



Rewiring Justice: Operationalizing Intersectionality for an equitable Smart Energy Future in Great Britain

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Abstract

Smart energy technologies (SETs) are transforming Great Britain's energy landscape, yet emerging research reveals they risk reinforcing existing inequalities and creating new forms of disadvantage. Current understandings of their social justice implications focus narrowly on specific household attributes like low income or digital literacy, often overlooking how they compound each other or relate to social categories such as gender, ethnicity, and (dis)ability. Critical analyses of techno-optimistic narratives and top-down implementation of these technologies within neoliberal frameworks are also lacking. Using intersectionality as a radical orientation and transformative practical tool to address these research gaps, the study draws on 11 interviews and case studies across 3 pioneering organizations—a charity, social enterprise, and energy distributor—to uncover critical justice concerns and propose strategies that go beyond surface-level fixes to address the root causes of energy inequalities.

Findings reveal that, despite variations in how inclusion strategies are implemented and motivations for prioritizing intersectionality, ensuring fairness in the ongoing smart energy transitions remained an urgent priority across all three organizations. Intersectionality proved to be a valuable tool for understanding the interconnections between household capabilities and building solidarity across diverse SET experiences. Although each organization recognized its potential to improve inclusivity and address blind spots, operational constraints often hindered deeper, transformative engagement.

This thesis proposes three novel focal points for future studies: (i) centring diverse user identities, recognizing the varied influences of gender, ethnicity, age, and income on SET engagement and flexibility market participation, and emphasizing tailored policies to address specific barriers; (ii) examining how legacy inequalities, such as those impacting private renters or low-income households, persist within smart energy contexts, increasing accountability for institutions involved; and (iii) addressing intersecting power structures—capitalism, racism, and

ableism—that compound energy vulnerabilities, like housing inequalities affecting certain demographics.

Rewiring approaches to justice is indispensable for developing a truly inclusive smart energy future. While operationalising intersectionality may present risks and challenges, it holds the potential to initiate the incremental changes needed to radically dismantle the root causes of injustice within the smart energy landscape.

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Preface

“Another world is not only possible, she is on her way. On a quiet day, I can hear her breathing.”

— Arundhati Roy, War Talk (2003)

This thesis is born from a deep commitment to understanding the complexities of justice in energy transitions and a desire to confront the systemic inequalities embedded within them. At its core, this work is an exploration of how smart energy technologies (SETs), often heralded as silver bullets, much like their other ‘smart’ cousins, risk reproducing the very inequities they seek to address if their implementation disregards the intricate realities of human lives.

If you were to ask my friends or family, they might say this work is an extension of my lifelong habit of complicating things for myself. Whether it’s trying to turn a simple family debate into a philosophical inquiry or insisting on finding the most convoluted way to solve a mundane problem, I’ve been teased for my tendency to chase complexity. Yet, in a world that so often prioritizes simplicity at the expense of nuance, I’ve come to see this trait as a strength—one that has profoundly shaped my academic journey and this thesis.

A significant influence on my approach to intersectionality and energy justice emerged from long, thought-provoking discussions with my partner, Aaron, about his own master’s thesis. Although our fields are vastly different, our conversations often centred on a dichotomy we found fascinating: the technical versus the magical. Inspired by the writings of Italian philosopher Federico Campagna, we explored how the technical worldview seeks to simplify, strip complexity, and solve problems through reductionist logic—a perspective that has given rise to capitalist structures and many of the social and environmental crises we face today. In contrast, the magical worldview embraces the interconnectedness and fluidity of life, celebrating its inherent messiness and resisting the urge to confine it to neat boxes. Campagna’s notion of the magical offered us a framework for imagining a different way of engaging with the world, one that values depth and nuance over efficiency and control. It recognizes the world not as a set of problems to be solved but as a tapestry to be understood in all its intricacy.

These conversations shaped my approach to this thesis, inspiring me to reclaim a "magical" perspective in my work. By embracing complexity, I sought to develop methodologies and insights that could do justice to the intricate realities of human lives and energy systems. My goal was not just to critique existing structures but to imagine pathways for transformative change that acknowledge and respect the richness of intersectional experiences.

While this approach is central to my research, it is equally important to situate this thesis within the broader context of the Horizon 2020 GECKO Project, of which my doctoral research forms a part. Initiated in 2020-21 and funded by the European Union (EU), GECKO brings together 15 PhD researchers from diverse disciplines—including humanities, information science, design, and engineering—with a shared mission: to advance knowledge and practice in developing accountable, transparent, and responsible artificial intelligence (AI) solutions addressing urgent energy challenges.

GECKO's vision recognizes the transformative potential of AI in enabling clean energy transitions but acknowledges the limitations of current AI technologies deployed across domestic, commercial, and industrial energy systems. By prioritizing user-centric design, the project seeks to align AI systems with societal values, mitigating the risks of harmful or biased outcomes. GECKO also promotes interdisciplinary collaboration to ensure that the adoption of AI and machine learning models within clean energy initiatives is transparent, ethically sound, and trusted, all while tackling pressing sustainability challenges.

My work contributes to GECKO's broader mission but evolved independently through extensive literature reviews, consultations with my supervisors, and a commitment to addressing energy injustices. By focusing on the operationalization of intersectionality within energy practices, this thesis bridges the technical and the magical, offering a nuanced lens through which to interrogate the assumptions and limitations of smart energy transitions.

Of course, when the lofty ambitions of this perspective met the grounded realities of my case studies, I found myself in a challenging but rewarding balancing act. Engaging with organizations steeped in technical frameworks required me to navigate both views, finding ways to make complexity tangible and actionable without losing its depth. This negotiation shaped much of my work, compelling me to craft tools and strategies that could bridge the reductionist pragmatism of the technical with the expansive richness of the magical.

This thesis is an invitation to see complexity not as an obstacle but as a source of possibility. By embracing the nuanced intersections of identities, systems, and oppressions, we can envision energy futures that go beyond the bare minimum, challenging us to design transitions that are not only just but also reflective of the intricate, magical realities of human lives.

Nikhil Sharma

Norwich, January 2025

1. Introduction

1.1 Smart Energy Transitions in the UK

The UK has one of the most ambitious and challenging NetZero 2050 goals among developed nations becoming the first G7 nation to set itself a legally binding emissions-reduction target in 2019 (BEIS, 2019, Dixon et al., 2022). Although there are several pathways to achieve this goal, the future energy system is envisioned to be transformed into a more decentralised, digitalised, decarbonised, and flexible system. While these pathways are intertwined, digitalisation is the core focus of this thesis as a critical pillar of the narratives around NetZero, enabling the management of complex energy flows through advanced data systems. Central to this transformation is the UK's recent strategic emphasis on artificial intelligence (AI). In January 2025, Prime Minister Keir Starmer unveiled the AI Opportunities Action Plan, stating, *"Artificial Intelligence will drive incredible change in our country."* (Department for Science, Innovation and Technology, 2025) This plan includes the establishment of dedicated AI Growth Zones and significant investments in data infrastructure, such as Nscale's \$2.5 billion commitment to build the UK's largest sovereign AI data centre in Loughton by 2026 (ibid). Smart, AI, and machine learning (ML)-based technologies are rapidly becoming integral to virtually every sector, reshaping industries and driving innovation at an unprecedented scale.

Smart energy technologies (SETs) – digitally-enabled devices capable of seamless communication between the supply and demand sides of the energy system – play a pivotal role in enabling the digital energy transition envisioned in the UK's NetZero strategy. These technologies, which include smart meters, battery storage systems, automated heating controls, and smart appliances, facilitate the efficient use of energy by providing real-time data, automating energy consumption, and enabling demand-side flexibility. Flexibility, in turn, is critical for

integrating variable renewable energy sources like wind and solar into the grid by balancing supply and demand dynamically.

Moreover, SETs have the potential to empower households, businesses, and communities to become active participants in the energy landscape, whether by reducing consumption during peak demand periods, selling surplus energy generated from rooftop solar panels, or storing energy for future use. This integration not only supports the decarbonisation of the energy system but also fosters more decentralised, independent, and sustainable clean energy systems, creating pathways to reduce reliance on centralised fossil-fuel-based energy infrastructure. Therefore, there is a keen interest in SETs in the Department of Energy Security and Net Zero (DESNZ)'s most recent report on digitalisation in the UK:

The energy system needs to transform significantly to reach our climate change targets at the lowest cost. The cheapest and quickest way of getting there is using the energy that's already on the system, instead of building expensive new infrastructure. This means getting the millions of low carbon technologies across Britain talking to each other. Solar panels, wind turbines and battery storage, to heat pumps, electric vehicles and smart appliances, all have a role to play in a smart and flexible energy system. Connecting these technologies digitally will create data with incredible value. Everyone can benefit from this technological revolution: better knowledge, insights and analysis will drive better quality products and services.

Energy Digitalisation Strategy, 2021, pg. 4

Due to an increase in renewable energy production worldwide, the need for an upgrade of the electricity grid designed in the 60s-80s, and an increasing policy inclination towards the *smartification* of society (Sadowski, 2020), several cross-national, cross-sectoral stakeholders have begun to adopt them with great urgency (Mathisen et al., 2019). A future smart energy system, as highlighted in such government narratives, depends on consumer participation, accurate information, and technological adoption. Households are expected to shift demand, engage with energy markets, and adopt new technologies to benefit from lower costs and cleaner energy.

It is unsurprising then that as of September 2024, 65% of British households have a smart meter (DESNZ, 2024). In winter 2022, 1.6 million households participated in the inaugural

Demand Flexibility Service (DFS) being paid 10£ per hour for shifting their electricity demand. The UK's flexibility market is also one of the fastest growing in the world, with the available flexible capacity quadrupling between 2019-2023 – it is no doubt that the future of the British electricity sector is a smart and flexible one (Energy Networks Association, 2024).

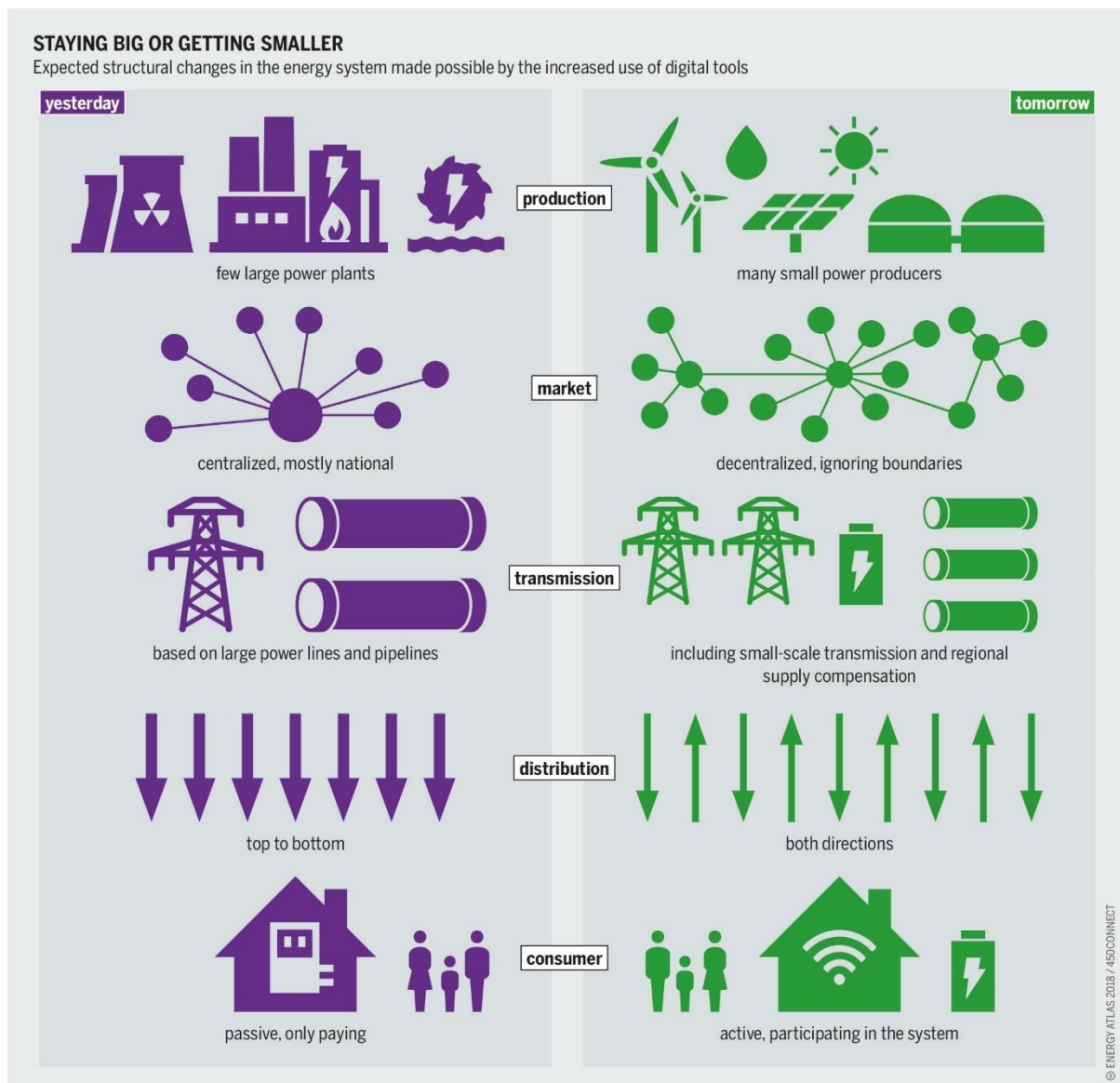


Figure 1.1 Transitioning Energy Systems: Yesterday vs. Tomorrow

Image Source: [Symmetry Electronics](#)

This transition reflects a broader, global shift in energy systems, as illustrated in Figure 1.1 the structural evolution of energy systems which is currently underway. It highlights a shift from centralized, large-scale operations to decentralized, small-scale, and participatory frameworks. It

emphasizes the role of digital tools in enabling (i) production: from few large power plants to diverse, small-scale producers utilizing renewable energy sources, (ii) market: from centralized, national markets to decentralized networks that transcend traditional boundaries, (iii) transmission: evolving from reliance on large power lines and pipelines to incorporating small-scale, localized transmission with regional compensation mechanisms, (iv) distribution: moving from a unidirectional, top-down flow to a bidirectional, interactive energy exchange, (v) consumer role: shifting from passive consumers to active participants engaged in the system through energy production, storage, and management technologies.

However, it has been argued by both academics and frontline organizations that these smart energy transitions are being transcribed onto a highly unjust energy landscape – reinforcing and deepening existing inequalities while creating new ones. During the energy crisis in 2022, 1 in 4 British households were forced to choose between staying warm and other essential needs such as food or healthcare (Simcock & Bouzarovski, 2023).

The neoliberal structure of the UK energy market, which prioritises market mechanisms and competition to deliver energy solutions to households, has played a significant role in sustaining these high levels of energy inequality (Middlemiss, 2017). The UK has also developed a substantial body of pioneering energy poverty research since the 1990s (Ambrose & Marchand, 2017). This research highlights how intersecting inequalities—spanning housing, health, geography, economic status, and sociopolitical factors such as income, gender, ethnicity, and (dis)ability—shape access to energy products and services, leaving many households vulnerable to market fluctuations. Scholars have increasingly called for deeper engagement with the structural inequalities perpetuated by overarching power systems, including neoliberalism, capitalism, and racism, to address these vulnerabilities effectively.

In the context of SETs, emerging evidence suggests that it is likely that their envisioned benefits are more accessible to certain demographics – often White, upper/middle class, energy literate, technophilic households, and often at the cost to other households. Future flexibility

markets also demand certain capabilities from households in order to open up to them, raising concerns that this will create new inequalities such as for those with special medical needs or for families with inflexible energy needs such as those linked to young children or the elderly. The magnitude of efforts being put to promote SETs and regulate their proliferation by the government in comparison to other pressing needs such as insulating households have also called into question the techno-optimism at the heart of these technologies. Given that the transition to SETs is opening up new possibilities – for all stakeholders from energy suppliers to energy consumers to the energy regulator, it becomes crucial to investigate which social justice issues are at the heart of this transformation, and how it can be reoriented towards justice to create possibilities for a diverse range of households, tackling some of the existing inequalities.

Just smart energy transitions must also confront the power dynamics and structural inequalities embedded in the energy system. To counteract the neoliberal model which considers social justice retrospectively, policies and business models must prioritise inclusivity and fairness alongside economic viability. Additionally, the dominance of Whiteness and maleness in energy and digital technology industries must be challenged to foster greater diversity of smart energy possibilities. These structural inequalities influence not only who benefits from smart energy transitions but also whose voices are heard in shaping its future. To tackle this need, this thesis proposes intersectionality, a social theory originating from Black feminist thought, as both a method and a radical orientation which is discussed in the next section.

1.2 Rethinking energy justice using an intersectional lens

While considering the social justice implications of smart energy technologies (SETs), it becomes evident that the dominant framework remains the energy justice framework. However, this framework has limitations, particularly in addressing the structural inequalities underpinning

energy transitions. In this section, I briefly discuss these limitations and present the case for adopting intersectionality as a complementary theory to overcome them. The energy justice framework has been widely applied to understand the implications of clean energy technologies globally, drawing heavily from environmental and climate justice discourses. These frameworks have made significant strides in engaging with ideas of social justice and social identities, yet certain critical aspects remain unexplored.

Intersectionality, rooted in Black feminist thought, has begun to appear in energy justice discourse (c.f. Mejía-Montero et al., 2023), uncovering how intersecting social categories shape vulnerabilities to energy access, energy consumption and climate change impacts. For example, intersectional analyses have highlighted the compounded vulnerabilities of Indigenous women during climate disasters, critiquing the essentialism in single-axis frameworks that homogenize identities like "women" (Perkins, 2019; Arora-Jonsson, 2011). Despite these advances, intersectionality remains underutilized in energy transitions research, especially in the context of SETs.

The energy justice field, while influential, is often critiqued for its narrow focus on distributive, procedural, and recognition justice, leaving deeper structural inequalities unexamined. Common applications emphasize distributive outcomes without interrogating the institutional and systemic mechanisms sustaining energy inequalities. For instance, energy infrastructures, institutional practices, and deliberative processes are often acknowledged in theory but overlooked in practice, particularly within smart energy transitions. Scholars argue that energy justice lacks a normative framework to address systemic inequities or power imbalances within energy systems. Wood (2023) suggests that energy studies must incorporate moral and political philosophy to address these shortcomings, calling for methodologies that not only document inequities but dismantle the structures generating them.

Nancy Fraser's (2004) distinction between affirmative and transformative strategies offers a critical lens for understanding energy justice. Affirmative strategies aim to correct inequitable

outcomes within existing systems, whereas transformative strategies seek to restructure the generative frameworks of injustice. Energy justice often leans toward the former, addressing symptoms rather than root causes. However, as Fraser argues, transformative change is essential to achieve genuine equity within energy systems.

To progress, energy justice must move beyond universalized and uncritical perspectives aligned with modernization and development paradigms that often ignore the historical and spatial dimensions of energy systems (Torel, 2023). Feminist scholarship, particularly anti-oppression approaches, emphasizes the structural inequalities embedded in energy markets, cultures, and practices, as well as the political power sustained through these institutions. This shift aligns with the imperative to transition from reactive distributive justice models to proactive, transformative frameworks that address root causes.

Intersectionality provides a robust framework for addressing these gaps in energy justice. By examining how overlapping social identities—such as race, class, gender, and disability—intersect to shape experiences, intersectionality moves beyond single-axis analyses to reveal the nuanced ways power systems generate and sustain inequalities. In the context of SETs, intersectionality can uncover how technological advancements may inadvertently reinforce or exacerbate existing disparities.

For instance, evidence suggests that the benefits of SETs, such as smart meters and demand-side flexibility, disproportionately accrue to specific demographics—often White, upper/middle-class, energy-literate households—while marginalizing others. Intersectional analyses can reveal how these patterns intersect with broader power systems like capitalism, neoliberalism, and racism, offering actionable insights to reorient policies and technologies toward inclusivity.

Intersectionality also challenges the "checklist" approach to justice, which reduces individuals to fixed categories and overlooks the fluid and dynamic nature of identities. By centring the lived experiences of marginalized groups, intersectionality ensures that policies and interventions are

responsive to diverse needs. This approach aligns with transformative justice frameworks that embrace complexity rather than seeking oversimplified solutions.

Furthermore, intersectionality interrogates power dynamics within energy systems. For example, Jenkins (2018) notes that household benefits from smart energy transitions often depend on the willingness of energy suppliers to pass on savings—an outcome influenced by systemic inequities. Applying an intersectional lens allows researchers and practitioners to explore these dynamics and develop strategies to hold institutions accountable.

An intersectional approach to SETs rejects techno-utopian narratives that portray technology as liberating autonomous subjects while ignoring the racialized and gendered labour underpinning these systems. It challenges the dominance of Whiteness and maleness in energy and digital technology industries, advocating for diverse perspectives and possibilities. By centring complexity, interrogating power dynamics, and embracing transformative change, intersectionality provides a strong foundation for reimagining energy systems that are not only technologically advanced but also socially just.

Integrating intersectionality into energy justice is not merely an academic exercise but a practical necessity for creating equitable and inclusive energy futures. This thesis builds on these insights, exploring how intersectionality can inform the design, implementation, and evaluation of SETs to ensure that no one is left behind in the transition to Net Zero.

1.3 Research Questions

In this thesis, I investigate, through 11 qualitative interviews and 3 in-depth case studies at a charity, a social enterprise, and an energy distributor, the social justice issues at the core of smart energy technologies (SETs). I examine the barriers that hinder these technologies from promoting inclusivity and equity, paying attention to how they reinforce existing inequalities or generate new ones. As SETs become increasingly embedded in the energy landscape, they bring both

opportunities and challenges, particularly for vulnerable populations. This raises critical questions about who benefits, who is left behind, and how the design, deployment, and governance of SETs can align with broader social justice goals.

Crucially, my case studies delve into the extent to which these organizations engage with intersectional concerns when working with diverse households and smart energy systems. I investigate their strategies to confront emerging inequalities while grappling with systemic challenges such as neoliberal market structures, unequal access, and entrenched biases. In addition, I introduce intersectional tools and generate discussions about their transformative potential to address these challenges in meaningful ways.

The thesis is structured around three overarching research questions:

- **RQ1:** How do the ongoing smart meter rollouts in Great Britain impact social justice, and to what extent do they address intersectional concerns?
- **RQ2:** How do organizations working with SETs conceptualize and respond to the social justice implications of their initiatives, and why do they engage (or fail to engage) with intersectional praxis?
- **RQ3:** How can organizational practices be better aligned with intersectional praxis, and how might such alignment advance or hinder the transformative potential to dismantle inequalities in GB's transition to SETs?

1.4 Thesis Outline

This thesis weaves a narrative that begins by questioning the foundational assumptions of smart energy transitions and culminates in a call for reimagining justice through intersectionality. The story begins in Chapter 2, where I explore the intersection of smart energy technologies

(SETs) and justice, grounding my research in three interconnected bodies of literature. First, I examine the energy justice framework and energy vulnerability studies to understand the persistent inequalities in the UK's energy landscape. Next, I critically analyse the social justice implications of SETs, revealing how existing research on the topic often overlooks deeper systemic issues. Finally, I introduce intersectionality as both a theoretical and practical tool, demonstrating its potential to transform how justice is conceptualised and applied in smart energy transitions. This chapter also lays out the novel intersectional theoretical framework that shapes the rest of the thesis.

In Chapter 3, I turn to the methodological choices that guided my research. Here, I share the evolution of my approach, reflecting on how my positionality and philosophical commitments influenced the design of the study. I outline the three interconnected research phases: initial stakeholder interviews to map the terrain of SETs and justice, in-depth case studies involving participatory workshops to explore intersectionality's potential, and co-design workshops to operationalise these insights. This chapter describes the methods I used to bring the theoretical framework into dialogue with real-world practices.

The narrative then shifts focus in Chapter 4 to examine a critical case: the GB smart meter rollouts. Using insights from interviews, I analyse how these rollouts, despite their promise, have perpetuated existing injustices. I uncover how distributive, procedural, and recognition justice concerns have disproportionately benefited wealthier households while marginalising vulnerable groups. By placing these injustices in the context of the 2022 energy crisis, I reveal how systemic inequalities intersect with smart energy technologies. This chapter concludes by arguing that intersectionality provides a radical lens to challenge these inequalities and reimagine energy transitions.

Chapter 5 introduces the key actors in my case studies: a charity, a social enterprise, and an energy distributor. It delves into their current engagement with justice and intersectionality, tracing

their motivations and practices in the context of SETs. Through reflective spaces and dialogues, I uncover how these organizations perceive intersectional justice, where they fall short, and the opportunities they see for embedding intersectionality into their work. This chapter sets the stage for the practical interventions explored in the next chapter.

The narrative reaches its forward-looking peak in Chapter 6, where I examine how intersectionality can be operationalised within these organizations. Drawing on the case study findings, I outline three strategies for embedding intersectionality into energy practices: fostering critical reflection, building organizational capacities, and challenging systemic power structures. This chapter also critically evaluates the risks and challenges of these strategies, showing how each organization grapples with balancing transformative goals and pragmatic constraints. By reflecting on these findings through the intersectional framework developed earlier in chapter 2, I illustrate how intersectionality can reshape energy justice at the user, institutional, and power system levels.

Finally, Chapter 7 ties together the threads of this journey, reflecting on the contributions and implications of my research. I revisit the key insights and argue that integrating intersectionality into energy policy and practice is essential for addressing the intersecting vulnerabilities that shape energy inequalities. I propose practical steps for policymakers and practitioners, from justice by default policy designs to fostering organizational transformation. I also outline a research agenda to further explore the role of intersectionality in tackling macro-level power systems like capitalism, racism, and neoliberalism in energy transitions.

2. An intersectional approach to social justice implications of smart energy technologies (SETs)

In the introduction, I briefly highlighted the paradigm-shifting nature of the smart energy transitions currently underway in the UK and across the globe, driven by the transformative potential of smart energy technologies. These technologies signify a fundamental shift in how energy is produced, distributed, and consumed, underpinned by the increasing integration of digital and networked ICT technologies into the energy system (Shivakumar et al., 2018; Sareen et al., 2023; Hargreaves et al., 2022).

Smart energy technologies offer a range of benefits, most notably to (a) consumers, giving them the power to become prosumers instead of consumers; (b) energy suppliers, providing them reduced operational costs, increased consumer loyalty, etc., and (c) energy network operators, offering them improved technical efficiency and network responsiveness (Milchram et al., 2020). A key feature of these technologies is their ability to intelligently integrate the actions of all users connected to them to efficiently deliver sustainable, economic, and secure electricity supplies (Lund et al., 2017). Thus, digitalisation and automation are at their core.

Key technologies include smart meters, which allow real-time tracking of energy use, batteries that can store and discharge renewable energy for sustainable heat sources like heat pumps, and automated demand response systems that adjust consumption based on grid demand. Integrating these technologies, home energy management systems (HEMS) enable households to store excess renewable energy and optimise their usage patterns.

Many such smart homes collectively form critical nodes within the broader smart grid (figure 2.1), a network that integrates interconnected technologies such as sensors, processors, storage, and generators. The smart grid facilitates collaboration among various stakeholders—households, energy providers, and policymakers—to enhance the efficiency, reliability, and sustainability of electricity supply and demand.

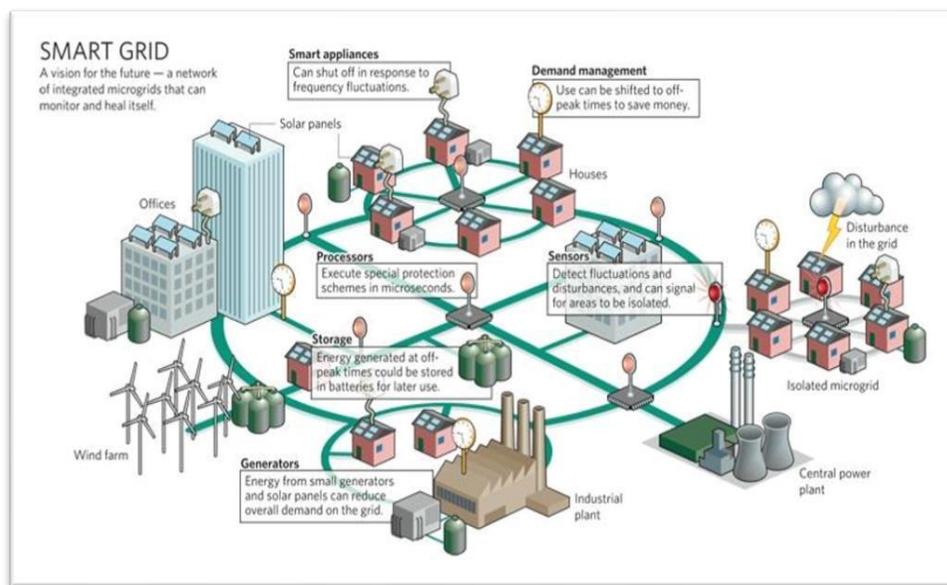


Figure 2.1: A schematic of the smart grid and all inter-related technologies. (Source: Irish Environment, Report on Smart Grids, 1 June 2014. Available at: [Smart Grids](#)).

On the business front, models like peer-to-peer energy trading and distributed aggregator services allow consumers to trade surplus energy or collectively respond to grid needs, creating a decentralized and participatory energy market (Lund et. al, 2017). Central to this has been the rapid development of an energy flexibility market (Calver & Simcock, 2021), based on the capacity of energy consumers to engage in demand-side response (DSR), which enables them to adjust their energy consumption patterns in terms of time, space, or intensity. This can be achieved through manual adjustments, direct load control, or the use of automated appliances (Smale et al., 2017). DSR allows households to reduce both energy consumption and costs through mechanisms like Time-of-Use (TOU) tariffs (Torriti & Yunusov, 2020), where electricity prices fluctuate based on the time of use. Additionally, households may receive financial incentives for shifting large energy loads, such as operating washing machines during off-peak hours (BEIS, Innovate UK & Ofgem, 2021) or be encouraged through non-financial incentives (Bradley et al., 2016).

However, beyond these technoeconomic shifts, the roles of energy consumers are also being transformed as they are envisioned as prosumers—both producing and consuming energy—taking on active roles in balancing the grid and reducing demand during peak times. These

technologies could therefore reconfigure social relationships such as those between electricity producers and consumers, between and within households, and through the creation of decentralised smart energy neighbourhoods (Smith et al., 2023; Sareen et. al, 2023). Furthermore, energy infrastructure digitalisation at the scale envisioned by smart energy projects also implies changes in critical societal infrastructures, such as data infrastructures and scope for new forms of control whose regulation is underdeveloped in existing institutional structures (Rommetveit et al., 2024). Yet, policy interventions aimed at increasing uptake of these technologies often claim that they will empower consumers, reduce reliance on traditional utilities, and increase system resilience while contributing to sustainability goals (Koomey et al., 2013).

While smart energy systems promise efficiency and environmental benefits, they also risk creating or deepening energy inequalities and underperforming in terms of their energy conservation goals (Smith et al., 2023). Smart energy technologies often require substantial upfront investments, high technical expertise, high energy literacy, and several other technical and social capabilities (CSE, 2020). This has raised concerns that the inclusive, empowering vision of a smart energy future might, in reality, only be accessible to certain households, while low-income households, renters, or those without reliable internet access risk being excluded from these benefits. Furthermore, issues such as privacy, data security, and agency over energy consumption (Hargreaves et al., 2015) create ethical dilemmas that must be addressed to prevent exacerbating vulnerabilities among marginalized households.

The academic literature on the adoption of SETs has effectively identified barriers, risks, and benefits, while raising ethical concerns about these systems. However, it has been less comprehensive in addressing justice-related issues, such as who is being left behind and why, as well as broader questions of distributive justice and equity. It has also inadequately explored the nuanced social contexts through which these technologies diffuse, the power imbalances between the stakeholders driving these transitions and energy consumers, and the lack of normative frameworks for assessing their justice implications. Moreover, it largely neglects how intersecting

household characteristics—such as income, geographic location, age, and digital literacy—can influence affordability, access, and adoption, often exacerbating disparities and leaving certain populations at risk of exclusion.

In this chapter, I position my research within three distinct yet interconnected bodies of literature:

- (i) the broad literature on energy vulnerability and the energy justice framework, which both serve as predominant tools for examining energy inequalities within energy transitions in the UK,
- (ii) the social justice implications of SETs, critically analysing existing studies and identifying limitations in current discourse; and
- (iii) intersectionality and its application in practice settings, with a focus on its potential to provide a more robust normative foundation for addressing social justice issues arising from the widespread adoption of SETs.

The chapter concludes by introducing a novel intersectional framework designed to address these concerns and articulating the rationale behind my research questions, setting the stage for the empirical work that follows.

2.1 Understanding current energy inequalities: Energy Vulnerability and Energy Justice

In this section, I will examine two influential frameworks within energy research that address inequalities in the energy system: energy vulnerability and energy justice. Energy vulnerability refers to understanding the drivers of energy-related hardships faced by households and individuals, often due to factors like low-income, high-energy costs, inadequate housing, or restricted access to affordable energy services (Bouzarovski & Petrova, 2015). It focuses on recognising the multi-dimensional nature of energy deprivation and the structural conditions that create it. In contrast, energy justice offers an ethical framework to assess energy injustices and

promote fairness across energy production, distribution, and consumption. It incorporates distributive justice (equitable resource allocation), procedural justice (inclusive decision-making), and recognition justice (respect for diverse needs) (Sovacool, et al., 2017).

The interrelationship between these concepts is essential: while energy vulnerability identifies those most affected by energy deprivation and the factors causing it, energy justice provides the ethical basis to address these issues. Together, they shape policy and intervention by revealing the structural origins of inequalities, guiding solutions to tackle energy poverty, and promoting fair treatment for vulnerable groups during energy transitions. These frameworks are particularly relevant to my research, as they represent the primary lenses through which UK stakeholders assess inequalities in the current energy system, recognize how these are amplified by smart technologies, and design strategies to mitigate them.

2.1.1 Energy Vulnerability

The concept of energy vulnerability has been used in academic literature to better understand the lived experiences of households experiencing energy poverty (Middlemiss & Gillard, 2015). Energy poverty refers to the inability of households to secure essential energy services—such as heating, cooling, lighting, and cooking—needed for a healthy standard of living (Bouzarovski & Petrova, 2015). This condition often results from the energy trilemma: low-income, high-energy costs, and poor home energy efficiency (Ruse et al., 2019). These factors force difficult trade-offs, compromising essentials like food and healthcare to meet basic energy needs. The UK, a pioneer in addressing energy poverty (often termed fuel poverty), has influenced other European countries, including France, Slovakia, and Poland, to adopt similar approaches ((Middlemiss, 2017; Chard & Walker, 2016; Bouzarovski et al., 2012). UK policies focus on identifying and supporting energy-poor households, assessing the impacts of cold homes, and implementing energy efficiency measures like insulation (Ambrose & Marchand, 2017). This issue has gained urgency, especially

after the severe hardships faced during the winter of 2022 when energy prices tripled (Simcock & Bouzarovski, 2023).

Energy vulnerability casts energy poverty as a complex condition that is not merely a result of low income or high energy prices but is shaped by an interplay of various factors, including housing quality, energy efficiency, access to affordable energy, social relationships, and broader socio-economic conditions (Robinson et al., 2018; Bouzarovski et. al, 2012). This perspective recognizes that it is influenced by a range of social, economic, and infrastructural variables that affect individuals differently based on their unique circumstances. Consequently, addressing energy poverty requires a holistic approach that considers these multiple dimensions to develop effective interventions (Bouzarovski & Petrova, 2015; Middlemiss & Gillard, 2015).

For instance, energy vulnerability considers income stability rather than just income level, offering a more nuanced, dynamic perspective on how households experience and navigate energy challenges. Middlemiss and Gillard (2015) highlight that, “*while household income has long been recognised as a factor in determining fuel poverty, the fuel poor in our sample are more concerned about the stability of that income, particularly in light of recent benefits reform*” (p. 152). It thus captures a more comprehensive view of energy hardships, reflecting the complexity of real-life challenges as households contend with fluctuating income and evolving policy impacts.

Research across different UK contexts reveals that certain household characteristics are more likely to be associated with energy vulnerability and its detrimental effects. For instance, households with *disabled individuals* in England show higher rates of energy poverty (Snell et al., 2015). *Elderly people*, particularly those at higher risk of increased blood pressure and coagulation, face the highest excess winter mortality rates, a phenomenon often linked to inadequate levels of domestic heating (Chard & Walker, 2016). *Digitally excluded households*, struggling with internet access or insufficient digital literacy, are less likely to engage with online energy-saving schemes that could reduce their energy costs (Williams et al., 2016). *Privately-renting tenants* often experience constrained housing choices that force them to accept substandard properties they might

otherwise reject. These poor-quality homes frequently result in inadequate insulation, high energy bills, and cold living conditions, directly impacting tenants' health and wellbeing (Ambrose et al., 2016). Additionally, significant *rural-urban divides* exist across the UK, with energy vulnerability in rural areas being more challenging to address (Mould & Baker, 2017).

Despite compelling evidence of gender disparities in experiences of energy vulnerability (Robinson, 2019; Petrova & Simcock, 2021) in-depth analyses along gender lines remain underexplored and current research tends to cast women as passive subjects, denying their agency in overcoming or changing these circumstances (Listo, 2018). Households reliant on prepayment meters are another vulnerable group, as they often pay higher-than-average energy tariffs (O'Sullivan et al., 2011). Privately rented households frequently encounter barriers in accessing energy efficiency schemes (Ambrose et al., 2019). Lastly, those residing in older urban housing, such as Victorian terraced homes with inefficient features like solid walls and single glazing, are also more energy vulnerable due to the increased heating energy required (Robinson et al., 2018). These characteristics are often implied when organizations in the UK energy sector – charities, suppliers, the regulator etc., refer to '*vulnerable consumers*' which will be a frequently occurring term in the results chapters 4-6.

This research has also been expanded by some academic studies to acknowledge that significant intersections between various household characteristics mentioned above. Studies have demonstrated that no single household metric can adequately capture the full extent of energy vulnerability; instead, a combination of household indicators must be analysed together (Clancy et al., 2017; Ruse et al., 2019). For instance, households with disabled individuals who are single and of working age are more likely to experience severe levels of fuel poverty. Additionally, these households are often equipped with prepayment meters, further compounding their energy vulnerability (Snell et al., 2015). These intersections suggest that certain households face more severe consequences due to the coming together of several sociotechnical factors which can either intensify or mitigate their experience of energy vulnerability.

Energy vulnerability research has laid a crucial foundation for understanding energy injustices, casting them as dynamic processes influenced by intersecting factors like income, housing quality, and access to energy services. It has also informed sector-wide definitions of vulnerable consumers, such as those adopted by Ofgem (Ofgem, 2019). Building on this groundwork, I will expand the research agenda by applying its insights to SETs, exploring some issues this literature has highlighted need further examination (Middlemiss, 2017; Simcock & Bouzarovski, 2023) such as systemic causes of vulnerability, the institutional and social power shaping energy inequalities, and the urgent need for radical interventions.

2.1.2 Energy Justice

While energy vulnerability provides a nuanced lens to examine household-level experiences and the immediate hardships faced by individuals, energy justice takes a broader approach. It focuses on the implications of energy policies and interventions, analysing their broader distributive, procedural, and recognition-based impacts on society. Energy justice is a comprehensive framework to understand how sociotechnical energy systems ensure or hinder equitable access to energy, the fair distribution of costs and benefits, and the right to participate in choosing whether and how energy systems will transition (McCauley, 2014). It has emerged as an important social science research field and has been applied to and integrated insights from energy policy, energy production, energy consumption, energy security, and energy activism (Jenkins, 2018; Van Uffelen et al., 2024; Sovacool et al., 2019; Fuller & McCauley, 2016). It is usually centred around three¹ pillars or the energy justice triumvirate (McCauley & Heffron, 2018):

- (a) **Distributive Justice** emphasizes fair access to energy resources, ensuring that the benefits, costs, and risks of energy production and consumption are shared equitably across society.

¹More recent dimensions of energy justice include restorative and cosmopolitan forms of justice, which refer to rectifying the injustice of the energy sector and considering the cross-border effects of energy activities, respectively (Tornel, 2023). However, for my discussion in this section I am neglecting these dimensions since they have been neglected in the context of SETs (although this is a critical oversight discussed in chapter 4).

It focuses particularly on mitigating the disproportionate burdens on marginalized communities, such as higher energy costs and environmental risks.

(b) **Procedural Justice** prioritizes the inclusivity and transparency of energy decision-making.

It underscores the importance of fair inclusion of affected communities, particularly vulnerable groups, in policymaking and implementation, as inclusivity fosters legitimacy and compliance with outcomes—even when outcomes may not favour all stakeholders.

(c) **Recognition Justice** calls for respect and acknowledgment of the unique identities, needs, and systemic challenges faced by marginalized groups. It seeks to rectify misrepresentation by ensuring all voices are heard and valued within energy decision-making processes (McCauley et al., 2019).

Energy justice, inspired by climate and environmental justice which came before it and whose philosophies it shares (Jenkins, 2018), was developed as a more focused model addressing energy-specific issues, whilst at the same time, offering a conceptual framework that emphasized applicability of the triumvirate (McCauley & Heffron, 2018; Sovacool & Dworkin, 2015; Jenkins et al., 2016). Its primary aim therefore is to overcome the broad, abstract aspects of environmental justice, providing a systematic, policy-oriented approach that integrates cross-disciplinary methodologies like participatory energy budgeting and qualitative interviews to guide ethical decision-making (Jenkins & Martiskainen, 2018; Jenkins et al., 2021). Since its initial emergence as a research topic at the nexus of energy transitions and social justice, it has been widely used for analysing the social impacts of new low-carbon technologies (Jenkins, 2018). Apart from inspiring a rich field of academic debate, it has also helped policymakers make informed choices by exploring social and spatial factors in energy transitions – going beyond the typical concerns of accessibility, affordability and security (Tornel, 2023; Sovacool and Dworkin 2015, Jenkins 2018).

In comparison to its predecessors, the energy justice approach can often be considered reductionist because it sharpens the focus of decision-making by critically analysing technical artifacts, technology implementation programs, and sustainable energy projects at local scales

(McCauley & Heffron, 2018; Jenkins et al., 2018). It allows for the identification of injustices within energy systems (Bouzarovski & Simcock, 2017), the recognition of newly affected societal groups, and the development of processes to prevent further injustices. This is particularly relevant given the interconnected nature of energy issues and the growing linkages between environmental, economic, and social aspects of sustainability (Sovacool & Dworkin, 2015). Furthermore, by expanding its normative reach to sociotechnical transitions, Jenkins et al. (2018) argue that the energy justice framework has also identified exclusionary and inclusionary technological and social niches before they diffuse into the regime level of the Multi-Level Perspective (MLP) (Geels, 2002). This has allowed for the description and normative judgment of existing regime players, framing energy justice as a priority at the broader landscape level (Jenkins, 2018).

Despite its strengths, the energy justice framework has faced criticism for employing a universalised approach that overlooks the complexities of social and cultural identities, as well as the power dynamics shaping sustainability transitions (Raj et al., 2024). It has also been critiqued for its lack of normative guidelines to steer energy transitions (Van Uffelen et al., 2024) and for distancing itself from the transformative justice ethos central to its predecessors in environmental and climate justice frameworks (Wood, 2023). Similarly to energy vulnerability, I will delve into these critiques in the following sections, assessing their relevance to the case of SETs and exploring how intersectionality might address and overcome these limitations.

2.2 Social justice implications of SETs

Having provided an overview of SETs and the predominant frameworks for examining energy inequalities in the UK, I will now undertake a detailed review of their social justice implications, exploring how these technologies intersect with broader questions of equity, accessibility, and systemic power dynamics. Due to their potential to revolutionize the role of households within the energy system, the deployment and adoption of SETs in domestic settings have been

extensively researched over the past decade from various social science perspectives. Skjølsvold et al. (2015) provide a comprehensive review of this literature, highlighting the prevalent issue of oversimplified assumptions about energy users and homogenous perspectives on how these technologies are integrated into homes by their developers and implementers. Such oversights often lead to challenges in adoption or technical malfunctions. There is a related body of work that highlights the misalignment between the design of SETs and user practices, leading to barriers in adoption and/or failure to achieve intended goals such as energy consumption reduction (c.f. Chamaret et al., 2020; Hargreaves et al., 2013; Adams et al., 2021; Smale, 2021; Bell et al., 2015).

Although this has advanced our understanding of the lived experiences of people using smart technologies such as in-home display devices, it stops short of naming and analysing injustices that arise due to their proliferation. As such, a second body of work emerged which includes studies that identify emerging 'winners and losers' in smart energy transitions, either through the lens of energy justice, or by focusing on how identities like gender affect domestic energy scenarios (cf. Jenkins et al., 2018; Sovacool et al., 2021; Milchram et al., 2018). A third related body of work includes studies that centre around *capabilities* for participating in flexibility markets. These are usually articulated in terms of household characteristics that facilitate or hinder participation – and more importantly – discuss the concept of 'Flexibility Justice' which places justice, equity, and inclusion at the heart of discussions surrounding SETs and demand side flexibility (cf. Powells & Fell, 2019; Fjellså et al., 2021; Hillerbrand et al., 2021; Johnson et al., 2024). These capabilities (or their lack thereof) correlate with the household characteristics that cause energy vulnerability, thereby this literature also highlights that SETs could both exacerbate and produce new energy hardships (Appendix A). In this section, I will briefly review these interconnected bodies of work and discuss key research gaps.

2.2.1 Barriers to adoption of smart energy technologies

The first body of literature highlights that the adoption of SETs faces significant challenges due to the disconnect between consumer behaviour, needs, and expectations and the actual design and performance of these technologies (Jenkins et al., 2018; Sovacool et al., 2017; Sovacool et al., 2019; Hargreaves et al., 2013). Concerns arising due to issues such as poor practices during the rollout, and an imbalance of risks and benefits for customers, perceptions that smart technologies will exert control over householders or interfere with their daily routines have led to a negative perception among consumers that have either stopped engaging with them or rejected them (Crispim et al., 2014; Hargreaves & Wilson, 2017; Hargreaves et al., 2015; Skjølsvold & Ryghaug, 2015; Furszyfer Del Rio, 2022).

This literature emphasizes that energy suppliers, policymakers, and researchers tend to prioritize the technical and economic aspects of flexibility, viewing it solely as a system characteristic or tradable commodity. This narrow focus neglects the deeper, social dimensions of energy use—such as habits, social relations, and cultural practices—that are integral to the success of SETs (Blue et al., 2020; Fjellså et al., 2021). The key argument is that household participation in the smart and flexible market will remain limited if these broader, socio-cultural factors continue to be marginalized (Strengers & Nicholls, 2017; Winther & Bell, 2017). Therefore, addressing learning, emotions, practices, and social contexts is essential to overcoming barriers to adoption and leveraging the complexity of domestic energy consumption (Bartiaux, 2022; Chambers, 2022; Bell et al., 2015; Hargreaves & Middlemiss, 2020).

