbon emissions is not a personal responsibility.	
5	I don't really think about my energy use; I have so many other things to think about.	

Table 28: Crib sheet for UK manifestation of market oriented perspective ($F2_{UK}$)

RANKED + 4		
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	
RANKED + 3		
17	No household should be unable to afford a basic level of energy use to cover their needs.	
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	
RANKING HIGHEST OF ALL		
2	Decisions in the energy sector should be based on expert calculations rather than democratic values and participation.	*2*
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*-1*
4	Reducing carbon emissions is not a personal responsibility.	*-1*
5	I don't really think about my energy use; I have so many other things to deal with.	*1*
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	*1*
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	*1*
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	*0*
19	When we buy coal, oil and gas from other countries, we essentially outsource our climate responsibilities and force communities in the exporting countries to bear the risks and damage of extraction.	*3*
23	The government should provide less subsidies for renewable energy and invests that money more appropriately.	*0*
24	Energy taxes are reasonable, they make sustainable energy development a common responsibility and mean that we as consumers pay for our damaging consumption.	*2*
25	Security of supply is critical. We are dependent on constant access to energy in our everyday lives.	*4*
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	*4*
RANKING LOWEST OF ALL		
6	Climate and energy politics greatly influence who I vote for.	*-4*
7	I would definitely participate in public consultations about local energy development.	*-1*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large/scale projects are too imposing.	*-2*
12	Energy should be produced locally for local consumption.	*-3*
14	It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	*-4*
20	Local people should have more influence on energy planning and decisions.	*-1*
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	*-3*
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	*1*
26	Making the necessary investments in the fight against climate change is not a question of affordability but of our priorities as a society.	*2*
27	I want my local politicians to take responsibility for acting on climate change.	*0*
28	Locally owned renewable energy is good for local communities.	*0*
30	I would love to get my energy from a public supply company that I get to have a say in, maybe by attending local events or taking part in online forums.	*-1*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*0*
RANKED - 3		
12	Energy should be produced locally for local consumption.	
21	I would want to be involved in a sustainable energy project run by a community group to look at reducing energy use and using local renewable energy.	
RANKED – 4		
14	It seems pointless for me in the UK to make a big effort to reduce my energy use, when people in other countries continue to use huge amounts of energy.	
6	Climate and energy politics greatly influence who I vote for.	

Table 29: Crib sheet for UK manifestation of politically oriented perspective ($F3_{UK}$)

RANKED + 4		
26	Making the necessary investments in the fight against climate change is not a question of affordability, but of our priorities as a society.	
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	
RANKED + 3		
29	The government has the greatest responsibility. The big changes have to come from national governments, such as investments in green infrastructure and regulation of industry.	
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	
RANKING HIGHEST OF ALL		
6	Climate and energy politics greatly influence who I vote for.	*2*
11	I prefer small renewable energy projects such as small wind turbines or solar panels on roofs; large technologies and large-scale projects are too imposing.	*-1*
20	Local people should have more influence on energy planning and decisions.	*0*
22	There should be a requirement for all buildings to meet a minimum standard of energy efficiency.	*3*
26	Making the necessary investments in the fight against climate change is not a question of affordability, but of our priorities as a society.	*4*
27	I want my local politicians to take responsibility for acting on climate change.	*2*
28	Locally owned renewable energy is good for local communities.	*2*
31	The green transition should lead to a more democratic energy system, where energy resources are more fairly distributed, democratically controlled, and managed to recognise the planet's limits.	*4*
RANKING LOWEST OF ALL		
3	There is no point in me choosing a green electricity provider or tariff; the electricity all customers receive in their homes is exactly the same anyways.	*-2*
4	Reducing carbon emissions is not a personal responsibility.	*-4*
6	Climate and energy politics greatly influence who I vote for.	*0*
8	Honestly, there has to be a financial benefit; at the end of the day it's mostly about money.	*-4*
13	A so-called "smart" energy system based on "smart meters" will not benefit me as a consumer; I would personally want full control over when I run my washing machine and dishwasher, for example.	*-1*
15	It is unfair to expect rural communities to bear the burdens of renewable energy projects so that cities can have access to sustainable energy.	*-1*
16	The UK does not need to take the lead on climate change; first and foremost, we need policies that work for us.	*-3*
18	It is fine that energy companies focus on making money. Making money isn't a bad thing. They are not charities, and they employ thousands of people.	*-2*
25	Security of supply is critical. We are dependent on constant access to electricity.	*0*
RANKED -3		
16	The UK does not need to take the lead on climate change; first and foremost we need policies that work for us.	
14	It seems pointless for me in the UK to make a big effort.	
RANKED -4		
8	Honestly, there has to be a financial benefit; at the end of the day it's mostly about money.	
4	Reducing carbon emissions is not a personal responsibility.	