These concerns have translated into issues with the UK's smart meter rollouts, confirmed by recent research on the subject. A recent Citizens Advice survey showed that 54% of respondents were dissatisfied with their smart meter installation, while 31% reported device malfunctions (Citizens Advice, 2024). The Department for Energy Security and Net Zero (DESNZ) also noted that 9% of smart meters had faults, and millions of SMETS1 meters are

already or soon will be obsolete (DESNZ, 2023). Additionally, although SETs aim to support a decarbonized grid, expected savings have fallen short, averaging 3% rather than the projected 9% (DESNZ, 2022), raising questions about the high taxpayer investment in the smart meter rollouts over alternative NetZero solutions (Sharma, 2024).

Doubts about whether these technologies will enable energy savings, allow for higher renewable energy integration, and contribute to national net zero targets or whether they will only provide security, satisfaction, recreation, and fulfilment to a select few sections of society are a common theme in the literature surveyed. This has interconnections with the next body of literature reviewed which deals with the question - even if smart energy technologies achieve these ambitious society wide targets, could they ensure equitable distribution of benefits and costs while preventing exacerbation of existing energy inequalities?

2.2.2 Social Justices Implications of SETs

2.2.2.1 Distributive Justice

Milchram et al. (2018) examined justice issues in smart energy systems, focusing on distributive and procedural justice. They found that low-income households face significant barriers to accessing and benefiting from SETs. These barriers include limited access to pilot projects, often targeting wealthier areas, and inflexible energy demand due to poor housing. Consequently, these households may pay higher energy costs during peak hours, worsening inequalities. The authors also highlight concerns about public funding for smart grid projects, which may disproportionately burden low-income consumers, particularly in countries like the UK and the Netherlands, where these costs might be passed on to them.

Evidence from the UK by Jenkins et al. (2018) also indicates that households experiencing fuel poverty and those with inflexible energy needs due to health conditions are particularly disadvantaged in this transition. These households are often unable to participate in demand flexibility services, preventing them from benefiting from lower energy prices during periods of

high renewable energy generation (Jenkins et al., 2018); Sovacool et al., 2017). This raises a significant challenge: the most vulnerable households are often unable to fully engage with demand-side response (DSR) technologies and time-of-use (TOU) tariffs, which could otherwise provide financial relief (Calver & Simcock, 2021).

Beyond cost savings and energy reduction, energy consumption data is a vital resource, and its distributive aspects need further research. Research indicates that energy suppliers or regulators may restrict access to this data, hindering efforts to address energy poverty (Casals et al., 2020) – benefitting more than the households who own the data. It also remains uncertain whether energy poor will have the financial means to invest in these systems or if business models that extend the benefits of a flexible energy system to them will emerge, as these services are still in development (Energy Systems Catapult, 2021; Citizens Advice, 2015). Recent pioneering research comes from frontline organizations like Citizens Advice and the Centre for Sustainable Energy. The Smart and Fair Phase 1 Report (CSE, 2020) highlights more serious distributive concerns, noting that low-income households bear costs for system upgrades, such as increased EV ownership, without benefiting directly.

2.2.2.2 Procedural Justice

The first key aspect of procedural justice in smart energy systems involves the handling of consumer data picked up by devices such as smart meters or smart electrical appliances. Consumers contribute valuable data that enhances the services offered by smart energy companies, raising ethical concerns about data usage and the potential private revenue generated from this data. For instance, Milchram et al., (2020) found that in the Netherlands, pilot smart energy projects faced challenges in maintaining transparency around knowledge exchange, especially given the proprietary nature of business models. This lack of transparency is a growing concern as smart energy systems become more prevalent, leading to potential issues with the automated, fine-grained collection of consumer data.

Procedural justice concerns also arise from the limitations in participating in flexibility markets for households with lower incomes, chronic health conditions, the elderly, and those with children—groups that are at a greater risk of energy poverty. If these households are made to feel obliged to participate in critical peak pricing trials through marketing campaigns that do not pay attention to their specific needs, they might experience financial penalties while participating in them (Calver & Simcock, 2021; Citizens Advice, 2023).

Research has also highlighted how marginalized households are often excluded from the governance of smart grid pilot projects. This relates to their exclusion from the popular energy imaginaries of a smart future prevalent in industry and policy (c.f. Dahlgren et al., 2021). Powerful private entities, such as utility and smart technology companies, dominate these projects and focus on the early adapters – typically upper-income technophilic households, leaving the participation of individuals and communities becoming limited, rendering the transition process inequitable (Jenkins, 2018; Milchram et al. 2018). Previous research (Sovacool et al., 2017) has also attributed the top-down execution of smart meter rollouts, with little household consultation, to the widespread rejection and difficulties in using the technology to understand energy consumption discussed earlier. Transparent communication processes about the benefits and risks of smart meters are essential but have so far been neglected (Sovacool et al., 2017); Jenkins et. al, 2018). Although some public transparency exists in certain smart energy projects, much of the research and development occurs within companies with little consumer engagement (Milchram et. al 2020, Calver & Simcock, 2021).

2.2.2.3 Justice as Recognition

Research on the UK smart meter rollouts has highlighted the importance of recognizing the unique challenges faced by low-income households, the elderly, and those with disabilities (Sovacool et al., 2017). It underscores that understanding the unique life circumstances of different households is crucial in designing effective and respectful smart energy-saving programs (Jenkins et al., 2018).

This would entail accounting for the specific needs of marginalized groups, such as higher energy needs for medical equipment or limited access to digital technologies.

Jenkins et. al (2018) highlight that the design of smart energy systems, particularly those that display energy consumption and pricing, often fails to consider the cognitive load and stress they may impose on vulnerable users, such as the elderly and those with learning disabilities. This oversight can lead to injustices stemming from misrecognition, as these systems may inadvertently exacerbate the challenges faced by these groups rather than alleviate them.

In addition to these issues, the homogeneous views of energy consumers within smart energy projects (Johnson, 2020; Strengers et al., 2022) have led to misrecognitions for certain households. For example, households with incompatible energy meters, such as pre-payment meters common among low-income households, or those unable to install relevant auxiliary technologies due to renting rather than owning their homes, face significant barriers to fully engaging with the smart meters (Sovacool et al., 2021). Psychological barriers have also been unacknowledged so far, such as risk aversion, which also play a role, with low-income and vulnerable households being less likely to engage with the smart energy market due to the perceived complexity of the energy market (Lunn & Lyons, 2010; Nicolson et al., 2018). Furthermore, skills-based constraints, where individuals unfamiliar or uncomfortable with digital technologies are unable to participate, add to the challenge of justice as recognition (Citizens Advice, 2011; Snell et al., 2015). The reality that households with elderly and disabled energy consumers (Snell et al., 2015) often face disproportionately higher energy bills than other groups underscore the critical need for ensuring that they are not left behind in reaping some of the cost-saving benefits of these technologies.

Furthermore, the impact of demand-side response (DSR) technologies on different household types, particularly those with varying social and physiological characteristics also remains under-researched (Calver & Simcock, 2021). Older individuals and those with chronic health conditions are more sensitive to temperature fluctuations, and the curtailment of heating or

cooling could have disproportionately harmful effects on these groups. Similarly, those with medical conditions requiring consistent energy use may face severe consequences if their access to electricity is restricted during a DSR event (de Chavez, 2017).

2.2.2.4 Differential impacts of SETs on various social groups

The dominance of majority voices—particularly those from the Global North, white normativity, and techno-masculinity—in energy research, policy, and technology is well-documented (Wilson, 2018). Studies also highlight the underrepresentation of gender and ethnic minorities in the governing bodies influencing energy policies (Blakelock, 2021; UKERC 2022). Despite increasing awareness, research exploring the varied impacts of smart energy technologies across diverse social groups remains limited, with most analyses focusing narrowly on low-income, elderly, and medically vulnerable households.

Recent consumer surveys, such as those involving some participants of the Demand Flexibility Service (DFS), reveal that certain demographics, notably younger individuals and renters, are underrepresented, while predominantly ‘better-off’ White British respondents are overrepresented (CSE & National Grid, 2023). However, the extent of this bias across the entire sample of DFS participants remains unclear. Moreover, some sociodemographic groups struggled to engage with DFS information, likely due to its complexity or inaccessibility.

A significant body of research has focused on the relationship between smart energy technologies and gender within domestic settings (Bartiaux, 2022; Aggeli et al., 2022; Chambers, 2022; Johnson, 2020; Strengers, Dahlgren, et al., 2022). Inspired by ideas from techno-feminism, this research further highlights that the efficacy, convenience, and comfort provided by smart energy technologies depend significantly on how these technologies are integrated within gendered household practices (Chambers, 2022). It is argued that many of the everyday adjustments households make to ‘flex’ their energy demand in response to DSR signals are typically managed by women, thereby influencing household routines, domestic responsibilities, and work–life balance (Johnson, 2020; Strengers & Kennedy, 2020). This aligns with earlier research that

behavioural changes intended to manage household energy demand are often culturally coded as ‘feminine’ and predominantly undertaken by women (Petrova & Simcock, 2021; Tjørring, 2016). Without systemic changes in gendered divisions of labour, DSR may exacerbate domestic workloads for women, a disparity that requires closer scrutiny in the design of energy flexibility policies (Johnson, 2020).

Parallel to gender, the intersection of race and energy consumption is another critical yet underexplored area. While some recent studies, particularly in the United States, have examined the differential health impacts of energy flexibility across various ethnic groups (White & Sintov, 2019) or how structural racism impacts energy efficiency of buildings (Lewis et al., 2020), there is a conspicuous gap in understanding this intersection in the UK and Europe (Narayanan et al., 2023). Addressing this gap is crucial, as structural and institutional mechanisms may contribute to unequal energy-related outcomes for racialized households, including difficulties in accessing quality energy advice and heightened energy poverty (Narayan et al., 2023; Bouzarovski et al., 2022). The lack of perspective-sharing and interconnected learnings between research at the nexus of gender, racial, and disability justice in the context of energy transitions also persists despite such links being well-established in other domains, such as health and the built environment (Narayan et al., 2023; Hargreaves & Sharma, 2023).

2.2.3 Flexibility Capabilities, Flexibility Capital and Flexibility Justice

The third body of literature addresses the social and material requirements at the household level that either hinder or promote participation in smart technology-enabled flexibility markets. Using this capabilities approach, it examines how households can fully capitalize on the flexibility services available through this participation (Hillerbrand et al., 2021; Powells & Fell, 2019; Fell et al., 2023; CSE, 2020). Unlike the previously reviewed literature, which often categorizes households as either early adopters or laggards, beneficiaries or excluded, this body of work acknowledges the current

injustices in the transition but shifts the focus to the capabilities or requirements that energy consumers must comply with in order to benefit from SETs-enabled flexibility, as highlighted in the excerpt below.

“If the system becomes reliant upon and is designed around the assumption that certain groups of customers will have to be compliant and offer flexibility, this compliance becomes self-perpetuating and is likely to become normalised and, effectively, locked in.”

- Powells & Fell, (2019), p.58.

It emphasizes which households may lack the necessary capacities for the top-down deployment of SETs. It offers a more bottom-up perspective on household capabilities and proposes pragmatic strategies to address the injustices that some households face. By doing so, it avoids reducing households to binaries and challenges the perception that some households lack the willingness, interest, abilities, and knowledge to become providers of flexibility to the electricity grid. Such judgments, prevalent in smart technology development, are often based on the assumption that individual users should behave rationally and conform to developers' expectations, effectively disconnecting users from their material, economic, and everyday circumstances (Fjellså et al., 2021).

One of the first studies which used the capabilities approach to understand and classify these requirements was in the context of the smart grid projects in the Netherlands by Hillerbrand et al. (2021). This study found that the benefits of integrating households into the smart grid, particularly through mechanisms like demand flexibility, are frequently contingent upon the availability of capital-intensive technologies such as renewable energy systems and battery storage. This reality creates an inherent barrier for lower-income households, who are unable to access these benefits due to a lack of financial resources, even if they had access to certain gateway

technologies such as smart meters (Milchram et al., 2020; Hillerbrand et al., 2021). Thus, both technical and financial capabilities are critical to benefit from SETs.

Similarly, the pioneering *Smart and Fair?* report by the Centre for Sustainable Energy (CSE) categorizes household capabilities into five clusters, outlined in Table 2.1 and Figure 2.2, based on UK-wide smart energy offers, stakeholder consultations, and household data (CSE, 2020). Using the Capability Lens, the report identifies which smart energy offers exclude or include specific household types depending on their capabilities and highlights which households face the highest risk of exclusion. By mapping smart offers to household capabilities, this framework has already guided policy development and have been used across a number of UK smart energy initiatives (Johnson et al., 2022).

Capabilities Cluster	Definition
Dwelling and Local Area	Concerns the readiness of a home and its location to support smart energy participation, including the presence of necessary infrastructure like a smart meter.
Energy Tech and Usage	Focuses on the compatibility of a household's existing energy technologies and usage patterns with the requirements of smart energy opportunities.
Digital Tech Readiness	Involves the household's access to digital technology, connectivity, and digital skills, which are crucial for engaging with smart energy systems, particularly those requiring app usage.

Financial Capability	Addresses the household's financial stability, including income, savings, creditworthiness, and money management skills, which impact their ability to invest in or benefit from smart energy technologies.
Personal and Social Factors	Encompasses individual mindsets, social connections, and values that influence the household's engagement with smart energy opportunities and their capacity to make necessary behavioural changes.

Table 2.1: Smart and Fair Capabilities cluster summarised from the Smart and Fair? Report (2020).

Another related concept is important to discuss – flexibility capital - which describes a household's ability to adapt energy consumption patterns in response to system signals, such as price changes or demand-side response (DSR) incentives. Powells and Fell (2019) describe this term in detail and note that flexibility capital is unevenly distributed across society, influenced by factors such as technology access, financial resources, and socio-economic circumstances. In casting the ability to move one's energy consumption in time as a form of capital they shift the conversation beyond economic and technical factors that enable participation, highlighting instead the many social and cultural attributes of individuals, households and communities that might also become valuable in the context of providing flexibility.

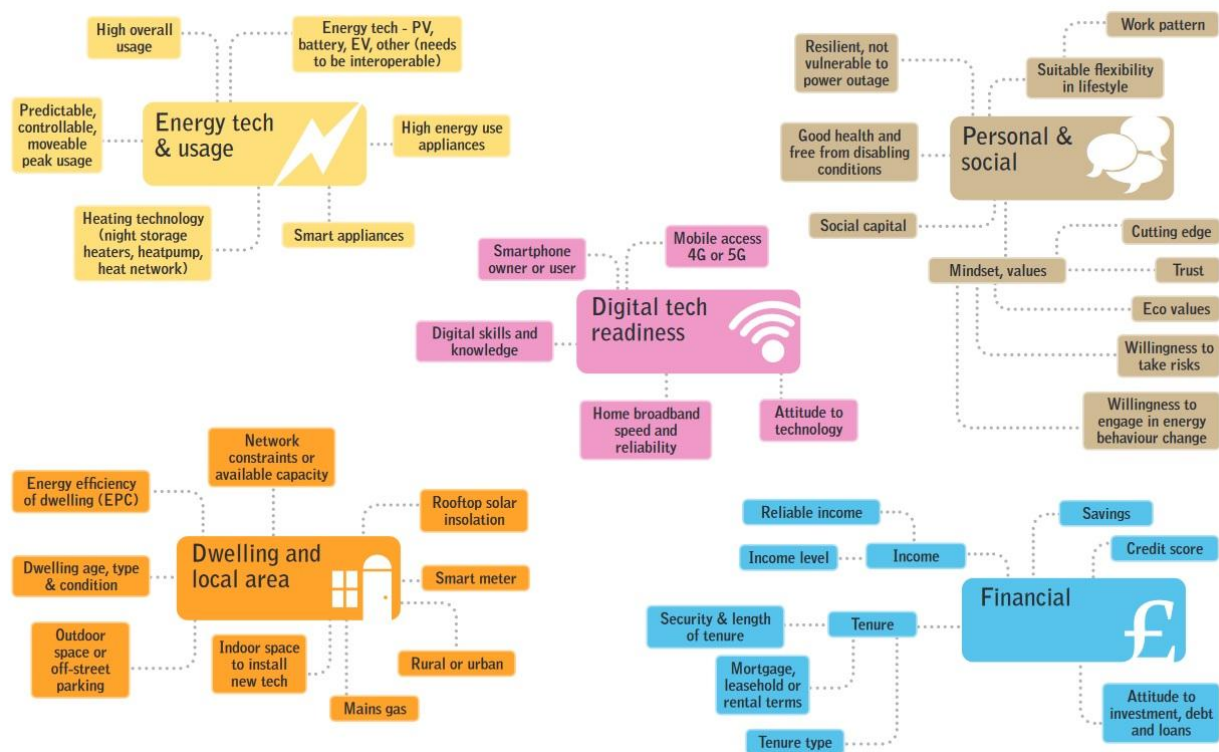


Figure 2.2: The capabilities clusters expanded to represent household capabilities.

Source: CSE, 2020, p.32.

This distinction moves beyond the capabilities approach, offering a more nuanced perspective on how households might benefit from flexibility. Powells & Fell (2019) discuss flexibility capital and its intersection with household affluence which makes this distinction evident. The capabilities approach typically considers less affluent households as having lower capacity to participate in and benefit from the smart energy market. However, examining this through a lens of flexibility provides a more complex and heterogeneous understanding. It reveals that even households lacking affluence may possess high flexibility capital derived from social sources, shaped by factors such as gender, age, digital skills, and other contextual influences. This perspective raises critical questions about how flexibility is distributed and valued within smart energy systems. Powells and Fell (2019) argue that the energy system has fixed capacity, and therefore flexibility is a zero-sum game. This means that there might be cases where some less affluent households with socially derived high flexibility capital might move their energy

consumption to their detriment, which might afford some more affluent households more uncompromised levels of energy consumption.

This moves the conversation even further to flexibility justice which seeks to conceptualise this imbalance, advocating for equitable access to flexibility benefits (Powells & Fell, 2019). Flexibility justice centres the overlooked impacts of energy flexibility on daily life, highlighting how changes in convenience, control, and quality of life often go underestimated. This important body of work calls for understanding how flexibility justice is influenced by social, cultural, and technical capital, making visible the injustices from participating in flexibility, and therefore, provides a more holistic understanding of how flexibility impacts diverse households (Powells & Fell, 2019; Fjellså et al., 2021; Fell et al., 2023).

In this section, I have traced the evolution of critiques and assessments surrounding the development of smart energy technologies, focusing primarily on literature from the Global North, where these technologies have gained the most prominence over the past decade. This important body of work has progressed from examining who is being left behind and how, to providing critical insights into how attributes such as gender and ethnicity shape demand-side energy consumption practices. It has evaluated the capabilities required of energy consumers by smart energy offers and, more recently, has delved into the concept of flexibility justice—arguing for its distinction as a separate framework to address unique equity concerns within smart energy systems. Before building further on these discussions, the next section will focus on critiques of the energy justice framework. Despite the emergence of several alternative approaches, energy justice remains the dominant lens for examining justice implications across sectors, including the impacts of smart energy technologies. This critique will provide a foundation for exploring how intersectionality might address its limitations and enrich justice-oriented analyses.

2.3 Limitations in the literature on the social justice implications of SETs

This section examines key limitations in the literature concerning the social justice impacts of SETs. As noted in the previous section, research at the intersection of SETs and social justice is still relatively sparse, yet the growing involvement of policy and industry groups highlights its rising significance (c.f. Citizens Advice, 2023). To contextualize these limitations, I will first review broader critiques of the energy justice framework, which remains the primary lens for examining energy justice, vulnerabilities, and inequalities in the UK. Following this, I will illustrate how, despite its strengths in highlighting SETs-related injustices discussed in section 2.2, the framework fails to address certain critical gaps.

2.3.1 Energy Justice: A Vital Framework in Need of a Stronger Normative Backbone

Despite its popularity as a framework to understand societal impacts of energy transitions, energy justice has been criticized for lacking a robust normative foundation (Jenkins et al., 2016; Sovacool & Dworkin, 2015; Pellegrini-Masini et al., 2020; Feenstra & Özerol, 2021). This limitation has led to generalized, superficial applications across diverse energy users, technologies and contexts. As Hillerbrand et al. (2021) and Calver & Simcock (2021) argue, a deeper normative foundation grounded in ethical and social theory is needed for energy justice to go beyond merely echoing public concerns and engaging critically with pressing ethical issues. This could allow researchers to evaluate power dynamics at the heart of energy transitions more thoroughly (Wood, 2023).

Some scholars have speculated the reason for the framework being absorbed superficially in analyses. One reason is attributed to mainstream approaches to just transitions, which often view justice as “a formalised and preconceived ‘thing’ to be delivered or applied” (Bouzarovski, (2022), p. 1004). This results in framework getting detached from fundamental ethical and

normative foundations. This was evident in a systematic review by Van Uffelen et al. (2024), which found that many energy justice contributions lacked a clear articulation of their normative claims. In practice, this gap could result in energy policies that fail to deliver equitable outcomes.

Therefore, scholars such as Tornel (2023) and Van Uffelen et al. (2024) emphasize the need to critically examine the foundational principles used to make normative judgments within the energy justice framework. Sovacool and Dworkin's (2015) important work proposed ten guiding principles for practitioners, urging that they be integrated into all energy planning. Yet Tornel (2023) argues these principles lack specific guidance for varied contexts, risking them becoming merely adopted as a checklist (see example in figure 2.3). Similarly, Van Uffelen et al. (2024) highlight that actors' differing worldviews can lead to contradictions in how justice principles are applied, pointing to another reason for ensuring stronger normative substantiation.

Scholars have also noted that energy justice's limited normative depth may stem from a disconnect with deeper justice concerns rooted in environmental and climate justice movements which preceded it (McCauley & Heffron, 2018; Fuller & McCauley, 2016). Wood (2023) argues that some policy-oriented analyses of energy justice often label grassroots movements as *naïve* which can create misrecognition by dismissing key concerns about race, class, gender, and other socio-political factors foundational to them. Wood (2023) further examines how this construes justice narrowly, viewing procedural, recognition, or distributive concerns, as isolated even though they are rarely separate in practice. Without critical reflection, energy justice thus risks creating a disconnect between its normative goals and practical applications.

Table 2
Energy justice decision-making tool.

Principle	Explanation
Availability	People deserve sufficient energy resources of high quality
Affordability	All people, including the poor, should pay no more than 10 percent of their income for energy services
Due process	Countries should respect due process and human rights in their production and use of energy
Good governance	All people should have access to high quality information about energy and the environment and fair, transparent, and accountable forms of energy decision-making
Sustainability	Energy resources should not be depleted too quickly
Intragenerational equity	All people have a right to fairly access energy services
Intergenerational equity	Future generations have a right to enjoy a good life undisturbed by the damage our energy systems inflict on the world today
Responsibility	All nations have a responsibility to protect the natural environment and minimize energy-related environmental threats

Figure 2.3: The underlying principles of energy justice used by policymakers for decision making. (Sovacool and Dworkin (2015), p. 440).

Here the lack of a normative foundation becomes evident, as critical questions remain unanswered: which nations have more responsibility? what does high quality information mean? who gets to define its quality? how does fairness of energy service change in different temporal or geographical contexts?

Critics have also pointed to the framework's predominantly Western perspective on justice, limited engagement with power structures, depoliticized application, and the exclusion of social categories beyond gender, race, and (dis)ability (Feenstra & Özerol, 2021; Tornel, 2023; Gram-Hanssen, 2024). They have suggested expanding energy justice by integrating it with value-sensitive design and energy democracy, critically reflecting on its Western-centric origins, and adopting pluralistic approaches aligned with contemporary social justice movements (Osička et al., 2023; Sovacool et al., 2023).

A related issue is the risk that energy justice, in its current form, might be absorbed into neoliberal policies that uphold systems like capitalism, colonialism, and patriarchy. Tornel (2023) and Wilson (2018) argue that despite energy justice's roots in social justice movements, it often adheres to Western, universalist justice frameworks. While scholars have attempted to address these limitations (c.f. Sovacool et al., 2023), current research largely reduces justice to a list of concerns or principles, without engaging with critiques from intersectional feminist, post-colonial, or decolonial perspectives.

Bouzarovski (2022) suggests this issue arises because energy justice is often framed within a "techno-managerial" approach, aligning more easily with decision-making frameworks focused on efficiency rather than socio-ecological justice. This dynamic is apparent in the European Green Deal, which aligns with neoliberal visions, forcing energy justice to fit within rather than challenge these frameworks. Bouzarovski and other scholars argue that true justice in energy transitions requires addressing the political economies of capitalism and questioning core justice assumptions (Lennon, 2021; Bell et al., 2020). Healy & Barry (2017) argue that by supporting incumbent power structures, energy justice risks reinforcing rather than dismantling hegemonic power dynamics. To avoid this outcome, energy justice must shift from incremental reforms toward a disruptive, transformative approach, directly challenging the structures sustaining injustice.

A final critique of energy justice is its narrow focus on social categories like gender, which risks excluding diverse knowledges, practices, and cosmologies in energy systems (Wilson, 2018; Tornel, 2023). Despite exceptions (c.f. Kumar et al., 2021), gender remains the primary social category within energy justice discourse. Gender-sensitive approaches in the field focus on disparities in energy access, workforce representation, and environmental harm (Poojary et al., 2022; Fraune, 2015). However, this limited focus often fails to address intersectionality or consider non-human actors—such as ecological systems—in its analyses, thereby reducing the framework's broader impact (Bell et al., 2020; Feenstra & Özerol, 2021).

In the absence of more critical, intersectional engagements, transformative actions like divestment are often dismissed as "utopian" or "unrealistic" using the energy justice framework (Healy & Barry, 2017). Relying solely on pragmatic approaches limits energy justice to minor reforms, overlooking the potential of democratically organized movements to drive transformative change (Wijsman & Berbés-Blázquez, 2022). Politicizing energy justice is therefore essential (Bouzarovski, 2022; Newell, 2021) to allow marginalized voices to meaningfully shape energy policy and address the systemic issues at the heart of energy transitions. To accomplish this, energy

justice must adopt a robust ethical framework capable of challenging dominant power hierarchies and aligning itself with grassroots movements that champion deep social transformation.

2.3.2 Limitations in the current discourse on the social justice implications of smart energy technologies

These limitations of the energy justice framework are especially evident in discussions of SETs, where scholars have critiqued its failure to address complex issues, such as the differential impacts of data-related harms (Sareen et al., 2023) and the lack of targeted interventions for marginalized households (Jenkins & Martiskainen, 2018; Calver & Simcock, 2021). Although broader literature on smart technologies has explored the political implications of new measurement regimes (c.f. Sadowski & Maalsen, 2020), the energy justice-oriented understandings of the social justice implications of SETs have been criticized for neglecting issues like surveillance, cyber threats and data breaches that risk disrupting grid reliability or enabling fraud (Gunduz & Das, 2020; Fell et al., 2023). Existing applications of energy justice to SETs often outline the disparities and risks in these technologies (c.f. Jenkins, 2018) but stop short of articulating how these issues constitute social injustices or link to pre-existing inequalities.

The first critical limitation in examining the social justice implications of SETs lies in the limited critique of the dominant techno-optimistic assumption that SETs will solve multiple issues, including cost reduction, grid efficiency, and democratization of energy access. Consequently, even critical work by frontline organizations often remains focused on promoting the adoption and use of SETs rather than stepping back to ask whether SETs are indeed the most beneficial technology for households, especially for energy savings. This became a particularly pressing question in light of the severe impact of fuel price increases on energy-poor households in the UK during the energy price surge in winter 2022 (Simcock & Bouzarovski, 2023). Organizations like Don't Pay² that

² <https://dontpay.uk/> Their website is regularly updated so there is a chance that the blog might have been removed. However, their critiques of SETs were significant given they were backed initially by more than 100,000 British energy consumers.

encouraged households to stop paying their bills during the crisis criticised techno-optimistic visions of smart energy against the bleak backdrop of one in four British households experiencing fuel poverty.

Mathisen et. al (2019) have argued that SETs fulfil all criteria for being included as integral parts of the broader utopian smart city visions. These visions promise to resolve a broad range of urban issues but tend to overlook the complex realities and genuine needs of households and their practices, reducing households to mere data points in an increasingly datafied, hyper-connected, and automated smart society (figure 2.4).

Yet, both academic and grey literature seems to have largely evaded discussing this issue, despite it being common in other discussions on smart technologies such as smart home technologies and smart cities (c.f. Shelton & Lodato, 2019).

Secondly, it is important to investigate how beneath the utopian political discourse that portrays SETs as a panacea lies the flawed assumption that energy transitions occur on a blank slate. Scholars at the intersection of energy transitions and energy ethics have debunked this notion, illustrating that these transitions are inscribed onto complex, interrelated social, technical, market, and political structures (Miller, 2014; Ahlborg, 2017; Moore, 2013; Özden-Schilling, 2021). Rather than upending existing inequalities, such transitions often operate within—and thus reinforce—neoliberal logics, perpetuating structural disparities while promising innovation. Recognizing this complex reality underscores the need to address both old and new injustices within SETs to create a truly equitable smart energy future (c.f. N. Hargreaves et al., 2022).

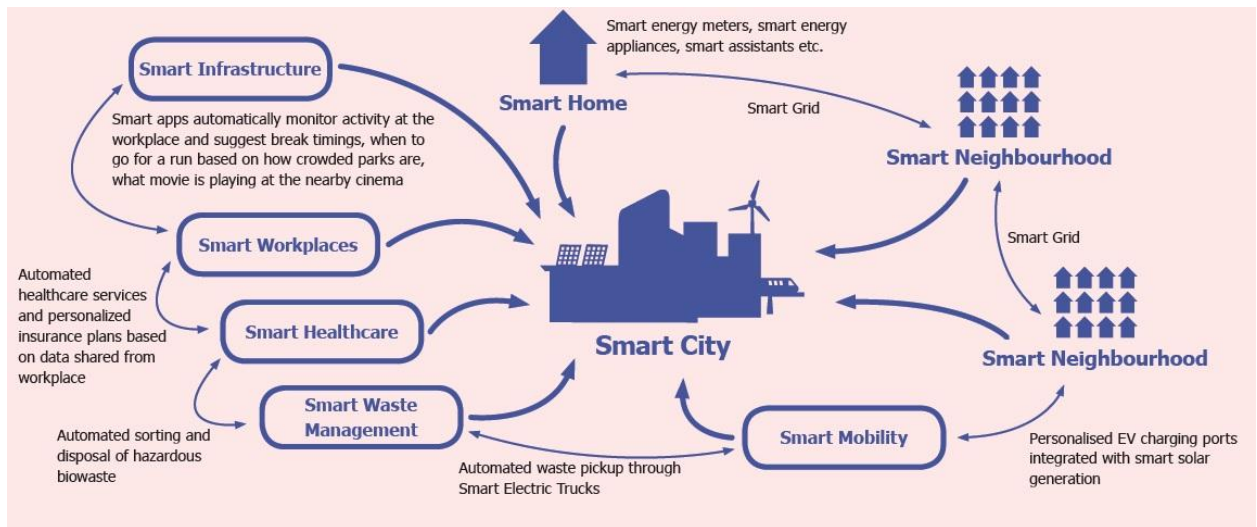


Figure 2.4. SETs as integral parts of the smart grid and the broader vision of smart cities.

Source: Aaron Kopp (2023).

This wider smart transition is being experienced globally. This has been subject to wide criticism based on how messy this transition has been in practice, very differently from this idealised version of a hyperconnected, seamless society depicted in this figure.

This assumption aligns closely with ideals which emphasise market-driven solutions and individual responsibility as the primary means of addressing energy challenges (Middlemiss, 2017, Bouzarovski, 2022). This has led to smart energy policy being focussed on technical fixes, such as improving energy efficiency, or access to better quality smart meters (c.f. DESNZ, 2023), while overlooking the lived experiences, practices, emotions, and coping strategies of those affected, missing out on the nuances of how smart energy is experienced at the household level.

Due to a neglect of the intricacies of social inequalities, historically, energy transitions have added renewable sources without fully displacing fossil fuels or transforming broader energy cultures (Bell et al., 2020). This additive approach is echoed in SETs, where despite promises of decarbonization and affordability, entrenched neoliberal power structures remain largely untouched. Consequently, SETs risks replicating the same socio-economic hierarchies and inequities, as foundational justice concerns are not sufficiently addressed.

These foundational justice concerns are inextricably linked to neoliberal market narratives, particularly the UK's "switch and save" model, which further cements inequalities (Middlemiss,

2017). At the heart of the UK energy market, this model promotes the idea that competition will drive down costs, leaving energy consumers to navigate complex energy markets. This cornerstone of neoliberalism shifts responsibility onto households to monitor their energy consumption using SETs, shifting focus from tackling the structural roots of energy vulnerability using technology. In the context of SETs, such a narrative risks moralizing disadvantaged groups, by promoting smart, energy efficient behaviours as personal responsibilities (Listo, 2018). This emphasis also conceals the role of powerful market actors and austerity policies in perpetuating energy injustices.

Although critiques of market-driven approaches are prevalent in broader discussions on energy vulnerability, their application to SETs is limited. A notable limitation persists in examining how neoliberal market logics—and the institutions that sustain them—continue to promote techno-utopia and obstruct transformative justice for marginalized consumers. Current solutions to the inequalities in smart energy transitions, continue to be conceived within these neoliberal policy and practice settings, underscoring an urgent need for research that addresses the role of not only the market itself but also the institutional frameworks that perpetuate inequalities as SETs continue to proliferate.

Thirdly, the intersections between social categories—such as ethnicity, gender, class, and ability—and their role in shaping energy vulnerability, particularly in the context of SETs and broader energy transitions, have been largely overlooked in both academic research and policy discussions. While these intersections are acknowledged in the literature, recent work by Bouzarovski et al. (2022) highlights a critical need for deeper exploration, especially regarding the relationship between energy vulnerability and ethnicity in the UK. Bouzarovski's (2022) critique of just energy transitions also emphasizes the importance of engaging with power structures, such as colonialism, racism, and patriarchy, that underpin the socio-economic landscape of energy transitions:

“The energy efficient upgrading of residential buildings is, however, currently taking place against the background of a capitalist economy, the legacies of settler colonialism, as well as a racialised and patriarchal socio-cultural order.”

- Bouzarovski, (2022), p. 1006.

As this quote illustrates—and as seen in broader discussions on energy vulnerability (cf. Middlemiss, 2017; Simcock & Bouzarovski, 2023)—current approaches to addressing energy inequalities primarily focus on housing conditions, urban living environments, and technical energy efficiency measures to improve access and affordability for marginalized households. While these measures operate within neoliberal settings marked by intersecting power systems (such as patriarchy) that perpetuate some of these inequalities, the role of such power systems often remains unexplored. This oversight has also impacted SET initiatives in the UK: Smith et al. (2024) observe that smart local energy projects, although concerned with justice, often neglect to include vulnerable households in procedural and structural decision-making processes due to a narrow focus on justice at an individual level informed by neoliberal framings.

A comprehensive approach is thus needed to assess which social categories are disproportionately disadvantaged by SETs, how intersecting identities influence experiences, and how structural power systems contribute to these dynamics. While some studies document vulnerable groups—such as young or elderly tenants and recent migrants, who rely on landlords for energy efficiency improvements (Ambrose et al., 2016)—the intersectionality of their energy vulnerability remains underexplored (Hargreaves & Sharma, 2023). This approach would not only identify salient factors like age and migration status but also examine how these characteristics intersect with gender and class to shape access to efficiency improvements, further revealing how ageism, racism, colonialism, sexism, and other structural forces are embedded in the housing market.

The final critical research limitation concerns the underexplored environmental and data justice impacts of SETs. The deployment of SETs often requires new equipment and hardware upgrades, contributing to embedded emissions and electronic waste. This environmental burden is exacerbated by potential incompatibilities across equipment from different providers, leading to increased resource consumption and wastage (Jenkins et al., 2018; Broman Toft & Thøgersen, 2015). Additionally, the global digitalization driving SETs disproportionately impacts the Global South, which supplies the material and human resources essential for sustaining these technologies. While such concerns have been examined within smart urbanism and AI (Crawford, 2020), their specific implications for SETs have yet to be adequately addressed.

Equally significant are the data justice concerns surrounding SETs, particularly as these technologies collect vast amounts of user data, raising questions of privacy, consent, and control. D'Ignazio and Klein's *Data Feminism* (2020) underscores the importance of examining who benefits from data and who bears the costs, advocating for an approach that centres marginalized communities in data practices. Applying such a lens to SETs reveals an urgent need to ensure that the data collected from energy consumers is used ethically, avoiding exploitation and ensuring transparency in how this information is utilized and shared.

To briefly summarise this section, SETs are increasingly creating energy inequalities by benefiting resource-rich groups at the expense of more vulnerable populations. Current research reveals that while certain groups with greater flexibility and capital gain advantages from SETs, this often comes at a direct cost to others, such as through increased expenses or reduced service quality for marginalized households. Although SETs are promoted for their potential to lower emissions and operational costs, these benefits frequently mask the persistent inequalities and power dynamics that undergird the energy system. Moreover, existing engagements with energy justice in the context of SETs often focus only on surface-level fixes, such as addressing exclusion or unequal access to smart meters, while leaving root causes and normative assumptions unchallenged. In the following section, I explore this problem through an intersectional lens—a

politically engaged theory aimed at dismantling power structures—to pursue transformative justice and offer a more inclusive framework for understanding energy inequalities.

2.4 Intersectionality: brief history, applications and limitations

2.4.1 Intersectionality: Origins and a brief history

Intersectionality—the concept that social categories such as gender, race, and class intersect to co-produce lived experiences —has existed since at least the early 19th century, manifesting in diverse social, political, and geographical contexts (Yuval-Davis, 2006; Collins, 2020). A common thread in these articulations is that intersectionality has consistently been voiced by marginalized women, whether Black women in the United States, Black and Indigenous women in Brazil, or Dalit (lower-caste) women in India (Chen et al. 2013; Collins and Bilge, 2021; Overstreet et al., 2020). A second common thread relates to their emergence in the context of struggles for social and political justice. For example, the feminist-abolitionist politics of Frances Harper’s advocacy for equal voting rights and the efforts of intersectional feminists like Lélia Gonzalez and Savitribai Phule for equal access to education and healthcare exemplify this connection (Barreto, 2019; Desai & Roy, 2022). These women at the forefront of feminist movements in their respective contexts did not use the term ‘intersectionality’ despite embodying it in their struggles against oppression – as evident in Harper’s quote below.

“The white women all go for sex, letting race occupy a minor position...we must remember that we are all bound up together in one great bundle of humanity.”

- Frances Ellen Watkins Harper, Abolitionist, Poet and Suffragist at the Eleventh National Women's Rights Convention in New York City, 1866. Source: (McDanel, 2015)

The term "intersectionality," as it is understood in contemporary feminist scholarship, was coined by legal scholar Kimberlé Crenshaw in 1989. Crenshaw developed the concept through her analysis of a lawsuit filed by Emma DeGraffenreid, an African American woman who claimed she was discriminated against by a potential employer based on both her race and gender. The case was dismissed by a Chicago court on the grounds that the company employed both Black individuals and women. However, Crenshaw's examination revealed that while the company did hire Black people, they were predominantly men employed in physically demanding jobs, and while women were hired, they were mostly White and placed in front-desk positions (Ray, 2011; Walby, 2007; Spade 2013).

In her field-defining work, Crenshaw (1989) highlighted that the courts failed to recognize that someone who is both Black and a woman could face unique forms of discrimination not captured by considering race and gender separately. By naming this concept "intersectionality," Crenshaw provided a label for an experience already well-known to Black women and other women of colour advocating for their rights. She argued that Black women are subjected to both racism and sexism, but also to forms of discrimination that arise specifically from the intersection of these two oppressions—such as racialized sexual harassment—which cannot be neatly categorized as either "race-based" or "gender-based" discrimination.

Crenshaw's work has laid the foundations for academic debates on the topic (Salem, 2018), the core tenets of third and fourth wave feminism (Munro, 2013), and for grassroots activism, as exemplified by the work of the Combahee River Collective (Verloo, 2013; Peller, 2011). Intersectionality, as an academic theory, methodology, and praxis (Collins and Bilge, 2021; May, 2015), has closely intertwined and co-evolved with progressive politics surrounding race, class, and gender. Despite ongoing debates over its precise definitions, benefits, and limitations, and its application to real-world contexts, there is a consensus that intersectionality involves studying the experiences of multiple forms of discrimination, rejecting the notion of treating social categories

such as race, gender, class, caste, ability, and sexual orientation as separate or additive (Hancock, 2007). Instead, intersectionality examines how these categories intersect to create complex forms of oppression, such as racialized sexism and gendered racism (Crenshaw, 1991).

Figure 2.5 illustrates a series of cartoons that depict the intersectionality of women's diverse lived experiences, which historically have been at the crux of exploring the concept in academic debates (Cho et. al, 2013). Matsuda (1990) describes intersectionality as "asking the other question," highlighting the idea that while feminism primarily battles against patriarchy, it cannot succeed without addressing the various other forms of oppression women face. Thus, lived experiences of women of colour, Muslim women who choose to wear the hijab, lower-income women, trans women, and lesbians are all integral to discussions on intersectionality.

Intersectionality highlights how multiple systems of oppression and exploitation such as racism, sexism, colonialism, etc. shape society and lived experience in overlapping ways. This central idea of overlapping of power systems has since been used as a conceptual tool in the burgeoning literature on this topic since the 1990s and has developed into an intersectionality tradition (Cho et al. 2013; A. Davis, 2019). Intersectionality has been studied by and within disciplines such as healthcare, medicine, social policy, legal studies, racial studies, gender studies, indigenous studies, queer studies, science and technology studies, and psychology (Walby, 2007). This body of literature has explored the nuances of marginalised identities and the dynamism of lived experiences both at micro (individual) and macro (societal) levels, as well as the interactions, commonalities, and differences between parallel movements and liberation struggles, and the advantages and disadvantages of the intersectional tradition for analysing social injustices and mobilising political action (May, 2015).



Figure 2.5. Series of cartoons depicting the intersectionality of women's lived experiences.

Artist: Talhí Briones Source: [Tumblr](#).

2.4.2 Characterising intersectionality

Intersectionality illustrates that systems of oppression are neither stable nor singular; instead, they permeate and co-produce one another. This approach embraces discussions about power and privilege, framing their connections with social categories as complex, dynamic, and fluid. However, scholars have noted that the concept has often been misrepresented and reduced to a buzzword due to its rapid proliferation in recent years (K. Davis, 2008; Mohapatra, 2013). These misrepresentations frequently impose reductionist meanings on the concept, leading to single axis thinking that oversimplifies the interactions between different identities (Hancock, 2007).

Nonetheless, intersectional debates have included a wide range of topics such as the inclusivity of liberation movements, questioning whether individuals can fully express all aspects of their identities within these spaces (Lorde, 2007), relationships between power systems and the oppressive logics of capitalism (Bohrer, 2019), theorizing connections between identities, experiences, and struggles (K. Davis, 2008); acknowledging differences instead of focussing on the sameness of struggles to foster solidarity (Bohrer, 2019), as well as the neoliberal misappropriation of intersectionality (Bilge, 2013). Intersectionality resists creating a hierarchy of struggles (Hutchinson 2001; Cho et. al, 2013; Vergès 2021) and instead focuses on recognizing the diversity of experiences.

Two cases illustrate these key aspects of intersectionality. First, intersectional feminists critique France's hijab bans as perpetuating structural discrimination under the pretence of gender equality (Bassel & Emejulu, 2010; Wyles, 2017; Jeannot, 2021). They argue that France's approach misrecognizes intersecting identities, particularly those of Muslim women, by ignoring how gender, religion, race, and migration status interact. This imposes a White, secular feminist perspective, excluding Muslim women's voices (Collins & Bilge, 2021). Second, intersectional analysis of the Rana Plaza tragedy, where over 1,100 garment workers died, reveals how global capitalism exploits

marginalized populations, particularly women and migrants, through dehumanizing labour conditions. Following the tragedy, global protests under the slogan “Rana Plaza is everywhere” exemplified intersectional activism uniting diverse groups to demand accountability and transformative justice (Fakhoury, 2019; Collins & Bilge, 2021; May, 2015).

Thus, intersectionality serves as a framework for connecting everyday struggles with broader systems of oppression and their institutionalisation. It also helps uncover how policies for equality might deliberately or inadvertently propagate and project injustices into the future. It provides a basis for solidarity and collective liberation by acknowledging how systems like white supremacy and patriarchy oppress groups in interconnected ways. It also acknowledges that doing intersectionality in practice is complex, situated, uncomfortable, and that these are key characteristics that must be retained for any quest for transformative justice (Overstreet et al., 2020).

2.4.3 Operationalising Intersectionality: Core Tenets of Inquiry, Prefigurative Politics, Reflexivity, and Radical Orientation

So far, I have explored the critical limitations of the predominant frameworks for addressing energy-related justice issues and highlighted the need for literature on the justice implications of smart and flexible technologies to go further. I have also introduced the concept of intersectionality. In this section, I will examine what it means to operationalise intersectionality, briefly discussing its core tenets—*inquiry*, *prefigurative politics*, *reflexivity*, and *radical orientation*.

Intersectionality has enjoyed a remarkable trajectory as a critical theory (Lutz, 2014). Since its inception, it has evolved into both a theory and praxis, widely employed in critical feminist scholarship, though its influence extends beyond this field (Davis, 2008; Kennedy, 2005; Luisa De Vita et al., 2016). Intersectionality is most commonly recognized in three key applications: first, as a framework for analysing intersectional dynamics of lived experiences; second, in discursive

debates surrounding its scope and content as a theoretical and methodological paradigm; and third, as a lens for political interventions (Cho et al., 2013). From its roots in Black feminism, intersectionality has since been applied to various disciplines within the humanities, social sciences, and natural sciences, and across diverse global contexts (Walby, 2012). In adapting to these different discursive and research environments, intersectionality has at times modified how race, gender, and other social dynamics are conceptualized and intertwined, as well as how the central subjects and categories of intersectionality are identified (Crenshaw, 2021).

Given the complex nature of intersectionality and its wide-ranging applications across various social issues (Collins and Bilge, 2021), it is more productive to view intersectionality as a dynamic, context-dependent approach rather than as a fixed theoretical concept (Cho et al., 2013). Cho et al. (2013) discuss the debates surrounding whether there is an essential subject of intersectionality and, if so, whether this subject is static in terms of identity, geography, or temporality. While the specifics of these debates extend beyond the scope of this discussion, the key takeaway is that intersectionality is operationalised in plural, fluid, context-dependent ways. The adaptability of intersectionality is crucial, as it allows the framework to be relevant in various contexts but also highlights the need for continual reflection on its effectiveness and appropriateness in different situations.

As such it spans a broad spectrum of activities, from grassroots movements advocating for economic justice for low-income women of colour (c.f. Carastathis, 2013; Chun, Lipsitz, and Shin 2013), to legal and policy efforts aimed at addressing gender and racial discrimination (c.f. Verloo, 2013), and scholarly activism focused on dismantling state mechanisms such as prisons and immigration laws, which disproportionately harm communities of colour, women, and LGBTQ+ individuals (c.f. Spade, 2013).

These scholars and activists emphasize that intersectional praxis must inform theory, and vice versa, to ensure that intersectionality goes beyond theoretical understanding to enact real-

world change. This approach highlights the normative and political imperatives of intersectionality, illustrating its fullest potential when applied in practical contexts, transforming oppressive structures and empowering marginalized communities (Crenshaw, 2021).

Intersectionality and reflexivity are also deeply intertwined in both theory and practice. Reflexivity in intersectional research involves critically examining how researchers' own identities, power dynamics, and social positions influence their work and understanding of complex social realities (Atewologun & Mahalingam, 2018; Evans & Lépinard, 2019). Without reflexivity, intersectionality risks being reduced to a mere buzzword, losing its critical edge and becoming ineffective in addressing structural inequalities. Reflexivity also demands that researchers and activists consistently engage with how power operates within their work, ensuring that their analysis does not reproduce the very inequities they aim to dismantle.

Finally, intersectionality should not be considered a 'grand and totalizing theory' but as an orientation (Lutz, 2014) that enables thinking about contingency and connectedness in social and political phenomena and a refusal to reduce them to single causes or solutions. As Williams (2021) writes in her intersectional critical analysis of social policy in the UK, intersectionality offers social scientists a kind of transformative thinking and prefigurative politics which can help practice in the present what might herald change for the future. Intersectionality should be considered an analytical framework that can hold space for cultivating the deep deliberative dialogue required for such transformative thinking and can foster alliances and solidarities between different social justice struggles (Rodriguez & Ridgway, 2023). Operationalising intersectionality thus requires reflexivity to acknowledge how inequalities transform under different social settings and to be prepared for the 'uncomfortable conversations that follow' (Ishkanian & Peña Saavedra, 2019). Thus, intersectionality helps us do politics in a more 'care-full' way – and be more mindful in our struggles for social justice (Williams, 2021).

These key features of intersectional praxis are summarised in table 2.2.

Intersectional practitioners must embrace	Intersectional practitioners must avoid
<p>Analytical and political orientation: They must maintain an active, continuous engagement with both analysis and political action, rooted in reflexivity.</p>	<p>Rigid, standardized methods with strict boundaries: They should not imagine intersectionality as a methodological paradigm which operates within fixed frameworks with clear-cut rules and subject-object divisions.</p>
<p>Approach subjectivity and power as multi-dimensional ('both/and' logic): They should understand subjectivity and power as complex and layered, embracing a 'both/and' perspective.</p>	<p>Assimilationist approach: They must avoid add and stir techniques – for example, piling analysis of patriarchy on top of analyses of capitalism on top of one another. This leads to making superficial adjustments while maintaining the status quo.</p>
<p>Explore points of contact between the liberatory and the coercive: They must investigate the intersections where liberation and coercion meet.</p>	<p>Exclusive focus on identities and identity politics: They must not concentrate solely on identities without addressing the broader, interconnected systems of oppression.</p>
<p>Engage with both the micropolitical level of everyday life and the macropolitical level of social structures: They must examine both the intimate, everyday dimensions of power at the micro (individual) level and the broader, structural and cultural forces at play.</p>	<p>Selective engagement with systems of oppression: They cannot choose to address certain oppressions while ignoring others.</p>

Consciously oriented towards transformative social change: They must actively focus on challenging and dismantling dominant power systems with the goal of social transformation.	Overarching, totalizing theories: They should not claim to offer universal solutions to all forms of injustice, often oversimplifying complex issues.
Dynamic process: Intersectionality should be seen as a verb. It serves as a heuristic tool that is context-sensitive, draws on lived experience as a source of knowledge, and continually questions prevailing assumptions.	Static and unchanging concept: Intersectionality should not be treated as a fixed concept or noun. It should avoid being a one-size-fits-all tool that can be applied ignoring context or shying away from lived experiences as irrelevant or too complex.

Table 2.2. Summary of scholarly work on how intersectional practitioners can strive for transformative justice.

This table highlights how intersectional praxis can stay true to the demands for radical change and justice central to Black feminist scholarship (Crenshaw, 2011; Collins & Bilge, 2021; May, 2015).

Based on this brief description of applying intersectionality and based on the practice-oriented works of intersectional feminist philosophers such as Patricia Smith Collins, Sirma Bilge, Vivan May, Nicole M. Overstreet, Nira Yuval-Davis, and Helma Lutz (Collins & Bilge, 2020; Lutz, 2014; May, 2015; Overstreet et al., 2020; Yuval-Davis, 2007); I define intersectional praxis as follows and will use this to inform my research questions and methodology.

Intersectional praxis is both expansive and context-dependent, yet it has a powerful core: relentlessly challenging dominant societal narratives by exposing interconnected systems of oppression and foregrounding the lived experiences of the marginalized. It strives to not only interrogate the complex web of power systems which are enacted by institutions on individual lives,

it also repositions those most affected by injustice at the centre of the discourse, driving a more profound and transformative change.

Having examined the core tenets of intersectionality and outlined what intersectional praxis should entail, I will now turn to the next section to explore how these principles have been applied in practice settings beyond academia.

2.4.4 Understanding intersectional praxis applied outside academia

Outside of academia and grassroots activism, intersectionality has increasingly been applied in various settings, particularly in the Global North and in social policy and development work (c.f. United Nations, 2019; Scottish Government, 2022; Global Citizen, 2023; National Institute for Health, 2020). Operationalizing intersectionality within such organizations offers significant benefits but also presents substantial challenges (Tomilson, 2015; Jensen, 2015). Intersectional frameworks enhance DEI initiatives by recognizing and addressing overlapping social identities, where more nuanced policies reflect the lived experiences of marginalized employees facing multiple layers of discrimination. This approach builds trust, fosters belonging, and helps organizations move beyond superficial diversity metrics, promoting inclusivity and engagement (New Tactics in Human Rights, 2017).

However, operationalizing intersectionality also risks diluting its transformative potential. Many organizations adopt a checklist approach or aim for “diversity without disruption,” undermining intersectionality’s critical focus on structural inequalities. Equality organizations and public sector initiatives often address specific identity-based needs but struggle to integrate a comprehensive intersectional approach due to institutional constraints and funding pressures, leading to fragmented practices. These limitations can reduce intersectionality to a reactive tool, rather than a strategic framework for challenging systemic oppression and entrenched power

structures, as seen in "crisis mode mobilizing" that emphasizes symbolic solidarity over sustained structural change (Jensen, 2015).

The UK where its operationalization has recently gained traction (c.f. Moreno-Agostino et al., 2024; Christoffersen, 2024; Acheson et al., 2024; Codioli McMaster & Cook, 2019) is especially significant given its unique approach to unifying equality legislation (the Equality Act of 2010) and policy frameworks, which creates distinct opportunities to examine how different social categories interact (Hankivsky et al., 2019). As such its operationalisation has been appropriated and given various meanings depending on the context, at times retaining and at times deviating from its key characteristics described in the previous section. Therefore, concerns persist about its appropriation in increasingly neoliberal and predominantly White settings (Parken, 2010; Christoffersen, 2019).

Ashlee Christoffersen's recent studies offer valuable insights into how intersectionality is conceptualized and applied within the UK. Christoffersen (2021) notes that intersectionality can be a challenging concept for policymakers and equality practitioners to navigate. While practical application is often seen as more significant than abstract definitions, Christoffersen argues that these definitions shape operational practices, which subsequently influence and refine the concept itself (Christoffersen, 2019, 2021). Recognizing which definitions correlate with particular practices is essential to capture existing knowledge without imposing researchers' biases.

Despite practitioners' alignment with intersectionality and a genuine interest in deeper integration, the complexities of implementing it within neoliberal contexts have led to definitions that sometimes stray from its foundational principles as understood in scholarly and activist circles. This divergence underscores the ongoing challenge of preserving intersectionality's integrity as it is applied across diverse, often constrained settings. Her research highlights and puts forth distinct ways that practitioners interpret and apply intersectionality in their day-to-day work, drawing on three networks of third sector organizations that address issues such as feminism, queer rights,

disability, and refugee rights, and their intersections. These concepts will be further explored in chapter 5.

2.5 Bringing intersectionality into a conversation with the social justice implications of SETs

In the penultimate section of this chapter, I will argue why intersectionality could provide a valuable theoretical lens for addressing some of the limitations I have discussed thus far. In particular, the literature has revealed that energy vulnerability is closely linked to broader social inequalities – for example economic and health. It is exacerbated by neoliberal policies that often overlook the lived experiences of marginalized groups. As SETs are deployed, they tend to reinforce these pre-existing inequalities within neoliberal frameworks, focusing on technical solutions like energy efficiency while neglecting the systemic issues driving and sustaining energy vulnerability. Additionally, there is a critical gap in addressing how various social categories—such as ethnicity, gender, and ability—intersect to exacerbate the problem.

An intersectional approach is essential to fully understand and address these complexities, particularly in developing transformative political actions that challenge austerity-driven policies and restructure the frameworks that are used to understand the emerging injustices from SETs. I propose a framework designed to understand the social justice implications of SETs, rooted in a deep commitment to intersectional theory and technofeminism (Wajcman, 2007; Molldrem & Thakor, 2017; Collins & Bilge, 2020; Luisa De Vita et al., 2016). I have previously used the framework to articulate intersectional critiques of smart urban technologies (Sharma et al., 2023) and Stable Diffusion, an image generation artificial intelligence software (Jääskeläinen, Sharma et al., 2025 (forthcoming)). Rather than calling for entirely new frameworks or simplistic solutions, this approach aligns with the need for broad, thorough conceptualizations that embrace complexity, as suggested by scholars like Wood (2023) and Fraser (2003). Intersectionality provides

the normative and ethical foundation for my approach, aiming for radical reformulations of justice pertaining to SETs, which has thus far been missing in academic discourse.

The three-pronged framework proposed here consists of three approaches to intersectionality – a user-focussed (micro-level), an institution-focussed (meso-level), and a power systems- focussed (macro-level) approach. The framework seeks to address the gaps identified in existing approaches, particularly the failure to fully engage with the complexities of inequity and intersectionality. It challenges the techno-solutionist and techno-masculinist logics that often dominate discussions around smart energy technologies.

2.5.1 User-focused approach

This approach utilises the tenets of intersectionality which refuse to universalise subjects. It focuses on understanding how diverse individual experiences and practices challenge dominant user narratives, such as the "resource man" (Strengers, 2014) and "Homo economicus" (Williams, 2021) models. It is interested in examining how practices and social relations related to smart energy technologies vary across different social categories, such as gender, age, ethnicity, and more. It explores how diverse households manage and interact with these technologies, identifying characteristics that either serve as barriers or facilitators of engagement. By emphasizing the intersectionality of identities like gender, race, and class, it helps identify and deconstruct universalist approaches, highlighting the multifaceted and interlinked nature of inequalities related to these social categories.

It also enables deep dialogue across different groups' lived experiences with similar smart technology infrastructure (c.f. Crawley et al., 2023; Hargreaves & Sharma, 2023). In the case of the smart energy consumer, it could look at how current discourse tends to typecast certain user characteristics and thereby their energy related-behaviours and practices. It can help more precise identification of these issues and to foreground them as a specific area of concern – and achieve

precisely what Skjølsvold et al., (2015) have called for – making everyday practices the basis of smart technology design.

A user-focused approach to intersectionality is crucial because it illuminates the intricate relationships between social identities and energy consumption practices. For example, emotions, deeply tied to individuals' social positions and belonging to specific sociodemographic groups, significantly influence how energy is used, shaping practices such as heating and interaction with smart controls (Longhurst & Hargreaves, 2019). These social determinants not only influence specific practices but also play a vital role in shaping relationships within households, as well as between households and other actors or elements of the energy system (e.g., bills, prepaid meters). This, in turn, affects energy vulnerability (Longhurst & Hargreaves, 2019; Hargreaves & Middlemiss, 2020). Therefore, integrating a user-focused approach into industry practices and support organizations could have profound implications. Early consideration of these factors in policy design could help address both the symptoms and the systemic causes of energy inequalities.

As Middlemiss & Gillard (2015) argue, it is essential that understandings of vulnerability engage with 'emic' perspectives—those rooted in the lived experiences of households. This approach can provide rich insights into how households face and cope with energy-related challenges, revealing both their vulnerabilities and resilience. Indeed, the primary objective of this approach is to explore how a bottom-up understanding of the lived experiences of smart energy households can be effectively translated into strategies for identifying and alleviating energy vulnerability and meeting their specific energy-related needs without causing distress. While this repositions vulnerable households as agents capable of influencing their circumstances, a user-focused, bottom-up approach must also ensure that these coping strategies are not overstated, as doing so could contribute to neoliberal strategies (Middlemiss, 2022) that normalize inequalities and shift the burden of unjust living conditions onto those affected, forcing them to rely on their own limited resources.

A user-focussed approach thus investigates how social identities, and their intersections influence the capacity of energy users to incorporate flexibility into their everyday lives, their potential for interacting with SETs more broadly while tackling how these capacities could be envisioned in potentially harmful ways by energy system developers. The implications of applying this approach go beyond merely designing user-friendly interfaces to reduce energy consumption and costs. It also emphasizes the importance of effectively marketing these technologies and schemes to ensure equitable access. For instance, research has shown that Asian/Asian British households are more likely to desire certain energy efficiency improvements, such as solid wall insulation, but are less likely to receive them compared to White households (Sky, 2023).

A user-focused approach, therefore, seeks to balance the narrative. It not only critiques the ways in which SETs can reinforce existing inequalities but also highlights the agency, power, and capacity of diverse users to engage with and potentially disrupt these technologies.

2.5.2 Institution-focused approach

This approach scrutinizes the role of institutions, such as nation-states and industries, in creating and perpetuating social hierarchies and power structures. It unpacks how historical and ongoing institutionalization embeds inequalities—like racism, sexism, and colonialism—into societal norms and practices. By acknowledging these embedded injustices, the approach advocates for structural interventions and reparative justice in the development and deployment of smart technologies.

The roles of institutions that determine how energy inequalities are tackled in the UK have been subject to much debate in the academic literature. This includes UK government departments, the regulator Ofgem, and to a lesser extent energy companies such as suppliers and distributors. Critiques often link the inadequacy of mainstream energy policies to the market-driven approach to energy vulnerability and austerity-driven welfare policies. For example, Snell et

al. (2015) link distributive injustices faced by disabled households in fuel poverty directly to austerity policies such as stricter regulations on providing evidence to prove disabilities. Despite warnings from academics, rapid changes in fuel prices driven in which market mechanisms are implicated have been ignored in energy justice policy, contributing to gross distributional injustices.

The Energy Company Obligation (ECO), meant to ensure energy companies are held accountable for reaching out to poorly insulated households has been criticized for reaching only 30.2% of those in energy poverty. It has been argued that this policy is highly ineffective because not only does it not reach the households most in need, but it also passes on the burden of paying for energy efficiency upgrades to the households through minor increases in energy bills. An institution-focussed approach scrutinises both the regulator Ofgem and the energy companies which are responsible for delivering ECO in failing to protect consumers, and propagating injustice through a capitalist, market-driven approach which has mostly benefitted energy companies.

Despite Ofgem's comprehensive vulnerability strategy, which penalizes energy companies for example in the context of the smart meter rollouts (Parliamentary Affairs Committee Report, 2022), the fundamental issue remains the uncritical reliance on market mechanisms. This reliance shifts the burden of protective measures onto end consumers, while energy companies often evade regulations or, at best, strive for equality for vulnerable consumers—such as prioritizing smart meter rollouts—however only when it aligns with their profit-driven goals.

Increasingly, state-funded energy advice programs for low-income households have been replaced by private sector initiatives, often inadequate and inconsistent nationwide (Ambrose et al., 2019; Simcock & Bouzarovski, 2023). As a result of this reliance on privatisation, measures tend to be short-term fixes, neglecting the deeper, structural causes of energy inequality.

It follows from the literature that neoliberalism is at the heart of the UK energy market (Poudineh, 2019), characterized by a “switch and save” model, which poses significant barriers for

fuel-poor households—especially older adults, ethnic minorities, and private renters—who struggle to navigate its complexities (Middlemiss, 2017; Ambrosio-Albala et al., 2020). Despite calls for addressing the root causes of inequality, government focus remains on facilitating market participation rather than on protection and meaningful interventions. This approach, therefore, highlights the critical need for policies that challenge the underlying assumptions of market effectiveness and advocate for systemic change at this institutional level.

Another important aspect of this approach is to integrate intersectionality's focus on reading history against the grain, to imagine radical futures. This would involve a critical assessment of all actors at the forefront of the SET and their historical roles in sustaining power systems such as neoliberalism, even if inadvertently. The importance of this approach has been demonstrated by Middlemiss (2017).

“None of these documents (fuel poverty strategy documents from the 2010s) made sense unless seen in historical context, and key outputs in fuel poverty research and policy dating from before the coalition government (from the period 1990-2010) also formed part of the analysis.”

-Middlemiss, 2017, p.428

In her work, Middlemiss exemplifies the intersectional approach by tracing the genealogy of fuel poverty policies, analysing not just the most recent review but also historical documents from the 1990s to 2010. She emphasizes that understanding any intervention in tackling energy poverty requires grappling with its political nature and the structural inequalities it perpetuates. Middlemiss critically examines how energy vulnerability has been problematized, which technologies are promoted as solutions, who is authorized to speak for the fuel poor, and the forms of knowledge prioritized in policy-making—all key concerns of intersectional inquiries into social justice. She argues for an integrative approach in research to reveal "what is hiding in plain sight" and critiques the tendency within policy departments to favour technological fixes over deep understandings of behaviours and practices.

Thus, the genealogy of institutions is crucial to understanding injustice because it reveals the historical roots and enduring structures that perpetuate inequality. Institutions are not neutral; they are shaped by historical processes that embed power dynamics, such as racism, sexism, and colonialism, into their very foundations. By tracing the development and evolution of these institutions, we can uncover how past injustices continue to influence present practices, policies, and outcomes. This awareness enables a more comprehensive critique of contemporary issues, showing that they are not isolated problems but are deeply connected to longstanding systemic inequities. Understanding this genealogy is essential for developing informed and effective strategies for reparative justice and meaningful structural change.

2.5.3 Power system-focused approach

The final approach critiques the limitations of existing just transition frameworks by integrating multiple critical perspectives—such as decolonial, anti-racist, and queer theories—to explore how various power systems, including capitalism and heterosexism, interact to co-produce inequalities. By advocating for a multifocal intersectional framework, this approach recognizes the specificities of different struggles while identifying commonalities in power dynamics. It aims to harmonize critiques across various dimensions of injustice, offering holistic and transformative solutions for SETs.

A power systems-level analysis is essential to address the structural forces that propagate and stabilize inequalities, often overlooked in mainstream discussions of energy vulnerability. The unexamined power systems—such as neoliberalism intersecting with capitalism and racism—entrench these inequalities, creating ripple effects that exacerbate social divides, especially in deprived areas suffering from austerity-related spending cuts (Bouzarovski, 2022; Narayanan et. al, 2023).

UK institutions, particularly those based on retail markets, tend to favour individuals with greater economic, social, and cultural resources, further entrenching inequalities. For instance, the most deprived local authorities in England experienced spending cuts of 28% per capita from 2009 to 2016, compared to just 16% in the least deprived areas (Robinson et al., 2018), which are often also areas which have higher working-class populations and histories of migration (ONS, 2021). This disproportionate impact underscores the necessity of examining how intersecting power structures influence energy vulnerability and welfare policies, which often fail to acknowledge dynamics at this level (Middlemiss & Gillard, 2015).

Even though it operates at a theoretical level, this approach can be operationalised through reflection from participants representing marginalized households in the SET. It makes them reflect whether they accurately represent the interests of these households or inadvertently propagate injustices due to their own entanglement in power systems. For example, when connections are made between poor housing stock, inadequate energy advice, and ethnicity (influenced by racism), it's essential to consider how these issues are further exacerbated or influenced by other social characteristics, such as gender (patriarchy) or class (classism).

The three-pronged approach to applying intersectionality—user-focused, institution-focused, and power system-focused—offers complementary perspectives for examining energy justice in smart energy transitions. The user-focused approach highlights how intersecting identities like gender, ethnicity, and age shape households' engagement with SETs, critiquing universalized user narratives and integrating lived experiences into policy and design. The institution-focused approach examines how organizations and policies perpetuate inequalities through their structures and practices, advocating for systemic reform and reparative justice. Finally, the power system-focused approach critiques how broader systems of oppression—such as neoliberalism, racism, and patriarchy—co-produce energy inequalities, connecting systemic forces to individual experiences and calling for transformative, holistic solutions.

While these approaches provide valuable insights, it is crucial to recognize that they are interdependent. Applying only one in isolation risks undermining their transformative potential, as I have argued in another application of this framework (Sharma et. al, 2023). For instance, an over-reliance on the user-focused approach, often favoured by neoliberal organizations, risks reducing justice to individual user experiences. This can shift the burden of responsibility onto consumers, conveniently ignoring the role of institutions and systemic power structures—a critique explored in section 2.4.

By integrating an intersectional lens across its three prongs, this framework also directly strengthens each dimension of the energy justice triumvirate. The user-focused approach deepens **distributive justice** by revealing how intersecting social positions shape the unequal distribution of energy resources, technologies, and burdens. The institution-focused approach enhances **procedural justice** by critically examining how decision-making processes, participation mechanisms, and policy structures may include or exclude marginalized voices. Finally, the power system-focused approach sharpens **justice as recognition** by foregrounding the systemic erasure and misrecognition of complex identities and lived experiences within dominant energy narratives. Rather than treating these tenets in isolation, the intersectional framework insists on their interdependence, and positions justice not only as a matter of fair outcomes or inclusive processes, but also as a commitment to structural transformation rooted in normative and emancipatory goals. Importantly, the framework shows how failures in one dimension—such as the lack of recognition of certain identities—can reinforce procedural exclusion and distributive injustices, highlighting the need for integrative, multi-scalar interventions that address justice as a relational and systemic construct.

By developing the meso- (institutional) and macro- (power system) levels in conjunction with micro-level (user) analysis, I have ensured this framework offers a more holistic approach. In this case, it calls out how institutional practices and neoliberal logics shape energy systems, preventing the reduction of justice to individual behaviour. Only by engaging with all three strands

can transformative justice be achieved, ensuring that SETs address not only the symptoms of inequality but also the structural forces that sustain them.

2.6 Research Questions

Having developed the three-pronged framework, it was crucial for me to explore how I could apply it to the UK's smart energy transitions. Therefore, I realised that I need both research questions and a research methodology that are able to bridge the gap between intersectional theory and praxis, and bring this framework to sites where SETs are being deployed and developed. Since the framework proposed in section 2.5 largely theoretical, I had to ask myself which type of interrogations about SETs can be generated using each of the three prongs of the framework and how these can be brought into practice. Based on these reflections in table 2.3, I developed the research questions which are described here.

	Function/Impact What does it do?	Key Questions What questions does it ask about SETs?	Intersectionality What elements of intersectional praxis does it involve?
Mirco or User-focussed	Involves understanding the diversity of individual practices to challenge the dominant universalist imaginaries at the heart of smart energy initiatives	Which identities of people might we be excluding when we choose certain co-creation/collaborative methods? How much attention are we paying to the	Pluralising the universal subject, Interrogating epistemologies, Radical Interventions

		<p>differences within the households in a community when we approach them with flexible solutions?</p>	
<p>Meso or Institutions- focussed</p>	<p>Involves investigating the role of institutions and how they sustain social hierarchies and uphold/disrupt power structures</p>	<p>What springs to mind when we imagine ‘vulnerable’ households in the flexible energy system?</p> <p>Where (from which institutions) do these definitions arise?</p> <p>Which institutions are responsible for the structure of the energy market which creates energy inequalities?</p>	<p>Prefigurative Politics, Radical Interventions, Questioning Epistemologies</p>
<p>Macro or Power Systems- focussed</p>	<p>Involves developing a more complex ethics by simultaneously confronting multiple power systems such as capitalism,</p>	<p>Which households are overrepresented in our discussions around vulnerability in the context of SETs?</p>	<p>Reflexivity, Prefigurative Politics</p>

	heterosexism, racism etc., exploring the interactions and co- productions between them	Which inequalities stemming from the current structure of the energy system do we want to disrupt?	
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Table 2.3 Summary of the three-pronged approach as applied to SETs

Before describing the research questions, I briefly argue how they address key limitations in the literature on the social justice implications of smart energy technologies could serve several purposes. Firstly, building on the foundational work of Mikulewicz et al. (2023), it's clear that both climate and environmental justice, along with intersectionality, are deeply committed to addressing the marginalization of vulnerable populations in neoliberal contexts. This shared focus on human emancipation and dismantling oppressive power structures is precisely what is needed in the realm of energy justice as it has lagged behind so far. In doing so, intersectionality can deepen discussions on distributive justice by analysing not just who wins and losses in the transition to SETs, but also which visions of the transition predominate and who is left behind as a result. By integrating intersectionality into energy justice, we can blur the lines between academia and activism, ensuring that the framework remains resistant to co-option by dominant power structures.

Intersectionality's emphasis on questioning the norms and institutions that govern social life makes it highly compatible with the research agenda on bringing critiques of the market and neoliberal institutions into the discourse on energy vulnerability (c.f. Middlemiss, 2022). Furthermore, unlike traditional approaches that cast users as static and perpetually vulnerable, intersectionality acknowledges the dynamic nature of vulnerability and recognizes that individuals can move fluidly between positions of power and privilege. This narrative is more empowering

and reflective of real-world complexities – and could be useful in determining how smart energy technologies can serve energy consumers rather than how they should adopt them.

Thirdly, intersectionality paves the way for prefigurative political action that challenges mainstream social structures and techno-managerial decision-making – and therefore aligns with scholarly debates (c.f. Bouzarovski & Simcock, 2023) calling for these to be replaced by more explicitly justice-oriented approaches. It also pushes back against the positivist methodologies prevalent in energy justice literature, advocating instead for co-produced, context-specific, and decolonized methods. Moreover, intersectionality's focus on the intricate web of political, economic, and cultural processes that produce both privileges and oppressions allow for a more nuanced understanding of inequalities. It directly confronts the structural forces—such as patriarchy, racism, and colonialism—that sustain these inequities. These strengths of an intersectional approach are implemented through the framework using the following three sets of interconnected research questions.

RQ (1): How do the ongoing smart meter rollouts in Great Britain impact social justice, and to what extent do they address intersectional concerns?

The current academic discourse on SETs has effectively highlighted a variety of risks and benefits of these technologies and raised important ethical concerns in the GB context but has inadequately considered the nuances of the variety of social contexts through which these technologies diffuse, the power dynamics between those at the forefront of this transition, and what normative frameworks actors should use for deliberation about the justice implications of these technologies.

The first research question aims to analyse the most current social justice implications based on a series of stakeholder interviews using the smart meter rollouts as a point of departure, and to what extent they deal with intersectional concerns highlighted in the framework above (chapter 4).

RQ (2): How do organizations at working with SETs in GB conceptualize and respond to the social justice implications of their initiatives, and why do they engage (or fail to engage) with intersectional praxis?

SETs are rapidly reaching not only households but also organizations that are piloting innovative models for renewable energy generation, energy flexibility, energy literacy, and energy savings. In these settings, SETs intersect with broader issues such as fuel poverty, carbon reduction, economic development, housing, and welfare reform – leading to rich discussions on social justice issues. As these technologies advance, they must navigate a complex landscape that attempts to integrate these interconnected agendas while confronting the existing social disparities in energy access and affordability.

The second research question looks at how organizations are making sense of the evolution of energy injustices as smart energy transitions progress, and their engagements with intersectional praxis. It also analyses the reasons for these current engagements. This is answered in chapter 5, analysing results from three case studies at three organizations at the forefront – a charity, a social enterprise and an energy distributor.

RQ (3): How can organizational practices be better aligned with intersectional praxis, and how might such alignment advance or hinder the transformative potential to dismantle inequalities in GB's transition to SETs?

A final critical gap in the current discourse on energy vulnerability, particularly within neoliberal energy markets like the UK, is the absence of what Bouzarovski and Simcock (2023) refer to as "*transformative*" political action. This form of action would aim to dismantle austerity-driven policies that have resulted in real-terms reductions in state benefits for marginalized households, coupled with increasingly stringent eligibility criteria. Furthermore, it would involve a comprehensive

reconfiguration of the structural and institutional frameworks that perpetuate energy poverty. For such an approach to be effective, whether in research, civic engagement, or policymaking, it must be concerted, comprehensive, and ambitious in its pursuit of social justice.

Bringing intersectional praxis to these organizations, the final research question answered in chapter 6, explores possibilities of making their practice around smart energy more aligned with intersectional praxis. It also analyses how these organizations appropriate intersectional principles into the realities of their respective work settings, highlighting in each case how this furthers or hinders transformative action.

3. Bringing intersectional praxis to smart energy organizations

In the previous section, I demonstrated how academic discussions on the social justice implications of smart energy technologies (SETs) have provided crucial insights into how these technologies often fail to serve everyone equitably. Ethnographic studies and other qualitative methods have illuminated the diversity of experiences and challenges faced by different households. Additionally, this research has argued that future research must integrate multiple disciplines and address structural inequalities related to race, gender, and disability. Scholarship has also called for more policy-oriented research to provide practical solutions and improve the frameworks for understanding energy inequalities, thus offering policymakers more effective tools for addressing these issues (c.f. Foulds & Robison, 2018; Ambrose & Marchand, 2017; Simcock & Bouzarovski, 2023; Bouzarovski et al., 2012; Sovacool et. al, 2018; Hargreaves & Middlemiss, 2020). However, as I argued in the previous chapter, a transformative, intersectional approach demands a more holistic and interconnected framework—one that simultaneously examines users, institutions, and power systems. This integrated perspective is essential to fully capture the complexities of energy inequalities and address the structural dynamics perpetuating them.

These findings from my literature review were instrumental in shaping my research methodology which aimed to explore intersectionality's potential to add depth to the conversations on energy inequalities in the context of SETs. While developing my methodology, I aimed to add evidence which explores systemic injustices related to social categories, and at the same time, does it in a practice-oriented setting. Through an intersectional lens, my aim was not to engage in abstract theorization, but rather to explore the context of how people understand, perceive, and act upon injustice in smart energy transitions.

My methodology is thus, exploratory in nature, seeking to understand if and how intersectionality can make a difference and through what avenues. It was inspired by Flyvbjerg (2001)'s critique of social science's role in theorizing as a predictive tool, akin to the natural sciences. Instead, Flyvbjerg argues for a phronetic approach, which is more critical and grounded in practical wisdom and knowledge of the studied field. Following this approach, my research was shaped by a commitment to spark reflection and challenge the status quo in practice-oriented settings, with the conscious goal of identifying organizations willing to enact transformative change. During my data collection I wanted to create spaces where disconnecting from the traditional ways of looking at injustice becomes possible and is replaced by the idea of ethical reflection on particular contexts rather than universal rules—focusing on “what is good or bad for humanity” as a guiding principle (Flyvbjerg, 2001, p.57).

This formed the foundation of my research design, which was divided into three interconnected phases, employing a mixed-methods approach (Table 3.1). The first phase of the study, conducted through 11 stakeholder interviews, sought to examine the current trajectory of SETs in the UK and their intersection with issues of energy injustice. The subsequent phases narrowed the focus, selecting three organizations identified through Phase 1 for in-depth research. In the second phase, through an initial workshop, one-on-one interviews, and self-reflection templates, adopting the dual role of consultant and researcher, I introduced intersectionality as a radical, transformative theory rooted in Black feminist thought, while observing participants' reactions and current applications of the concept to their work on smart energy. This phase explored the strengths, limitations, and potential of intersectionality as a tool for critical practice in addressing social justice. The third and final phase operationalized the findings of the second, investigating how intersectionality could inform and enhance the existing practices of these organizations and what value it could add to their efforts to address social justice within the smart energy landscape. This was followed up by a final dissemination event held at Citizens Advice where the three organizations participated in a face-to-face discussion and Q&A with an audience

from the broader UK energy landscape where they reflected on their key takeaways from engaging with my work.

Research phases	Methodological Tools	Research Question
Phase 1: Map (November 2022 – January 2023) aimed to critically explore energy injustices in the UK's smart energy transitions by examining their emergence, mapping key stakeholders' actions and contributions, and analysing the impact of smart energy developments on justice outcomes.	11 Stakeholder Interviews	RQ (1): How do the ongoing smart meter rollouts in Great Britain impact social justice, and to what extent do they address intersectional concerns?
Phase 2: Engage (September 2023 – January 2024) aimed to examine how practitioners in the smart energy sector address social justice issues, evaluate the potential of intersectionality as a critical tool for practice, and explore how it could enhance or challenge current approaches to justice.	3 Case Studies: 1 Workshop, 7 One-on-One Interviews and Participant Self-Reflection	RQ (2): How do organizations at the forefront of SETs in Great Britain conceptualize and respond to the social justice implications of their initiatives, and why do they engage (or fail to engage) with intersectional praxis?
Phase 3: Apply (September 2023 – February 2024) aimed to identify areas of participants' work in the smart energy sector where intersectionality could be applied and evaluate its potential to enhance efforts in addressing energy injustice.	3 Case Studies: 1 Workshop & 1 Final Dissemination Event	RQ (3): How can the practices of these organizations be better aligned with intersectional praxis, and how might such alignment advance or hinder the transformative potential to dismantle inequalities in the context of SETs?

Table 3.1 Summary of research questions, corresponding research methodology, and objectives.

3.1 Research Philosophy

Before detailing the three phases, I will discuss the foundational elements of my research design, beginning with reflections on my prior research experiences and positionality. These "embodied" experiences of intersectionality served as a priori knowledge, shaping my understanding of the literature (Chapter 2) and informing my research approach. I will then explore the philosophical considerations that guided my methodology.

3.1.1 Reflection on Positionality

Feminist scholars have argued that there is no "neutral ground" or a purely objective perspective in any research, as all research is inherently shaped by the researcher's positionality. My research design choices were influenced by my own identities and context, and I consciously adopted certain perspectives over others, appropriating them in ways aligned with my lived experiences. It is especially relevant to discuss this in ethnographic research, where the researcher's identity and pre-understanding become central to the research process (Alvesson & Sandberg, 2022). In my case, my pre-understanding was profoundly shaped by my experiences as an intersectional subject - brown, post-colonial, queer, cis-male, and first-generation educated individual. As with all identities, these intersect and create dynamic realities depending on the context (Moya, 2011). For example, at a climate action event in Gothenburg in 2018, a colleague remarked that my identity as a queer Indian male (instead of *just* Indian male) made me more "interesting" to people in the office. This anecdote highlights how different facets of my identity become more or less salient depending on the social and professional setting. Throughout the course of my PhD, my post-colonial identity (Treacher, 2005), in particular, emerged as a particularly influential factor in shaping my research process.

To ensure reflexivity, I maintained a research journal throughout my secondments and during the three phases of data collection. This journal became a space for reflecting on both the subtle and profound ways in which this identity influenced my research. For instance, travelling to my case studies on bright, pleasant summer days, I found humour in finally understanding Shakespeare's Sonnet 18 which I first studied as a high school student, where he compares youthful beauty to a summer's day—an analogy that felt far removed from my experience of summer days in India, which often exceed 35°C. However, more profound reflections pertained to how my familiarity with the English language and similarities between institutional structures in India and the UK gave me confidence in navigating UK policy settings. In contrast, I struggled initially in

Sweden, where I spent worked and studied for 5 years, due to unfamiliar institutional setups, compounded by my limited knowledge of Swedish.

On a few occasions documented in my research journal, I encountered British participants—both White British and Asian British—who expressed surprise at my upbringing in India, as they had assumed my familiarity with British institutions stemmed from being raised there. This recognition provided me with a sense of comfort and acceptance, which upon reflection, may have been tied to a deeper desire for approval from colonial structures—an internalized remnant of my post-colonial identity. These experiences influenced my research relationships, as I felt more at ease and pursued contacts where such conversations occurred. This, in turn, shaped the trajectory of my research, as the recommendations and connections from those interactions influenced the organizations I focused on. Thus, my embodied intersectionality and the salience of my post-colonial identity played a significant role in shaping the direction of my research during Phase 1.

Another striking observation was the authority I was granted within the organizations I worked with. Since they had dedicated valuable time to collaborate with me, they entrusted me with a certain level of authority on intersectionality. This was not solely because of my academic background or my association with Citizens Advice, where I was required to do a secondment as part of my PhD funding, but also because I was open with them about my multiple intersecting identities. I never claimed authority over intersectionality based on them, nor explicitly discussed how I personally navigated these identities—since I aimed to avoid conscious bias—my extended time with the organizations (ranging from 15 to 25 hours) meant that informal conversations often arose during workshops and one-on-one meetings. In these settings, discussions of our identities naturally emerged. I suspect that some of the predominantly White participants may have felt more comfortable engaging with a concept so deeply rooted in the experiences of marginalized groups because they perceived me as someone who embodied intersectionality and could therefore speak

for it. For example, one participant remarked during an initial conversation, *"It's easier to talk about some of this stuff with you, because I am always worried that I am dismissing someone's experience while thinking about these issues."*

While this dynamic may have been advantageous in fostering trust, allowing participants to feel more open to share and engage with the concept of intersectionality within their organizational contexts, it also had potential drawbacks. Specifically, I may have unintentionally become a proxy for all marginalized identities, which could have affected the scope and depth of the discussions.

The situatedness of my research within the GECKO project—where secondments formed an equal part of my PhD journey alongside primary data collection—played a crucial role in shaping my research approach. The interviews and pilot studies conducted during these secondments, at Citizens Advice in London³ and KTH in Stockholm⁴, provided practical insights that significantly refined my research questions and objectives (figure 3.1). Citizens Advice gave me initial access to their social network – which enabled me to reach out to stakeholders hassle-free.

My training as an engineer and prior experience in business development are also important elements of my positionality. On one hand, I was adept at understanding organizational structures, reading between the lines, and adapting my communication to suit different organizational contexts. For instance, I could design effective strategies, such as tailoring posters on the core tenets of intersectionality to fit the fast-paced working environment of organizations I conducted the case studies with. Furthermore, the 'language' I used to communicate, was also

³ Report on the workshop I carried out with CA can be found [here](#).

⁴ The findings on 'operationalising' intersectionality in broader sustainability transitions which I researched in Stockholm was presented at the International Sustainability Transitions (IST) [Conference](#) in Utrecht, 2023.

shaped by my years of training as a business consultant, were also critical in shaping which organizations I ended up working with.



Figure 3.1 Pilot Workshop, Stockholm (April 2023). Source: Author.

Note: During my secondments through the GECKO project, I was able to trial my workshop on bringing intersectionality - particularly its core concerns around critiquing power systems – into practice settings. The feedback I received helped me significantly in refining my final research design.

As I observe in my research journal, I had to constantly remind myself to carefully tread between the dual roles of researcher and consultant. The journal helped me reflect on when and how I was shifting between these roles, allowing me to adjust and recalibrate when necessary. The design of my workshops (section 3.3) used learning strategies such as those from *Liberating Structures*⁵ which reflected my systems thinking approach and were influenced heavily by my role as the learning coordinator for the Global Solvers Accelerator. These techniques helped break

⁵ [*Liberating Structures*](#) are a set of tools by scholars Henri Lipmanowicz and Keith McCandless, based on their experiences of working with complex social innovation projects around the world. They present a set of tools that can help bring individuals together while complex problem solving.

down complex intersecting identities and show how they interact. However, my techno-managerial background also posed difficulties in the early years of my PhD. I struggled to adjust to the social sciences' more exploratory and emergent methodologies, which contrasted with the cumulative and predictive nature of natural sciences and business studies that I was accustomed to.

Flyvbjerg (2001) acknowledges that it is impossible to formalize exactly which skills a researcher brings to the production of knowledge, as these skills continuously evolve and adapt based on interactions with research subjects. Yet, I have tried here to account for the procedures and background skills that shaped my research. Building on these reflections, I will now explain the research philosophy and principles that underpin my methodology – aligning theory with practice and centring ethical considerations.

3.1.2 Action-oriented, co-design approach

Action-oriented (or second-order research) emphasizes researchers become embedded in the concept, and recent scholarship has argued that it is particularly relevant in energy transitions research (Fazey et. al 2018). This approach moves beyond traditional first-order research, which often views researchers as detached observers, and instead engages them as active participants in the process of change. In the context of my research, this was a crucial shaping factor, as it facilitated a collaborative and reflexive relationship between myself, and the organizations involved in my case studies. Rather than imposing rigid, pre-tested methodologies, I co-created the research design with the case study organizations, trying to ensure that it was both theoretically robust and practically relevant to their specific contexts.

In order to realise these principles in practice, I adopted a co-design approach, which meant that although I had my research questions fixed, the methodology I chose was contingent upon my consultations with the three case study organizations. This meant constantly having to negotiate my *minimum* requirements as a researcher. It also meant that each of the three

organizations had significant input into how the case studies were designed and conducted. I ensured that they had a say and felt empowered to customise, the time they were willing to dedicate, which topics they wanted to prioritize alongside my core research objectives, and which projects they wanted to bring forward for analysis. This process allowed them the freedom to choose areas that were most relevant to their work, thereby increasing their engagement and investment in the research outcomes. For instance, they were involved in determining key reflection questions that focused on how intersectionality influenced—or could influence—their work, ensuring that these reflections were both meaningful and context-specific.

The most direct application of the co-design approach occurred during the final workshop with each organization. Here, the organizations took the lead in creating guidelines aimed at enhancing their engagement with intersectionality in the context of smart energy. I provided a basic structure or 'scaffolding'—such as suggestions on potential elements for the guidelines or inspiration from the Design Justice Principles (Costanza-Chock, 2018)—but the content was shaped entirely by the participants. They debated and selected the core values to be embedded in the guidelines, identified "low-hanging fruit" where intersectionality could be easily integrated into their work, and determined the tone and messaging of the guidelines.

3.1.3 Reflexive approach inspired by Feminist STS

Feminist Science and Technology Studies (STS) offers a valuable lens for examining the co-production of science, technology, and society, emphasising how knowledge is shaped by social, cultural, and political contexts. Reflexive approaches, central to this perspective, encourage researchers to critically evaluate their role in knowledge production and to recognise how their work interacts with and is shaped by the subjects they study. Reflexivity, as highlighted by Downey and Zuiderent-Jerak (2017), frames knowledge-making as a collaborative process influenced by the diverse actions, interpretations, and embodied experiences of all participants involved.

In my research, I drew on feminist STS principles to explore how knowledge about intersectionality and smart energy was co-produced between myself and the participants. By fostering reflective dialogues, I examined how different meanings were assigned to intersectionality and smart energy technologies, a process facilitated through self-reflection templates (Section 3.3). These tools enabled us to remain mindful of how our interpretations were shaped by our unique experiences and expertise, which I integrated into my analysis.

Feminist STS also highlights the significance of practical skills and embodied knowledge in research (Peters, 2018; Mansour, 2009). My active participation within organizations provided firsthand insights into how intersectionality could be applied in their work. At the same time, I contributed my own embodied experiences and skills related to intersectionality, creating a reciprocal learning process. This dual role allowed me to navigate the nuances of organizational practices while critically assessing how intersectionality might challenge or enhance their approaches to energy justice. Adapting to organizational terminology, maintaining analytical distance, and embracing the co-productive ethos of feminist STS were essential to this reflective and collaborative process.

3.1.4 Pragmatism

Pragmatism, as articulated by John Dewey, posits that theories are not static truths, but evolving instruments meant to address real-world problems and guide action (Bohman, 2002). For Dewey, the ultimate value of knowledge lies in its ability to inform and lead social transformation and liberation, rather than merely representing reality. This philosophy strongly influenced my research approach, particularly as it guided me towards engagements with Babasaheb Ambedkar's writings on social democracy and anti-caste, decolonial justice in India (Das, 2018; Erik-Berg, 2020). Ambedkar is regarded as the father of the Indian constitution, a prominent scholar, social activist, reformist, and one of the most influential figures in India's struggle for independence. As a student of Dewey, Ambedkar extended his mentor's ideas by linking Dalit emancipation to the

transformative potential of knowledge and education, and to the ethical imperative of confronting complex social realities.

During a visit to Ambedkar's memorial in Mumbai (figure 3.2), conversations with Dalit activists reaffirmed this connection, highlighting Ambedkar's belief that true liberation for marginalized communities would not only come through constitutional reform but also through the practical application and understanding of justice in everyday life. This means that theories must be used as tools to address real issues, and it shaped how throughout my research I was guided by the desire to bring intersectionality to practice settings not just as a theory but as a radical tool which can lead to transformative outcomes. I imagined my participants as active change agents, who could engage with intersectionality for liberatory outcomes – thus, there was a heavy focus on not only understanding intersectionality or understanding the social justice implications of SETs but also how to use it within organizational contexts to centre marginalised households.



Figure 3.2: Babasaheb Ambedkar's Memorial in Mumbai. Source: Author.

Note: During my visit to the memorial in 2023, I engaged in conversations with Dalit activists about social justice, pragmatism, and Ambedkar's connection to John Dewey. These discussions inspired me to consider how intersectionality could serve as a practical tool for addressing systemic inequalities.

Thus, I approached intersectionality as a practical instrument, one that needed to be made accessible and desirable to my participants. Throughout my research, I employed a pedagogical method, introducing intersectionality through reflective inquiry. For instance, in Phase 2, I provided interviewees with flexibility cases to which intersectionality could be applied (appendix H). This reflective process allowed for practical engagement, whereby participants could reflect on their own practices and explore how intersectionality could be integrated as a tool to advance social justice. The goal was to move beyond theoretical discussions and ensure that intersectionality was actively shaping their approaches to SETs in meaningful, transformative ways.

3.1.5 Intersectional feminist, anti-racist, decolonial principles

In conducting my research, I drew significant inspiration from Intersectional Feminist, Decolonial, and Anti-Racist principles. While these movements are distinct in their rhetorical, political, and philosophical elements, they share commonalities in both scholarly and activist traditions. These principles have been widely used in academic contexts, but their application in practice—as I have done—serves as a strategic political intervention aimed at disrupting dominant ways of thinking about injustice (Luft & Ward, 2009; Lutz, 2014). However, these methods can sometimes become popular and overused, losing connection with their core messages if not carefully applied (Davis, 2008; Daniels, 2008). This tension defined a significant part of my methodology, as I sought to stay rooted in these principles while making them more accessible and experimental.

These theories provided a crucial orienting framework throughout the research process, helping me not only maintain my commitment to intersectionality but also integrate and interact with other philosophical cornerstones of my research design, such as pragmatism. Pragmatism's emphasis on practical, evolving knowledge worked in concert with intersectionality, enabling me to foster a collective learning experience that encouraged participants to think critically and reflexively about their practices. Building trust with my research participants through the co-design approach allowed me to practice radical honesty. For example, I acknowledged that when

intersectionality is applied in institutional settings—particularly within neoliberal frameworks—it is often stripped down to superficial Diversity, Equity, and Inclusion (DEI) efforts. This reflection ensured that the participants and I remained mindful of intersectionality's broader potential for transformation, as well as the risk of it being watered down.

Additionally, I employed decolonial metaphors from initiatives such as Gesturing Towards Decolonial Futures⁶ (GTDF)'s Broccoli Seed Agreement. This metaphor reminded participants that, while we were creating tangible guidelines, the deeper outcomes of operationalising intersectionality are often less immediately visible. Like planting broccoli seeds, the process requires patience, nurturing, and sustained effort over time, as opposed to the instant gratification sought in more superficial approaches to learning. Participants often arrived with expectations for convenient, quickly consumable solutions ("candy"), but I framed our work around planting "broccoli seeds" that would require ongoing care for future growth and change. By shifting this perspective, I encouraged participants to engage with intersectionality not as a quick fix but as a deeper, long-term commitment to social justice – using memes to keep the message light and easy to understand (figure 3.3).



⁶ Gesturing Towards Decolonial Futures (GTDF) is a transnational and intergenerational arts/research collective comprising researchers, artists, educators, students, social justice and environmental activists, and Indigenous knowledge keepers. Their collaborative work focuses on artistic, pedagogical, cartographic, and relational experiments aimed at identifying and deactivating colonial habits of being, thereby gesturing towards the possibility of decolonial futures.

Figure 3.3 The Broccoli Seed Agreement depicted using a popular meme.

Source: Author.

Note: I was inspired by GTDF's Broccoli Seed Agreement which encourages slow, patient, reflective results on justice rather than expecting quick results. I delivered this message to my case study participants in Phase 2 through a popular meme. Source: Author.

3.2 Sampling and choosing my empirics

Flyvbjerg (2001) argues that methodology is not a universal theoretical rationality but rather a concrete practical rationality. This perspective represents the overarching reasoning behind the selection of my empirics. While formal frameworks grounded in my research philosophy, guided my surveys of the field to understand where to collect relevant data, practical considerations such as time constraints, access to participants, and feasibility also played a significant role.

This section will provide a detailed rationale for the selection of research participants for my data collection. As discussed earlier, I opted for a broad, exploratory, qualitative approach using semi-structured interviews in Phase 1, to map key justice concerns in the context of SETs. The distributive impacts of the smart meter rollouts served as a starting point to identify these concerns. To further explore these issues and introduce an intersectional lens, in phases 2 and 3, I chose a case study approach, which allowed for a more in-depth examination of how different organizations are grappling with justice and equity in the smart energy landscape. Throughout this process, in consultation with my PhD supervisors, I tried to ensure that my rationale for choosing empirics remained flexible, balancing robustness but also being adaptable to the constraints and opportunities that emerged during the fieldwork.

3.2.1 Rationale for selection of interviewees for Phase 1

For the semi-structured interviews, I followed both Robinson (2013)'s practical guide to sampling for qualitative interviews, as well as leveraged my literature review and informal conversations at Citizens Advice during my secondment, to pay attention to which stakeholders might be critical

to include in the study. I quickly realised that my *sample universe* - the number of organizations involved with SETs in the UK is impossible to estimate correctly. I could decipher from my secondment that stakeholders involved in the smart energy sector in the UK could be in the hundreds, including government bodies, private companies, non-profits, and community groups (see Appendix B for a list of stakeholders I considered for my sample size). The Smart Metering Steering Group alone includes several representatives from both large and small suppliers, industry trade bodies, and consumer advocacy groups like Citizens Advice (Ofgem, 2023; DESNZ, 2023, UK Parliament, 2023).

Key organizations like Ofgem and the Department for Energy Security and Net Zero (DESNZ) are central players in all smart energy initiatives as they set the playing rules, and I identified them early on as significant stakeholders. The next set of key stakeholders included industry representatives, suppliers, DNOs, the National Grid, aggregators, etc., that work more directly with households to advance the smart meter rollout and provide smart energy services and/or DSR programs.

A third set of organizations such as Innovate UK, the Centre for Sustainable Energy (CSE), and the Centre for Research into Energy Demand Solutions (CREDS) along with various academic institutions formed a third set of significant stakeholders that are actively engaged in smart energy research, focusing on smart systems, flexibility, and inclusion more directly in energy digitalization. Finally, as mentioned earlier, smart energy initiatives are often coupled with decentralisation and decarbonisation efforts in the UK, and decentralized energy systems, often led by local councils, universities, and community groups, are also becoming increasingly prevalent. These stakeholders are working on Smart Local Energy Systems (SLES) and similar projects aimed at integrating renewable energy, storage, and local grid management. From these stakeholders, I shortlisted 17 stakeholders for consideration as key stakeholders that could be relevant for my research.

Although intersectional analyses often centre on the complex lived experiences of individuals, I made the decision to exclude direct interviews or case studies with energy consumers within households due to ethical considerations (further elaborated in section 3.5).

To ensure that household perspectives were not entirely absent and to pay attention to both the philosophical as well as practical concerns around interviewee selections (Robinson, 2013), I developed specific inclusion criteria for the stakeholders I interviewed. First, participants had to be directly engaged with households, as this ensured that their perspectives were grounded in practical experiences with energy consumers. Second, interviewees needed to be actively involved in or concerned with issues of equity, inclusion, and justice within the context of SETs, or more broadly within the UK energy sector.

Furthermore, I prioritized senior management personnel as interviewees, recognizing that their strategic role within the organization would provide a broader perspective on institutional priorities and decision-making processes. In addition, senior managers possess the authority to speak on behalf of their organizations and articulate how high-level decisions intersect with operational practices. Their inclusion could also enhance the perceived credibility of my findings, making them more impactful for understanding the systemic challenges and opportunities related to intersectionality in the smart energy sector.

Lastly, interviewees needed to be available for interviews during the designated period, November 2022 to January 2023, to ensure timely completion of the data collection process. Given that Citizens Advice was keen to review the findings by March 2023, this timeline was critical for allowing sufficient time for analysis and report preparation. Based on these criteria, I recruited 11 stakeholders as the final interview sample (see Table 3.2).

Research Participant (Pseudonym)	Designation	Organization
Martin	Senior Policy Manager	Energy Volunteers Network
Natalie	Head of Compliance	Energy Markets Association
Samuel	Policy Head	Nationwide Energy Charity
Amelia	Professor and Senior Researcher	Nationwide research network on fuel poverty
Tristan	Senior Researcher	Nationwide research network on energy, net zero and climate change
Spencer	Head of Energy Markets	Think tank on energy and climate change
Catherine	Senior Researcher	National charity working on sustainable energy and vulnerability
Fiona	Senior Marketing Professional	Nationwide not-for-profit working on energy digitalization
Ewan	Director of Customer Services	Regional energy distributor
Katie	Head of Regulation and Compliance	Energy Supplier
Willem	Energy Policy Officer	Europe-wide consumer organization

Table 3.2: List of research participants (interviewees) in phase 1 of my research.

3.2.2 Rationale for selection of case study organizations for Phases 2 and 3

The aim of the case studies was to investigate the extent to which intersectional concerns—specifically, the identities and lived experiences of energy consumers—are being considered in the

pursuit of a more equitable, smart, and flexible energy system. More importantly, the research sought to explore how intersectionality could be integrated into the daily operations and practices of my case study organizations. While case study selection was based on formal guidelines (drawing on Flyvbjerg, 2006) to determine the type of case I sought, the process also remained flexible and responsive to contextual factors. Keeping in mind the importance of context in case study research, I paid close attention to insights gained during interviews in Phase 1, especially regarding where complexity and learning opportunities existed in the system vis-à-vis transformative justice. However, the process was not entirely under my control, as elements such as chance, uncertainty, and conflicting interests also played a role in shaping the selection.

Although case studies are often used to test hypotheses or theories' predictive capacities and facilitate generalization, Flyvbjerg (2001), referencing philosophers like Thomas Kuhn and Harry Eckstein, argues that case studies are equally valuable for generating context-specific, descriptive, and phenomenological knowledge and as such generate new hypotheses. This type of knowledge contributes to the "collective process of knowledge accumulation in a given field or society" (Flyvbjerg 2001, p76). This formed the premise and motivation behind my case study selection and design.

During Phase 1, it became clear that social justice, inclusion, and equity are already well-represented pivotal concerns in the UK's SETs discourse. Several interviewees highlighted cross-sectoral and interdisciplinary initiatives addressing these issues (ex: Warm Homes Prescription Service by Energy Systems Catapult). But, when I encouraged interview participants to respond to more radical statements on energy and flexibility justice (see table 3.4, section 3.3), I sensed that what was missing was a truly transformative approach to social justice—one that could address the underlying structures of inequality during this window of opportunity for systemic change represented by the ongoing radical transformation of energy markets due to the introduction of smart technologies. This realization further motivated my decision to examine how

intersectionality could be practically applied within organizations already engaged in or open to disruptive work on this front. My goal was to illustrate, through my case studies, what Flyvbjerg (2001) refers to as "the power of the good example," which he argues is often underestimated in social scientific research.

In selecting case studies, similar to my strategy for Phase 1, my sampling strategy was shaped by both logical and practical considerations. From a logical perspective, I adhered to the phronetic approach, which emphasizes reflective judgment, consideration, and context-specific knowledge on the part of the researcher. In this light, my selection process involved making conscious, radically oriented choices aimed at identifying organizations that could serve as *critical cases*. Thus, I was looking for organizations such that if certain outcomes, processes or dynamics that I uncover proved true (or false) within them, these findings could potentially be generalized to the wider smart energy system. However, while I sought conceptual generalizability, the primary guiding principle was the context-dependent, reflexive nature of phronetic research. The novelty of applying intersectionality to SETs also made the choice of critical cases particularly important, as the findings from these cases could act as a springboard for future research in this area.

In addition, the context-dependent lens ensured that my secondment experience at Citizens Advice also played a crucial role in case selection. I aimed to work with organizations that were either significantly ahead of others in tackling issues of justice and inclusion, or those that had established themselves as trendsetters within the energy sector. Furthermore, by prioritising the selection of organizations that were well-connected and capable of activating further actors and mechanisms within the system, I sought to maximize the potential impact of my findings. During the selection process, I evaluated not just their volume of experience, but the specificity of each organization's work, their collaborations, and their expressed positions on social justice. Preference was given to those already aligned with principles of intersectionality, particularly those advocating for systemic changes or working with local energy systems in an attempt to mainstream

community-level concerns within smart energy transitions. While it was not always possible to fully gauge how ‘radical’ an organization might be before engaging with them, I focused on those that I perceived as willing to explore uncharted territories and disrupt conventional ways of thinking about justice. The assumption was that these organizations would be more open to intersectionality’s critical perspective on dismantling dominant frameworks.

While this strategy of engaging with organizations already attuned to justice and inclusion was promising, it also presented certain limitations. Specifically, the openness of these organizations to intersectional thinking cannot be divorced from the broader policy and regulatory environment in which they operate. The UK’s liberalised energy market, established in the 1980s under the “switch and save” model (section 4.4), has consistently failed to deliver equitable outcomes for consumers—especially those in vulnerable circumstances. In response, regulatory bodies such as Ofgem have made concerted efforts in recent years to hold energy providers accountable, mandating greater attention to distributional impacts, fairness, and accessibility. The organizations selected for this research have positioned themselves at the leading edge of this regulatory shift, actively engaging with agendas around vulnerability, equity, and structural reform.

This context helped create fertile ground for the application of an intersectional framework. However, it also raises questions about how transferable my findings may be to organizations less invested in, or even resistant to, these justice-oriented commitments. As Chapter 4 will demonstrate, many actors in the UK energy landscape continue to uphold market-based logics—such as the enduring belief in consumer switching as a primary mechanism for empowerment—despite substantial evidence of its limitations. In such contexts, the uptake of an intersectional methodology may face significant institutional, ideological, and epistemic barriers (discussed further in chapter 7).

On top of these criteria, I employed a maximum variation strategy to explore how intersectionality could be applied across different organizational contexts. This led me to select

organizations that varied significantly in terms of size, purpose, revenue models, and geographical location. Although they shared core characteristics relevant to my research topic, their differences allowed for a broader understanding of how intersectional justice could be operationalized in diverse settings.

Finally, practical considerations were also central to the selection process. I needed to ensure that the organizations were both interested in and capable of dedicating at least between 8 to 10 hours over an 8-week period. While I was able to leverage initial connections made through interviews, I also had to establish new contacts with some organizations. Based on the aforementioned criteria, I initially shortlisted seven organizations, from which I ultimately selected three case studies: the charity, the social enterprise, and the energy distributor. To respect their anonymity and their willingness to engage openly with my research, these organizations will be referred to by these generic titles throughout the study.

Although five of the seven organizations expressed interest, I chose these three for specific reasons. The charity and the distributor had previously worked with me in Phase 1 and were willing to prioritize my research due to its relevance for a project on including low-income households in smart energy initiatives that they were co-leading. The social enterprise, on the other hand, was a new connection that emerged through the interviews in Phase 1. They were preparing to launch a new smart energy service in their county in 2025, and, reflecting on the lack of diversity in their previous NetZero initiatives, they were eager to integrate intersectional considerations from the outset. They saw intersectionality as a valuable framework for ensuring that justice and equity concerns were embedded in their project design from the beginning. Table 3.3 provides a brief overview of the organizations, while chapter 5 will cover them in more detail, including their motivations to participate in the case study.

Case Study Organization	Organization Vision
The charity - Policy research and advocacy organization	The charity envisions a future where sustainable practices are embedded in everyday life, harmful emissions are minimized to safe levels, and equitable access to energy eliminates fuel poverty. Through the sharing of knowledge and practical experience, the organization helps individuals transform their approaches to energy use and conservation. Furthermore, it hopes to actively lead the UK's inclusivity efforts within smart energy transitions.
The social enterprise – Community renewable energy services provider	The social enterprise provides services to promote increased clean energy production. It focusses on energy efficiency, bolstering local energy production, advocating for the transition to electric transportation, and fostering community ownership. The enterprise endeavours to access a large portion of the clean energy funds allocated by their local county to push the NetZero transition and activate the local economy.
The energy distributor – regional electricity and gas networks operator	The distributor aims to maintain its position as one of the leading operators in the UK, guided by a set of predetermined values. It aspires to be the preferred operator, facilitating the Net Zero transition for all stakeholders, earning trust as a reputable corporate entity, and ensuring sustainable cost efficiency.

Table 3.3 Brief vision statements of the three organizations selected for the case studies.

3.3 Data Collection Methods

3.3.1 Data Collection Phase 1: Semi-structured interviews

My data collection approach followed a funnelling strategy across three phases, starting with mapping broad justice issues related to SETs and progressively narrowing to explore nuanced applications of intersectionality for driving transformative change within practice settings where decisions about future SETs are shaped (figure 3.4).



Figure 3.4: Summary: Three phases of data collection.

In Phase 1, I wanted to explore broad social justice issues at the heart of SETs using a diverse range of perspectives. As such, semi-structured interviews were an obvious methodological choice (Magaldi & Berler, 2020). This method allowed me to prepare key questions in advance

while also adapting to the flow of conversation, enabling the exploration of unforeseen areas of interest that emerged during the interview. The interviews were designed to start with a “*What do you think section?*” meant to serve as an icebreaker. I purposively chose a series of statements from academic literature (table 3.4) and showed them to interview participants. They were asked to react and share their responses around various policy and technology measures relating to energy inequalities - ranging from windfall taxes on energy producers, tailored-energy advice to the most vulnerable households, and the ethics of demand flexibility schemes.

As mentioned previously, the statements were meant to be provocative (Appendix C) grappled with some of the underlying systemic factors that create energy vulnerability discussed in Chapter 2. Furthermore, the conversational nature of this initial exercise also helped build rapport between the participants and me, fostering a more comfortable environment for discussing sensitive topics.

This was followed by in-depth 60-90-minute semi-structured interviews structured around the primary concerns of RQ (1). All interviews were held on Microsoft Teams and transcribed together with any notes I took while conducting the interviews. Please see Appendix C for questions.

3.3.2 Data Collection Phases 2 and 3: Participatory Workshops, Self-Reflection, One-on-one conversations

Following Phase 1, I initiated the process of identifying and contacting the organizations that stood out as potential case study candidates. By reviewing my interview transcripts, I focused on those organizations that demonstrated an experimental approach and aligned with the case study selection criteria outlined in the previous section. After narrowing down the potential candidates, I began initial conversations with each organization by identifying a primary point of contact.

For the charity, I reconnected with Catherine, who had already participated in my interviews, facilitating a seamless transition into the case study phase. For the social enterprise, one of my interview participant (Tristan) introduced me to Melanie, the head of the smart energy projects division within the organization. Similarly, for the distributor, Ewan, the Director of Customer Services directed me to Cody, who was leading discussions on justice within smart and flexible energy projects.

After several initial touchpoints—including emails, multiple online calls, and, where feasible, in-person meetings—I provided a detailed explanation of the research questions I aimed to address. I emphasized my interest in exploring pragmatic ways to apply intersectionality in understanding justice concerns within their respective smart energy contexts, which resonated strongly with all organizations. As noted earlier, while the overall structure of the case studies followed a broad framework, specific details—such as participant involvement, the projects discussed, and the duration of each component—were tailored on a case-by-case basis to reflect the unique needs and contexts of each organization.

While my initial intent for the case studies was to foster deep reflection on how values, ethics, and judgments about energy consumers could be integrated into the design of future smart energy systems, the actual focus shifted in a more pragmatic direction. My own understanding of pragmatism was rooted in the idea of embedding these value-judgement discussions within real-world settings, but I failed to anticipate that, for the three organizations involved, pragmatism would be more narrowly interpreted as operationalization. Instead of operationalizing intersectionality based on my understanding, where the end goal would be to engage in ethical and context-dependent discussions (Flyvbjerg, 2001, p. 58) about smart energy—the organizations were more concerned with producing organization-specific, actionable guidelines which could enable them to appropriate into their current practices.

As a result, much of the research design was centred on how to apply intersectional tools (I researched some intersectional tools which could be useful for the organizations, see Appendix E) and the correct processes for doing so, moving away from direct engagements with the three-pronged framework. This led the methodology to become more oriented towards understanding the practical context in which intersectionality could or could not be applied, overshadowing some of the broader inquiries into its strengths and weaknesses in addressing social justice within smart energy. This reflects the prominence of co-design and second-order elements, where the process was largely shaped by the needs of the participants.

While the methodology still aligned with my research questions, it leans more towards practical guidelines than the complexities of intersectional identities of energy consumers. As a result, I present a broader theoretical take on intersectionality toward the end of Chapter 6 and discuss how the case studies were largely an act of balancing instrumental rationality with value-rationality for both my case study organizations and me. In hindsight, I believe, a theoretical approach as I had desired, could have risked becoming too abstract and detached from the operational context, ultimately rendering it less usable for the organizations.

Despite these concerns about the case studies becoming overly instrumental, respecting emergence and co-design philosophies, I opted for a participatory workshop methodology to create intersectional guidelines, supplemented by a self-reflection template designed specifically for participants. The workshops were chosen because they fulfil participants' expectations by engaging them in discussions that align with their interests, offering practical insights they can apply in their work. Simultaneously, this method supports the research goal by generating reliable, context-specific data that accurately reflects the participants' perspectives (Ørngreen & Levinsen, 2017).

Additionally, participatory workshops facilitate collaborative problem-solving, allowing participants to interact with each other and the researcher to co-create solutions (Spinuzzi, 2005).

A key concern throughout my research has been reflexivity, which is essential for any discussions on social justice (Lykes & van der Merwe, 2019). Thus, the guiding principle for my case study methodology was to promote reflexivity and learning among participants, while also generating rich qualitative data to inform both this thesis and broader policy and practice. In order to promote reflexivity, I ensured that there were spaces for individual reflection through providing a self-reflection template and creating spaces for optional one-on-one conversations with me about the participants' reflections. Before delving into the details, I highlight the list of participants in the case studies from each organization (table 3.4) for additional context.

Sl. No.	Participant Name (Pseudonym)	Organization	Designation
1	Catherine	The charity - Policy research and advocacy organization	Head of Research
2	Emily		Project Manager
3	Neil		Project Manager
4	Claire		Project Manager
5	<i>Sheila</i>		Retrofit Coordinator
6	<i>Jane</i>		Retrofit Manager
7	Kayla		Researcher
8	Rex		Senior Project Manager
9	<i>Sarah*</i>	The social enterprise – Community renewable energy services provider	Social Impact Director
10	Melanie*		Smart Energy Director
11	Tony		Project Manager
12	<i>Joe</i>		Smart Energy Trials Manager
13	Audrey		Business Relationships Manager
14	Moir		Community Engagement Manager
15	Chloe		Net-zero Community Manager

16	Cody*	Distribution	Innovation Project Lead
17	Sandhya	network operator	Transmission Security Engineer
18	<i>Fleur</i>	(DNO)	Innovation and Consumer Vulnerability Lead

Table 3.4 List of Participants in Phases 2 and 3.

Notes: *These participants were the main point of contact between the participants and the researchers. They also played an active role in aligning the case study slightly to match their unique needs and motivations to participate.

Participants in *italics* - These participants only took part in some parts of the study owing to prior work commitments, sickness, or other personal reasons. Shiela did not find the first workshop comprehensible and decided to withdraw from the case study. This will be discussed further in chapter 6.

3.3.3 Conducting the case studies: Phase 2

Phase 2 for each case study began with an **exploratory workshop** focused on introducing the basics of intersectionality and its relevance to practice. Crucially, this phase introduced the core tenets of doing intersectionality (Section 2.5) through intersectional metaphors and tools (Appendix D & E). The 3–4-hour workshop began with an exploration of participants’ work on social justice and smart energy. This was followed by a 30-minute presentation on intersectionality, where I documented proceedings, capturing key insights and feedback shared during reflective and collaborative group tasks. A co-facilitator from my research group occasionally joined to support facilitation or provide expertise in intersectionality discourse. Participants shared their thoughts using post-it notes, which also fed into the data collection (figure 3.5). All proceedings of the workshop (excluding informal conversations during lunch and other breaks) were recorded and transcribed.



Figure 3.5. Participants from the social enterprise during the first exploratory workshop working with an intersectional tool, the Web of Identities.

I introduced intersectional tools, including the Web of Identities (figure 3.5), to help participants map how intersecting social identities—such as race, gender, class, and disability—impact household experiences with smart energy technologies. The tool provided a visual means of understanding consumer vulnerabilities in energy flexibility contexts. Participants used three flexibility case studies (Appendix E) to apply the tool: Gill, a suburban single mother with financial instability; Farrah and Brandon, elderly pensioners facing mobility and technological challenges; and Abdul and Sarah, asylum seekers concerned about data privacy and autonomy in shared housing with smart energy upgrades. These case studies facilitated discussions on challenges and

opportunities for integrating intersectionality into smart energy projects. A detailed workshop report is in Appendix F.


After the workshop, participants received a self-reflection template (figure 3.6) with instructions to complete weekly notes, accompanied by reminders. The template, designed to facilitate reflections on the potential to apply intersectionality and one-on-one discussions with me, provided participants with a private space to share thoughts they might have been uncomfortable voicing in a group setting. It also encouraged them to reflect on their embodied experiences of intersectional privilege and discrimination. This reflection aimed to deepen their understanding of intersectionality, enabling them to apply it meaningfully in their work while building solidarity.

While anonymity was preserved, participants were encouraged to share insights in the concluding workshop. Additionally, they could schedule virtual consultations or interviews with me. However, professional commitments limited engagement with the template, with only 12 out of 18 completing templates and 7 out of 18 participating in one-on-one consultations. All completed self-reflection templates and online consultations were recorded and transcribed.

After this phase, I analysed all collected data to determine:

- (i) to what extent their current work was already intersectional (highlighting key strengths),
- (ii) identifying some "low-hanging fruit" or areas where the work could immediately begin incorporating intersectional methods and ideas (points of intervention), and
- (iii) how the organization could engage with intersectional social justice in the long term (best practices).

These became the starting point for the final co-creation workshop during phase 3.

**EMBEDDING INTERSECTIONALITY
IN PRACTICE** 

DATE(S) OF ENTRY:					YOUR NAME:	
WHICH TOPICS FROM THE 1ST WORKSHOP CAME/UP IN YOUR OBSERVATIONS?			HOW IS MY WORK ALREADY ENGAGING WITH INTERSECTIONALITY?			
THE 4 METAPHORS FOR 'DOING' INTERSECTIONALITY						
TOOLS FOR INTERSECTIONAL PRACTICE						
SOMETHING ELSE?						
NEEDS & OBSTACLES			HOW COULD MY WORK ENGAGE MORE WITH INTERSECTIONALITY?			
WHAT WOULD I NEED TO WORK MORE WITH INTERSECTIONALITY?						
WHAT COULD PREVENT ME FROM ENGAGING WITH INTERSECTIONALITY?						
			WHAT POWER SYSTEMS DO I CONFRONT IN MY WORK?			

Power systems

- Affect who works at [redacted], & therefore lack of diverse experience
- Our projects often need to conform to bid parameters / topic, KPI etc.
- Use experience & knowledge to write bids, but not bring in client voice on what they need.
- Racism, colonialism - it is harder for people from different ethnic backgrounds or non-English speakers to access our services. We have accommodations but they need to reach us first & barrier.
- Capitalism in terms of benefit system, cost of living etc. We have to do a lot more around financial support compared to energy advice
- State holds / orops work with or refer - not sure where the power lies - feels balanced.
- Power with us when work with clients, though we are generally tailoring it to their needs.

Figure 3.6: (Above) Sample self-reflection template given to all 18 participants at the end of the inaugural workshop. (Below) Sample reflections based on the template brought to the final co-creation workshop by Claire from the charity.

Note: In this reflection, the participant considers both institutional power and broader power systems, including capitalism, racism, and colonialism. For instance, Claire highlights the barriers that people of colour or non-English speakers may encounter when accessing services like on-call energy advice. While acknowledging existing accommodations, she stresses the need for greater recognition of how systemic racism can further hinder access to these services.

3.3.4 Conducting the case studies: Phase 3

The final phase 3 of the data collection began with a co-creation workshop involving all participants from the research process. This phase focused on exploring and deliberating over the results from the previous phase, specifically reflecting on the new perspectives intersectionality could bring to the selected projects in both the short and long term. Participants worked collaboratively to co-create guidelines for integrating intersectionality into future projects and more broadly into their organizational processes. The aim was to ensure that the insights gained through the research were not only applied to current work but also formed the foundation for transformative, long-term engagement with intersectionality.

In contrast to the initial workshop, characterized by substantial input from my end, the final workshop was crafted to be participant-led and elicit participant insights regarding the future application of intersectionality and participants' experiences with issues of social justice and equity. Therefore, I paid extra attention to participant conversations during the four-hour session, opting instead to employ double the audio-recording devices than in the first workshop to capture the proceedings comprehensively.

Preparations for the final workshop encompassed two primary tasks: firstly, transcribing the inaugural workshop, filled-in self-reflection templates and any subsequent one-on-one interactions, extracting recurrent themes, and curating anonymized quotations to serve as catalysts for discussion (see figure 3.7 for example); secondly, devising a structured framework to guide participants through the collaborative process of guideline co-creation. This structured approach commenced with a definition of the guidelines' essence, defining its core attributes and delineating parameters of exclusion. Subsequently, participants deliberated upon the prioritisation of values

pertinent to guideline design and implementation, engaged in discourse surrounding emergent themes that I provided from Phase 2, debated aspirations pertaining to intersectionality integration, and ultimately, formulated the guidelines themselves. For further details, please see Appendix D.

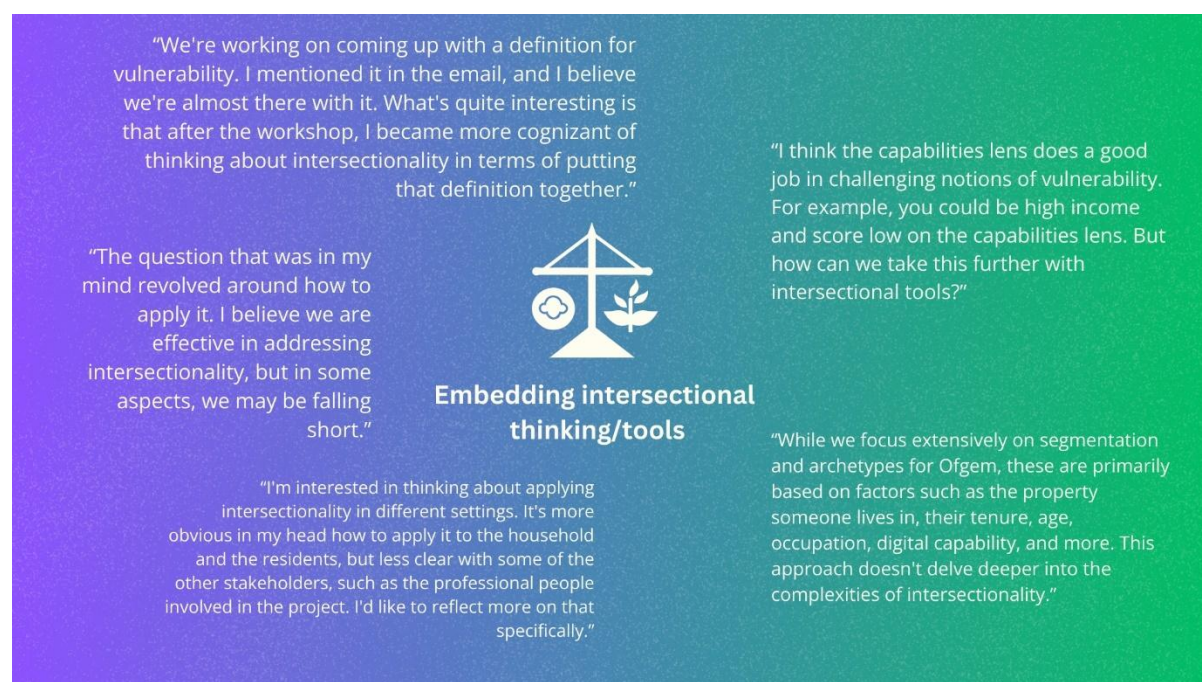


Figure 3.7: Example of a Theme Created for the Final Workshop

Note: This theme, *Embedding Intersectional Thinking/Tools*, was created by me prior to the final workshop. Each theme was illustrated with participant quotes and displayed as a poster on the wall throughout the workshop to stimulate thought and discussion among participants as to how intersectionality could be operationalised in future smart energy projects.

A final dissemination event at the end of the case studies was also crucial for sharing research insights with a broader audience and ensuring that the findings have practical impact. It also ensured that the organizations had a chance to thoroughly reflect on their learning through the process. It was also an opportunity for me to reflect about the strengths and limitations of my research. By inviting all three organizations to a public event held at Citizens Advice and organised

by TIDE⁷ (Tackling Inclusion and Diversity in Energy) Taskforce, I facilitated an open exchange of ideas among the three organizations, allowing participants to reflect on their shared experiences and contribute to sector-wide learning. The event, open to members of a professional network that promotes diversity, equity, and inclusion in the UK energy sector, further opened up discussions about the relevance of intersectionality in shaping energy justice. While the event was recorded with consent from the audience, no data from external audiences was transcribed.

The following table provides key dates, locations and participants for each part of the case study per organization (table 3.5).

Organization	Case Study Phase	Dates	Location	Participants
Charity	Initial Contact with organization and pre-case study approval	July – August 2023	Online	Carol
	Phase 2: Exploratory Workshop	17th October 2023	In-Person	All from the charity
	Phase 2: Self-Reflection	18 th October – 20 th November 2023	Online	Carol, Neil, Emily, Rex, Kayla and Claire
	Phase 3: Co-creation workshop	29 th November 2023	Hybrid	Carol, Neil, Emily, Kayla and Claire
Social enterprise	Initial Contact with organization and	September - October 2023	Hybrid	Melanie and Sarah

⁷ [TIDE](#) (Tackling Inclusion and Diversity in Energy) is a UK-based cross-industry initiative that focuses on fostering equity, diversity, and inclusion (EDI) in the energy sector. Established by key stakeholders such as Energy UK, the Energy Networks Association (ENA), and Ofgem, TIDE seeks to create actionable change by promoting best practices, sharing insights, and driving collaboration across the sector.

	pre-case study approval			
	Phase 2: Exploratory Workshop	12 th December 2023	In-Person	All from the social enterprise
	Phase 2: Self-Reflection	13 th December 2023 – 15 th January 2024	Online	Melanie, Tony and Joe
	Phase 3: Co-creation workshop	18 th January 2024	In-Person	All except Sarah and Joe
Energy Distributor	Initial Contact with organization and pre-case study approval	September - December 2023	Online	Cody
	Phase 2: Exploratory Workshop	5 th January 2024	Online	Cody and Sandhya
	Phase 2: Self-Reflection	6 th January – 20 th January 2024	Online	Cody and Sandhya
	Phase 3: Co-creation workshop	29 th January 2024	In-Person	Cody, Sandhya and Fleur
Final Dissemination Event	N/A	7 th February 2024	Hybrid	Carol, Melanie, Tony and Cody plus, an external audience of 12

				professionals working with diversity and inclusion in the UK energy space)
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Table 3.5 Key Dates and Events of the Case Studies

3.3.5 Field notes and observations

Given my research philosophy, which emphasises the researcher’s role in shaping the fields under study, I maintained informal field notes throughout my fieldwork, primarily captured on my phone. These notes spanned moments and thoughts from before, during, and after interviews, as well as impressions from workshops, office visits, and informal conversations with participants. I also noted observations from external online events where the case study organizations presented their work. In workshops where I was supported by co-facilitators, we debriefed and recorded shared reflections after the workshop.

My notes captured contexts, surroundings, and situations rather than systematically observing people. Though these informal observations were not formally analysed or extensively included in this thesis, they provided critical context and helped shape my understanding of the data. These reflections formed a foundation for analysing the data and provided a richer understanding of the broader dynamics at play. Excerpts from these notes are included in Appendix K.

3.4 Data analysis, interpretation and writing up

In qualitative research, coding is essential for organizing and interpreting data. There are various techniques for coding, however most qualitative researchers adopt either a deductive (guided by pre-existing theories and research questions) or inductive (emerging organically from the data) approach, or a combination of the two (Yin, 2013). In my analysis, I was rooted in reflexive thematic coding, which emphasizes the balance between engaging with theory and maintaining a

strong connection to the guiding research questions and the researched field. It allows for flexibility in responding to emergent data patterns, without being bound to rigid, predetermined theoretical frameworks—while also avoiding becoming atheoretical (Terry & Hayfield, 2020). This approach ensured that the analysis remained grounded in a theoretical foundation but adapted to the nuanced realities uncovered during data collection.

Leaning on my focus on adopting a phronetic approach as set out at the beginning of the chapter, I interpreted the data using a context-sensitive approach that combined these two methods. I manually coded the data based on my research interests, research questions and the theoretical frameworks outlined in chapter 2. All codes were stored, sorted, and synthesised in spreadsheets using Google Sheets. Through several iterations, I remained open to new insights, for example, by referencing my field notes, drawing upon my own inferences and experiences as a *consultant* to interpret the deeper, less overt meanings from the data (Clarke & Braun, 2017). Participants' informal comments, the subtext of their statements, and their non-verbal cues often provided critical insights into their underlying concerns about justice and smart energy.

3.4.1 Data analysis via qualitative coding

The coding methodology I followed was based on a grounded theory framework (Stern, 2007). It involved dissecting the collected data, identifying patterns, and reassembling it to create meaningful insights. With nearly 400 pages of transcripts from interviews, workshops, and field notes, my coding process combined both structured methods and emergent flexibility to align with the complexity of both the diversity of stakeholders I consulted, as well as the topic of operationalising intersectionality. It involved 4 steps, each of which was first carried out linearly, and then in a non-linear manner based on emergence. The process is summarised in Table 3.6.

Step 1: Indexing for Categorisation

The first step in managing the extensive data involved indexing, which helped categorize large datasets into smaller, referenceable segments. This initial step aligned with what Richards and Richards (1994) describe as “code-and-retrieve” indexing—identifying all sections of the data relevant to the specific research inquiry, regardless of their chronological order. This included broad codes of relevance such as ‘smart energy technologies’, ‘smart meter rollouts’, ‘intersectionality’, ‘energy distributor’ etc. This allowed me to explore the data holistically, beginning the process of sense making, and get a feel for which sections of data are most relevant for my analysis. Thus, by indexing, I began organising my data for subsequent layers of analysis.

Step 2: Open Coding – Initial, Low-Level Inference

In the next stage, I employed open coding, systematically breaking down the categories of data into smaller, descriptive units. Open coding aligns with assigning “low inference” codes, which are primarily descriptive and serve to summarise segments of data. These codes were informed by my theoretical frameworks, such as the energy justice framework and the core tenets of doing intersectionality. For example, codes such as “distributional injustices” or “user experiences with smart technologies” or “limitations of current justice frameworks” provided a descriptive basis for deeper exploration. While open coding relied heavily on my theoretical grounding, I remained open to emergent codes—concepts or phrases from participants’ own words such as “structural injustices” —which grounded the analysis in my empirical context.

Step 3: Axial Coding – Relating and Reassembling

Once open coding had identified key low-inference or descriptive codes, axial coding followed as the next logical step. This phase involved reassembling the data by exploring interrelationships between the low-inference codes. Axial coding allowed me to link low-level codes such as “inefficiencies in customer engagement” with other codes like “institutional barriers to

intersectional justice.” It deepened my understanding by highlighting how themes interconnect, moving from fragmented insights to a more coherent narrative.

Step 4: Selective Coding – Crafting a Narrative

In the final stage, selective coding was applied to refine and integrate the codes into a central, cohesive narrative. This focused on identifying core categories that encapsulated the central phenomena in my study, such as “barriers to intersectional engagement in smart energy practice” or “emerging strategies for operationalising intersectionality.” Selective coding enabled me to align the findings with the overarching research objectives and develop new theoretical insights.

While the coding process was structured, it was not strictly linear. Following the principles of grounded theory, I revisited earlier stages to accommodate emergent themes or refine existing codes. Axial and selective coding sometimes necessitated the creation of new lower-level codes or the merging of existing ones. This iterative approach ensured that the analysis remained true to the data while evolving alongside my theoretical understanding.

In line with the qualitative nature of this thesis, I did not prioritise the number or frequency of codes to avoid them being conflated as indicators of significance. Instead, the analysis focused on identifying patterns and outliers to uncover nuanced insights. By adopting this layered and reflexive approach to coding, I tried to navigate the complexities of qualitative data while maintaining alignment with my research objectives.

3.4.2 Writing as a Space for Analysis and Closure

After completing the coding process, I transitioned to writing the results chapters, initially grappling with how to balance capturing the depth of each organization’s interests, motivations, and future applications of intersectionality without being overly descriptive. With guidance from my supervisors, I reframed writing as more than just a means of presenting findings—it became an integral part of the analytical process. Writing allowed me to observe and refine the emerging

central narrative of the thesis while also serving as a space to reflect on and bring closure to 3.5 years of doctoral research.

While the coding process provided the foundation, writing enabled me to synthesise insights, draw connections, and articulate theoretical contributions. Chapters 5 and 6, in particular, became spaces where the analysis came to life. Writing these chapters involved weaving together codes, theoretical insights, and practical implications. For example, while earlier stages of coding highlighted patterns and anomalies, writing helped articulate their relevance to the broader context of intersectionality and energy justice in the UK.

	How	Outcome
1. Indexing	Read all transcripts. No parts are skipped. Segregate data into broad categories of themes.	Data reduced from 400 pages to 320 pages, with broad codes such as “smart energy technologies” or “vulnerable smart energy consumers” used to categorise only chunks of data relevant to research inquiry. 20 broad codes were generated, such as: <ul style="list-style-type: none"> • <i>Smart energy technologies</i> • <i>Intersectionality</i> • <i>Organizational roles</i> • <i>Justice frameworks in smart energy</i> • <i>Barriers to inclusion</i>
2. Open Coding	Read the outcome from Step 1, with reference to research questions as well as theoretical frameworks informing the study.	Several sets of new codes which divide earlier data into smaller chunks of data which are interconnected through the code such as “structural injustices” – still broad and descriptive. Around 45 descriptive codes were created, including: <ul style="list-style-type: none"> • <i>Structural injustices</i> • <i>Limitations of current justice frameworks</i> • <i>User engagement with smart technologies</i>

		<ul style="list-style-type: none"> • <i>Intersectionality in practice</i> • <i>Definitions of vulnerability</i>
3. Axial Coding	Read the outcome from Step 2, with more attention to theory building and constant reflection around latent meanings.	<p>Moving beyond descriptive narratives towards reflective, inductive, and analytical narratives through new codes which interconnect already existing categories of data.</p> <p>Approximately 15 interconnected codes emerged, examples include:</p> <ul style="list-style-type: none"> • <i>Institutional barriers to intersectional justice</i> • <i>Inefficiencies in customer engagement</i> • <i>Social determinants of energy vulnerability</i> • <i>Intersectionality as a design principle</i>
4. Selective Coding	Read all codes in parallel. Using Google Sheets, an all-case matrix was created to develop an overall cohesive narrative.	<p>Interconnected sets of excerpts with headings such as “emerging strategies for operationalising intersectionality” that can be developed into writing of the results chapters.</p> <p>8 core themes were identified to guide the narrative, such as:</p> <ul style="list-style-type: none"> • <i>Emerging strategies for operationalising intersectionality</i> • <i>Barriers to intersectional engagement in smart energy practices</i> • <i>Institutional power dynamics in smart energy transitions</i>

Table 3.6: 4-Step Non-Linear Coding Process for Data Analysis

Note: This table outlines the 4-step non-linear coding process used to analyse data from all phases of data collection. Steps 2-4 were performed iteratively, incorporating emerging insights throughout the process. For the full list of codes, please refer to Appendix I.

	Example Quote: “So, I think ultimately it is like a positive thing that it can be nuanced, and you can have a discussion and also it can change and evolve over time because Ofgem regulations are for at	Example Quote: “We're doing an event in a couple of weeks and speaking on the panel to talk about intersectionality and what we are doing with it to challenge ways of looking at intersectionality. He got more
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	least for this regulatory period which is 5 years. Ofgem has a huge role to play here, in determining what counts as vulnerability.” (<i>Cody, Energy Distributor, Workshop 1</i>)	excited when I was like, Ofgem will be there. It’s a great chance to showcase what we do and that we take consumers seriously.” (<i>Ffleur, Energy Distributor, Workshop 3</i>)
	Codes Assigned	Codes Assigned
Step 1: Indexing, Broad Codes Identified	Organizational Roles	Organizational Roles
Step 2: Open Coding, Descriptive Codes Identified	Definitions of Vulnerability, Short-termism in policy measures	Institutional Practices of Intersectionality, Organizational Motivations to Engage with Intersectionality
Step 3: Axial Coding, Interconnected Codes Identified	Epistemic authority in smart energy transitions, Institutional agency in shaping/contesting epistemic authority	
Step 4: Selective Coding, Core Themes Identified	Institutional power dynamics in smart energy transitions	

Table 3.7 Illustrating the steps of the coding process using example quotes.

Note: This table demonstrates the progression of the coding process across four stages, highlighting how interconnected quotes and themes become increasingly integrated as the analysis advances to higher coding levels.

One of the most challenging aspects of the writing process was balancing the richness of the data with the need for focus and clarity. The sheer volume of data, codes, and analytical insights far exceeded what could be included in a single thesis. Writing required careful deliberation to decide what to include, prioritising relevance, transformative justice, critical attention to institutional power dynamics, while retaining the diversity of perspectives gathered during the research. This process involved constant negotiation—distilling complex, multifaceted data into accessible arguments without oversimplifying.

Writing also provided a forum for theorising about the study’s contributions. By engaging deeply with the data during the writing process, I could move beyond mere description to interpretation and theory development. It helped me more than just describe patterns in the data; it allowed me to theorize about two critical contributions of my thesis. First, by analysing data and

engaging thoroughly with the three-pronged intersectional framework, I identified which aspects of the UK's smart energy transitions can be effectively informed through an intersectional lens. This, in turn, can contribute to a more just and equitable transition by highlighting areas of inequality that may otherwise be overlooked.

Second, based on the data from Phases 2 & 3, I explored the practical challenges and opportunities of operationalizing intersectionality within three connected smart energy organizations in the UK. These practical insights highlighted both the difficulties of integrating intersectional praxis in institutional settings and the potential for organizations to use intersectionality to tackle entrenched issues of energy justice.

Throughout this process, I tried to move beyond mere data description and into interpretation (Coffrey, 2018). By integrating my observations, qualitative data, and reflections on my positionality and philosophical orientation (described in section 3.2), I could not only describe the data but also ascribe meaning to it, grounded in the perspective that I brought through my unique positionality.

3.5 Ethical considerations

Conducting research on social justice issues within the context of SETs demanded a deeply reflexive and iterative approach to ethics. Formal ethical approval for this research was secured from the University's SCI S-REC (Faculty of Science Research Ethics Subcommittee) under application number ETH2223-0050 on 15th September 2022. Ethical concerns, however, were not confined to this procedural step. Instead, they emerged throughout the research process, requiring ongoing reflection and, at times, revisions to the initial plan. Any unforeseen ethical dilemmas were discussed with the committee, and approvals were updated as necessary. Below, I summarise some key ethical considerations.

Firstly, due to the close proximity with which UK energy stakeholders work and given that some stakeholders offer unique perspectives which could render them identifiable, anonymity and consent were critical. All 11 interviewees and their organizations, as well as all three case study organizations and the 18 participants were anonymised. For ease of analysis and readability of this thesis, they were assigned pseudonyms along with proxy designations which capture their job titles. All data collected was anonymized for research publications unless otherwise agreed upon with the organization. Before beginning any data collections, participants were assured anonymity, and informed consent was obtained. They were encouraged to share as openly as possible to ensure that the findings were both actionable and contributed to honest discussions on intersectionality in the smart energy sector.

Secondly, in one of the co-design conversations the benefits to participants in the case study came up. Although I had not thought about this, it emerged that although one organization felt it was beneficial to participate in my case study, they wanted to involve some frontline energy advisors as the topic of intersectionality would be particularly relevant to them. This meant that they would have to take crucial time away from their important work with energy poor households, while at the same time cost them working hours which they could not afford as they primarily relied on donations. I considered this an important ethical concern in my research, as I thought I would benefit greatly from their perspectives, but did not want to take their participation for ‘free’.

As such, I made an application to the Ethics Committee at my university, requesting whether I could compensate the organization for their time monetarily through my personal research funds allocated by the Horizon 2020 program. Contingent upon ensuring that the participants do not feel obliged to take part in the research and understand what the study entails and how it could benefit them personally, the committee approved my request, and £900 were paid to the organization for participation.

Thirdly, although intersectional analyses often centre on the complex lived experiences of individuals, I made the decision to exclude direct research with energy consumers or households due to ethical considerations. My research planning coincided with the peak of the cost-of-living crisis following the sharp rise in energy prices in November 2022. During this period, an estimated one in four households in Great Britain were struggling to afford basic warmth, significantly impacting their well-being (Middlemiss, 2022).

Given the immense pressure households were already facing, I felt that involving them in research could add to their cognitive and emotional load during a time of crisis. This decision was also informed by feedback during the early mapping phase of my research, where several organizations working directly with vulnerable households advised against initiating new engagements at that time, citing risks of traumatization and ethical overload. Their guidance reinforced the need for careful boundary-setting in times of crisis, while also highlighting the broader gap in sustained, ethically grounded, user-focused research that centres lived experience—an area I see as vital for future inquiry within intersectional energy justice work. This decision undoubtedly represents a limitation of my research design, as it constrains the direct exploration of individual experiences at the household level. However, I sought to mitigate this by incorporating the flexibility case studies (Appendix H), conducted with my three case studies. These studies allowed me to maintain a focus on households, albeit indirectly, by engaging with stakeholders who work closely with them. While developing the case studies, I had to be careful in using words which sensitively reflect the vulnerable characteristics they describe. While the studies were fictional, they were based on research from organizations such as Citizens Advice (c.f. Citizens Advice, 2023), and as such it was critical to be mindful to avoid misrepresentation.

Finally, throughout the research process, I remained cognizant of the professional and personal demands on participants' time. To reduce participant burden, I introduced mechanisms such as self-reflection templates, voluntary participation and flexible scheduling for one-on-one

interviews wherever possible. These efforts ensured that participants could contribute meaningfully to the research without feeling overwhelmed or pressured.

This chapter has detailed the methodological approach and data collection strategies employed across three distinct yet interconnected phases of this research. Phase 1 (*Map*, November 2022 – January 2023) critically explored the emergence of energy injustices in the UK's smart energy transitions, mapping the actions and contributions of key stakeholders and analysing the impact of smart energy developments on justice outcomes. Phase 2 (*Engage*, September 2023 – January 2024) examined how organizations in the smart energy sector address social justice issues, evaluating the potential of intersectionality as a critical tool to enhance or challenge current approaches to justice. Phase 3 (*Apply*, September 2023 – February 2024) focused on identifying opportunities within participants' work where intersectionality could be practically applied, assessing its potential to deepen efforts in addressing energy injustice in the context of SETs.

These research phases employed a context-sensitive, co-productive, and phronetic approach, offering an iterative framework to understand and operationalise intersectionality in smart energy practice. This ensured that both broad systemic issues and sector-specific challenges were explored in a way that was grounded in real-world contexts and responsive to stakeholder insights.

The insights generated through these phases will be presented in the results chapters, where I analyse how intersectionality can offer transformative potential in reshaping smart energy transitions toward greater equity and justice.

4. Emerging evidence on the social impacts of the GB Smart Meter Rollouts: A perspective beyond energy justice

This first results chapter examines the social justice implications of smart energy technologies (SETs) in Great Britain⁸, using the smart meter rollouts, initiated in 2011, as a point of departure. Drawing on insights from 11 semi-structured interviews, this chapter analyses two primary topics:

(i) the latest evidence on the impacts of the smart meter rollouts, framed through the energy justice triumvirate: distributive justice (e.g., benefits disproportionately favouring higher-income households), procedural justice (e.g., exclusion of vulnerable households from the design and trials of demand-side solutions), and recognition justice (e.g., misrecognition of households with specific sociotechnical needs, such as those using pre-payment meters or living in low-efficiency homes);

(ii) the deployment of SETs onto pre-existing inequalities within the UK's energy landscape. These systemic inequalities—shaped and sustained by the neoliberal market structure—were starkly illuminated by the 2022 energy crisis during which energy prices tripled, which coincided with and therefore constituted an important backdrop to my interviews.

My analysis underscores interview participants' perspectives on the need for a truly transformative approach to SETs, one that moves beyond superficial fixes to address these systemic inequalities. Interview participants further highlight that as the UK's energy landscape is significantly reshaped by smart technologies, it presents an opportunity to prevent the injustices of current energy systems from being perpetuated in future ones. Based on these discussions, I

⁸ While talking about the smart meter rollouts, I shall refer to Great Britain (GB), as Northern Ireland has a separate rollout and the data in this chapter only applies to GB. However, while referring to the broader energy market and the NetZero transition, I will refer to the United Kingdom (UK) as this is defined by the Department of Energy Security & NetZero (DESNZ) for all 4 UK nations.

conclude this chapter by arguing that intersectionality, with its radical commitment to dismantling oppressive systems, offers a fitting lens for understanding and addressing this in impactful ways.

While various technologies, business models, and evolving stakeholder roles shape the social justice landscape of the UK's smart energy transitions, this section focuses on smart meters. As the foundational technology enabling other smart energy advancements, smart meters have been widely promoted by the government, heavily funded (Sovacool et al., 2017), and have reached nearly two-thirds of British households (DESNZ, 2024), making them a pivotal focus for any analysis of the social justice implications of SETs.

Falling short of their original goal for 100% rollout by 2020, the Department for Energy Security and Net Zero (DESNZ) has now set a revised target to cover 74.5% of GB households by the end of 2025 (Update on the Rollout of Smart Meters, 2023). However, studies from consumer advocacy organizations reveal significant challenges: 54% of users report dissatisfaction with their smart meters (Citizens Advice, 2024), and 16% indicate device malfunctions (Which?, 2024). These numbers raise concerns not only about rollout speed but also the effectiveness of installations and their energy-saving potential. Numerous studies show that already marginalised groups are more likely to experience these issues and less likely to benefit from the technology (Update on the Rollout of Smart Meters, 2023; Citizens Advice, 2024; CSE & National Grid, 2023).

In this chapter, I examine the social justice impacts of the rollout through the energy justice lens, drawing primarily from my expert interviews and supplemented by academic, policy, and industry data where relevant. While academic studies have previously explored this (Section 2.2), I provide the most recent evidence, as these were conducted during the initial stages of the rollout. Furthermore, my analysis offers two key distinctions from earlier studies:

- (i) **it adopts a whole-system approach** - zooming out and reflecting on the social justice impacts of smart meters beyond accessibility to the meters and ease-of-use, focusing also on which types of households are being left behind not only

from the rollouts, but also from future developments enabled by smart meters and why. As such my analysis will discuss both injustices in the smart meter rollouts and how they impact the smart energy landscape in the UK more broadly.

- (ii) **it goes beyond the household level** to include an examination of the roles and responsibilities of key energy stakeholders in ensuring that the largest government-run rollout in GB history is delivered through just mechanisms.

4.1 Distributive Justice: Who has benefitted most from the smart meter rollouts?

Distributive justice addresses the equitable distribution of energy resources, benefits, and costs. Most analyses of the smart meter rollouts thus far have been focussed on costs and benefits, although they do not provide exact numbers. This is primarily because as the rollout remains incomplete, system-wide benefits and costs are merely speculative. The predecessor of the current DESNZ, the Department for Business, Energy and Industrial Strategy's 2019 Cost-Benefit Analysis projected total rollout costs at £13.5 billion and benefits at £19.5 billion, with a benefit-cost ratio of 2.86 (BEIS, 2019). However, these projections did not account for rollout delays, rising energy prices, or fines imposed by Ofgem on slow suppliers (Update on the Rollout of Smart Meters, 2023). No updated assessments of these cost-benefit distributions have been conducted.

While distributive analyses thus far have been focussed on costs, my analysis goes beyond by also assessing improved energy literacy as a potential benefit to households. Additionally, I conceptualise access to smart meter data as a form of capital (Sadowski, 2019) for stakeholders such as suppliers and DNOs, providing them with a competitive edge in developing and profiting from emerging smart services like heat-as-a-service.

These uncertainties regarding the quantification of distributive impacts, were also acknowledged by most of my interview participants, however, they stressed that any assessment would remain inaccurate since access to financial data relating to suppliers or distributors, for example, can be challenging and on the consumer side, the financial benefits vary greatly based on how much different businesses and households utilize and engage with smart meters in reducing their energy consumption. The following sections will thus detail the distributive impacts across GB households and other stakeholders involved in the rollout based on experts' perceptions of cost-benefits distribution not based on exact quantitative analyses.

4.1.1 Affluent households might have benefited disproportionately

All interview participants noted that affluent households have disproportionately benefitted from smart meter rollouts, though they found it challenging to quantify the extent of this disparity. As illustrated in the quotes below, these benefits often accrue to households equipped with technologies like electric vehicles (EVs), which allow them to take advantage of the smartness of their meters, for example by smart charging during periods of excess renewable energy production.

I mean, obviously there have been consumers for whom it has worked well. So for example, there are those consumers who are more sophisticated users, maybe EVs or something who can now access cheaper tariffs and need a smart meter to do that, so probably if you want me to identify the one stakeholder that has benefited, I would say consumers who are able to take advantage of the tech to reduce their energy costs of their devices, primarily electric vehicles. (Spencer, Energy & Climate Change Think Tank).

Households who have benefitted undoubtedly are people with EVs who can smart charge them during off-peak hours. That has been transformational. I think that's the clearest business case for getting a smart meter that I can see... and the biggest success story (Samuel, National Charity).

These snippets confirm that an access to a smart meter in conjunction with a technology like EVs is currently favoured by flexibility market design. Such households can access financial

incentives by shifting their energy consumption to cheaper (and cleaner) times or by participating in demand flexibility trials. This means that households with high electricity usage, access to upfront capital for technologies like EVs, heat pumps, solar panels, and home batteries etc. are the ones that have benefitted and are likely to continue to benefit as the SETs-enabled flexibility market grows.

None of the interview participants who highlighted the disproportionate benefits of SETs for affluent households addressed other critical factors, such as gender, age, family size, dwelling efficiency, or occupancy. When prompted to consider household characteristics beyond affluence, income, or access to technologies, interview participants frequently expressed uncertainty or admitted insufficient knowledge to comment. This lack of awareness signals a critical gap in understanding the distributive impacts of SETs.

This gap is particularly concerning given a recent report by the UK House of Commons' Committee of Public Accounts underscored that the benefits of smart meters are not equally distributed across energy consumers.

We are concerned that smart meters are not achieving the consumer benefits they are supposed to and are benefitting certain, often wealthier, consumers more than others... If consumers are older, male, on high incomes, or homeowners then they are more likely to have smart meters. Wealthier people are also more likely than less wealthy people to be able to purchase new replacement appliances (such as washing machines) if their smart meter suggests high running costs of older appliances they may own.

Update on the rollout of smart meters, House of Commons, Committee of Public Accounts, 2023, pg. 5

As seen in the excerpt above, the report specifically highlighted disparities linked not only to income but also to age and gender. In response, the Committee called on DESNZ to refine its evidence base to better identify the consumer groups that benefit most from these technologies. While the evidence consistently shows that high-income households are the primary beneficiaries of SETs, the extent to which other characteristics influence these benefits remains unclear. This

oversight is significant, as it neglects households disadvantaged by additional factors known to affect engagement with SETs (section 2.2). Consequently, these inequities risk remaining outside stakeholder consideration. What is overlooked cannot be measured, and what isn't measured risks deepening future injustices in SETs.

Beyond the distribution of the financial benefits, interview participants also pointed to studies in both academia and industry that have shown that households who engage with their smart meters and actively monitor their energy usage can save small amounts on their energy bills but more significantly, experience an increased understanding of their energy consumption behaviour, as highlighted by Fiona below.

I think in terms of benefits for households, it's that visibility of energy consumption that is important. Without smart meters, energy is just an invisible commodity you are consuming. Improved energy literacy coupled with having accurate bills...so not having estimated bills that makes a significant difference to people – particularly those in fuel poverty. They can have that feeling of being a bit more in control, potentially, around what their energy costs are going to be....and I am concerned that this benefit is only being enjoyed by those who have been prioritised in the smart meter rollouts – those early adopters. (Fiona, Digital Energy Not-for-profit).

Thus, energy literacy is a key benefit of smart meters. Beyond providing greater control over energy consumption and costs, enhanced energy literacy equips consumers to adopt and adapt smart technologies to meet their specific needs, optimize energy usage, and challenge exploitative tariffs or business practices. Concerns regarding the uneven distribution of energy literacy benefits, particularly among 'early adopters,' were raised by eight other participants. These disparities were also evident in a recent consumer survey linked to the National Grid's Demand Flexibility Service (DFS)—the largest demand response trial in Great Britain to date (National Grid ESO, 2023). The survey highlighted the underrepresentation of younger individuals and renters, groups less likely to own smart meters and, consequently, less informed about their energy consumption, in this inaugural DFS.

Some groups were significantly underrepresented in the survey respondents. This includes younger people, renters, people in London and Scotland. White British respondents were overrepresented and other groups underrepresented, particularly Asian or Asian British. Females are slightly overrepresented. The age profile of male respondents is older than for female respondents. Survey participants were predominantly better off, with a high representation of older retirees and professionals. Most do own their own homes, more households than average had solar PV.

- DFS Consumer Survey, July 2023, pg. 35

Respondents who were ‘predominantly better off’ and White British were overrepresented. However, it remains unclear if this bias is also present in the entire sample of DFS participants as not all participants were surveyed. Despite these recent reports, interview participants believed that data on the benefits across households with smart meters is lacking, and therefore, predicting their distributive impacts remains challenging.

It is important to note that just as interview participants were uncertain about which other household characteristics other than income could have benefitted households, they also frequently mentioned certain vulnerable characteristics that could have disadvantaged households – these characteristics are well-established in literature on energy inequalities in the UK and includes tenants, elderly, households with children etc. To simplistically assume that these households have not had any benefits is problematic. In some interviews, this was an important topic of discussion.

As Catherine argues below, while some vulnerable⁹ households may have accessed digital services for topping up their pre-payment meters it still remains difficult to assess how much this benefit is relative to other households who might have financially benefitted from accessing

⁹ The interview participants and the literature analysed tend to variously use low-income households (LIHs), vulnerable households and fuel poor households to interchangeably refer to all households who are disadvantaged by smart energy transitions.

cheaper tariffs. Given that the smart meter rollouts are consumer-funded, this is a significant knowledge gap in understanding the full distributive impacts of the rollouts.

I guess we don't know much beyond just who has access to a smart meter... I'd assume some vulnerable households will find it easier to use or top up their meters if they are able to do it via a digital app, but I guess it is hard for me to make these relative judgement calls because I don't really know how it's distributed, and I don't really know the cost and benefits. But I mean, we are all paying for the smart meter rollout but certainly we're all not gaining from it (Catherine, Energy Policy & Advocacy Group).

Another issue which came up was bundling all vulnerable households together which oversimplifies a heterogeneous group, as indicated by the quote below. Some of these households with large, flexible energy demands could have benefited significantly if prioritised, while others, already engaging in energy self-rationing, are unlikely to gain from demand flexibility trials.

The low-income household group is very heterogenous, for instance, a low-income household could have a very big demand, that is very flexible in which case they'd benefit, but in some cases it's also possible that they have a very small, inflexible demand and they are consuming very little in the first place, so it doesn't really make a difference to them. So those households that are rationing now, smart won't do much for them – because they don't have much to reduce (Tristan, NetZero Think Tank).

This heterogeneity among vulnerable households is exemplified when examining households such as those on prepayment meters (PPMs). These households might have experienced both advantages and disadvantages from the rollouts. Vulnerable groups, including households with disabilities or special needs, are more likely to use PPMs and face disconnection due to inability to afford top-ups (figure 4.1). Transitioning to smart PPMs has reduced travel costs and inconvenience by enabling digital top-ups and easier access to emergency government schemes for these households, as indicated in the quote below.

So, where we get really valuable feedback on the smart meters is from people who have moved from traditional prepayment to smart prepayment. So, the difference there in terms of being able to pay for their energy online - not having to go to a shop, being able to visibly see when they're running out, being able to

apply for emergency credit as well, and being able to see how much energy budget they have left has been very valuable according to reports from households (Fiona, Digital Energy Not-for-profit).

However, in early 2023, it was reported that suppliers had remotely switched several vulnerable consumers with a smart meter to prepayment mode. This resulted in vulnerable households being disconnected as they did not have the economic means to top up their smart PPMs and had to temporarily live without electricity and heating during the winter of 2022 (c.f. REF, and quote from Martin below). After criticism from organizations like Citizens Advice, Ofgem banned remote switching to PPMs.

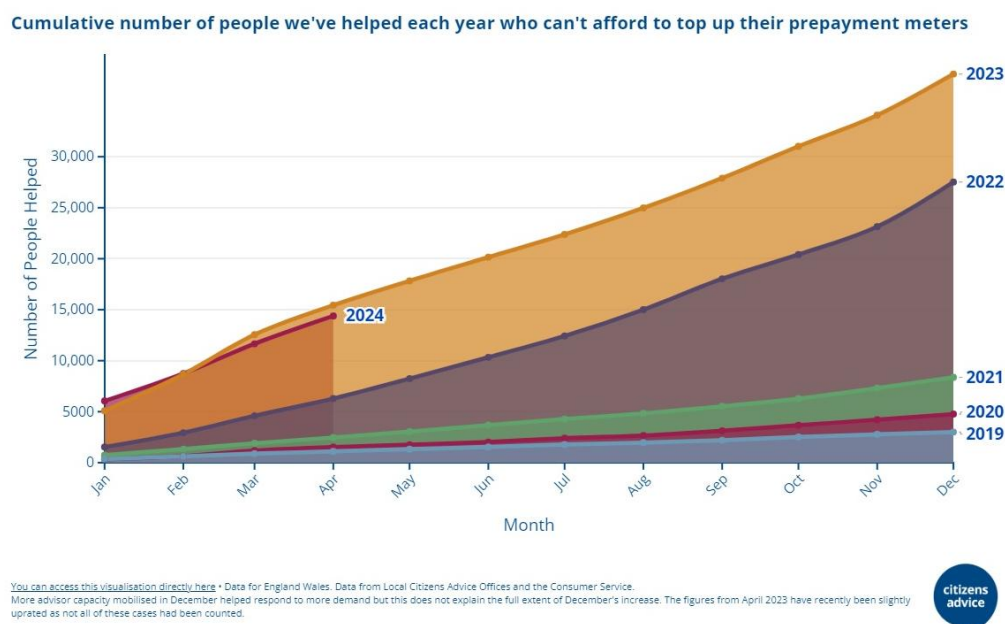


Figure 4.1: Impact of the 2022-2023 Energy Crisis on Households with Prepayment Meters (PPMs).

Note: The number of households on prepayment meters reaching out to Citizens Advice for assistance quadrupled during the 2022-2023 energy crisis, underscoring their heightened vulnerability within the UK energy landscape (Source: Citizens Advice, accessed 30th May 2024).

On the flip side, there were cases where customers struggling to pay direct debits or following poor advice were remotely switched to prepayment meters. Some, like an elderly man without electricity for two weeks

who thought it was a power cut, didn't realise they'd run out of credit. These supply chain decisions can inadvertently lead to severe consequences if left unchecked" (Martin, National Volunteer Network).

The distributive justice implications of the smart meter rollouts reveal a complex, uncertain, and concerning picture. While precise cost-benefit analyses remain unavailable, stakeholder perspectives suggest that certain sociodemographic groups—such as low-income households (LIHs), those with long-term health conditions, and households in fuel poverty—have likely not experienced the benefits of these initiatives. In contrast, affluent households with access to technologies that leverage SETs appear to benefit disproportionately. Moreover, distributive justice discussions often default to binary categorizations—affluent versus vulnerable households—overlooking the significant heterogeneity within both groups. This underscores an urgent need for granular, evidence-based data to illuminate the uneven distribution of risks and benefits associated with smart meter rollouts, enabling more accurate evaluations of distributive justice impacts and more just SETs.

4.1.2 Suppliers and DNOs: The Primary Beneficiaries of Smart Meter Rollouts?

As indicated earlier, a key difference in my analysis of the smart meter rollouts compared to earlier studies is an assessment of distributive impacts not just among households, but also among other important stakeholders in the smart energy landscape. Interview participants believed that the smart meter rollouts currently favour energy suppliers by providing valuable data and reducing operational costs, such as the need for manual meter readings, as highlighted in the quotes below. Suppliers could use this data for better energy use predictions and wholesale market forecasts. 9 out of 11 interview participants agreed that suppliers might have benefitted the most, although, once again, there is a lack of transparent data on the overall benefits. Suppliers like Octopus and Ovo have been proactive in leveraging smart meter opportunities, leading in innovation and associated services.

I think the main benefit right now is for suppliers, with access to data simplifying operations and reducing costs like meter readings. However, delivering the rollout is a huge cost and reputational issue for them. DNOs are only starting to explore smart meter data to support consumers in their areas. (Fiona, Digital Energy Not-for-profit)

For suppliers, smart meters reduce operational costs and improve forecasting for wholesale purchasing and imbalance management—though whether they are fully realising this is debatable. DNOs are gaining better visibility of grid-end activity, which is a significant advantage. (Martin, National Volunteer Network)

Distribution Network Operators (DNOs) were also mentioned as the top beneficiaries by 7 out of 11 interview participants, as they are starting to explore the benefits of smart meter data to enhance grid management, although they are still behind suppliers in this regard, as indicated by Fiona above. This outcome is not unexpected, given that SETs are inherently designed to facilitate bidirectional information flow between consumers and energy suppliers or distributors. However, the distributive impact of these rollouts is significant: 6 out of 11 participants believed that suppliers and DNOs likely benefit more from these technologies than households.

Despite widespread perceptions that energy suppliers and DNOs are the primary beneficiaries of smart meter rollouts, representatives from these organizations presented a contrasting view, downplaying their own advantages. Ewan, from a distributor, emphasised that although suppliers and DNOs gain operational efficiencies and improved data for energy management, households benefit the most.

Customers have benefitted the most, followed by suppliers and then us. There's good data for network planning and diverse tariffs, but we aim to pass these benefits back to customers, especially vulnerable ones. How much suppliers have truly benefitted remains unclear due to a lack of transparent data (Ewan, Energy Distributor).

Similarly, a supplier representative (Katie) claimed that the DNOs have benefitted the most, emphasizing that while these operational benefits are clear for the DNOs and National Grid,

it remains uncertain whether these benefits will flow through the entire system to benefit the consumers.

It depends on what we mean when we say benefit. I think the ability to use demand side response has benefited the National Grid and the DNOs. The ability to reduce their operations through better planning and network optimisation should have massive financial benefits to them. Whether these benefits are shared by them and if that flows through the entire system remains to be seen (Katie, Energy Supplier).

These insights from DNO and supplier representatives highlight a landscape where perceptions of smart meter rollout benefits diverge. While external stakeholders often view suppliers/DNOs most of which are large corporations as the primary beneficiaries, those within the industry argue that consumers gain significant advantages. This contradicts reports that consumers face unfair additional costs due to inefficiencies, such as cancelled installation appointments and faulty meter replacements. It also diverges from BEIS's cost-benefit analysis mentioned earlier which calculated household benefits were at £7.5 billion, compared to £8 billion for industry, with an additional £1.3 billion potentially accruing to households via demand flexibility (BEIS, 2019).

Lastly, fewer interview participants identified other stakeholders as major beneficiaries of the rollout. Energy technology companies, such as those producing EVs, heat pumps, and smart batteries, were seen as significant beneficiaries, as they can integrate their products with smart meter data to enhance product value.

There are also definitely the energy technology companies – those who produce batteries and solar panels and heat pumps etc. I would say they have benefitted from this in a *major* way – they've been able to ensure that there is a proposition for their customers to access more value from their products (Tristan, NetZero Think Tank).

Additionally, the Data Communications Company (DCC), which controls smart meter data, was perceived as a major benefactor.

The DCC has benefitted the most, with a generous price control system and annual funding increases, but their performance hasn't been that impressive. I would like this as an anonymous statement **laughs** (Samuel, National Charity).

As Samuel argues, despite receiving funding and holding the authority to control access to smart meter data, the DCC's performance has faced significant criticism. Participants noted that data sharing from smart meters and the generation of household energy consumption insights have fallen short of stakeholder expectations. While some of these gaps could have been addressed under the DCC's leadership, they were not. This view was echoed by a portion of the interviewees, with 4 out of 11 participants identifying persistent challenges in the DCC's overall operations.

4.2 Procedural Justice: Evaluating the Fairness of Processes in Smart Meter Rollouts

4.2.1 Top-Down Mechanisms in the Delivery of Smart Meters

The procedural dimension of the energy justice framework addresses the fairness of processes that shape energy-related decisions and outcomes. It emphasises the importance of inclusive, transparent, and equitable practices in policymaking, implementation, and regulation, as outlined in section 2.2. In the context of smart meter rollouts, procedural justice necessitates actively engaging low-income households, renters, and other vulnerable groups to understand and address their specific needs. However, prior research (Sovacool et al., 2017) highlights the top-down nature of these rollouts, with limited household consultation leading to rejection or ineffective use of smart meters. My findings corroborate and extend this evidence, as demonstrated in the quotes below.

I mean I have no idea what the proportion is, but I think most people somewhere along the line they've got the smart meter fitted and then it has stopped working because they switched supplier, or maybe because it was faulty and you think well, what was the point of that? And so, they're back doing their own estimated readings, you know, and no one will come out and sort it out. So, you think what a waste of time (Spencer, Energy & Climate Change Think Tank)!

...and all the people on SMETS1 meters that don't work anymore **laughs**... I mean the most *basic* functionality is that they send accurate readings to suppliers but that has not happened. So, I suppose there have been lots of promises, but along the way lots of things have gone wrong. There seems to be such a disconnect with the ground reality. (Samuel, National Charity).

The top-down approach is evident in Samuel's observation, highlighting a disconnect between rollout targets and practical implementation. The emphasis appears to be on completing installations rather than ensuring smart meters are effectively used. Ofgem, for instance, has penalised suppliers up to £1 million for missing installation quotas but has imposed no penalties for failing to replace faulty meters (Update on the Rollout of Smart Meters, 2023).

This prioritisation could marginalise certain households further especially because it reflects an install-and-go mindset, which could add to the stress of energy vulnerable households. This is in line with research on new energy technologies which shows that early adopters easily accept them, while vulnerable households often struggle since they are often an afterthought, bolted on to processes designed without explicit consideration of their needs. For instance, research by Energy Systems Catapult (Project Involve, 2021) confirms this trend and highlights how these procedural injustices are typically addressed only retrospectively. Smart meter rollouts exemplify this neglect, as highlighted in the quote below.

Well, this has been a classic non-consumer driven, top-down roll out, you know it has been almost a sort of an object lesson in how not to do it **laughs** There are a lot of stakeholders for whom smart meter deployment has not been a happy experience and that has put them back in terms of their willingness to accept technology as a vehicle to help them with their energy needs so a lot of people have had an unhappy experience and they will therefore be very wary in future and that will be to their disbenefit (Spencer, Energy & Climate Change Think Tank).

Suppliers focused on meeting rollout targets and maximising profits often overlook the diverse needs of households in the heterogeneous GB energy market. This top-down approach fosters one-size-fits-all solutions, neglecting specific needs of certain vulnerable households who

could have benefitted significantly with minimal effort. The issue is exemplified by the case of Scottish dynamic teleswitch meters, as described by Samuel:

People who should have been prioritised but ended up being left behind are those with dynamic teleswitch meters. These are like 1980s smart meters in Scotland, switching on storage heaters when the grid offers cheap electricity via a radio signal. There are only a few of them, so there are limited tariffs, and those tariffs aren't competitive. The Competition and Markets Authority investigated and said more needed to be done. Ofgem's response? *'Smart meters are the answer, and we'll roll them out to this group first.'* But, they're still waiting for the smart meter solution, even half a decade later. These households, often in poor housing, low-income, and living in Scotland's biting cold, could have really benefitted but haven't. It's extremely disappointing" (Samuel, National Charity).

Households with outdated dynamic teleswitch meters—predominantly low-income, in poor housing, and exposed to Scotland's harsh winters—were identified as needing priority attention. Yet, despite regulatory recognition and promises of smart meter rollouts as a solution, these households have waited over five years without resolution. This neglect exemplifies how blanket policies fail to account for specific circumstances, leaving vulnerable groups further marginalised and excluded from the benefits of smart energy advancements.

The one-size-fits-all approach also extends to communicating the benefits of smart meters, failing to tailor messages to different household types. While the way diverse households could benefit from SETs varies, there is a lack of targeted narratives to explain how specific households might benefit under their unique circumstances. This gap in communication also represents a procedural injustice, fostering fear and resistance among vulnerable households, as highlighted in the quotes below.

There's a huge issue of understanding. That lack of understanding breeds fear and worry about things you don't understand. And if you're wary of something, you'll reject it. We don't have a clear narrative on the role and relationship consumers will have with energy going forward. It's bonkers! Smart energy tech is incredible—it improves comfort, convenience, reduces costs, and helps us decarbonise. We just need to communicate different benefits to different audiences! (Tristan, NetZero Think Tank)

I don't think we've quantified the benefits well. Eight out of 10 people at the pub wouldn't have a clue why a smart meter is better. It's about careful, consistent articulation of benefits that builds credibility. Smart meters are a bit like Marmite—some love them, some don't—but with a campaign that speaks to everyone, we'd have more believers than sceptics. (Ewan, Energy Distributor)

Thus, the current top-down approaches to smart meter rollouts prioritize installation quotas over meaningful use, marginalizing vulnerable households and fostering procedural injustices related to targeted communication, proactive support for diverse household needs, etc. This raises critical questions about SETs: How are vulnerable households being left behind in the rush to meet targets? How can a one-size-fits-all approach ever address diverse needs? Without tailored solutions and inclusive communication, how are we perpetuating inequities rather than resolving them?

4.2.2 Should vulnerable households purposely be excluded from DSR trials?

Some interview participants noted that the lack of consideration for the diversity in household needs in the smart meter rollouts also extends to demand-side response (DSR) trials. Although these trials are theoretically open to all, participation is unequal, as highlighted in the National Grid survey on the DFS in section 4.1.2. One key barrier is the lack of clear and understandable information about how households can benefit from their smart meters, for example, by opting in for variable tariffs – yet the information available continues to remain confusing and untransparent, as Tristan suggests below.

And of course, it's a good idea to roll out smart meters to let consumers benefit from dynamic price tariffs or DSR and save money. But if they don't trust these tariffs—and every month you get a surprise with a new variable tariff calculated in a very untransparent way through some extremely complex index from the wholesale market... I mean, I work in energy and haven't got a clue—imagine struggling households! If it's

not clear, and you don't understand what's behind it, you probably won't engage and would rather stick to a fixed price tariff (Tristan, NetZero Think Tank).

This issue is particularly concerning for vulnerable households, such as those with specific medical needs or those experiencing fuel poverty, who already face significant anxiety over energy bills. For these households, the prospect of opting into a tariff without a clear understanding of how monthly bills might fluctuate can foster fear and uncertainty. As a result, many may choose to disengage from flexibility initiatives altogether. Providing these households with clear, detailed, and accessible information is essential to build trust, alleviate fears, and empower them to participate confidently in energy flexibility programs. Aside from a lack of clear information, interview participants also suggested that a lack of tailored communication within DSR programs is a significant issue. Amelia's perspective highlights that excluding vulnerable households from these programs might be prudent to prevent harm. Encouraging participation without accounting for unique circumstances risks grave consequences, as those most responsive to energy reduction messages are often the ones who should be maintaining or even increasing their energy consumption for their well-being.

There are major dangers in not engaging end-users in demand side response because it can cost people their lives. Research by the IEA shows that those most receptive to demand reduction messages are often those who need to maintain or increase their energy consumption. Meanwhile, higher-consuming, well-off households tend to be more inflexible. I'm very sceptical about DSR, particularly when targeted at early adopters who just want to have fun with it (Amelia, Fuel Poverty Research Organization).

Additionally, even though DSR can help some households save money or feel empowered, vulnerable households may already consume less than they need for safe and comfortable living. Asking these households to reduce energy use further could jeopardize their health and well-being. As Katie (who works for a supplier that has been a trailblazer in DSR schemes) pointed out, the goal of DSR is not to force everyone to shift their energy load but to ask those who can to participate voluntarily.

We're not forcing people to participate. It's totally optional. If just 5% of the country shifts load, you stop a coal power station from turning on. It's not about everyone participating but asking those who can. This balancing of the grid helps those who can't, so maybe it's good to exclude vulnerable customers to avoid pressuring them (Katie, Energy Supplier).

Although comparing this with both the quotes above, it seems that this message that it is voluntary is not understood by vulnerable households who might feel compelled to participate or overestimate their cost savings potential. Some interview participants, like Natalie, viewed the exclusion of low-income households as an expected feature of market dynamics. They argued that new technologies typically begin with affluent early adopters who can afford them, driving down costs over time and gradually increasing accessibility.

So, lots of new technologies will start off with more affluent consumers, because those are the people who are going to buy them. And that brings the cost down. And that's just how technology deployment works, so I don't think that's entirely unreasonable to leave low-income households out. From my perspective, I think the big problem in terms of smart is that there aren't enough metres and there aren't enough markets – the rollout is just too slow (Natalie, Energy Markets Association).

From this perspective, the initial exclusion of low-income households is seen as a pragmatic outcome of the economic trajectory of technology deployment, rather than an inherently unjust process. Thus, while smart meter-enabled DSR participation could yield significant savings to vulnerable households, there is tension between inclusion, protection, and market-driven logic. This highlights the need for tailored DSR programs that not only balance these competing priorities but also actively ensure vulnerable households are neither unfairly excluded nor inadvertently harmed during the transition.

4.2.3 Procedural Justice: Untapped Smart Meter Data – The Key to a More Equitable Energy Future

Interview participants unanimously agreed that energy consumption data visibility holds transformative potential for all stakeholders, from policymakers to households. However, realising

this potential requires seamless and transparent data sharing, which remains hindered by inefficient and opaque procedures. The existing discourse on procedural justice has largely focused on ensuring fair access to smart meters or empowering participation in DSR trials. Yet, the procedural inefficiencies that obstruct the flow of critical data—thereby limiting its benefits for vulnerable households and other stakeholders—have been overlooked in the literature. This section addresses this gap.

I think the visibility that the smart meter provides around energy use is critical to helping with all the rest of it. I also think for a lot of government measures in terms of energy efficiency, how do they know that those measures are working as planned? And unless they have the data to support that, to show that people aren't using their heating as much because they have better insulation, for example. Or if someone is at the risk of self-disconnection. You need the smart meter to provide that data, so I think it's really important to prioritise access to that data. And of course, people need to be informed properly about how their data will be used and by whom. It requires patience but it is key (Fiona, Digital Energy Not-for-profit).

As Fiona highlights, smart meter data is essential not only for helping consumers save money and supporting policymakers in achieving Net Zero targets but also for evaluating energy efficiency retrofits and identifying vulnerable households at risk of self-disconnection. However, as Amelia from the Fuel Poverty Research Organization warns, leveraging this data must be approached carefully to avoid causing stress or anxiety among vulnerable households. While this data could enhance understanding of demand patterns, its constant display may inadvertently create more harm than good, particularly for those already struggling with energy costs—a concern even felt by individuals like Amelia, who do not face financial difficulties.

Smart meter data could improve our understanding of vulnerable households' demand patterns, but I worry about the anxiety this constant display of data causes. Even I find it unsettling, and I can afford to pay my bills. For some, it might do more harm than good. (Amelia, Fuel Poverty Research Organization)

Furthermore, Fiona highlights below that smart meter data could play a role in identifying fuel-poor areas and enabling targeted interventions, promoting more just outcomes for vulnerable

households. However, current procedures often aggregate data to safeguard consumer privacy, limiting its ability to reflect the nuanced challenges faced by these groups. While data aggregation is vital for protecting personal information, Fiona suggests that refining these processes could unlock the potential of smart meter data beyond NetZero goals, driving equity-focused initiatives.

I think we need to proactively recognise that we can use smart meter data beyond accomplishing NetZero targets. DCC can provide access to data at an aggregated level so stakeholders can start identifying areas of fuel poverty which can make it easier for them to optimize support by targeting the right areas. And I think that is important but bringing it down to that personal level is far more difficult to do because it is a very personal choice and consumers don't want to think of their data going everywhere, understandably, but there must be some consensus on how to adopt procedures that could facilitate that? I don't know, it's tricky. (Fiona, Digital Energy Not-for-profit)

Ewan, who works with the senior management of an energy distributor, emphasizes that smart meters offer an unprecedented opportunity to gather disaggregated, half-hourly data, providing a detailed understanding of household energy consumption. This level of insight could enable a shift from generic energy-saving advice to tailored recommendations, significantly improving energy efficiency and financial well-being for vulnerable households. However, current funding for personalized energy advice remains insufficient and most advice is general.

Funding for tailored energy advice to vulnerable energy consumers is insufficient. However, industry is fit for stepping into some of those gaps...we go out to 900,000 customers a year on energy efficiency advice. But again, it's a generic model. You know, rather than just being turn your lights off here and there, we need to give them that specific advice that could make a massive difference...and with smart meters, for the first time we could have access to half-hourly data....there's a level of depth about household energy consumption rather than just breadth that we could unlock and start to focus on. This could be a gamechanger. (Ewan, Energy Distributor)

Industry players like them, Ewan argues, must step up, refining data disaggregation processes to deliver targeted, impactful interventions that could enable the energy efficiency

savings smart technologies guarantee. In order for this vision to materialise, procedural justice is needed, to ensure that the disaggregation does not come at a cost to vulnerable households.

The top-down, one-size-fits-all approach to smart meter rollouts has not only prolonged the process, leading to inefficiencies and delays, but also neglected critical procedures for data collection, sharing, analysis, and insight generation. This represents a significant procedural injustice, as these procedures would likely have been prioritized if affluent households or suppliers experimenting with new business models had demanded them. Instead, their absence hampers efforts by policymakers, charities, and frontline organizations to use smart meter data to identify and support vulnerable households. Prioritizing these processes is essential to empower those working to alleviate energy vulnerability.

4.3 Justice as recognition

4.3.1 Recognition is foundational for just smart energy transitions

Justice as recognition refers to acknowledging and respecting the identities, experiences, and needs of all individuals and groups within a society. It emphasizes that everyone is seen, heard, and valued in the decision-making processes that affect their lives.

The discussions I had with my interview participants confirmed that misrecognition of the specificities of household needs highlighted by earlier studies has continued. As Natalie points out, this is evident in some adopting smart home technologies like Alexa while rejecting smart meters due to data concerns. Generic messaging about data safety protocols appears insufficient to address these fears.

People are really worried about what's going to happen to their data with smart meters. For some reason, they're not comfortable with it...like they think the trade-off isn't worth it. I mean it's irrational because

they're fine with other smart products like Amazon Alexa *laughs*...but maybe they feel the benefits are worth the risk to their data. But with smart meters, they just don't see the value. We need to tell a much better story about why smart meters are important. Right now, the information we're giving isn't convincing enough. How do we change their minds? (Natalie, Energy Markets Association).

This nuanced understanding of households' diverse relationships with smart technologies could help suppliers engage them effectively especially as the rollouts are now targeting those who are not early adopters. As the rollout targets 85,000 daily installations to meet DESNZ goals, acknowledging these dynamics will be crucial.

Another quote relates to the debate on inclusion of vulnerable households in DSR trials highlighted in section 4.2.2. Demand flexibility services enabled by smart meters may not benefit all households equally, emphasizing the need to recognise unique household routines and motivations. For example, voluntary services designed for upper-income households with older members may inadvertently harm low-income families with young children as Amelia highlights. Motivated by cost savings, such families might reduce energy use during peak times, disrupting essential routines like television time, crucial for children's well-being.

My colleague researches energy poverty's impact on children... incentives to adjust demand can disrupt routines, like bath times or winding down with TV during peak hours. Older people, meanwhile, take flexibility programs too seriously, cutting heat to unhealthy levels (Amelia, Fuel Poverty Research Organization).

This highlights the importance of understanding motivations. Older consumers, influenced by wartime public announcements, may view flexibility programs as directives, reducing energy use to potentially harmful levels, Amelia added. These examples highlight that smart energy solutions must account for user motivations, daily life impacts, and unintended consequences to avoid creating new burdens. Recognizing these factors can help suppliers and policymakers design demand flexibility services that address diverse household needs without exacerbating inequalities.

Deliberately collected and responsibly shared smart meter data, coupled with fair procedures like tailored energy advice, provides a practical and impactful pathway to advancing energy justice and addressing inequalities. As Fiona notes,

Even among people who have got a smart meter, I think some people need more support than others to benefit from that, and there's certainly a role here for other organizations who are supporting people around their energy to understand how these smart meters work in fuel poor households and what they can tell us about their relationship with energy. This is the simplest way of making smart technologies work for vulnerable consumers, I think. (Fiona, Digital Energy Not-for-Profit).

Thus, I argue that integrating justice as recognition into smart meter rollout strategies and broader energy initiatives ensures inclusive participation while advancing sustainability goals and reducing energy consumption equitably. Thus, justice as recognition is foundational to achieving both distributive and procedural justice because it ensures that the unique identities, experiences, and systemic barriers faced by diverse groups are acknowledged and addressed, thereby creating equitable processes for participation and fair distribution of benefits across all households.

4.3.2 Justice as recognition within innovation processes

Circling back to the exclusions highlighted in the distributive justice impacts in section 4.1, current DSR programs often exclude vulnerable households due to their circumstances. However, as Samuel notes, innovatively appropriating technologies and business models could help include these groups in the future energy system. Solutions like integrating smart electric and thermal batteries into these households could make energy consumption appear flexible to the grid without disrupting household routines.

Some people just can't respond to DSR due to their circumstances. But what if we put electric and thermal batteries into homes? From the grid's perspective, it looks like usage is reduced, but nothing changes at home. This could be a gamechanger. (Samuel, National Charity).

Samuel emphasises the importance of proactively understanding who is being left behind and finding ways to include them – justice as recognition must therefore be at the heart of such innovation. Ewan further highlights that this requires recognising the needs of those not naturally benefiting from smart technologies and developing tailored products to address their challenges.

What products do we need to positively discriminate? How do we incentivize flexibility markets to create solutions for hard-to-reach households? Some fuel-poor households may have the most malleability but face the biggest barriers to entry. Yet, system-wide consensus to prioritize them is extremely challenging. (Ewan, Energy Distributor).

They argue that the current focus on early adopters to reduce costs needs to shift. Flexibility markets must incentivise participation through mechanisms beyond mere return-on-investment, prioritising hard-to-reach households.

As the smart energy system progresses towards greater automation, trust emerges as a critical factor that could benefit from justice as recognition. The previous section highlighted how "one-size-fits-all" procedures erode customer trust, an issue compounded by the failure of the current smart meter rollouts to engage diverse households. Automation offers the potential to keep bills low by scheduling appliance use in ways that suit household requirements and access cheaper energy. However, as Catherine points out, enabling households to trust automated systems requires carefully addressing design, communication, and pricing structures based on their specific needs.

For automation to work, people must trust that organizations act in their best interest, keeping their bills low and meeting their household needs. The rollout hasn't engaged enough households effectively—it's been a dumb meter rollout. Rebuilding trust is essential. (Catherine, Energy Policy & Advocacy Group)

Financial accessibility must also be recognised to ensure all households can benefit from smart energy technologies, particularly fuel-poor households. Many vulnerable households cannot afford the significant upfront costs of technologies like heat pumps or smart controls. As Samuel

highlights, innovative financing solutions—such as low-cost loans or supplier contracts focused on energy efficiency—could address these barriers.

Low-income households shouldn't have to pay upfront for technologies like heat pumps. Grants or loans where savings offset costs could make these solutions accessible, ensuring vulnerable households see lower bills without the financial burden. (Samuel, National Charity)

To summarise, the future of a just and inclusive smart energy system hinges on proactive innovation which includes those traditionally left behind. Current smart meter rollouts and associated flexibility trials and tariffs have excluded vulnerable households, focusing on early adopters while neglecting those with the greatest barriers to entry. Integrating smart technologies such as electric and thermal batteries, automating energy flexibility, and offering innovative financing mechanisms can address these inequities. However, achieving this requires a fundamental shift: trust must be rebuilt, one-size-fits-all approaches must end, and flexibility markets must prioritize hard-to-reach households. Justice as recognition which is key to both procedural and distributive injustices must guide this transformation, ensuring no household is left behind.

4.4 Neoliberal energy markets and systemic inequalities

My analysis of distributive, procedural, and justice as recognition dimensions underscores the deep-seated injustices in the UK's smart energy transitions. Vulnerable households face limited access to flexibility schemes as well as systemic neglect in smart meter rollouts that prioritize affluent early adopters. Procedural inefficiencies, such as the absence of tailored data-sharing processes, further marginalize those who could benefit most. Yet, while the energy justice triumvirate vividly exposed injustices—and how they erode trust, amplify existing energy inequalities, and reinforce systemic neglect—it falls short of offering solutions or prescribing how to mitigate them. This failure stems from a reliance on retrospective critiques that lack a normative framework to interrogate the structural roots of injustice (section 2.5).

This was reflected in my results – the interview questions derived from the energy justice triumvirate framework (Appendix C), could not alone uncover systemic justice issues without relying on my *"What do you think?"* section.

The interviews were conducted against the backdrop of the 2022–23 energy crisis which exposed the depth of injustices in the energy landscape and the inadequacy of existing policy responses. Triggered by the Ukraine war and post-COVID inflation, energy prices tripled, leaving 1 in 4 British households unable to afford heating, despite government measures like the Warm Homes Discount (Simcock and Robinson, 2023). This crisis not only amplified existing inequalities but also created newly vulnerable populations. As Samuel from the national charity observed: *"Prices were already unaffordable before they went up... Everything that has happened over the last years has exposed how deep these inequalities are and how desperately we need to do things differently."*

To investigate the structural drivers of these inequalities—particularly the neoliberal market design—I framed interviews within this crisis context. Using academic statements critiquing market structures and advocating for systemic change, I encouraged participants to reflect on systemic injustices. These statements, summarized in Appendix C, prompted interviewees to open up about the deeper structural issues shaping energy inequalities.

In the discussions surrounding these statements, the need to tackle systemic causes of energy inequalities was a theme in 8 out of 11 interviews, with interview participants worried that looking for solutions in business-as-usual scenarios was futile, for instance, Catherine argues that quick fixes (bandages) to deep-rooted inequalities are insufficient.

The cost of energy is unrealistically high...no one should be paying the current prices, which are likely to stay for another 12 to 18 months. We need to focus on the root of the problem, and I am worried that the energy price cap is just putting a bandage on the problem. Instead of temporary fixes, we need significant investments in renewables, infrastructure, tailored advice to ensure long-term price stability. The energy price cap freeze raises concerns. People will bear the cost later, potentially falling into debt or risking their health by not heating their homes....

The assumption that the market will fix everything is everywhere...that it is the best way to achieve inclusivity...but this is flawed. Energy is a basic need, not a consumer good, and should be accessible to all at affordable rates (Catherine, Energy Policy & Advocacy Group).

Catherine's views are compelling, because they have co-authored a recent influential report on justice and smart technologies. They argue in the quote above that the inequalities arise due to an emphasis on energy as a commodity within a competitive neoliberal market structure. This approach tends to overlook the fundamental necessity of energy for survival. The argument posits that the discourse among GB energy stakeholders should shift to recognize that while energy prices are indeed high, the solution lies in guaranteeing a minimum amount of energy to all households. This would ensure that energy, as a basic need, is accessible to everyone, thus addressing both affordability and equity issues.

Later in the interview, I asked what role they think SETs had in mitigating energy poverty, and once again, we arrived at the topic of structural market reforms. This time, the discussion went deeper into their perceptions on the role of the market and the need to confront the realities of how the liberalised nature of GB's energy sector propagates and/or sustains consumer vulnerabilities.

There's potential for smart energy technologies to alleviate energy poverty, but only with radical market reforms. The energy market creates poverty, not the technology. For smart solutions to work, the market must prioritise those in need with cheaper electricity access. Currently, energy is treated as a consumer good, with liberalised markets expecting active consumer engagement. This complexity disadvantages vulnerable households, who may lack the capacity to navigate tariffs or switching. Energy should be a basic right, ensuring minimum household needs are met regardless of supplier or pricing complexities (Catherine, Energy Policy & Advocacy Group).

My interviews corroborate academic, policy and industry research, affirming that the 'switch and save' strategy has not been effective in ensuring fair energy pricing (see quotes from both Catherine above and Spencer below) and yet it remains the predominant delivery mechanism

for new pricing, even in the future smart grid. Many energy consumers find it too challenging to switch suppliers due to the complexity of determining which option is better, despite the availability of energy advice. This difficulty is especially pronounced among lower-income and vulnerable households, who struggle the most with these choices.

The consumer approach developed over the past decades has proven to be not only unhelpful but detrimental. There has been a lack of direction and development from the consumer side simply because it is too complex, but the 'switch and save' narrative has led suppliers to adopt a "don't lose" rather than a "win" strategy. Most consumers don't switch suppliers, resulting in government intervention and fines for companies. This creates a system where everyone is disadvantaged (Spencer, Energy & Climate Change Think Tank).

Even energy suppliers who were considered the biggest beneficiaries of SETs, such as the one founded in the past decade whom I interviewed, agree that the current market structure is flawed. Their representative (Katie) highlighted that the systems are burdened with inefficiencies stemming from their 1970s origins. Despite the liberalisation intended to promote competition, many energy producers, not just the Big Six¹⁰, are profiting excessively, the interview participant argues, claiming also that this scenario benefits everyone in the market except the consumers.

Yeah, the systems are bloated with inefficiencies because they were built in the 1970s and the energy producers are making a ton of money when they shouldn't be. When we talk about windfall taxes, we need to look beyond just the Big Six because others in the liberalised market are also massively benefiting right now.... everyone except consumers! (Katie, Energy Supplier).

Thus, even though it was assumed that competition would be enough to keep prices low, protect consumers, and drive innovation, what is emerging in the context of a smart and flexible future energy system is continued disadvantages to consumers, and a systematic exclusion of

¹⁰ In the UK energy sector, the "Big Six" refers to the six largest energy suppliers that have historically dominated the market: British Gas, EDF Energy, E.ON, RWE Npower, Scottish Power and SSE.

vulnerable households. As argued in the quote below, the current innovations around SETs are being guided by a search for fertile markets.

Since DSR and the smart energy market are mostly driven by market forces, developers are naturally looking for fertile markets to build their businesses rather than tackling the challenging ones (Spencer, Energy & Climate Change Think Tank).

However, this was the most contentious topic emerging from the interviews. Despite most interview participants expressing serious concerns over exclusion of vulnerable households from DSR trials, 4 out of 11 interview participants expressed optimism that market mechanisms will ultimately benefit everyone within the energy system. As Fiona, argues, it is acceptable to exclude vulnerable consumers for now, as this serves to protect them from the uncertainties of a developing market where the benefits of demand-side response are not yet guaranteed. This perspective suggests that as the market matures and stabilizes, the advantages will become more widespread, eventually including even the most vulnerable households.

It's really important that all consumers get involved in this development so that solutions are made for everyone, not just a select few. I understand why organizations start with early adopters to see if things work and how they work. From that, you can develop services that help those who can't or won't engage with the system but still benefit. So yes, I agree it's happening (DSR development excluding vulnerable households), but I'm not saying it's necessarily a bad thing. But yea, we do need progress, but we also need something that brings everyone along (Fiona, Digital Energy Not-for-profit).

In neoliberal markets prioritizing competition, achieving transparency is challenging (Cardullo & Kitchen, 2019), especially in the context of the global development of smart technologies (Sadowski, 2020). A key issue is the reluctance to share data, as firms protect their innovations to maintain a first-mover advantage. This approach, rooted in aggressive *do first, fail fast, and learn later* strategies, often results in valuable insights being withheld, hindering societal benefits. Worldwide, energy companies face excessive costs transitioning from fossil fuel-

dependent systems, and therefore, if they find means to lower these costs, it further discourages data sharing. Martin highlights this issue.

It's all just wrapped up and it's certainly harder... with innovators and community groups and people who are operating with a different set of values, it is really hard for them to get into the game, and to really start setting the terms of how energy should be produced and consumed so... there needs to be more kind of a collaboration or an opening up for innovation to be done by organizations driven by public good or an environmental motive... rather than just how much can we sell. Because then we'd start to push against some of these kind of market constraints that serve to protect the profits of the biggest organizations... (Martin, National Volunteer Network).

Furthermore, neoliberalism's embrace of techno-optimism (Brady, 2014) is evident in austerity-driven European governments turning to technologies like SETs and hydrogen as catch-all solutions for complex societal challenges (Cardullo & Kitchin, 2019). This reliance allows them to champion high-tech narratives while sidelining critical but less glamorous interventions, as Willem critiques:

Policymakers obsess over technologies while neglecting effective measures like renovations, which are more impactful for low-income households. Comparing dynamic pricing benefits to even shallow renovations, renovations win. Yet, indiscriminate subsidies, like Belgium's €100 to all consumers, waste resources that could support sustainable solutions for vulnerable populations. Governments love flashy tech but fail to fund essential programs like building upgrades. (Willem, European Consumer Organization).

This obsession with technology is reflected in the case of smart energy transitions. Despite the tremendous increase in resources such as government funding for the smart meter rollouts, establishment of Smart Energy GB which deals solely with smart energy advice and advocacy, and the availability of energy consumption data of nearly two-third British homes, there remains a significant gap in addressing the needs of the most vulnerable populations, as I have demonstrated throughout this chapter. The smart meter rollouts have been fraught with challenges, missing targets multiple times despite strict regulations and substantial spending. I argue that this failure

highlights the inadequacies of a system driven by profit-driven innovation and the allure of technological solutions as silver bullets.

From the findings of this chapter, it follows that the neoliberal market's focus on techno-optimism and a belief that the benefits of smart technologies will trickle down from the early adopters and suppliers and distributors to vulnerable households, has led to a lack of a nuanced, tailored approach necessary for successful and inclusive smart energy transitions.

I argue instead that an inclusive smart transition should develop comprehensive strategies that consider the social and economic contexts of all households – a strong consumer narrative on the benefits of smart technology, and a focus on consumer empowerment through increased energy literacy, as argued by Spencer.

Government needs to take the lead, but a significant barrier is that energy policy and strategy have historically focused on the supply side. It's always about building large, impressive engineering projects where officials can have ribbon-cutting ceremonies. When discussing long-term energy policy, the focus tends to be on nuclear power, hydrogen, smart batteries, or offshore wind, with little to no consumer narrative. We must include households as active participants – and I mean *all* households (Spencer, Energy & Climate Change Think Tank).

Dominant neoliberal logics—competition, profit-driven innovation, and trade secrecy—deeply influence the energy landscape driving the proliferation of SETs, shaping even the perspectives of independent advisors tasked with consumer protection and support, as Amelia explains:

The person from NEA started by saying, "Well, of course, we need to prioritize economic growth." I come from the opposite position because the constant chase for economic growth has led to a very unequal distribution of resources. The growth experiment hasn't worked. What struck me was how conventional this viewpoint is. Volunteer community organizations and charities stick to dominant paradigms because they have to. Their funding depends on aligning with the prevailing ideas of government and Western society.

So, it's no surprise that people want to keep doing things the way they've always been done. Someone is going to have to do the radical thinking, haven't they?

But it worries me that people are not prepared to be radical at a time of such deep crisis.

Surely this is a time for new ideas (Amelia, Fuel Poverty Research Organization).

The complexities of the UK's energy market and its role in sustaining inequalities require deeper exploration, which is beyond the scope of this thesis. However, this section underscores the urgent need for radical interventions to ensure a fair smart energy future. My interviews went beyond the energy justice framework's tenets, exploring not just the nature of injustices and where they lie but also why they persist and how they should be addressed.

4.5 Intersectionality and inclusive smart energy transitions

In this chapter, I analysed grey literature - such as policy reports on the smart meter rollouts and evaluations by regulatory bodies—alongside expert stakeholder interviews to address the first research question: **How do the ongoing smart meter rollouts in Great Britain impact social justice, and to what extent do they address intersectional concerns?**

Using the energy justice framework, I demonstrated that affluent consumers—particularly upper-to-middle-income households, older, White, and without special needs—are more likely to be both recipients and active users of smart meters. This disparity has positioned these groups as the primary targets for ongoing smart energy market offers, such as the Demand Flexibility Service (DFS) run by the National Grid.

Furthermore, I highlighted that the current smart meter rollouts continue to lack thorough engagement with the diverse relationships GB households have with energy and smart technology. As a result, they have perpetuated existing inequalities within the energy system. The need for transformative thinking is evident, creating space to interrogate systemic forces underlying these entrenched inequalities, which, if left unaddressed, risk being carried into the smart energy future.

My findings align largely with previous work on the topic that employed the energy justice lens but I have updated the evidence by connecting the literature on smart meter accessibility to the emerging literature on flexibility justice, emphasizing that smart meters serve as key access points to these initiatives, thereby broadening the understanding of their distributive impacts.

Crucially, my analysis reveals that the energy justice lens, while valuable, falls short in capturing the normative implications of the unjust distribution of costs and benefits. This limitation is particularly evident in the context of remote switching, where the unfair impacts exacerbate existing inequalities and represent a gross misuse of power, as underscored by the interview quote below.

Yes, the prepayment metering is scandalous. I mean what we're seeing at the moment is that basically energy companies do not want to spend the next...I don't know five years recovering the debt from this period (of high energy prices), so they're doing everything in their power to prevent the most vulnerable people getting into debt, even if that means it puts them into a untenable situation financially, so I've seen it myself I've had my direct debit just ramped up without consultation. People being switched on to prepayment meters without having a say is ridiculous abuse of the smart meters (Catherine, Energy Policy & Advocacy Group).

Through the energy justice lens, the disproportionate burdens placed on households with prepayment meters (PPMs) can be evaluated against the benefits they receive from smart meters. However, the profit-driven motivations of suppliers, which created these risks in the first place, remain unexamined. This deeper understanding is essential for developing effective interventions to address these injustices.

Interview participants also provided valuable perspectives on an overlooked discussion regarding how SETs are being layered onto an already unequal energy system and the systemic factors that sustain these inequalities. My analysis underscores that smart energy transitions are predominantly framed as a technological challenge—evident in the fixation on ensuring every British household has a smart meter—and as an economic and innovation challenge, driven by the

belief that market experimentation with smart energy features will eventually lead to benefits trickling down.

This narrow framing has led to the neglect of alternative approaches to smart energy, energy sufficiency, and addressing the systemic causes of fuel poverty. Moreover, it has stifled critical reflection on the difficulty of challenging dominant paradigms within the UK's energy market. Inclusive smart energy transitions are, therefore, as much a social and political challenge as a technological one. They must create space for deliberation and evidence-building to challenge the belief in the invincibility of market mechanisms, fostering critical reflections on market competition, techno-optimism, and neoliberalism in perpetuating energy inequalities.

Thus, my analysis in this chapter highlights that there is growing concern that the benefits of SETs are unjustly distributed across social groups and that the 'usual suspects' underlying these inequalities enshrined in market logics need to be investigated.

My analysis calls for additional analytical frameworks that can better address underlying power structures, providing a more comprehensive understanding of not just who benefits and who pays - but also providing a normative grounding for (smart) energy justice - what leads to this distribution and why, and most importantly what should be done about it.

As highlighted by Catherine below, the conversation around a truly just future smart energy system is a difficult conversation involving historic and current injustices, radical ideas, direct and indirect burden of decarbonisation, and these conversations are uncomfortable but necessary.

We need to have more conversations about the moral responsibility of energy consumption, especially for people who have constrained incomes. These folks put the least demand on the energy system but don't get any benefits from it. Meanwhile, if you have a lot of money, you can buy as much energy as you want without question. It's seen as your right to heat your swimming pool and drive multiple Tesla cars because you can afford it.

Until we start questioning this, smart technologies alone won't be enough. I'm not saying we don't need better technologies—we absolutely do. We need to install heat pumps and decarbonize homes, but this has to be part of a broader public discussion about why we're doing it and what it means for everyone's responsibility in managing energy and making sure it's affordable for all – and those conversations can be extremely uncomfortable. (Catherine, Energy Policy & Advocacy Group).

Catherine's insight highlights the intersection between systemic inequality and moral responsibility, underscoring that technology alone cannot solve deeply ingrained injustices. Instead, these discussions must extend beyond technical fixes to confront uncomfortable truths about energy consumption, privilege, and affordability. This necessitates a shift in public discourse to challenge assumptions about entitlement and demand greater accountability, making social justice a central pillar of energy transitions.

Building on this, the final two results chapters, examine how intersectionality—as both a critical method and a radical orientation (section 2.5)—can be applied to analyse SETs through a transformative lens. These chapters will demonstrate how intersectionality offers not only fresh critiques (normative) but also practical solutions for emerging injustices (prescriptive).

As Ewan, whose organization extended their involvement in my research through the case studies, highlights:

Best of luck with your topic—it's a good one! One word of advice when you visit us: make it actionable for us. The theory is great, we have been talking about it a lot internally, but the challenge is implementing it. How do you get an intersectionality model to fit into business as usual? Even if we manage to implement it internally how do we get others to understand the theory? That's been tough. So, focus on how the energy industry can follow the theory and actually put it into practice (Ewan, Energy Distributor).

This challenge of applying intersectional ideas in practice will be a central theme running through the analysis in the next chapters. They will explore how the robust framework that intersectionality provides for critiquing injustices and imagining equitable alternatives, can be integrated into practice settings where its transformative potential could be translated into actionable strategies.

5. Current approaches to intersectionality and smart energy technologies (SETs)

In the previous chapter, I outlined the need for engaging with social justice in smart energy transitions as a valid normative concern in itself instead of merely for practical outcomes such as to increase the uptake of smart meters and greater participation in the flexible energy market. Through stakeholder interviews, I highlighted the need to address the root causes of unequal impacts, such as neoliberal market structures, and to discuss the burdens and benefits of decarbonization among different social groups. I also highlighted how intersectionality could provide a transformative lens to address these issues and explore how it can be applied in practice.

In this chapter, I will present the findings from a case study with three leading UK organizations at the forefront of smart energy transitions. Through group and one-on-one dialogues, I created critical spaces for participants to reflect on the practical incorporation of intersectionality in their work. I modified the theoretical core of intersectionality and brought it to these practice spaces (section 3.3), exploring how intersectionality could be operationalized in real-world settings. The findings from this exercise will be discussed in the current and following chapter.

First, I provide a brief overview of each organization, detailing their roles in the ongoing smart energy transitions and their efforts to promote fairness, inclusion, and social justice. Next, I categorise their motivations for engaging with intersectionality through my work as either intrinsic or extrinsic, highlighting the background work and projects driving their interest.

I then examine how participants engaged with intersectionality, focusing on its core tenets, their connections to previous social inclusion projects, and the insights these reflections offer about the potential applications of intersectionality in the context of smart energy. Finally, I analyse how each organization conceptualises intersectionality using Christoffersen's (2021) five practice-

oriented definitions. These definitions provide a lens for understanding how intersectionality is operationalised within organizational practices and for assessing their alignment with its radical principles. Collectively, these discussions offer a comprehensive analysis of how organizations currently approach and apply intersectionality, linking their motivations, practices, and conceptualisations while addressing the second set of research questions.

2(a) How do organizations conceptualize intersectionality in the context of SETs?

2(b) To what extent do they engage with or neglect intersectionality in practice, and why?

5.1 Case Study Organizations: A Brief Introduction

5.1.1 The charity

The charity is an independent organization committed to tackling the climate emergency through addressing energy injustice and making renewable energy affordable to all. Their mission revolves around creating a fairer energy system, empowering individuals and organizations to rethink energy consumption, and alleviating fuel poverty. The charity's work spans diverse domains, from supporting net-zero ambitions at a policy level to addressing the root causes of those who cannot afford heat during winters.

Collaborating with councils, community groups, and organizations, they help design and implement practical strategies. Their tools and insights are widely used by decision-makers at local and national levels to ensure energy transitions benefit everyone, particularly vulnerable households. Fuel poverty remains central to the charity's *raison d'être*. Their advice service reaches thousands of households, helping them reduce bills, access benefits, and improve home energy efficiency. Their ability to blend on-the-ground advocacy with strategic research has made them a respected voice in shaping the UK's energy policies.

The charity's reputation as a trusted stakeholder extends to their work on the UK's smart energy transitions. Their research into inclusion issues within the smart energy market has involved partnerships with suppliers, network operators, and other charities. They have conducted studies to explore how vulnerable households interact with emerging smart energy technologies and markets, such as flexibility services enabled by smart meters. One notable project led by a senior executive at the charity, Catherine, who also participated in my interviews (chapter 4), focused on understanding household characteristics that may lead to exclusion from flexibility markets.

This multi-stakeholder project was widely acclaimed for its comprehensive approach to inclusion. However, the team recognised the need to explore new frameworks for justice, particularly to address gaps in their understanding of overlapping vulnerabilities. During my interviews, I introduced the idea of applying intersectionality to smart technologies to Catherine. The discussions resonated, prompting her to share the idea with the team working on the aforementioned project. Recognising the potential of intersectionality to offer fresh perspectives on justice, the team sought practical insights on how to integrate this framework into their work. Between June and September 2023, I collaborated with the charity to discuss and develop a detailed plan for applying intersectionality within their organizational practices (chapter 3). In October–November 2023, the case study was conducted.

5.1.2 The social enterprise

The social enterprise originally focused on replacing a coal and gas-fired county-level power station with a series of renewable energy projects. Now, its mission has expanded in response to growing national momentum toward a NetZero energy system. Today, the organization plays a vital role in facilitating the transition to renewable energy at local levels, operating at the intersection of technology, community, and sustainability.

Positioned as an intermediary between the complexities of NetZero technologies and local communities, the social enterprise's goal is to implement renewable energy systems that benefit both people and the environment. Its projects range from large-scale roof-mounted renewable energy installations on businesses, schools, and community buildings across the south-eastern county where it operates, to supporting local energy efficiency initiatives. Additionally, it partners on innovative pilot projects that advance community energy initiatives, often incorporating smart energy technologies like smart meters and batteries to optimise variable energy generation.

Distinct from other organizations in this study, the social enterprise is deeply rooted in its local county. Therefore, its scope is regional rather than national, and this proximity offers a unique perspective on energy inequalities, which the team observes directly within the communities they serve. This grassroots connection has influenced their work, embedding justice, fairness, and ethics into the design and implementation of their smart energy projects. For instance, during a recent smart energy trial, the social enterprise publicly shared its findings and called for ethical considerations such as ensuring communities not only receive information about smart technologies but also understand the implications of their installation. They have also emphasised the need to design flexibility schemes that prevent harm now or in the future.

Unlike the other two case study organizations, the social enterprise did not have prior contact with me. However, its emphasis on justice in smart energy projects made it a recurring name during my interviews. I reached out to the team in September 2023, and after several email exchanges and online meetings, we finalised the details of their participation. The case study took place between December 2023 and January 2024.

The social enterprise's motivation for participating in the study stemmed from its desire to refine its internal ethical framework into a practical toolkit for enhancing accessibility and expanding inclusivity within smart energy. The team sought to use insights from intersectionality to reach more diverse communities and develop inclusive products. This collaboration was also

an opportunity for the organization to reflect on its internal diversity practices, including plans to diversify its non-executive board to ensure a broader range of representation and thought leadership.

5.1.3 The energy distributor

The energy distributor, a key player in the UK's energy market, operates and maintains distribution networks in key regions of the UK. While it has several operational areas, it has most recently established itself at the forefront of smart energy transitions. It has developed a comprehensive digitalisation strategy targeting both households and businesses. Positioned at the forefront of flexibility innovation, the organization develops offers for end-of-grid users to engage in flexibility markets, enabling the efficient use of energy, minimising energy costs and supporting decarbonisation. Their initiatives aim to capture the flexibility market by fostering participation among diverse consumers efficiently integrating renewable energy into the grid while ensuring they save operation and maintenance costs.

Recognising that smart and flexible energy systems demand significant new capabilities from energy consumers, the energy distributor has been vocal about the need for inclusivity. They have initiated, funded, and co-developed numerous projects centred on flexibility and social inclusion. These projects particularly focus on understanding how barriers such as limited digital skills or unfamiliarity with flexibility markets hinder certain households. The organization has also been proactive in exploring intersectionality to analyse how social factors intersect to create unique challenges or opportunities for different households. They argue that the complexity of household experiences must be understood to design equitable and effective solutions.

However, the organization has faced criticism for its handling of costs related to social initiatives. It has been scrutinised for passing the costs of energy advice for vulnerable households onto other customers' bills. Critics, particularly the regulator Ofgem, have called on the

organization to absorb these costs internally rather than shifting the burden to consumers already grappling with rising energy prices. While the distributor defends its approach as a balanced strategy that distributes the significant costs of advice internally and among consumers who are not vulnerable; public perception remains mixed, underscoring the tension between its profit-driven structure and its social commitments.

The distributor's decision to participate in my research was driven by two ongoing projects: Project Pathfinder and Project Flex. The former, a collaboration with the charity, explores low-carbon technologies, while the latter focuses on household demand flexibility. Both projects emphasize the importance of adopting an intersectional mindset to understand how social circumstances shape participation in flexibility markets. The organization recognised that vulnerability is not a singular concept and that nuanced approaches are critical to reaching and engaging diverse demographics. They were also keen to explore internal strategies for embedding intersectionality within their organizational culture, particularly through skill development and fostering culture change across teams.

As with the charity, my initial contact with the energy distributor began through an interview with Ewan, a senior executive, who expressed strong interest in the potential of intersectionality in smart energy systems (Chapter 4). Ewan connected me with the leads of the Pathfinder and Flex projects, initiating detailed discussions on how intersectionality could inform their work. After several email exchanges, I formalised the case study arrangements in September 2023. Conducted through a hybrid model between December 2023 and January 2024, the case study explored both their ongoing projects and their aspirations to create a more inclusive energy system.

5.2 Motivations to operationalise intersectionality

In this section, I will discuss the primary motivations of the organizations to operationalise intersectionality. These are foundational because they influence how intersectionality is conceptualised, which in turn determines how it is appropriated and incorporated into practice. I will also classify them into intrinsic (related to the interest, passions, and day-to-day work of the organizations) and extrinsic (related to external rewards such as investments and recognition).

5.2.1 Intrinsic Motivations: Aligning Organizational Goals with Social Justice

The charity, widely regarded as a pioneer in researching and analysing social justice issues within the context of SETs, had established a strong reputation among UK energy stakeholders. This reputation was rooted in its extensive experience, which, as noted in the quote below, had already introduced intersectionality into various organizational functions. The motivation for participating in the case study stemmed from a desire to consolidate these dispersed perspectives on intersectionality and develop a cohesive approach to addressing social justice issues in the evolving smart energy landscape.

Yeah, so intersectionality is something we think about a lot.... We saw an opportunity here (in the case study) to bring together our different teams.... advisors who help households, our community empowerment team, and our research team. Even though we all deal with intersectionality we do it in very different ways. This was a chance to unite these different perspectives and embed intersectional analysis across the organization. I think we also wanted to engage with intersectional tools to help us think about how we can better address the complex issues our clients face (Catherine, Charity).

During consultations with Catherine and her team prior to the case study, it became evident that a key intrinsic motivation for the charity was to learn how to effectively implement intersectional tools. While the team was familiar with intersectionality conceptually, they sought practical methods to apply it in projects. A notable example is the Pathfinder project, co-led with

the energy distributor, which aimed to reduce performance gap of smart technologies in low-income and vulnerable households. They viewed intersectionality as a valuable framework for designing tailored interventions for these households and better understanding the nuanced vulnerabilities impacting engagement with SETs.

.... I am looking at how to reduce the performance gap of low carbon technologies like solar panels and the heat pumps that are part of smart energy offers and have been recently installed in low income and vulnerable homes. So, trying to reduce that performance gap through creation of social interventions...I am curious to see how intersectionality applies to co-creating those interventions with the households (Emily, Charity).

Building on their experience leading discussions on the inclusiveness of emerging business models to engage energy consumers with flexibility offers, participants from the charity expressed concern that historical injustices might be replicated in the emerging energy system. They felt overwhelmed by the influence certain powerful actors exert in shaping the terms of smart energy markets, as Catherine highlighted. This fear of perpetuating inequalities serves as a significant intrinsic motivation for the charity to engage with intersectionality and explore ways to address these systemic challenges effectively.

.... our current energy market creates huge amounts of inequalities and now we're building towards this new flexibility market, which is completely replicating that, but also, you're seeing the kind of capture of the institutions that make the rules by certain interest groups who are serving a particularly limited set of wealthy consumers. And they're like, OK, we're going to make a system with a set of rules and innovate with you guys in mind. I worry that we'll see the existing effects of previous inequality being reproduced, and we are already seeing a new layer of new types of vulnerabilities and inequalities emerging. So, it's also sort of overwhelming. Like what can we do about it with an intersectional mindset (Catherine, Charity)?

Like the charity, for the social enterprise, the intrinsic motivation primarily derived from having reached a point in their work where intersectionality seemed to offer the most promising solution to make their work more inclusive. They work extensively with installing smart and flexible renewable energy solutions in local communities. As the quote suggests, they have thus far

been focused on optimising the financial and decarbonisation aspects of these installations, and although inclusion has been a focus – which they also developed into an ethical framework mentioned earlier, intersectionality seemed to be the next logical step in building on this framework.

Our key focus is community-owned renewable generation...and decarbonization. And we have seen that work very well from a reducing carbon and economic feasibility perspective, but we've missed out a bit on the social aspect.....we have been exploring smart energy systems through some smart and fair neighbourhood projects... Based on our experiences with the projects, our social impact team developed an ethical framework to make our future work more accessible.... We want to continue to build on that work and reach underserved communities...This (intersectionality) aligns well and builds on that goal (Melanie, Social Enterprise).

For the social enterprise, advancing social inclusion was not only a moral imperative but also aligned with financial incentives. Expanding their reach to underserved communities promised both enhanced inclusivity and the opportunity to unlock new business models. This dual motivation was evident in their approach, as Tony, an engineer and project manager overseeing smart energy community projects like PV installations paired with smart batteries, highlighted. These projects could provide underserved neighbourhoods flexibility and reduce energy costs, aligning inclusivity efforts with economic benefits.

We're also evolving our business, developing new products like smart community energy schemes. I think Nickhil's work might be a natural progression for us to think of really leaving no one behind in our future work and grow our business at the same time (Tony, Social Enterprise).

Thus, for the social enterprise, intersectionality presents an opportunity to design smart products and services tailored to vulnerable households within energy communities. As highlighted in the previous chapter, organizations increasingly view the participation of vulnerable households in the smart energy market as a business opportunity, not merely a matter of justice or inclusion.

At the outset, for the energy distributor, a large and well-established corporation, the primary intrinsic motivation mirrored that of the social enterprise. Through previous projects with SETs, they had recognized that these technologies were predominantly designed to include affluent households, leaving others excluded. They acknowledged the "potentially massive benefits" smart technologies could offer to low-income and vulnerable households, benefits that remain largely untapped and underexplored.

I'm thinking about adopting an intersectional mindset in a project that I'm developing...building on some previous work we've done to stimulate the flexibility market to try and reduce the chance that people are left behind. ...with smart and flexible, people immediately think, well, who's got an EV, they'll benefit.... that just misses out loads of customers, right? Lots of other households could really benefit from saving money on their energy bills and if they can access the flexibility market, they could have potentially massive benefits, which they need more than the people that can charge their EV overnight (Cody, Energy Distributor).

As the case study progressed, it became evident that the energy distributor's intrinsic motivation was closely linked to expanding their business models, as reflected in the quote below. This anticipated expansion was also driven by financial incentives, including the potential first-mover advantage in the evolving smart energy market. As a significantly larger organization compared to the charity and the social enterprise, the energy distributor possesses substantial economic capital and extensive networks, including connections with aggregators and energy suppliers. These resources position them to stimulate flexibility on a much larger scale, thereby opening up opportunities for considerable financial benefits.

So, what can we do not just as a large company internally through our business models, but how we can stimulate the whole flexibility market. So, how can we be a bit more nuanced and understand this complexity? I think that's what we are starting to explore with intersectionality, and it's exciting, but the challenge now is embedding it long-term and ensuring everyone can engage with it effectively (Fleur, Energy Distributor).

Additionally, there was evident enthusiasm among some participants to explore intersectionality, driven by their familiarity with and personal interest in the concept. As

highlighted in the quote below, there was a strong intrinsic motivation to popularise intersectionality within the organization, recognising it as a powerful yet relatively obscure tool for addressing inclusion issues.

I'm familiar with intersectionality, but this kind of way of applying it is really new, and I think really interesting in terms of something tangible to get out of this. And I think it's so powerful but not commonly known unless you're, I guess, passionate...and specifically read around the diversity and inclusion space, or particularly feminism and so on. I wouldn't say it's commonly on people's radar, which is why I'm excited that we are talking about it...and applying it (Cody, Energy Distributor).

Participants from the energy distributor, like those from the charity, expressed concerns about the risk of perpetuating existing injustices faced by certain households in the UK's energy system into the future smart energy landscape. However, I argue that these concerns were also closely tied to their focus on the efficiency—and ultimately the profitability—of their operations such as customer support, as reflected in the quote below.

I think she (Crenshaw)'s really right in that unless people are specifically talking about and trying to address these issues, then you just keep perpetuating them. And that's why I think I'm keen for us to start talking about it (intersectionality). Because are we not maybe targeting our customer support well enough or offering it as efficiently as possible? If we're not considering some of those other more entrenched kinds of historic disadvantages that a lot of people are facing, we're just going, oh, some people need help, let's offer it through these established systems kind of thing.... there's a real risk here (Cody, Energy Distributor).

The primary concern is that failing to address the nuanced needs of their diverse customer base risks perpetuating historical disadvantages. Uniform customer support is unlikely to resonate with all groups, potentially driving customers to seek alternatives from competitors. In the UK's competitive energy market, this translates directly to a loss of capital. Thus, engaging with intersectionality is not only a step towards rectifying systemic injustices but also a strategic move to mitigate business risks tied to outdated and inefficient customer support systems.

In summary, all three organizations share a common intrinsic motivation to operationalise intersectionality to advance their work on inclusion within SETs. However, for the charity, primarily funded by public sources, the focus is entirely on ensuring that marginalised households are supported and included in conversations about smart energy. The social enterprise and energy distributor, which rely on profits, balance their motivations between expanding their business models to reach underserved households through profitable smart energy schemes and ensuring their operations uphold the principle of “leaving no one behind.” Intersectionality offers them a dual pathway: enhancing social justice while addressing business goals.

5.2.2 Extrinsic motivations: Gaining Recognition, Funding, and Avoiding Penalties

External pressures to demonstrate inclusivity often serve as key extrinsic motivations for organizations to engage with intersectionality. For the charity reliant on external funding from government or industry projects, fulfilling funder goals related to inclusivity is one way this manifests. There was an impression that operationalising intersectionality could aid in meeting project targets, as illustrated in the quote below.

I have been thinking about applying intersectionality in reference to a kind of cross team project... We were helping to provide this information resource tool for advisors to be able to provide smart energy advice to some clients of ours. It was funded by a DNO who have set a massive target, I think of like 600,000 clients over the next couple of years whom they really want to engage with smart energy...We could use it to understand the clients better and ensure subtle variations in needs are reflected in the tool (Neil, Charity).

This highlights a belief that engaging with intersectionality could help unpack the nuances among diverse consumers – similar to the perceptions of the social enterprise and the energy distributor discussed earlier. In this case, it could enable advisors to better target customers and meet the ambitious targets set by their funder. Similarly, the social enterprise, which also partially depends on external funds in addition to the revenue from their renewable energy installations,

aimed to make their applications for these funds more inclusive by using intersectionality. They anticipated that a potential change in government (which materialized in July 2024) could provide additional capital for inclusive smart energy projects, further reinforcing the importance of aligning their strategies with emerging social justice priorities.

Politically and morally, the idea of a fair smart energy system that benefits everyone is becoming crucial, but it also makes economic sense for us. With Labour potentially coming in, there might be significant investment, and we can access this investment only if our business models make a noticeable difference in vulnerable people's lives given their current hardships (Melanie, Social Enterprise).

Participants from the social enterprise believed that future investments would prioritize projects with demonstrable high social impact. This created an extrinsic motivation to adopt intersectional concepts and tools to showcase how smart, renewable energy initiatives could positively affect vulnerable households. As the case studies unfolded, participants explicitly expressed their intention to integrate intersectionality into their bid writing processes, viewing it as an evolution beyond their current inclusion strategies. Consequently, the anticipation of increased investment due to potential government changes, coupled with the perception that intersectionality could strengthen their funding applications, emerged as significant extrinsic motivations for the organization.

100% I see potential for intersectionality....so in our bid writing process...we have been seeing for example with three bids to Innovate UK recently and one of their slots has always been inclusion and diversity. They want you to show that you are being inclusive and diverse and that you are taking it seriously. That's where intersectionality comes in, I think. Because then we're going one step beyond (Joe, Social Enterprise).

For the energy distributor, enhancing inclusivity aligns closely with meeting regulatory expectations set by Ofgem, which updates its comprehensive vulnerability strategy every five years. Ofgem can impose fines or penalties on suppliers, distributors, and aggregators for failing to adequately serve vulnerable consumers, such as by passing on excessive costs, disconnecting without due process, or excluding them from new energy market developments. As the participant

below acknowledges, the organization is concerned that if their smart energy products and services fail to reach the "right" vulnerable groups as defined by Ofgem, they risk penalties. Engaging with intersectionality offers a pathway to deepen their understanding of vulnerability, ensuring compliance and legitimacy in Ofgem's eyes.

The work we do with vulnerable customers are tied to incentives and penalties. So, it's partially, to be blunt – we profit out of the regulatory system. We want to be cautious around spending money on inclusion and outreach to households that need to better engage with the smart energy system because Ofgem could turn around and go well, we don't really think they're vulnerable or we think you've just done what's easier because you're trying to earn more money, you evil corporation! So, it's down to that justification that we are doing the right thing for the right reasons in a way that Ofgem can agree to give us that kind of shiny gold sticker. And intersectionality can help us unlock new definitions of vulnerability that fit the bill (Cody, Energy Distributor).

An analysis of their motivations to engage with social justice issues through the lens of intersectionality reveals a strong link to reputation management, as hinted by the mention of the "shiny gold sticker". Independent assessments commissioned by Ofgem on inclusivity efforts, covering customer communication, business model development, and internal alignment with Ofgem's vulnerability strategy, show the organization scoring higher than all its competitors. This drive for external recognition was frequently evident during the case study, where participants emphasized the importance of projecting a public image that demonstrates genuine concern for vulnerable consumers. As reflected in the quote below, they expressed a desire to publicly highlight their intersectionality efforts on their website and signal their commitment to addressing consumer vulnerability (CV) through concrete actions, including investments in this area.

So, I think it's a good opportunity when discussions come up around what values are important to us to maybe occasionally mention intersectionality.... Or even on the website, there's a written definition of our values – we should mention it there. We have a proper CV strategy from last year. It's also included in the company strategy as a stream that we want to work on, which we've made quantified commitments. I think it's a signal to whoever we talk to within or outside the business to say it is not just a nice thing to think

about when we have time and debate about as a societal topic. But it's something that the company is investing money in today (Ffleur, Energy Distributor).

The extrinsic motivations across the three organizations shared similarities, primarily driven by external pressures to enhance inclusivity and align with funding or regulatory requirements. The charity's motivation stemmed from meeting funder expectations and leveraging intersectional tools to better target diverse consumers, aligning with project goals set by external stakeholders. The social enterprise sought to attract investment by demonstrating high social impact and anticipated government funding shifts, integrating intersectionality to boost funding prospects. The energy distributor's motivation was rooted in maintaining legitimacy with Ofgem and avoiding penalties, using intersectionality to improve inclusivity and manage reputation. A brief summary of both the intrinsic and extrinsic motivations is provided in Table 5.1.

I argue that both the charity and the social enterprise seemed to prioritise consumer interests over other motivations, since the discussion reveal that adopting an intersectional perspective that centres consumers could positively influence their research and outreach efforts respectively. In contrast, the energy distributor's primary motivation in better understanding their consumers appears to stem from opportunities to capitalize on new markets. Continued engagement with intersectionality for them is also contingent upon long-term financial benefits and incentives from regulatory bodies like Ofgem.

Organisation	Intrinsic Motivations	Extrinsic Motivations
The charity	<ol style="list-style-type: none"> 1. Build on previous work on just smart energy transitions 2. Bring together different understandings of intersectionality within the organisation 3. Concerns about historic injustices being transferred onto the new energy system 	<ol style="list-style-type: none"> 1. Meeting targets (such as number of households supported with smart energy advice) set by external funders
The social enterprise	<ol style="list-style-type: none"> 1. Build on previous work on just smart energy transitions 2. Better understanding of underserved communities 3. Improve/diversify business model 	<ol style="list-style-type: none"> 1. "Leg up" while writing grant applications 2. Improved access to inclusive innovation funds
The energy distributor	<ol style="list-style-type: none"> 1. Improve/diversify business model 2. Build on previous work on just smart energy transitions 3. First-movers advantage in creating new flexibility markets 4. Academic interest/personal passion 5. Concerns about historic injustices being transferred onto the new energy system 	<ol style="list-style-type: none"> 1. Being recognized as inclusive by external stakeholders 2. Avoiding penalties/loss of incentives by Ofgem

Table 5.1 Summary of the primary motivations of the three case study organizations

The differences in expressing concerns about passing on historical injustices of the energy system between the charity and the energy distributor are also noteworthy; highlighting that for the latter, intersectionality is only feasible if it benefits the business. The charity discussed feeling overwhelmed by existing power structures, demonstrating a focus on fairness and a desire to act against these injustices. In contrast, the energy distributor exhibited a tendency to simply appropriate intersectionality into a tool for improving customer service, linking this motivation to customer retention and ‘exciting’ new business opportunities. This indicates a more pragmatic approach where the primary driver is not solely fairness but enhancing or maintaining their market position.

5.3 Participants' reflections on current engagements with intersectionality

In this section, I will examine how participants from my case study organizations reacted to the core tenets of doing intersectionality (see section 2.4) that I introduced during a workshop and subsequent one-on-one interviews with some participants (see Section 3.3 and Appendix D & E for details on how these were introduced). These tenets were discussed with the participants using various examples both relevant to SETs and social inclusion more broadly. Participants discussed how and why they currently use, do not or cannot use or plan to use them in their work. Their reflections encompassed past, present, and future contexts of SETs where intersectionality could be relevant. I will examine these insights, highlighting different approaches to adopting and varying levels of engagement with these core tenets of doing intersectionality.

5.3.1 Challenging embedded knowledge systems and dominant imaginaries

While exploring how intersectionality is currently applied or could be applied to SETs, the first set of discussions were centred around examining the knowledge systems used to shape policy decisions and inform industry actions. Participants questioned the underlying logics within smart energy transitions that perpetuate inequalities but are often taken for granted and considered natural. This questioning is crucial because intersectional scholars argue that achieving transformative justice requires going beyond superficial changes which can only be achieved through challenging “received logics” (Collins, 2019).

Critical self-reflection on knowledge creation

Participants from all three organizations, acknowledged significant knowledge gaps in understanding the complex needs of their energy consumers, gaps that remain unaddressed due to a lack of resources. I argue that this acknowledgment successfully elevated participants to a meta-cognitive level of thinking, prompting them to reflect critically on the need to update their knowledge—a sentiment encapsulated by the term "*greater awareness*" in the quote below.

Not everyone has the time or the expertise to really delve into that greater awareness, which means they could be exclusive by accident because they're not aware about some of the nuances. I'd say that when it comes to understanding complex consumer energy needs and how they relate to their identities – we definitely have so many blind spots...that no one really challenges. We should be asking in a consistent and continuous manner to what more could we do? What are we forgetting? (Fleur, Energy Distributor)

Furthermore, the participant suggests that assessing whether their knowledge is thorough and comprehensive should be an ongoing practice – which also demonstrates that the participants began to reflect about the processes of knowledge production. The discussions also prompted participants to reflect on the reasons behind this incomplete knowledge. For example, one participant, with a background in engineering, who often struggled to fully grasp the concept of intersectionality and expressed this difficulty multiple times.

I think this meta-level understanding of the things we take for granted could be because a lot of our innovation and consumer vulnerability teams are very technical-trained people, so engineers or technical field staff. Even for me, I studied engineering, I feel I never learned about the stuff we discussed about vulnerability and intersectionality. Even though I'm very interested within those topics, I don't think I have the mindset to just think about it or understand it – I am still confused exactly what intersectionality means (Sandhya, Energy Distributor).

Here, there is a realization that the energy distributor's inability to fully address the complexities of consumer vulnerability stemmed from a dominant, homogeneous mindset typical in technical settings, which often lacks a focus on understanding societal nuances. This dominant

perspective is a root cause of many injustices associated with digital technologies today, which often trivialises or reduces the complexities of society. Thus, the participants observed that there is an insufficient questioning of dominant epistemologies – a key element of ‘doing’ intersectionality.

Epistemic authority on the definitions of consumer vulnerability (CV)

The discussions also delved deeply into the concept of epistemic power—examining who holds the authority to define vulnerability and how these definitions are constructed. Organizations engaged in critical thought about how their own epistemic authority could influence the transition, reflecting on the circumstances under which they possess the power to shape knowledge and guide the development of smart energy technologies. By leveraging this authority, they recognised their potential to nudge SETs in directions that align with their priorities, whether toward inclusivity, justice, or innovation, thereby influencing not only practices but also the broader narrative surrounding energy transitions.

Participants often began by questioning how vulnerability is conceptualised in the context of SETs, noting that these definitions frequently go unchallenged and are more often assumed than critically examined. As explored in Chapters 2 and 4, financial vulnerability typically dominates perceptions of vulnerable households. However, this narrow focus often neglects other equally significant forms of vulnerability, as highlighted in the quote below.

I'm also thinking about how we imagine vulnerability. Vulnerable to what? And if you're talking in a climate change context, so are you vulnerable to power outages? Are you vulnerable to price rises? Your vulnerability could be expressed in different ways. This is usually ignored (Sarah, Social Enterprise).

Participants further uncovered how unquestioned knowledge systems have led to fixed definitions of consumer vulnerability, which is detrimental as it directs innovation in a specific way, potentially leaving some consumers behind. This is particularly concerning given the emergence of new vulnerabilities in the smart energy transition. As exemplified in the quote below,

the predominant definition of vulnerability is built on how the energy system has traditionally created vulnerability in terms of fuel poverty and is often linked to the Priority Services Register (PSR).

... when we say vulnerable, so many of our colleagues immediately assume either fuel poor or for the priority services register and they have a really fixed image of what vulnerable is in their minds. And it's especially when we're looking at flexibility and the net zero transition is really turning a lot of those previous assumptions on its head. So, it's kind of getting people to actually challenge their assumptions and picturing something and going, well, no, you're only designing a solution based on a particular assumption, which then means that you're not potentially addressing other vulnerabilities because of it (Cody, Energy Distributor).

Although this definition is being challenged by SETs, it remains entrenched in practice spaces where innovation projects focus on just outcomes primarily in terms of these unchallenged definitions. Within my case studies, there was consensus that the definitions rarely move beyond fuel poor households or households on the PSR. Interestingly, even though the impression among participants was that the definition of CV is static, the authority that sets the definition - Ofgem – defines vulnerability as dynamic. In their latest vulnerability strategy (Ofgem, 2019) they define vulnerability as ‘a dynamic state influenced by various personal characteristics, the circumstances people find themselves in, and the nature of the energy market itself’.

The participants also examined power dynamics surrounding the definition of vulnerability, reflecting that stakeholders must adhere to Ofgem's definition. However, this discussion also highlighted the complexities of power. For instance, the participants from the distributor believed it could influence Ofgem's priorities and advocate for an intersectional perspective, as it has done so previously. Despite Ofgem's epistemic authority in this domain, there remains the potential for influence, and it appears that the distributor is already ‘doing’ intersectionality by challenging Ofgem's proposed definitions.

We're pretty strategic about how we handle vulnerability. We've had some sway in this area; we knew net zero was going to be a big deal and got involved in talks with Ofgem before it was part of their current vulnerability strategy. So, we can choose whether to go along with the rules or try to shape them.

If we can back up our points with academic papers, research, or customer feedback that uses intersectionality, we can then debate with Ofgem about how the definition of vulnerability should be and how it should be applied with an intersectional mindset (Cody, Energy Distributor).

Nevertheless, it is noteworthy that while their actions can be seen as intersectional, focusing solely on challenging epistemologies may not necessarily result in equitable outcomes. The distributor is primarily motivated by minimizing penalties when dealing with Ofgem as detailed in the previous section, which may lead them to influence definitions based on this objective rather than ensuring a comprehensive consideration of vulnerability contexts.

Whose knowledge is valued, and whose is overlooked?

Across the three organizations, reflections on dominant knowledge systems and epistemic authority naturally led to questioning which forms of knowledge are marginalised or discredited and whose perspectives are privileged. SETs are often portrayed as universal solutions to household energy issues as well as pressing sustainability issues, with users cast as passive recipients. Discussions that critically examined this top-down depiction of users as disengaged from energy usage or efficiency emerged. One participant, reflecting on smart plugs, highlighted that many users already adopt climate-smart behaviours, prompting a re-evaluation of the trade-offs between the resources required for smart technologies and the effectiveness of their existing 'dumb' energy-saving practices.

From my experience, when people think about smart meters or smart plugs, some are really concerned about the resources used to make them. This is something we should address. I think any project should mention the resources involved.... saving energy can be as simple as turning something off manually, which is less energy-intensive than using a smart plug. Often, the people with the least money are already doing everything they can to save energy because they have to.... instead, there is this background worry for many people

about what's happening, and it feels like their efforts aren't being recognized. We need to connect these dots and inform ourselves about what people are already doing rather than just what more they could do (Kayla, Charity).

Thus, the implication here is that dominant knowledge frameworks should recognize and integrate user knowledge on smart technologies rather than marginalise it, ensuring that the value of smart technologies is explained in a manner that respects and does not patronize. Furthermore, often discussions focussed on "hard to reach" groups, encompassing individuals who may distrust the system or lack the means or awareness to engage. In all three cases, the importance of recognizing that there is valuable feedback and knowledge being effaced because these groups are not being effectively engaged was underscored.

Another important discussion around whose knowledge is granted space in the discourse (and hence, authority) centred around how certain types of users dominate the smart energy space, thereby dictating the prevailing language and jargon. This excludes demographics who do not use or understand this language. This issue was evident in the work of the social enterprise, which involves distributing pamphlets about smart energy offers and conducting community consultations about new smart community energy schemes. These spaces are often dominated by middle-aged, white men who are technophilic.

The social enterprise's observations as evidenced in the quote below, indicate that the epistemologies of the energy sector are quite exclusionary.

Sarah: I think being aware that the language that we use to reach diverse consumers itself is a barrier.

Audrey: Absolutely! This jargon is defined by people like us...so it is worth saying that in terms of engagement, like with communities if you go to these environmental networking events that relate to energy or just general networking, it is amazing how white they are. I mean, we're in quite a multicultural city here, but definitely that environmental space. Oh, my goodness, is it white?

Moirra: It's also old generally and quite middle class. It hasn't changed much over the years (Social Enterprise).

The social enterprise had already begun discussing their communication styles with different types of energy consumers, effectively 'doing' intersectionality. They also successfully demonstrated the need to disrupt the dominant language they have inherited, which only serves already advantaged groups in the transition.

Furthermore, participants in the charity also highlighted that current conceptions of vulnerabilities neglect external vulnerabilities created due to digitalization of the UK's energy system. For example, the participant argues below that current vulnerability definitions often fail to account for the broader implications of mining and resource extraction necessary for SETs. This omission underscores the necessity of expanding our analytical lens to include the environmental and ecological impacts of SETs, which can create new geographies of vulnerability both within and beyond human communities.

So, we are currently operating within very much the human realm and we're not thinking about mining and resource extraction in a broader kind of multi-country, multi-species realm, if you like. And the impacts of digitalisation beyond our borders on humans and non-humans (Kayla, Charity).

Finally, the aspiration to uncover hidden agendas and read between the lines also emerged as a significant aspect related to epistemologies, since it allows for a deeper understanding of vulnerability by examining underlying motives and unspoken implications which is critical for a comprehensive analysis of injustices in the transition. In the quote below, the participant remarks on this utility.

I just think these discussions about knowledge are useful. I think the way we discussed how we must examine how certain policies are framed – especially in neoliberal contexts is quite interesting. I think intersectionality helps you uncover those hidden agendas and think about what is *actually* being said (Emily, Charity).

Engaging with intersectionality in this manner which got participants to reflect on their knowledge represents both an aspiration and a call to action, encouraging a conscious acknowledgment of existing blind spots and questioning of inherited knowledge. As discussed in

the quote below, incorporating this into practice and critically questioning one's own knowledge—and, by extension, the knowledge of the broader UK energy system—in itself is a significant step forward.

If you can question your own knowledge, and of course that means the knowledge of the rest of the energy system in the UK, then I feel like just that exercise and indulging with that reflection is taking a step forward and saying we are consciously defining other forms of vulnerabilities (Moir, Social Enterprise).

Focussing on a critical reflection on knowledge production consciously could lead to defining and recognizing other forms of vulnerabilities, which may be equally or more important than traditional measures such as inclusion on the priority services register. However, in general, my analysis indicates that these organizations are not actively questioning existing knowledge systems. In some instances, they do influence these systems actively, but this is often driven by concerns for profits or self-interest – particularly in the case of the energy distributor.

5.3.2 Pluralising the smart energy consumer

The second focus during our reflections on intersectionality dealt with ontologies of smart energy consumers – individuals and households. During these reflections across all three organizations, participants recognized that identities are inseparable and lack hierarchies (section 2.5); and that they are fluid and constantly evolving based on the context. The discussions also emphasised that identities are not objective depictions of reality but rather discursive constructs that continually shape the realities they describe – therefore leading to situations in which energy consumers possessing multiple identities could experience both privileges and penalties.

Discussions thus moved from questioning knowledge on vulnerabilities, towards reflecting on the various identities of the vulnerable households that they want to engage with smart energy. Across all three organizations, these ideas around identities being dynamic and intersecting was perceived as the most complicated, to both understand and apply, as mentioned below.

I feel like I am still kind of struggling to get my head around this....it gets a bit confusing because we seem to be separately acknowledging identities but still considering them together (Neil, Charity).

The challenge expressed by the participant above can be attributed to conceptualizing plural identities as distinct yet coexisting entities, each maintaining salience while interacting with macro structures – which became apparent during initial discussions. Through examples from both within and outside the energy domain, participants gradually grasped this more clearly – leading to discussions which underscored the issue of homogenizing vulnerable households.

Many participants acknowledged that they seldom considered the diverse identities within a household, instead treating all vulnerable households as a singular, universal subject (section 5.4). As exemplified below, this helped them realise that in their previous work they often equate vulnerability with a single identity (such as having special needs or being elderly), but that their approach overlooks the complex interplay of various identities each person has.

We tend to see vulnerable people and lump them together. We are used to seeing like one vulnerability –this is a household with someone with special needs or someone elderly but like forgetting about their other identities. And this helps us separate that out and see how they interact with one another instead (Claire, Charity).

The participant also suggests that there is a need to separate and understand these different identities and see how they interact with one another. This single-axis view on vulnerability, which fails to see beyond a single household vulnerability at a time, stems from the highly prevalent multi-strand equality definitions of intersectionality prevalent in both the organizations I studied and the broader UK energy discourse, as will be discussed in section 5.4.3.

Beyond just helping visualize several identities simultaneously (pluralizing the universal vulnerable household – that is moving from multi-strand to diversity within), these discussions also acknowledged that vulnerabilities continuously change from one context to another. While the previous subsection dealt with reflections on vulnerabilities likely to change due to the

sociomaterial aspects of the energy market/system, such as increased digitalization, here the focus is on how they change based on various capabilities and how these capabilities are tied to different identities. For example, the quote below highlights that organizations might already be thinking of vulnerabilities in context-dependent ways and therefore acknowledge that the vulnerabilities need to be co-defined with others, such as in this case local authorities or other project partners, however they do not focus on the intersections between the different capabilities.

Yeah, for some projects we do have to create a specific definition for vulnerability...often with other project partners or local authorities to account for local household contexts...because it can change. But we do not usually go beyond the usual capabilities such as being digitally excluded or fuel poor...and we rarely think about how they intersect or how they change from context to context (Sandhya, Energy Distributor).

The conflation between identities and capabilities in the context of smart energy as defined by the CSE report is noteworthy here. While discussing pluralizing vulnerability or vulnerable households, there was a tendency in my case studies for participants to visualise different capabilities and associate them with vulnerabilities, rather than making connections to identities such as ethnicity, gender, or physical ability, which intersectionality typically concerns itself with.

Conversations also led to discussions on the adverse effects of not incorporating intersectionality to pluralise energy consumers. For instance, in the quote below, the risk of designing solutions that focus on one household identity while ignoring others is highlighted.

...it was a light bulb moment for me, realizing that you need to consider identity in specific situations. There's a risk in assuming the most relevant part of someone's identity in one context, since it might not be the case in another. This can lead to missing a nuanced understanding of how identities affect behaviour, especially in less obvious ways when it comes to using smart or flexibility services that we design (Melanie, Social Enterprise).

This single-strand approach leads to assumptions about energy users that might overlook essential aspects of their lived experience, crucial for understanding their engagement with smart technology. Thus, the key takeaway was challenging the prioritization of certain household aspects

over others when designing smart energy services. For instance, designing a service for an elderly couple in a rural home while ignoring their digital skills, income, or medical condition. The organizations also recognized the critical need for intersectional tools to prevent the homogenization of vulnerable households. Such tools would highlight the fluidity of identities, challenging assumptions and enabling diverse household characteristics to surface as they interact with smart energy technologies in their homes (Chapter 6).

Improving design, support, and inclusion in demand flexibility

These discussions then led to participants discussing the need to broaden knowledge to not only include new types of vulnerabilities but also recognize the uniqueness of each vulnerable group and how their various capabilities (and underlying identities) intersect. This approach of viewing vulnerability as situation-dependent and malleable led participants to deeper reflections on ethical questions—also discussed in the previous chapter—such as whether vulnerable households should participate in demand flexibility trials, as indicated in the quote below.

So, to give a very specific example, households that are medically dependent on electricity, do they have any flexibility? Should they be protected from participating in demand flexibility trials? Or is that exclusionary? And are you creating a barrier that doesn't need to be there because there isn't a risk factor if the project is designed properly? Maybe by acknowledging the nuances within that household, we could help people have more control over their energy use and more control over their energy costs. So, I think that's a very specific example for which I don't have the answer, as we have never done this before. But it is something important to understand (Catherine, Charity).

As the quote suggests, recognizing the unique needs within these households through an intersectional lens can enable them to gain more control over their energy use and costs. This might mean that households traditionally considered inflexible could participate in the smart energy market. I argue that beyond just questioning the ethics of excluding certain participants, these discussions also helped participants realise that a nuanced understanding of household identities is useful to make better design and support decisions. This is echoed in the next quote,

which further highlights the usefulness of looking at how identities interact – uncovering vulnerabilities which are due to several identities coming together which the current ways of thinking vulnerability could miss.

(Energy Distributor) Cody: Yeah, I think the oil and water one's really interesting because it's almost like you've got to understand how different household identities might interact in different situations... So, I think this is where intersectionality plays into consumer vulnerability in a really relevant way... By applying that intersectional lens, we can understand more what we can do to support customers that might need very specific support in certain areas or identify potentially larger sets of households that we may not even realise might need support.

Thus, my analysis indicates that organizations do pay attention to how vulnerability varies across different projects or regions, and have already begun to pluralise identities, but they often fail to

- (i) move beyond the 'usual' capabilities that dominate the current understanding of vulnerability,
- (ii) reflect on the interconnections between multiple household capabilities such as income, age, type of housing, and social capital, and,
- (iii) most importantly, consider household identities such as ethnicity, gender, and other social demographics, and how these might relate to and influence those capabilities.

5.3.3 Cultivating solidarity with vulnerable energy consumers

The third set of reflections revolved around a fundamental principle of intersectionality, advocating for solidarity among various social justice struggles. It emphasizes that while different social groups have unique experiences and perspectives, their struggles' consequences should resonate universally.

The previous two sets of reflections provided significant insights on the epistemologies of vulnerabilities and how plural identities compound them. They prompted reflections on current shortcomings in accounting for justice in the context of SETs and focussed on separation of the

various capabilities that are often homogenised in the justice discourse. These reflections, in contrast, served as a reminder of commonalities. While all three organizations had already begun questioning their knowledge as well as reflecting on multiple ontologies, they had not begun fostering solidarity, although they acknowledged its importance.

The two key reflections were:

1. There was a recognition that smart energy transitions could symbolise acts of solidarity to address historical injustices. As these transitions disrupt established systems and redefine stakeholder roles, they provide an opportunity for organizations to acknowledge diverse consumer experiences, remedy past neglect, and promote remedial justice for all affected groups.
2. It provided an antidote to the overwhelming feeling of tackling systemic injustices. It motivated participants to persist despite the entrenched norms that perpetuate injustices. Our discussions of solidarity from an intersectional perspective, which distinguished it from sameness, involved tapping into '*something within*' which led to an elevated understanding among participants that everyone experiences intersectionality—that they themselves encounter both privilege and penalties. Thus, solidarity, a facet of intersectionality was experienced as embodied, which fostered greater empathy for the diverse vulnerable households they aim to support in smart energy transitions.

The first outcome is exemplified in this quote below where the participant from the energy distributor, that has been pioneering several new digital services enabled by SETs, highlights that with these innovations there is a significant opportunity to better understand diverse household needs. Previously, reliance was on secondary sources of data, which limited the scope of understanding. However, with energy consumption data becoming more accessible, deeper insights into consumers are possible.

With many digital energy services being developed now and hopefully, more reaching different types of households, we could really understand our customers. Because so far, we had to rely on finding charities that quite often go into people's homes, for example. And with that there's only so niche we could go, whereas as with the digital age, things become kind of more widely accessible...so we have to use this opportunity, and I guess that maybe feels a bit like a way of showing solidarity? (Fleur, Energy Distributor).

Furthermore, the focus on solidarity led to reflections on how critical it is to understand that there are differences among people, particularly in times of crises. In the quote below, the participant reflects on how the COVID-19 situation revealed the disparities in experiences among people – drawing an analogy to the idea that while everyone was in the same storm, they were in very different boats.

But this reminded me of the whole thing during COVID with politicians saying that we're all in the same boat. It's like, no, we're all in the same storm but in very different boats! (Sarah, Social Enterprise).

As the quote indicates, these discussions led participants to focus on their own identities as part of understanding what operationalising intersectionality means since the boats here are symbolic of one's own privileges. A critical part of doing intersectionality this way is self-reflecting and tapping into *something within*, and this was successfully initiated during our discussions. As another participant shares, their journey into consumer vulnerability work began with an academic interest in feminism, where they started to understand how societal issues affected them personally.

I guess for me personally, the whole reason I've kind of got into consumer vulnerability is because I started to get into feminism and intersectionality at university, started to read about how things were affecting me, as a non-binary person. And then I was like, my God, there's other things affecting other people and even though we have different struggles there is something within in common. So, intersectionality has made me understand how I move through the world and how different that is for other people.....I'm very aware of the barriers I've faced, it's why I'm really interested in understanding what other people face and see what we can do about it, I guess. Thinking about social justice in any context can just wear you down, but I think if you're passionate about it, it can be a joyful experience (Cody, Energy Distributor).

This awareness of shared struggles broadened their perspective, leading them to recognize and empathize with the challenges faced by others. And thus, their passion for intersectionality is deeply tied to their personal experiences and desire to address the barriers different people face, driven by a commitment to making a positive difference in the world. This was discussed as an intrinsic motivation earlier, and here it has also extended to understanding the core of cultivating solidarity, and this was the second key outcome since the participant also mentions that this passion is what helps them cope with the immense weight of fighting for social justice.

Like the previous sets of reflections, participants also considered practical steps to build solidarity with their projects. For example, in the quote below, the participant suggested incorporating mechanisms for differential pricing for smart, renewable energy which are determined by the community so as to ensure that even those who cannot afford to pay some higher costs can participate.

I am thinking about building in mechanisms to allow the communities to decide how to be inclusive in smart energy trials. So, for example, one of the things we've talked about is that you can have differential pricing in a way which is controlled by the community, so that if the community says, here's a group of people that the community recognise are more vulnerable, they might be paying less for the service in the future than those that are not vulnerable (Tony, Social Enterprise).

While discussions on solidarity inspired self-reflection and practical ideas, they also opened space for challenges that might arise. Participants grappled with the dilemma of conflicting notions of fairness within the transition, since sometimes different vulnerable groups might value different things and therefore one solution in a community might not be considered fair by all, which means achieving solidarity could be challenging.

Well, I think solidarity can be challenging. Because we have to be aware that there's different varieties of fairness. It's not just what we think is fair and I think this would involve people understanding each other's position on fairness better and opening up better. And I think that's where intersectionality really plays a role, but it is no easy task (Chloe, Social Enterprise).

This reflection underscores the complexities of navigating fairness in diverse community contexts, particularly in situations where trade-offs between competing needs and values are unavoidable. While intersectionality provides a framework for fostering mutual understanding and amplifying marginalized voices, it also requires consistent effort to address the nuances of fairness and ensure inclusivity in decision-making processes. As such, achieving solidarity demands not just tools and frameworks but also the willingness to engage deeply with difference and disagreement.

5.3.4 Breaking Cycles: Envisioning Intersectional and Inclusive Smart Energy Futures

The final set of discussions underscored the importance of historicity and envisioning future possibilities. Participants discussed how to break away from unjust frameworks and to consciously imagine radical and speculative smart energy futures. As discussed previously, SETs are an opportunity to disrupt the perpetuation of past injustices into the future. All three organizations agreed with this, highlighting their awareness and intent to use these technologies to challenge traditional energy systems and promote inclusivity.

This understanding is exemplified in the following quote:

The system still has a profit-driven mindset—more flexibility makes network management easier. But it also means that those who can afford things like batteries and Teslas benefit more because they can access cheaper energy. So actually, it's the people that already have a lot are benefiting further from the system because of their kind of privileges and their situation. And we don't want this and are therefore asking, how can we make it easier for vulnerable customers to benefit too? (Cody, Energy Distributor).

Thus, the energy distributor views SETs as an opportunity to transform traditional business models and inclusion practices, moving beyond trickle-down economics to find ways to include a wider variety of people. In their view, this inclusion would also mean more flexibility, which translates to more flexibility. They see this as disrupting the existing model where

traditionally privileged households, the early adapters, such as those with higher incomes and larger electricity loads like EVs, benefit the most.

During these reflections, I noticed a stark difference between the discussions among the participants from the energy distributor and the charity and social enterprise. While the former interpreted these radical interventions via intersectionality as a lucrative business opportunity, the other two began questioning their extractivist relationships with energy communities and vulnerable households, recognizing the tendency towards top-down installations and information extraction without fostering bottom-up empowerment of end consumers.

Yeah, I looked through the notes and I was reflecting on our discussion on the old wine in new bottles idea. That's a big concern for me in our projects, because they are new, and we can do things differently. One key thing we can contribute to is emphasizing the importance of taking local household views into account and really making local people the drivers of change. Rather than just gathering information about these households to make top-down decisions.... we need to avoid slipping back into that mindset, especially in projects led by big organizations like DNOs and suppliers who we work with. We should be disrupting that (Tony, Social Enterprise).

Thus, while the distributor chose to disrupt traditional business models which are exclusionary, the social enterprise chose to disrupt their top-down approach which ignores local energy needs. Furthermore, this quote exemplifies how these discussions instilled a sense of agency among participants, as they envisioned taking a pragmatic role in the transition. They saw themselves as pioneers and gatekeepers, ensuring that traditional methods of data extraction and management are replaced with approaches that recentre the voices of marginalized communities. This shift reflects a commitment to moving beyond merely collecting data to genuinely empowering and including vulnerable groups in the transition process.

As discussed previously, for the charity, there was a sense of urgency and feeling overwhelmed that the traditional methods of innovation in the energy sector had neglected several households and that these methods were being replicated in current practices. In the quote below,

the participant raises critical questions about how, without disrupting these conventional approaches, the energy transition might reinforce existing inequalities—specifically noting that the burden of flexibility may disproportionately fall on lower-income women.

The energy transition is simply building on and reconsolidating existing inequalities. So, we're seeing things in like the way that domestic demand flexibility intersects with gender and class, and that some people have options to access flexibility markets, and that would be easy for them. And other people will have to carry out increased unpaid domestic labour, which typically falls on lower income women. So, I think intersectionality really helps dig into that and think through, okay, how is the energy transition reinforcing existing inequalities? And what can we do about it? (Catherine, Charity).

The participant understands the mechanisms perpetuating these inequalities and offers a framework for devising strategies to address and remedy them. It is crucial to highlight that, apart from this instance where class and gender are explicitly mentioned, the participants did not consider how certain sociodemographic groups have been disadvantaged in the UK's energy transition, although this is essential to ensure an intersectional approach; since 'doing' intersectionality also involves consciously engaging with histories of oppression, particularly in relation to energy.

This was not adequately addressed, with the focus being more on market mechanisms and their disruption, rather than understanding which households have unfairly borne the burdens of the unjust energy market. I contend that this lack of reflection on historical injustices stems from an absence of initial connections between capabilities and identities, let alone reflecting on their intersections.

5.4 From homogeneity to additivity: The ongoing journey towards intersectionality

In this section, based on the variety of ways the three organizations engage with intersectionality, I examine how they conceptualise intersectionality in the context of SETs.

Although I did not explicitly ask them to define intersectionality, their motivations for engaging with my research and aspirations to operationalize the concept form the basis of my analysis. Broadly, all three organizations acknowledged that they had engaged with intersectionality, despite lacking formal examples of explicitly intersectional projects.

They frequently cited their successful inclusion-related operations as evidence of already applying intersectional principles, believing that intersectionality, as a more comprehensive approach to inclusivity, was likely a contributing factor to their success. For instance, Ffleur from the energy distributor noted, *"...the fact that we've reached such a high level of good customer service...it is because we have put efforts to understand the diversity of our customer base...we must be doing something right in that space already, just that we don't think about it as intersectionality."* This example illustrates how the organization had, in practice, already begun pluralising their understanding of energy consumers. By recognising and addressing the diversity within their customer base, they were moving beyond static and binary categories, such as vulnerable and non-vulnerable, to adopt a more nuanced approach. While they may not have explicitly framed these efforts within the language of intersectionality, this shift indicates an emergent awareness of the dynamic and multifaceted nature of consumer experiences, laying the groundwork for a deeper engagement with intersectional principles. This sentiment illustrates a common scenario across the case studies: intersectional practices are present but not explicitly recognized as such.

I analyse the prevalence of five ways in which intersectionality is perceived by participants (Christofferson, 2021, section 2.5), ranging from generic (minimal engagement) to intersection of strands (maximal engagement). My results show that most conceptualisations fall in the middle of this spectrum across all three organizations. While more radical definitions—those that challenge systemic power structures and treat household characteristics as intersecting—remain rare, there is a growing awareness of the limitations of generic approaches (figure 5.1).

I will now go through each of these conceptualisations, as they reveal the journey that all three organizations have undergone. By engaging with social justice, they have realised that the more basic and superficial definitions of intersectionality fail to address the complexities of energy inequalities. This realisation has prompted a gradual shift away from these simplistic approaches. However, while progress has been made, the organizations have yet to reach the optimal level of engagement needed to fully operationalise intersectionality in transformative ways.

5.4.1 Generic Intersectionality – Non-existent

Generic intersectionality overlooks specific vulnerable groups, assuming uniform benefits from identical interventions. In the context of SETs, this view suggests mere access to smart meters enables all households to save energy, ignoring how diverse household characteristics create barriers for some and opportunities for others. This contrasts sharply with intersectionality's core principle of critically examining and addressing nuanced differences. As visualised in figure 5.1, a generic approach would view all households as a single homogenous group, engaging with smart energy.

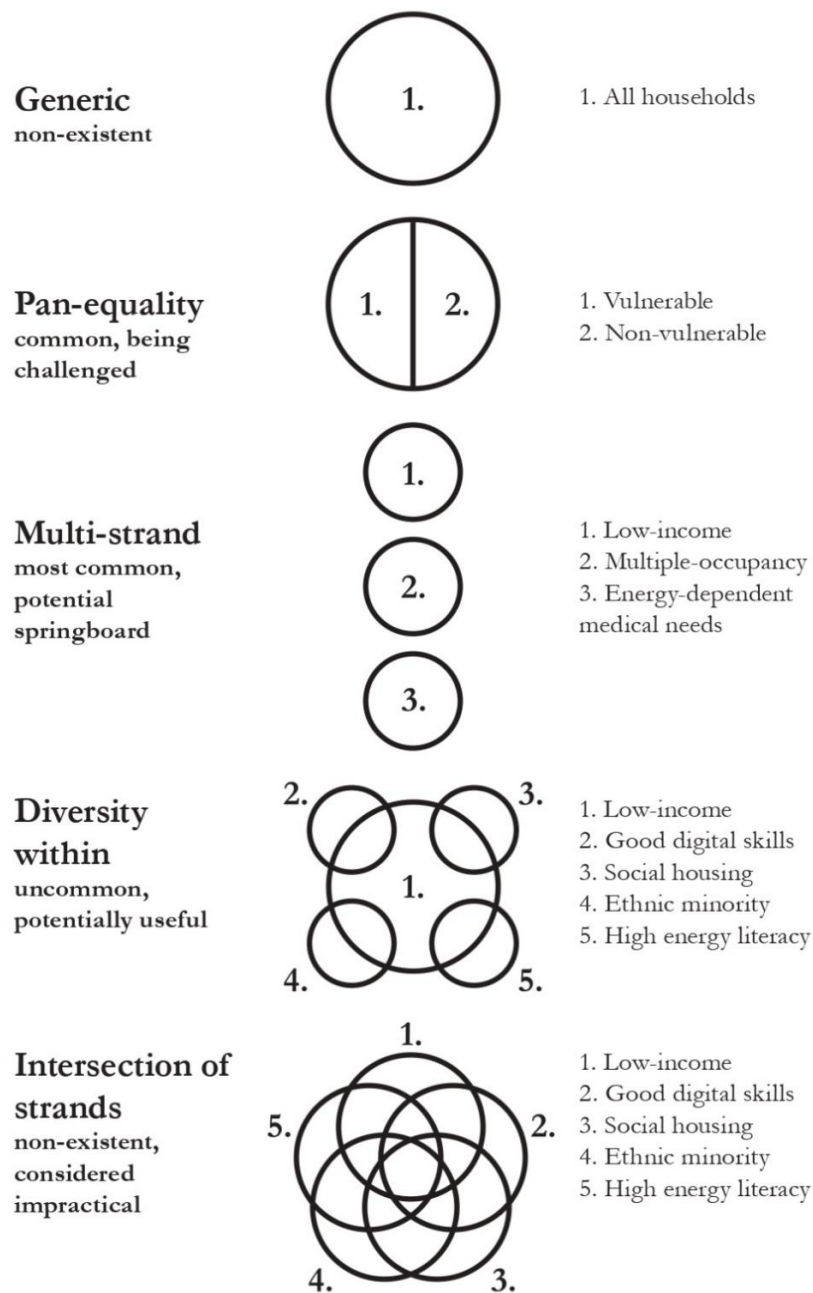


Figure 5.1: Prevalence of Intersectionality Definitions and Views on Household Capabilities in SETs

Note: This figure illustrates the prevalence of Christoffersen's (2021) intersectionality definitions (left) across the three organizations and how these are applied to visualise household capabilities concerning Smart Energy Technologies (SETs) (centre and right). The additive multi-strand definition dominates, while the

more nuanced definitions, which delve into intersections (bottom two categories), remain largely underutilized (Source: Author, Credits: Aaron Kopp).

My analysis indicates that this definition of intersectionality is not used within the organizations I studied. This is because there is a critical self-awareness that a more nuanced approach is necessary for a just transition, as highlighted in the quote below.

Our approach so far is traditionally...okay, there's some people in a building, let's help them based on their generic circumstances....and this just does not work. So, we need to discuss if there's possibility within the project of understanding maybe more about these unique intersectional things and saying, oh, actually there's specific learnings we can gather from that (Emily, Chairty).

This is a result of the shortcomings in several projects that they have undertaken that have shown that a one-size-fits-all approach does not work. Furthermore, in the broader UK energy landscape, generic approaches that assume energy innovations will eventually benefit everyone through a trickle-down effect have also been challenged, and there is already a plethora of initiatives that consider the differential impacts on vulnerable households.

5.4.2 Pan-equality intersectionality – Common, being challenged

Pan equality intersectionality addresses issues that impact all or most marginalized groups simultaneously. This approach has a strong tendency to categorize vulnerable consumers as a homogenous group, which is largely a legacy from regulatory frameworks such as those dictated by Ofgem. Traditionally, this group of households is fuel-poor, low-income households on the Priority Services Register (PSR). As discussed earlier, organizations want to ensure that they are in line with Ofgem's definitions of vulnerability to gain financial incentives and/or avoid penalties thereby avoiding engaging with their own explorations of redefining vulnerability. Thus, as seen in Figure 5.1, this conceptualisation moves a step further and now classifies households into two sets

– vulnerable and non-vulnerable households, treating both groups as independent homogenous entities.

Most traditional approaches to vulnerability therefore still often lean towards this perspective and it continues to persist, with most organizations working on smart energy projects continuing this status quo, broadly considering vulnerable consumers as a single entity without delving into the specificities of their varied experiences. This also means that the focus when it comes to inclusivity efforts is on household characteristics typically associated with vulnerable consumers on the PSR – old age, physical and mental health impairments, chronic illness, low-income etc.

This was also evident in the way all three organizations broadly address the needs of vulnerable consumers without acknowledging the diverse challenges faced by different groups. For instance, gender-specific issues are often overlooked at the household level, as discussed in the context of the work of the energy distributor by Sandhya, “...*I've not seen gender inequalities considered in the smart energy projects I work with... So, we talk a lot about vulnerability in the projects we take up but do not really go into specifics...*”

However, since the organizations I worked with had all been pioneers in the inclusion space, they are starting to move beyond this definition. As another participant from the distributor reveals below, they are starting to move away from this approach to one that differentiates between the wide range of consumer experiences.

I'd say, consumer vulnerability is seen as a package of a certain type of consumers. There's an educational piece around, you say vulnerable consumers, even to customer service, and they just go, PSR, when we're trying to really widen that understanding...And it's often let's consider how this piece of technology will impact vulnerable consumers, and that means all PSR consumers even though that's such a wide range.... (Cody, Energy Distributor).

Thus, all three organizations are starting to challenge these broad categorizations and seek a deeper understanding – particularly of the definitions of vulnerability as I will discuss in the next section.

5.4.3 Multi-strand Intersectionality – Most common, a potential springboard

Multi-strand intersectionality addresses different identities in parallel, separately, and simultaneously. This is clearly seen in figure 5.1, this conceptualisation moves beyond the homogenous vulnerable household groups to recognising that there are multiple characteristics such as low-income or multiple occupancy that influence vulnerability. This approach is the most prevalent among the organizations I studied. While this is the first positive step towards engaging with intersectionality, it indicates that the understanding and application of intersectionality are still in their nascent stage – since this approach, considered additive, conceptualizes equality strands alongside one another without recognizing their interactions. Although this may not fully capture the depth of intersectional principles, it creates opportunities to explore how different inequalities intersect (section 2.5).

Across all three organizations, there was a prevalence of the use of CSE's Smart and Fair Energy tool which characterises in great depth the various capabilities that are required to engage with the array of smart and flexible energy offers available in the UK. These capabilities and their intersections formed the basis of our explorations of intersectionality. When we discussed intersectional projects within smart energy, organizations gauged themselves based on whether or not they were considering intersections of and interaction among these capabilities.

Therefore, these capabilities such as type of housing, personal financial history, family size, occupancy rate, digital skills etc., can be considered as equivalent to the equality strands or equality groups often discussed in the intersectionality discourse. Thus, this definition of intersectionality for the first time, considers the heterogeneity and the nuances within marginalised groups. Given

the extensive research on capabilities since the onset of SETs, the practice of accounting for household differences in capabilities when determining engagement with smart technologies has become the most prevalent approach. The following quote from a participant at the charity exemplifies multi-strand intersectionality in action.

In terms of the intersectionality - it was very much informed by the smart energy capability lens, so I kind of guess like a theoretical approach that considers the attributes that different clients might need to be able to participate in in smart energy offers and benefit from them. So, I think using that lens in itself is pretty intersectional. It considers how attributes like for instance person's income, or their health might impact how they might interact with an offer, and whether it would be suitable for them (Neil, Charity).

This definition while still not true to the core focus of intersectionality on intersections of identity markers can still be a springboard to deeper engagements with it. I discovered this while discussions with the energy distributor, using the example of a project discussed below which wanted to address inclusion of diverse types of households within smart energy programs.

We wanted to expand our outreach to include more types of households. We funded, to be blunt, I think it was just some white energy advisors to go into a local Muslim community and educate them about smart energy, and it was unsuccessful.... Then based off the feedback, we went in again and trained up members of the local community through the mosque to provide the advice....so people speaking to people from their own community in the way they're comfortable, even down to the detail of training different genders, because they tend to be more comfortable speaking to their own gender...So we haven't looked at intersections yet but I think that is clearly the way forward (Cody, Energy Distributor).

This quote illustrates that in the beginning of the project there was clearly a multi-strand approach because they considered reaching out to more types of households, although it is unclear exactly what they meant by this. The example they point to, hints that religion or ethnicity might be one category to make their smart energy advice outreach more inclusive, yet they quickly learned to go beyond and look at intersections such as looking at gender and how it influences tailoring interventions to the Muslim community's specific needs and preferences. This is exactly what the next definition of intersectionality entails.

5.4.4 Diversity Within – Uncommon, potentially useful

Diversity within an equality strand focuses on understanding the intersections and nuances that exist within a particular group – and often this group or equality strand is considered more important than others. This approach examines how different factors within a single category, such as low-income, can create varied experiences of inequality. Currently, the organizations studied do not seem to engage deeply with this definition, although there is an evident desire to do so. This is illustrated in the quote below which discusses the varying impacts of low-income based on household composition:

Your low income is also going to be related to how many people are in the household, right? So, if low income is classified as a £ 31K income or below, but you're a single person living in a flat by yourself, you can potentially live off that. But if you're earning that much money and you've got a large family and maybe you're a single parent, it might be really challenging, and you might have other vulnerabilities. I feel like we have a tendency to focus on just one vulnerability at a time (Chloe, Social Enterprise).

Thus, there is a clear understanding that income alone cannot determine how the household might experience SETs, and it is important to consider other factors such as, in this case, their household composition. A similar observation was made by a participant from the charity; by highlighting the unique experiences of two different ethnicities having similar family size and household types yet exhibiting differences in the ways they engage with SETs. Here, it becomes important to understand these nuances of how ethnicity intersects with family size, household type and composition (as age is mentioned).

We have done some work previously around similar homes of multiple occupation, particularly with Somali and South Asian communities. This work shows vastly different experiences of how energy is used and interpreted in a household with lots of different ages (Kayla, Charity).

I argue that there is a link between the intrinsic motivation related to the fear and worry about marginalised households being left behind and the desire to engage deeply with their intersectional experiences. This is evident in the quote below from a participant that works with frontline advice on smart energy offers where they talk about the subconscious consideration of intersectionality in their support efforts.

This is so typical of the clients we face...It's frustrating to not be able to go deep enough, because we are always worried about our clients and even though we're not consciously doing it, we consider intersectionality. If you're supporting a client, you are thinking about all these factors at the same time (Claire, Charity).

The recognition of these gaps presents an opportunity for deeper engagement with intersectionality. By consciously integrating a more detailed understanding of how different factors intersect within a single equality strand, organizations can better understand the experiences of marginalisation in the smart energy transition – although I argue that the frustration stems from a lack of intersectional tools that fit current practice. However, despite these acknowledgments, much of their current work remains superficial, often limited to segmentation based on property type, tenure, age, and digital capability – falling back to multi-strand equality type definitions.

5.4.5 Intersection of Strands – Rare, considered impractical

Intersection of strands represents the most advanced understanding of intersectionality, where no single vulnerability or equality strand is of particular importance. Instead, different strands are viewed as intersecting and creating unique realities. This approach aligns closely with the original definitions of intersectionality, focusing on the complex interplay between various identities and how they contribute to one's overall experience of inequality (figure 5.1).

In the discussions with organizations, it was clear that while there is an acknowledgment of intersections, there is a significant gap in practical implementation. This often stems from the challenges associated with data collection and the effort required to understand these nuanced

interactions. As highlighted in a quote from the charity, their approach to understanding different household experiences of participating in flexibility trials intentionally captured various attributes such as gender, ethnicity, financial status, and health conditions to account for intersection of strands.

We used the capabilities lens...in terms of recording some metrics that could be used to think through some of the intersectional aspects, we had a big survey asking people about their gender, their ethnic group, their financial status and security, socioeconomic background, health status, and energy system factors that affect vulnerability to meeting basic energy needs. So, we captured information on that, but I don't think we had tools necessarily to understand and interrogate what we might be seeing in terms of how these different factors interact related to affect people's experience (Catherine, Charity).

Thus, despite these efforts, there is an acknowledgment that they do not possess the tools necessary to fully analyse intersectional experiences of demand flexibility. The reasons for this are once again because the organizations' intrinsic motivations to engage deeply with intersectionality are outweighed by the extrinsic motivations to ensure that they meet certain goals set by external collaborators or funders – and in doing so rid intersectionality of its complex flavour. In this case, I discovered that the project to evaluate these flexibility trials was funded by a nation-wide transmission company and involved a quick turnaround time. Despite initiating the capture of data which could enable an intersectional analysis, there was no time, interest, or belief that such an in-depth intersectional analysis would be beneficial.

I don't think it would have been appreciated as like a universal value by everyone that we were working with on the project...especially the funders. It would also have taken longer to utilise and make sense of intersectional data. I think probably a lack of awareness and understanding at this stage more than anything else. So, I think there'd be a lot of work for us.... moving it from a theory into something that everyone acknowledges is a good thing and that we should be doing (Neil, Chairty).

By contrast, for the distributor, it was their intrinsic motivation to ensure financial feasibility of inclusive innovation which prevented them from engaging with this advanced meaning of intersectionality. Here, the quote demonstrates that there is an awareness that an engagement with intersections of ethnicity and physical ability, is not effective if there are not enough such cases which the organization can show it has helped and therefore justify the costs involved in such an endeavour.

There's a concept called effective altruism that I find fascinating and it's like understanding if you donate to a charity, what's the most good you could do? ... Intersectionality is a lot of work for us.... understanding how to collect data and the nuances of all those different potential intersectionalities, and is it worth that level of effort? What if we end up spending a lot of resources on the very small subsection of the population? Because if, as I say, if there are actually a fair proportion of Black women that are wheelchair users, we might go actually that makes sense to focus on that and we can really create something to their experience if we identify there's a potential (Cody, Energy Distributor).

The use of the word *potential* here is a nod to the fact that the organization finds intersectionality an interesting concept to expand their profits through involving more of their customers in the smart energy technologies-enabled services discussed earlier. Thus, for them, it is only pragmatic to engage with intersectionality if it is (financially) efficient to do so. Interestingly, as Christoffersen (ibid) notes, organizations that engage deeply with intersectional work often have less social power and are closer to intersectionally marginalized groups.

5.5 Summary

The definitions, current practices, and aspirations to operationalise intersectionality demonstrate that intersectional approaches remain marginal across the three organizations. Where intersectional thinking is incorporated into projects, it is currently being diluted to fit the organizations' various strategic intentions – leaving its radical potential largely untapped. I will contextualise this further through answering my research questions.

2(a) How do organizations conceptualize intersectionality within the UK's smart energy transitions?

The current conceptualizations of intersectionality within the examined organizations vary but generally tend to focus on considering diverse household capabilities such as digital literacy, income, and type of housing etc. These capabilities are typically addressed separately rather than exploring their intersections, reflecting a more additive rather than integrative approach to intersectionality. While the organizations are regarded as pioneers in promoting inclusion within smart energy transitions, they have yet to connect these capabilities to identities like ethnicity, class, physical ability, and religious beliefs, which are central to intersectionality discourse. This gap may be attributed to the sensitivity around collecting identity data and a lack of intersectional tools in their repertoire.

Furthermore, the limited engagement with advanced understandings of intersectionality is partly due to constraints imposed by external funders and collaborating organizations, which necessitate quick turnarounds and favour demonstrable, innovative inclusivity efforts over more comprehensive, time-intensive intersectional practices.

The motivations to engage with intersectionality varied both between and within the three organizations studied. The most striking difference emerged with the energy distributor, where deeper engagements with intersectionality were closely tied to profit-driven goals. While participants within the organization expressed genuine concern for inequality, the organization prioritized intersectionality only when it aligned with business objectives. In contrast, the charity and the social enterprise, while also pragmatic, viewed intersectionality as intrinsically valuable. For them, it offered opportunities to conduct detailed research, foster deeper relationships with communities, and create meaningful change for smart energy consumers.

2(b) To what extent do they engage with or neglect intersectionality in practice, and why?

Despite differences in motivations, current engagements showed more similarities than dissimilarities—most organizations only superficially engaged with intersectionality's core tenets or viewed them as aspirations. Currently, no organization fully engaged with critiquing power systems such as capitalism, neoliberalism, and racism which is central to intersectionality. Although discussions touched on marginalization within the energy market, reflections on power systems and their intersections only emerged when prompted by specific demonstrations. Organizations primarily focused on integrating intersectional tools into their projects to achieve specific goals, such as enhanced customer support and a better understanding of household energy behaviour – even though they did not seem to find any that could be readily applied.

This stems from a focus on applicability, measurability, and profitability of justice initiatives, allowing organizations to easily apply intersectionality to existing functions like data collection or design strategies. Consequently, this not only leaves intersectionality's transformative potential untapped but also fails to centre intersectionally marginalized smart energy consumers.

In the next chapter, I will explore how through intersectional tools (Appendix E), the organizations imagined what it would mean for them to truly align with the core tenets of intersectional theory. I will detail how they applied these tools and the challenges, limitations and benefits they envisioned of using them in practice. I will conclude by discussing the implications of bringing intersectional theory and tools into the discourse on just smart energy transitions.

6. Embedding intersectionality in the UK's smart energy future: from superficial to transformative change

In the previous chapter, I introduced the three organizations in my case study, analysed their motivations to operationalise intersectionality, and assessed their current engagements with it. Despite varying motivations, their approaches remained superficial, falling short of engaging with the core tenets of intersectionality that address justice at the intersections of diverse identities. None of the organizations had explored the lived experiences of individuals adopting smart energy technologies, though all acknowledged intersectionality's potential. I also demonstrated that their focus on pragmatic concerns, such as applicability and measurability, often diluted intersectionality's transformative and justice-oriented aspects.

Chapter 6 builds on this analysis by adopting a forward-looking perspective. It examines how the organizations, informed by workshops on the core tenets of intersectionality (see Appendix F & G), began strategizing towards embedding intersectional practices in the context of SETs. This chapter addresses the final research questions: RQ3: (a) How can intersectionality be applied? (b) What are the benefits and risks of applying it to explore the social justice implications of SETs?

Section 6.1 outlines three practical strategies that emerged for embedding intersectionality into future practice, balancing its transformative justice aims with pragmatic applications across projects. Section 6.2 critically evaluates the risks of these strategies, highlighting variations across the three organizations. Finally, Section 6.3 reflects on the data collection process using the three-pronged intersectional framework developed in Chapter 2, exploring the extent to which embedding intersectionality can advance social justice by addressing users, institutions, and power systems.

Thus, this chapter details the final contribution of my thesis – despite challenges in implementing the core tenets of intersectionality in practice in the context of the UK’s smart energy transition, intersectionality can successfully direct practitioners towards centring vulnerable energy consumers and hold them accountable for a just smart energy transition. However, it also shows that when intersectionality is operationalised without attention to its radical core, it might be appropriated for diversity washing instead.

6.1 Strategies for operationalising deeper engagements with intersectionality

This section examines how the organizations envisioned advancing beyond their existing additive approaches to intersectionality. As discussed in the previous chapter, all three organizations expressed a need for tools to operationalise intersectionality in their practices. During the initial workshops (section 3.3), I introduced several intersectional tools alongside three hypothetical household cases involving SET adoption (Appendix H). These tools were applied and discussed, and then during one-on-one discussions with me, participants reflected on their practical application which I collected as aspirations/ideas. This process culminated in the final co-design workshop where the participants collaboratively explored these aspirations in greater detail. Each organization ultimately developed a set of actionable guidelines based on these discussions.

By analysing this data and the resulting guidelines, this section provides insights into how the organizations balanced ease of applicability with the transformative potential of intersectionality. The analysis reveals three primary strategies for embedding intersectionality into their practices:

- a) Using intersectionality to create spaces for critical reflection,
- b) Building intersectionality capacity through using intersectional tools, and
- c) Leveraging intersectionality for challenging and/or subverting power structures.

Before delving into the strategies, it is important to examine how the three organizations engaged with the tools for operationalising intersectionality: the Intersectional Web of Identities, the Intersectional Reflexivity Box, and the Intersectional Identities Journal (Appendix E). These tools played a critical role in transitioning from the abstract, reflective discussions around the core tenets of intersectionality (outlined in the previous chapter) to more tangible, actionable approaches. While the earlier discussions effectively highlighted the necessity of intersectionality and revealed minimal engagement with its principles, participants often perceived them as overly theoretical and complex. The tools, in contrast, were seen as more practical and directly applicable to their work, as reflected in the quote below.

And I think I found the tools that you shared really helpful. I think I still struggle to get my head around some of the core tenets we discussed because they're more abstract. They're harder to get your teeth around whereas with the tools it's like, oh yes, I can apply this to my work. This is cool (Neil, Charity).

Thus, participants across all three organizations acknowledged that their current engagements with intersectionality, as assessed through the core tenets, required significant advancement. However, their entry point for envisioning this progression was through the tools, as these were directly applicable to their day-to-day organizational practices such as customer support, research, and outreach. Unsurprisingly, by the time this chapter was written, all three organizations had already started integrating the tools into their operations. For instance, as highlighted in the quote below, a participant from the charity had identified a clear and practical application for the intersectional journaling tool.

...one of the things we're toying with is running photo diaries with low-income and vulnerable households so that they can potentially take photos of their daily interactions with smart technologies. Could we potentially combine that with some intersectional journaling around that? Because we could explore how their identities intersect when they interact with those technologies...We also avoid going in with our own expectations (Emily, Charity).

Emily suggests integrating photo diaries with the intersectional journaling tool, which provides prompts encouraging users to reflect on their experiences through the lens of their intersecting identities. This combined approach would allow low-income and vulnerable households to document their daily interactions with smart technologies, offering insights into how their multifaceted identities influence these experiences and helping to minimize researcher biases by avoiding preconceived expectations.

The tools thus presented immediate opportunities for not only facilitating the application of intersectionality to a project they were doing – in this case to understand the intersection of various household identities while using smart technologies – but also for exploring the heterogeneity of household identities and understanding how they could constitute both penalties and privileges. Another example of how the tools helped navigate the dual concerns of application and adherence to the depth that intersectionality demands is in the quote below concerning the Web of Identities (figure 6.1), during the workshops in relation to one of the three fictional cases of intersectional households engaging with smart energy (appendix H).

We thought it was such a cool visual tool that helped us understand quite a lot rather quickly. Because when you're just coming at it without the tool, you're kind of almost trying to pick out everything. We asked a lot of questions... For example, we don't know whether being a social housing tenant is a privilege in all contexts.... I mean would it intersect with Gill only having temporary jobs? We also do not know whether being a PoC (person of colour) is above or below the axis. But I got so excited because this is a typical example of some households we work with, and we could use this right away across our teams... (Melanie, Social Enterprise).

Melanie highlights how the tool, a visual framework for mapping intersecting identities, helped her grasp complexities in household dynamics. Every axis represents an identity, in the case of SETs, a household capability or characteristic.

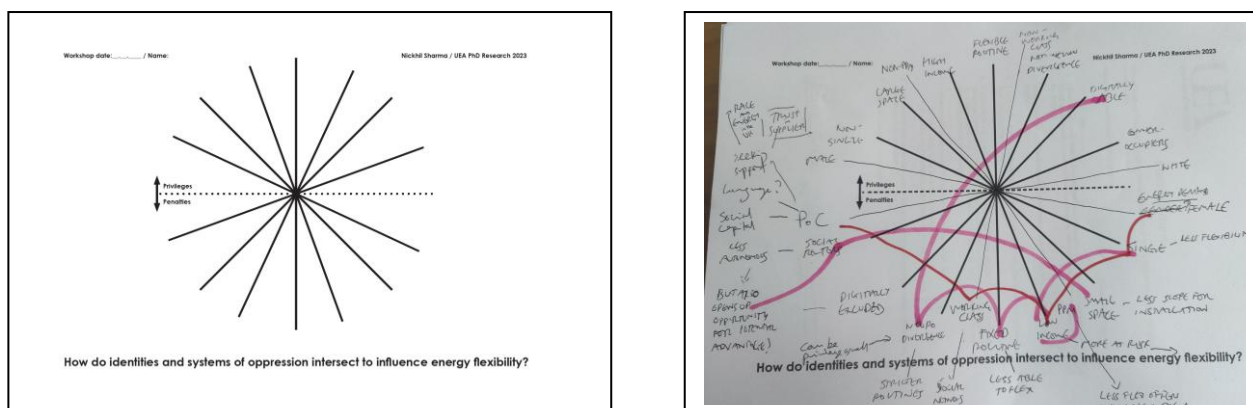


Figure 6.1: Web of Identities (blank, left) provided by me and Web of Identities (filled, right) after the group exercise (from workshop with social enterprise, 12th December 2023).

A point above the horizontal axis represents a privilege (ex: in the figure above, a digitally able household) and a point below represents a penalty (ex: fixed routines). The tool prompted them to ask nuanced questions, such as whether social housing tenancy intersects positively or negatively with factors like temporary employment or being a person of colour. Melanie and another participant were also able to identify key knowledge gaps in their approaches to inclusion in smart energy projects, expressing excitement about the tool's applicability to a typical case.

Based on the application of intersectional tools and discussions around intersectionality's core tenets, participants developed final guidelines (see Appendix I). These guidelines serve as initial steps toward implementing intersectionality in practice and embedding its core principles within projects. Notably, this was the only phase of the case study where I had no intervention; my role was limited to recording their insights.

By grouping similar guidelines during the analysis process (section 3.4, for coding process), I identified three key strategies for operationalising intersectionality:

1. **Creating spaces for critical reflection:** Encouraging reflexivity within smart energy projects, seen as the most fundamental and easily implementable strategy.
2. **Building competence through intersectional tools:** Integrating intersectional tools into projects to demonstrate their practical value and build organizational expertise.
3. **Challenging power structures:** Addressing institutional power to tackle systemic inequalities and reshape the UK energy landscape.

Table 6.1 provides a brief insight into the guidelines, with a short, paraphrased version of the guidelines. The next section explores this distribution and its underlying reasons.

	Charity (14 Guidelines)	Social Enterprise (12 Guidelines)	Energy Distributor (10 Guidelines)
Creating spaces for critical reflection	(i) We aim to include team reflections on systemic inequalities in our project timelines. (ii) We will leave space to ‘ask the other question’ in our practice. (iii) We aim to allocate more time in projects for team reflection on systemic social inequalities.	(i) We share and celebrate the positive impact of intersectionality to foster collective learning. (ii) We continuously challenge ourselves and others to reflect on vulnerability and inclusion definitions.	
Building competence through intersectional tools	(i) We aim to innovate by integrating intersectional tools into our work, setting examples for the energy sector. (ii) Our funding and management approach	(i) We use intersectional thinking to refine our offerings and better serve our communities. (ii) We seek opportunities to apply intersectional tools	(i) We incorporate intersectional tools to examine how projects may privilege or penalize vulnerable consumers. (ii) We use intersectional

	<p>ensures time and resources to embed intersectional tools effectively. (iii) We strive to build consensus on intersectional tools by showcasing them as a USP through our projects. (iv) We seek evidence of the positive impact of embedding intersectional tools and principles in our work.</p>	<p>for inclusivity and true collaboration. (iii) We commit to supporting each other in integrating intersectional tools into our work. (iv) We aim to apply intersectional tools with at least three external partners to showcase their impact.</p>	<p>tools in customer support to understand customer identities and improve services. (iii) We commit to using intersectional tools to embrace complexity in understanding vulnerability by asking: Who's included, who's excluded, why, and what risks might arise?</p>
<p>Challenging power structures</p>	<p>(i) We commit to long-term regenerative energy solutions that respect planetary boundaries and societal inequalities. (ii) We strive to prevent reinforcing structural inequalities in our work. (iii) We prioritise diverse voices, engaging groups whose needs are often overlooked. (iv) We adapt our strategies and processes based on insights from underrepresented communities. (v) We acknowledge the intersectionality impacting the people we serve, letting it guide our strategy.</p>	<p>(i) We strive to avoid putting those we work with at any disadvantage or risk. (ii) We ensure time and funds are equitably allocated. (iii) We collaborate with communities, valuing both their diversity (breadth) and meaningful engagement with them (depth).</p>	<p>We aim to apply an intersectional mindset to critically assess if we're engaging the right stakeholders with appropriate interests and to identify whether this approach risks excluding certain consumer groups.</p>

<p>Other organization-specific guidelines</p>	<p>(i) We want to embrace diverse strengths and identities, embedding intersectionality in daily work.</p> <p>(ii) We aim to align our internal EDI principles with the intersectional approach in our external work.</p>	<p>(i) We aim to showcase one successful example of implementing intersectionality with insights for the Board. (ii) We expect every project member to articulate how intersectionality is embedded in their work.</p> <p>(iii) We commit to moving beyond ‘signposting’ by supporting communities with tangible, actionable solutions.</p>	<p>(i) We aim to make smart solutions and the flexibility market accessible to all customers through clear communication and collaborative processes with external partners.</p> <p>(ii) We take responsibility for establishing centralized expertise on intersectionality, engaging both EDI and consumer vulnerability teams. (iii) We ensure knowledge on practicing intersectionality is accessible across the organization and beyond, seeking support where needed. (iv) We commit to placing diverse consumer groups—both included and excluded—at the core of our innovative services to ensure a fair energy transition. (v) We encourage senior management teams to</p>
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			embrace an intersectional mindset through performance-driven success stories. (vi) We aim to distinguish between consumer vulnerability and EDI efforts, clarifying their intersectionality engagement.
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Table 6.1 Paraphrased Organization-wise list of guidelines per strategy.

Note: Notably, the energy distributor did not dedicate any guidelines for the strategy around reflection spaces, and only 1 out of 10 for challenging power structures. The final row relates to organization-specific guidelines – directed at organization structures or projects.

6.1.1 Using intersectionality to create reflection spaces

The first strategy focused on creating open-ended spaces within practice for reflecting on the intersectional social justice dimensions of smart energy projects. Considered a ‘low-hanging fruit’ by the charity and social enterprise, this strategy was seen as versatile and immediately implementable at personal, team, and organizational levels without external dependencies.

At its core, this strategy views intersectionality as a catalyst for critical reflexivity, through which meaningful intersectional practice begins. Discussions in Chapter 5 revealed how intersectionality prompted participants to examine their biases, assumptions, and positionalities within energy systems. Tools like the intersectional box of reflexivity underscored that reflection spaces, while straightforward, are foundational to embedding intersectionality, requiring

acknowledgment of existing gaps in social justice approaches – which is a requirement for transformative justice.

Participants imagined deliberate reflection spaces as moments to pause and evaluate projects critically. Claire from the charity described this as "*using pause points in the project – using intersectionality as a kind of an evaluation*," emphasizing their importance in avoiding a reactive, "firefighting" mindset. Similarly, Chloe stressed the value of reflection in understanding the complexity of intersectionality and its time-intensive nature.

Sometimes I think it's just being interested in going that one step beyond and thinking hard. And maybe you must set time aside. It's very hard to do that. Everyone is very busy. But intersectionality is all about complexity, isn't it? And it is just impossible to do it without slowing down (Chloe, Social Enterprise).

Reflection spaces were also seen as crucial for aligning long-term organizational visions with intersectionality. Kayla highlighted the frustration arising from the competitive bidding process, which often pushes the charity to pursue projects without fully considering the justice implications. As a funding-dependent organization, the charity must prioritize securing bids, but Kayla emphasized the need for strategic reflection to ensure alignment with intersectional justice goals:

Sometimes we're kind of doing things just because we know we can... a funding opportunity comes up and there's a sense of almost having to go for it. But when should we step back and really look at the strategic objectives from an intersectionality perspective... could we be doing something now that would lead to something far better later? (Kayla, Charity).

It is suggested that allocating time effectively and declining projects that do not incorporate intersectional considerations could enable engagement with fewer, more relevant projects, allowing for comprehensive exploration of intersectionality. These spaces could also generate evidence

demonstrating that intersectionality is not merely theoretical but a practical, impactful methodology that benefits the most vulnerable energy consumers—a common goal across all three organizations, to be examined further in the next section.

Reflection spaces were also envisioned as opportunities to reposition participants as active agents of transformative justice rather than passive followers of regulatory frameworks like Ofgem. This proactive stance encourages the radical actions needed to embed intersectionality, such as centring marginalized households and challenging dominant narratives. For instance, reflection spaces could play a crucial role in addressing the challenges faced by "hard to reach" energy consumers, including those with limited digital skills or non-native English speakers, as highlighted in the quote below.

These pauses are so important to reflect about the “hard to reach” in our community groups. Because I always think, well, why are they hard to reach? Perhaps it's us. What can we do to make ourselves more welcoming, more open, more involving? Instead of just saying, we've got a great solution now let's raise awareness, because if you're involved in the decision making, then you're part of it and it automatically elevates your interest and engagement (Sarah, Social Enterprise).

As suggested here, this kind of reflection would help the social enterprise see themselves as proactive change agents who question their own role in propagating the negative connotations associated with the term and in doing so, challenge the status quo. Instead, Sarah implies involving these groups – and spending efforts to do so – in decision-making from the scratch before designing smart solutions could probably drive-up interest, and therefore engagement.

The following quotes illustrate that another goal of these spaces was to approach projects with openness and humility. Whether it involved recruiting households for smart community energy schemes, as with the social enterprise, or researching vulnerability, as with the charity, the organizations acknowledged that they do not possess all the answers. This attitude underscores the importance ongoing learning in addressing complex social justice issues.

1. Moira: We need to reflect and show a very specific type of leadership. It's not just like, yeah, everyone follows us. It's a learning, evolving leadership.

Audrey: Yes, reflecting about just the value of openness with our communities... and being transparent. So that, people understand where we're coming from, how we've formed, why we make the conclusions we make....and I guess where there is uncertainty and we really don't know the answers, but we're trying to find them out. But yea, doing that requires quite a lot of hard work.
(Social Enterprise)

2. Kayla: We must have humility and openness. And I think sometimes we do the easy thing of coming from a kind of expert base, which can shut things down while working with vulnerable households. Because that openness leads to understanding, and that leads to effectiveness of our justice interventions, I think...(Charity)

A more open and humble approach within these envisioned reflection spaces could be pivotal in driving bottom-up smart energy transitions, addressing a key justice concern in the UK energy landscape, as discussed in Chapter 4. Both Audrey and Kayla's statements reflect a genuine desire to connect with vulnerable households and recognize the complexity of doing so, emphasizing the importance of communication that respects and values their lived experiences. The nod to effectiveness in Kayla's statement underscores that this bottom-up approach benefits both the households and the organizations, fostering inclusivity by incorporating these perspectives before projects commence.

Additionally, engaging with intersectionality in a reflexive manner also necessitates mapping the organizations' positionality—the power and privileges they hold relative to vulnerable households and their representative communities. Audrey highlights that these reflection spaces should also facilitate such positionality analysis, as shown in the quote below.

Intention is simply not enough. I intend to be open and culturally sensitive, and I deeply believe in fairness and equality, but I've not got any reference of the lived experiences of vulnerable communities we work with.... how can we design something for them? So, really reflecting on these differences, being aware of our own background and culture, could also guide us to do things differently...(Audrey, Social Enterprise).

The reference to *background* and *culture* indicates that an acknowledgement of these differences is important in moving beyond *personal* intentions of wanting to be just towards a true centring of the perspectives of those who are marginalised. Thus, a key function of this strategy is to also hold the organizations accountable in ensuring that they do not reinforce existing differences in privileges through engaging in extractivist approaches as described in the quote below.

One thing that came into my head was the privileged position of a researcher And that they are in control of the process, and they are trying to extract information. And typically, that can create like a situation where power imbalances can seep into the situation. So, the reflexivity box helped me think about my own identities and the identities of the research participants... So, visualising them as a co-creator rather than a tool to extract information (Emily, Charity).

Here, the key word is '*co-creator*' which shows that through normalising reflection before action on social justice issues, the reflection space serves as equalising some of the power imbalances in the equation – a link to the third strategy of operationalising intersectionality. Notably, the concept of reflection spaces was less emphasized within the energy distributor compared to the other case studies. While there were some discussions about the importance of reflecting on their role in the smart energy transition, this did not emerge as a central priority. This may be partly due to the team's focus on embedding intersectionality within a highly structured innovation environment, where standardised procedures and measurable outputs tend to take precedence. In such settings, open-ended reflection activities can be seen as difficult to justify, particularly when they lack immediate links to performance metrics or operational goals. As one

participant observed, "if we can operationalize this through some kind of checklist, it would fit the process flow." Given that reflection spaces resist reduction to checklist-style tools, they were ultimately not included in the final set of guidelines co-developed with the distributor (see Table 6.1). This points to the need for ongoing dialogue about how more process-driven organisations can create space for critical reflexivity within their existing structures.

6.1.2 Building *intersectionality muscle* through using intersectional tools

The second strategy prioritized applying intersectional tools within projects to build expertise in addressing intersectionality in smart energy projects. Even though the first strategy was considered easiest to implement, it took a backseat to this approach when it came to setting guidelines for operationalising intersectionality, as reflected in Table 6.1. This was because of an underlying aim to normalize intersectionality by integrating it into multi-stakeholder projects often driven by tangible methods and results. By framing intersectionality as a practical, actionable tool, organizations sought to demonstrate internally and externally that it is not just a buzzword. The following quote highlights this perspective, particularly regarding the Web of Identities, the most discussed tool during the case study.

I think the Web diagram is a technique we can implement within our commitment to a just smart transition to make sure that we don't just say that in words, but we carry that in action. I think it is rather easy to get your head around (Cody, Energy Distributor).

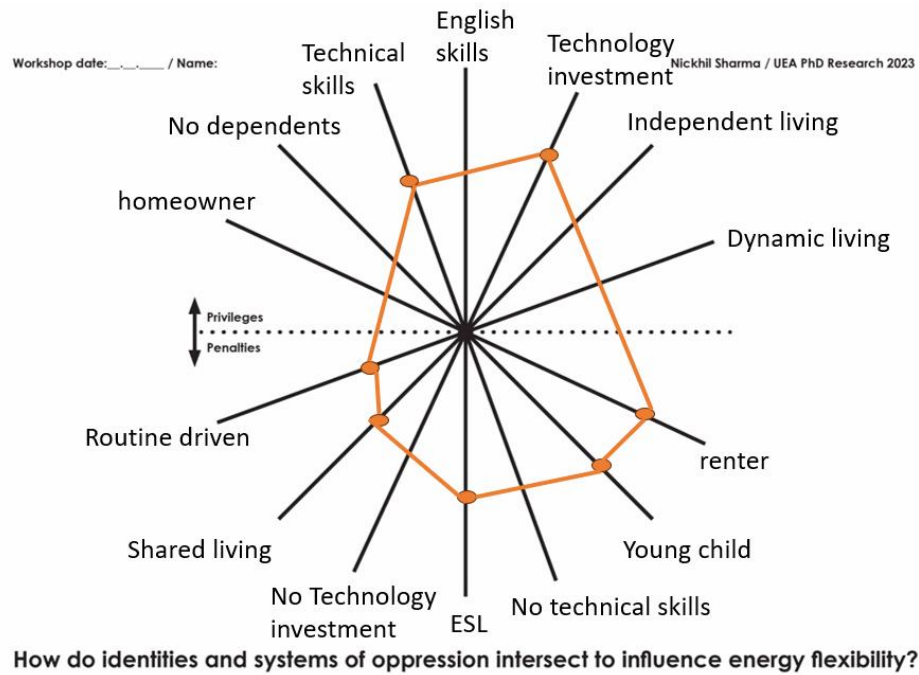


Figure 6.2 The ease of use of the Web of Identities is clearly shown here.

Note: Cody plotted the case of Gill and Archie (see appendix H) quite quickly and used the orange points to demonstrate their overall flexibility capacity is determined by an intersection of several capabilities which they either possess (privileges) or lack (penalties).

This experience of intersectionality as being applicable and measurable through the tool was critical because it meant it could be absorbed into organizational processes. Catherine from the charity describes this below as *“getting it into people’s processes”*.

So, I think getting it into people's processes is a good way to then shape, begin a conversation about what's the point of doing this, what's the value, not just to the organization, but to the work and to the client, how do we even begin to tell the client that they should be thinking about this? I think we need to start showing we can use these tools – develop the muscle.... there is a bit of a learning order here (Catherine, Charity).

Furthermore, it is implied in the quote through the word *learning* that this normalisation must begin within internal projects so they can confidently demonstrate to their clients – often funders who commission specific research on smart energy – that intersectionality is valuable, even in these fast-paced performance-oriented project settings. Before creating this perception

externally, it was considered important to build internal competencies on using intersectional tools as echoed in the quote below from the energy distributor.

...I think there is a perception that social justice work is not really serious or as important...The innovation team might see it as just a nice thing they do on the side. So, using this tool, for example with the customer support team and building that subject matter expertise on intersectionality is so important...This could challenge that perception and create that internal expertise which innovation projects can draw from (Fleur, Energy Distributor).

Once this was normalised internally, it could further drive consensus across the UK energy landscape that intersectionality is not just a theoretical utopia but a practical means of achieving equitable outcomes in real-world smart energy projects. But so far it seems that there is a lack of evidence that proves this claim, which means that it is not a funding concern – and therefore not on the radar. Neil describes this in the quote below.

I wonder if there's a lack of successful examples of intersectionality being useful in practise and maybe that's just not happening because there's not enough funding for such kind of things. So, unless somebody sees the importance of it, there's not going to be a translation into practise, because then it will remain in theory, and it will remain an idea (Neil, Charity).

In the last chapter, I demonstrated that one key reason for the superficial engagement with intersectionality was the dilution of its nuanced, reflexive approach due to a focus on measurable outcomes (section 5.4.5). To engage more deeply with intersectionality, organizations must dedicate time within projects to address its complexity while clearly demonstrating the value it adds to their work. This evidence could help secure funder support and gradually mainstream intersectionality's more radical and nuanced approach. Using these tools and building expertise could bridge the gap between intersectionality's core tenets and conventional project practices, enabling organizations to incorporate it meaningfully without overhauling their current methods

entirely. Thus, there is a critical insight for the organizations that the tools introduced during the case studies may offer the most effective entry point for such engagement.

6.1.3 Using intersectionality to challenge power structures

The third and final strategy for operationalising intersectionality revolved around confronting and challenging power structures within the UK energy system. While intersectionality concerns both power systems (racism, ableism etc.) and institutional power (section 2.5), in my case study the primary concern was institutional power. All three organizations frequently brought up the power of institutions such as Ofgem in setting the *rules of the game* and energy suppliers in utilising their market share to influence the energy landscape early on in the development of the smart energy market. There was also an impression, as highlighted in the quote below, that it was an inherent feature of society.

Institutional power is something that we can't really dismantle, maybe if it were an ideal world. But right now, we need to figure out how to navigate around and work with it (Cody, Energy Distributor).

Cody implies that perhaps attempting to dismantle institutional power is an exercise in futility, and what is more pragmatic is to work with it, not against it – a sentiment echoed across all three organizations. Thus, the final strategy centred around developing a consciousness on their own roles in the context of SETs and their own institutional power. The organizations discussed two primary cornerstones for this strategy:

- (i) critically reflecting on power dynamics when working with marginalized households and communities
- (ii) strategize ways to leverage their power to influence key stakeholders, including major suppliers and the regulator Ofgem

This strategy was regarded as the most challenging to implement – particularly by the charity. Advocating for marginalised perspectives and influencing stakeholders to confront institutional power would mean foregoing their ‘neutral’ image which is also a key factor why they are considered a trusted, influential player in the energy landscape. Moreover, there was also a perception that engaging deeply with intersectionality was inherently political. This raised concerns about crossing the boundary into activism, as suggested in the following quote.

Yeah, I think it is so tricky. What are the limits of the organization? Sure, we have the power to influence, but sadly we cannot be sure if that influencing will work...Nor can we take direct political action.... You also need to be out on the streets chaining yourself to things for change to happen. And how do we interface with that? A lot of these conversations about power for me are to ask ourselves...where does political action start and our work end? But we can and must support that next step. We can only go so far, but the stuff that we're doing can be directly useful for organizations that are out there campaigning and if we never get to that edge, we're never handing over (Catherine, Charity).

Similar reflections surfaced in the social enterprise, which had also understood that they would have to start actively representing marginalised households in their stakeholder meetings to influence the adoption of SETs as indicated in the quote below.

We can start having some of those conversations with less powerful groups and say, okay, we've got the resource to put in the application and say to them ‘you can set the agenda’... It can’t stop there I think, and, yeah, how can we kind of feed those perspectives into lobbying organizations or people who are having behind closed doors conversations with power brokers? I don't think we can always do that, but we're producing insights that Ofgem often uses to decide what needs to happen (Chloe, Social Enterprise).

Thus, bringing the marginalised households into these conversations is an act of redistributing the power across the system since their perspectives can now be at the decision-makers’ table. There is also an acknowledgement that they might not be as powerful as some of

the other organizations possibly due to their relatively small size and local focus, but a chance to have those perspectives reflected in the insights that their partners share with Ofgem on inclusivity in smart energy. I demonstrated in chapter 5 that the closer an organization is to the perspectives of the marginalised households, the more likely they are to engage with the radical elements of intersectionality – and based on the ways in which these two organizations envision confronting power – this seems to hold true once again.

Unlike the other organizations, the energy distributor approaches power structures through intersectionality primarily by focusing on equitable household engagement rather than influencing or redistributing power. Interestingly, while they admitted to being adept at influencing key stakeholders like Ofgem, this did not emerge as a significant focus. As reflected in the quote below, our discussions on power emphasized fairness in household interactions, critically examining the need to provide meaningful benefits to vulnerable households rather than simply fulfilling regulatory requirements.

Fairness should be included as part of our intersectionality work...we often decide to give away some small coupons to vulnerable households for participation...but we are doing it just because it looks good for our incentives (from Ofgem) not because it's going to be useful for customers. We have the power to change that and commit to doing better...and it's starting with those small steps (Sandhya, Energy Distributor).

As opposed to the charity and the social enterprise, only 1 out of 10 guidelines focussed on confronting or redistributing power (table 6.1).

(Energy Distributor) *We want to use an intersectional mindset to develop a critical understanding of whether we are working with the right stakeholders with the right interests - and whether this choice may be leaving certain types of consumers behind.*

As mentioned earlier, a comparison of the final guidelines offers insights into organizations' motives for engagement with each strategy. This guideline builds on the quote above – it is important to ensure that they work with stakeholders that are going beyond tokenistic engagements with inclusion. It seeks to prioritize stakeholders who do not have vested interests and are closest to marginalized households, to avoid further entrenching inequalities. However, it is notable that the classification of consumers as vulnerable or marginalized is missing. A comparison of the wording of the other two organizations reveals a stark contrast, with the charity and the social enterprise both clearly prioritizing their guidelines to challenge or subvert power directly at vulnerable energy consumers.

Although all three organisations recognised the relevance of challenging structural inequalities, the energy distributor's engagement with this notion remained relatively cautious. Rather than explicitly centring marginalised perspectives or naming the political nature of intersectional interventions in regulatory processes, their approach reflected a more incremental stance. This may reflect the institutional realities they operate within, as well as the fact that—as a large market actor—they are already embedded in regulatory processes and benefit from existing arrangements. These positional dynamics can shape what kinds of transformative ambitions are seen as feasible or appropriate from within.

Another difference in this strategy was how the social enterprise and the energy distributor addressed power in the context of financial risks for marginalized households. Both organizations recognized the importance of redirecting grant funds for smart community energy projects to underwrite financial risks for the most vulnerable households, aligning with the goal of challenging power structures. However, the distributor's approach appeared more oriented toward preserving organisational stability and managing risk, rather than directly confronting the underlying structural drivers of energy vulnerability.

I do recognize that the smart demand flexibility models are being developed with a relatively small subset of more privileged households. And I have been thinking about how we can rework grant programs to challenge that. We've got income that's coming in from industry and government for experimenting with smart energy offers but we don't entirely rely on it for our staff costs...

So, I'm wondering whether there's a way in which we could, say OK, well let's use some of that grant to underwrite the risk for certain vulnerable households that otherwise might not participate in such offers... And we could build a pot over a period of time where every project has progressively more inclusion because we have underwritten that risk (Tony, Social Enterprise).

Tony explains how they can use their power (in the form of grants) to challenge the neoliberal model through which the early adapters are often a certain demographic of people. Instead, Tony wants to use intersectionality to understand risks facing vulnerable households and how they can redirect some of their own financial resources towards these households, so they are capable of participation. This shows altruism which is a key component of intersectional solidarity.

For the energy distributor, engaging with altruism was contingent on its perceived effectiveness, as detailed in section 5.4.5. As Cody explained, "Sometimes our thinking when we are supporting people is cautious in that we basically don't want to expend resources on something and then have Ofgem go that doesn't count." Consequently, although the energy distributor was the most financially stable of the three organisations, it did not propose mechanisms to directly underwrite financial risks for vulnerable households. Efforts to redistribute resources or take on greater financial responsibility were typically framed in relation to regulatory approval or alignment with Ofgem's guidance, rather than as proactive or value-driven commitments. This reflects the broader institutional context in which risk mitigation strategies are often shaped by compliance considerations and external validation, rather than internal drivers of equity or social responsibility.

Thus, while for the charity and the social enterprise, engaging with my research involved a shift towards a more radical, political orientation when it came to challenging power structures,

for the distributor, it was a continuation of business as usual. An overall theme emerges from my discussion of the three strategies – for the charity and the social enterprise, much closer to marginalised energy consumers through their work seemed to also engage better with what Christoffersen (2021) would call the advanced meanings of intersectionality. The future-oriented guidelines they created thus vary significantly from those envisioned by the energy distributor.

At the conclusion of the case study process, it became clear that while all three organizations recognized the significant potential of applying intersectionality to inclusive smart energy transitions, their prioritization of the three strategies varied significantly. These differences were shaped by their motivations, proximity to marginalized groups, and their influence within the UK energy landscape.

Throughout their engagement with my research—covering intersectionality’s history, core tenets, and tools—participants from all three organisations took part in group and one-on-one reflections on the need to engage with power structures, centre marginalised perspectives, and consider approaches that move "beyond tinkering within the frame." However, in the case of the energy distributor, these reflections did not fully translate into concrete changes reflected in their final guidelines. Their focus remained primarily on integrating intersectionality within existing operational frameworks, rather than explicitly using it to question or reshape those structures in pursuit of more transformative outcomes. By contrast, both the charity and the social enterprise articulated a clearer orientation toward experimentation and systemic change, seeking to embed intersectionality more radically within their organisational practices and external engagements.

6.2 Concerns, risks and tensions in a balanced approach to operationalising intersectionality

In the previous section, I analysed the actions the three organizations intend to take to operationalize intersectionality, focusing on the guidelines they developed. This section shifts to exploring the tensions and risks inherent in implementing these strategies, as discussed during the

case study. Balancing pragmatic, application-oriented approaches with the more radical ambitions of intersectionality raised concerns about engaging selectively with its transformative core. This section examines how these risks were conceived across the organizations.

A key starting point is the shared perception that, despite the strategies being grounded in intersectionality's core principles through the tools, the process remains complex and resource intensive. This perception aligns with the challenges outlined in the previous chapter, where the difficulty of engagement with advanced intersectional concepts was linked to their inherent complexity, as well as constraints of time and resources. As a result, there is a persistent risk of reverting to superficial methods, a concern that participants frequently acknowledged during discussions.

6.2.1 Intersectionality requires time, resources and expertise

Without dedicating an adequate level of personnel and time to intersectionality, it was discussed that there is a risk that intersectional considerations will become yet another checklist within the project management toolkit.

Audrey: Intersectionality requires effort on your end. You're not just being told, okay, you apply this process and then you tick the box. You are going to have to think, but it's step change in how you think, but it's helping.

Moirra: Yeah, we need a shared language around it, shared understanding, which is a real understanding, rather than a sort of superficial understanding. We have a bunch of tools we use for projects, and we'll pull up a sheet and do a bunch of things on it. And I don't necessarily understand why. We need to avoid that.
(Social Enterprise)

In this exchange above, Audrey and Moirra discuss this risk and allude to it being rather common. The traditional way of dealing with justice seems to be using '*tools*' which not everyone within the organization seems to be on the same page with. Furthermore, the need for a 'real'

comprehension of the tools and their application implies that they would need some form of expertise that goes beyond scratching the surface. This sentiment was also a key highlight, and more directly articulated in the discussions with charity.

Emily: I guess we would need some form of accountability to doing intersectionality in the proper way. Just helping us use the framework and supporting us when we want to use it in projects. And reminding us that the more you do something even when the outcome is not always clear...the more you remember to do it again, it becomes more of a habit.

Neil: Yea and I think there are some cases where funders will care about it, and it can be like a USP for us as an organization. When we're pitching stuff. We can put into bids around social value or innovative approaches to working, things like that, so it can fit within those existing structures as well. But we need enough evidence first to build that expertise (Charity).

From this exchange, it can be inferred that the 'intersectionality expertise' requires not only a deep understanding of what it means to practice intersectionality but also recognizes the inherent experiential value in its application, despite the absence of clear-cut answers. This expertise is required to operationalise intersectionality and encompasses tacit knowledge in integrating it within existing structures in a way that appeals to funders.

Without clear guidance from team members with this expertise, there's a risk it could become diluted into 'business as usual,' losing its core meaning through improper application. Interestingly, although the energy distributor did not engage with the ideas around challenging power structures, they emphasized the importance of establishing skills for using intersectional tools in their guidelines, indicating their concern for operationalizing these strategies effectively – as seen in the guideline below.

(Energy Distributor) *We take responsibility in creating a central subject matter expertise on intersectionality – engaging both the EDI and consumer vulnerability teams. We also want to ensure that the knowledge on practicing intersectionality is easily accessible across the company and beyond.*

Although, this might be more to ensure that the tools are used efficiently in the context of their innovation teams, rather than for ensuring that they engage with its radical message. As I have already showed, for the energy distributor, the biggest focus among the three strategies was on building the skillset required to employ tools to create new business models or provide more efficient customer support, which are also socially just, making intersectionality a secondary concern.

However, this assertion that intersectionality is best applied by experts could have negative connotations, because it may lead to cases where expert opinion – often from academics or industry professionals trying to understand intersectionality – is valued over lived experiences of intersectionally marginalised households. This risk was experienced within the case study process - a participant who is a frontline worker and themselves identified as intersectionally marginalised, dropped out of the study because they felt that the case study approach was complex and failed to make space for their experience.

Sheila communicated to me after the initial workshop, “I found the subject hard to engage with on a personal level due to my socioeconomical lived experience. Whilst intersectionality is of interest to me partly because of my own perceived limitations (growing up poor, and not having opportunities for further education), I felt there was a barrier to my participation in the workshops – my ‘lack of education’ and neurodivergence”.

Reflecting on this incident, I realized that many participants from the charity could easily follow along with the rather complex process of engaging with the core tenets, intersectional tools, and flexibility case studies, despite not being familiar with them beforehand. Most of these

participants – 5 out of 8, were in the research team and were university-educated, as I gathered through informal conversations. They were used to engaging with sessions that were loaded with new academic concepts and quick to incorporate some new tools into their operations. Furthermore, the workshops were also content-intensive particularly because we only had 4 hours together and had to include an in-depth exploration of both intersectionality as a concept and its application to the charity's work on smart energy.

This meant that the pace of our explorations of intersectionality was set by the majority who were quick to grasp how to incorporate and appropriate it into their work. Given these circumstances, Sheila – who declared experiencing intersectionality and limitations related to their socioeconomic identities was left behind from the process. My analysis of intersectionality's potential application to the charity's work thus left out some crucial perspectives – an ironical situation which reflects well the fear of lived experiences becoming trumped by approaching intersectionality through solely application-oriented lenses.

Referring to Catherine's comments in the final workshop below, there is a clear indication and a reaffirmation that the charity, is indeed seriously committed to intersectionality – through mainstreaming the perspectives and the lived experiences of both the vulnerable households they work with as well as the intersectionally marginalised employees that work for them.

We have a lot to be cautious about as well, I think. So we have employees who haven't necessarily had university level education, where they've gotten used to using these kind of concepts, but they nonetheless have a really useful lived experience that we as an organization need to do more to engage better with, to make sure that the tools that we're using are also applicable to our own selves (Catherine, Charity).

6.2.2 Improper application of intersectionality could reverse progress in inclusion in smart energy transitions

The second risk was linked to the first, as the result of a lack of resources and expertise there could be superficial engagements with intersectionality leading to improper application. This risk was more pronounced in the discussions with the charity and the social enterprise. Participants highlighted this could include making assumptions in a rush to finish off projects – for example – plotting a Web of Identities for a marginalised household without conducting a thorough interview with them first. While we applied the tool to three fictional cases, there was an immediate call to caution in both these organizations – particularly in the frontline workers who shared how complicated it can be to reduce the identities of marginalised households onto a diagram. The risk of a reductivist understanding was more pronounced in case of teams further removed from household experiences as implied by Jane, a frontline energy support officer from the charity.

I think there's a danger that you can kind of assume what certain groups of people might want or need... especially if you have no experience engaging with them. Because it's so hard to know that without going out and asking lots of people – which requires a huge effort. So, I think there is always a temptation to make assumptions. But it's probably not all that useful (Jane, Charity).

From the social enterprises' perspective, there was also a clear affirmation that in the absence of an awareness of intersectionality's focus on the intersection of various social categories and on dismantling power structures, certain team members might be tempted to make assumptions while using intersectional tools without engaging with households which they are used to. As Moira explains below – it is challenging to truly get close enough to vulnerable households.

I was thinking while using the Web diagram, how do we avoid talking for people and therefore continuing that cycle? So, like what Sarah mentioned about someone who drew conclusions about why the individuals from social housing didn't get involved. That is also perpetuating that same privilege cycle of this is what must be going on to them. So, I think doing intersectionality is also frustrating because it might be that we are back to square one. Finding a way to engage certain households is so difficult! (Moir, Social Enterprise)

Thus, assumptions which might be projections of their own views of how certain vulnerable households behave with smart technologies might be the easy way out while engaging with a tool such as the Web of Identities. This means the intersectional realities of the household, are missed out. This could mean any progress in centring household perspectives is nullified.

Participants from both the charity and the social enterprise also reflected on whether engaging with such complexity might negatively impact morale, potentially making it harder to sustain motivation for pursuing inclusion. As Audrey aptly described, engaging with intersectionality can sometimes feel like navigating a labyrinth of inequalities, a daunting task that risks overwhelming participants.

And some of my personal anxiety is around.... this labyrinth of inequalities. To what extent does all the time and effort I'm putting in towards using intersectionality in my projects making a difference. Or is it even making a difference? You can sometimes just get lost in the complexity and feel like you're not making any headway (Audrey, Social Enterprise).

Two organization-specific tensions stand out regarding incomplete engagement with intersectionality. For the charity, which has experience addressing intersectional concerns in community settings within its city, there was a tension between fostering an environment where vulnerable communities feel empowered to discuss how their intersecting identities shape their experiences and ensuring this does not create such a sense of difference that solidarity becomes unattainable. Rex highlighted this concern during the conclusion of our initial workshop.

We had an EDI workshop this week – and it was an introduction to intersectionality. I like that we were able to talk about so many different identities and go beyond race, class, gender... But sometimes there is also a risk that while focussing on so many nuances we might come out feeling quite separated from everyone else even though we want to work on inclusion... because we were all going these are my identities and they are separate from yours... so sometimes I feel and wonder if I am putting people in different buckets instead of bringing them together...so the balance between like solidarity and difference is so tricky (Rex, Charity).

Rex's concerns highlight a key tension in applying intersectionality: ensuring that disentangling differences through intersectional tools fosters solidarity rather than division. Their experience suggests that, while intersectionality effectively highlights disaggregated identities and differences, it risks overemphasizing separations, potentially leading to alienation instead of kinship. Intersectional feminist scholars and activists stress that building solidarity across differences should be a core goal of intersectional approaches. Without consistent and deep reflection on how intersectionality is operationalized, there is a danger that emphasizing differences might hinder collective cohesion, both within the organizations and in the energy communities they serve.

For the social enterprise, a key tension lay in balancing climate targets with social justice goals. As Sarah highlights, applying an intersectional approach requires considering all vulnerable groups while striving for carbon neutrality in a region. The challenge is reconciling these ambitious goals with the practical pressures of acting swiftly, setting measurable targets, and meeting carbon reduction objectives—often the primary focus for their funders.

I think it is going to be tricky balancing our intersectional ambitions with real questions around impact....we can have lofty ambitions to be smart and fair, but when you're then stuck with the reality of trying to move fast and hit big carbon emission targets....there is a tension there because the big emitters are often not marginalised, and quick to adapt to the smart transition. The marginalised communities already tend to be consuming the least energy with emissions on the lower end. But they deserve and warrant greater support

from us. I think from the funding we receive, we are often running against a zero-carbon target, and then we are more likely to include and spend more resources on those big emitters (Sarah, Social Enterprise).

The tension lay in allocating resources to intersectionally marginalized households, even when they were not the largest emitters, which could be seen as investing significant time and resources for relatively limited carbon savings. This creates a conflict between ensuring equitable support and achieving zero-carbon targets, potentially resulting in smaller emitters being deprioritized despite the risk of their exclusion.

6.2.3 Aligning Intersectionality with Innovation: A Shift Toward Profit-Driven Applications

The tensions observed in the charity and social enterprise underscore their recognition that rigorous intersectional analyses require applying theory, tools, and data across multiple levels to uncover often implicit connections. In contrast, the energy distributor did not prioritize in-depth engagement with intersectionality's radical core while formulating their guidelines. Discussions primarily focused on the need to build intersectional expertise through internal capacity building and collaboration with external organizations, rather than addressing concerns about superficial applications.

For the distributor, intersectionality was perceived as a complex framework—particularly in relation to the practical constraints faced by engineering and innovation teams. This perception shaped how the concept was taken up: rather than being framed primarily through the lens of lived experience or structural injustice, intersectionality was approached as a potentially valuable tool for innovation and competitive differentiation within the smart energy market. While the charity and social enterprise often expressed frustration and concern about systemic inequities—and saw intersectionality as a way to challenge those directly—the distributor tended to view it more

optimistically, as a means to improve services and organisational performance. This difference reflects the distinct institutional logics and incentive structures within which each organisation operates, and highlights the importance of tailoring intersectional approaches to these varying contexts.

Participants from the distributor expressed concerns about their lack of expertise in applying intersectionality effectively, rather than addressing fears of engaging superficially with its radical, injustice-dismantling principles. While the other two organizations had successfully navigated the complexities of intersectionality and were worried that insufficient expertise might lead to business-as-usual scenarios where root causes of inequalities remain unexamined, the distributor viewed their lack of expertise as an obstacle to applying intersectionality in a way that aligns with their operational priorities. This meant they struggled to demonstrate, using standard business and engineering metrics, that incorporating intersectionality added tangible value, which for the distributor often translates to monetary benefits. Cody's statement exemplifies this perspective.

With intersectionality, it's not just data-driven value, there's other things – but I am worried that they might not be regarded as such. For us, it needs to be applicable in our innovation team where a lot of the smart energy transition is being shaped. And you know from a corporate perspective, we live to measure things. So, showing intersectionality has made a difference is challenging in those traditional ways. I can wax lyrical about intersectionality theory, and we can talk about it all day, but ultimately, if someone who's developing a project or working on it can't then apply those principles in a way that actually shows benefits, our senior management is not going to want to spend resources on it (Cody, Energy Distributor).

The energy distributor's interest in operationalising intersectionality within future smart energy projects was primarily framed through an innovation- and performance-oriented lens, with a focus on its potential to generate value within competitive market conditions. This orientation aligns with the motivations explored in Chapter 5 and was reflected in the composition of the case

study team. Unlike the charity and the social enterprise, which engaged staff working closely with vulnerable households, the distributor's participants were primarily drawn from engineering, business, and innovation departments. The consumer vulnerability team was not directly involved in the study, suggesting that intersectionality was initially positioned as a strategic opportunity rather than a core customer engagement concern. As a result, participants' engagement with the framework tended to be optimistic, with attention focused on how intersectionality could be translated into actionable, measurable benefits—particularly in terms of service improvement and organisational innovation.

6.3 Embedding intersectional social justice across users, institutions, and power-systems in smart energy futures

The three strategies for operationalizing intersectionality outlined in this chapter reflect varying degrees of organizational commitment to a more advanced definition and application of intersectionality within their SET initiatives. All three organizations developed guidelines that aim to surpass current approaches while simultaneously navigating the constraints of existing systems. This involves envisioning practical applications of intersectionality through measurable tools and aligning them with project lifecycles.

In Chapter 2, a three-pronged theoretical framework was developed to critically analyse the social justice implications of SETs. This framework was applied to the three organizations through workshops, interviews, and self-reflection templates (Chapter 3). Building upon the findings presented in Chapters 5 and 6, this section will critically examine the extent to which the envisioned future strategies address the critical elements of intersectional social justice at users (micro), institutions (meso), and power-systems (macro) levels.

6.3.1 User-focussed approach: Most prevalent in future strategies

The user-focused approach leverages intersecting identities revealed through an intersectional lens to challenge dominant narratives that abstract users into universal, undifferentiated figures assumed to engage seamlessly with smart energy technologies. These narratives often justify one-size-fits-all policies, overlooking critical social categories like gender, ethnicity, and migration status that influence capabilities and flexibility capacity—key factors for participation in smart energy futures.

The flexibility cases examined (Appendix H) enabled all three organizations to envision smart energy users as having multiple, intersecting identities that interact dynamically to create unique penalties and privileges. This approach allowed them to connect social categories to flexibility impacts and consider how to design more equitable and just smart energy offers. Melanie's reflections illustrate this process.

So, I thought it was interesting working on the Web. We just had so many questions about the family and their relationship with the landlady. We did not know which of their identities were impacting this interaction....and how it would change if the offer from the landlady change? Even looking at their migration background.... like whether you're from a migrant background or born in the UK, but even within that, you know, a major difference, whether you're from like, a like a European migrant background, or outside of the EU. This may be linked to completely different cultural contexts, and so maybe different experiences of things like surveillance and like you have different levels of trust in institutions. It's like one little line of data on the Web and suddenly it's like, there's a lot of questions and stuff you can really dig into there. Because yea there is a tendency to group identities together....so it was interesting to look at them in a disaggregated manner (Melanie, Social Enterprise).

In this example, Melanie is describing the application of the Web of Identities to the case of Abdul and Sarah, middle-aged Muslim family living in a shared household who have been

offered an automated temperature management system to conserve energy at home by their landlady who is tech-savvy and climate conscious. Typically, this would have been a case of vulnerability because they are private renters and live in a shared household where introduction of smart energy systems is shown to create vulnerabilities such as a disruption of routines (Citizens Advice, 2024). However, as Melanie describes, zooming in on the particularities of the case, and focussing on plotting their other identities (and related capabilities) and how they might intersect to create the specific circumstances in which they experience the smart energy offer helps move from their visualisation as just another privately rented, shared living household to a visualisation which acknowledges their other identities. This could mean for example, that despite Abdul and Sarah being tech savvy, and having a landlord that is supportive of their interest in smart energy, their immigration background might influence their concerns over the types of data that they collect and possibly create hindrances.

This nuanced approach aligns with intersectionality as a sophisticated social justice intervention and has tangible benefits. Identifying specific knowledge gaps, as Melanie notes—“discover new challenges that people are facing and then start to actually address that”—leads to better problem definitions and user-oriented solutions. These solutions are more likely to increase household acceptance and engagement, benefiting all stakeholders in the smart energy ecosystem. For the social enterprise and distributor, this also presents financial incentives to develop custom smart energy offers tailored to diverse user needs.

6.3.2 Institution-focussed approach: uncovering blind spots, enhancing accountability and focussing on long-term inclusivity

An institution-focused approach to intersectionality requires organizations to critically examine their role in perpetuating or dismantling systemic inequalities. This includes

acknowledging how past smart technology and infrastructure development has embedded injustices and ensuring these are neither repeated nor normalised in future smart energy transitions. Across the three organizations, applying intersectional tools helped reveal institutional blind spots and challenge entrenched assumptions, as Sandhya from the energy distributor noted: *“Acknowledging where our engagement with justice is incomplete allows for transparency and the potential to deepen that work in future projects.”*

Discussions on applying intersectionality underscored the need to move beyond superficial "tick-box" approaches to inclusivity within institutions. For the charity, Carol highlighted that deeper, household-led engagements could reveal granular insights, enabling them to demand justice in more specific and transformative ways, rather than relying on tokenistic efforts. Similarly, Audrey from the social enterprise critiqued rigid frameworks like the Priority Services Register, which oversimplify vulnerability. By leveraging intersectionality, participants sought to address root causes of exclusion instead, crafting solutions that avoid unintended consequences and ensure marginalised groups can engage with and benefit from smart technologies over longer, more sustained periods.

By contrast, the distributor's engagement with intersectionality revealed a different set of priorities. While they acknowledged the need to identify blind spots and address systemic injustices, their focus remained tied to operational efficiency and financial sustainability.

Through the box of reflexivity, I think I was thinking about the depth of help we offer. It got me thinking about how unaware we sometimes are when we reach out to vulnerable customers... And if it's not very deep support that we offer, could it just be the same people coming back to us over and over again? Because all the resources we put are not actually lifting them out of their circumstances...So, I think embedding intersectionality there, we can offer that deeper support because we can permanently change someone's situation. Then we can also justify using intersectionality.... articulate those benefits (Cody, Energy Distributor).

Cody indicates that they also wanted to prioritise long-term justice interventions that strike at the root causes of inequalities, and that deeper support for vulnerable households could permanently alleviate their circumstances, reducing repeated reliance on customer support and optimising resource allocation. However, embedding intersectionality was also viewed to enhance the long-term efficiency of their customer service, aligning with their profit-driven objectives rather than prioritizing a purely justice-oriented approach.

The institution-focused approach thus underscores the tensions between justice and pragmatism within these organizations due to their unique institutional dynamics. For the charity and social enterprise, intersectionality was framed as a mechanism to align organizational practices with justice-oriented goals, ensuring their work meaningfully addresses systemic inequalities. Meanwhile, for the distributor, intersectionality was valued primarily to enhance operational outcomes. Despite these differences, all three organizations recognised that addressing institutionalised inequalities through intersectionality requires a shift from reactive, short-term fixes to proactive, transformative practices that centre accountability and responsibility. Thus, intersectionality also brought to focus the upstream processes of institutionalisation that enable and normalise ongoing inequalities.

6.3.3 Power systems-focussed approach: moving beyond critiques of neoliberalism

The final approach focuses on macro-level power systems such as capitalism, racism, and neoliberalism as the underlying context for smart energy transitions. It emphasizes understanding how these systems influence diverse users' experiences with the benefits and risks of smart technologies, the extent to which their needs and expectations are considered in these technologies, and which institutions shape the development of smart energy systems and the mechanisms they employ. This section underscores a critical gap in addressing the effects of these power systems embedded within smart energy systems.

While critiques often target symptoms of inequality—such as the exclusion of specific user groups—they rarely challenge the structural forces underpinning these injustices. These forces include the historic institutionalisation of oppression and the normalisation of neoliberal, technosolutionist logics, which continue to shape energy policy and technology development. Intersectionality offers the potential to disrupt these patterns by placing radical social justice at the centre of energy transitions, yet this potential remained largely untapped through my case study.

Discussions during the case study engaged with power systems to some extent, particularly in recognising neoliberal markets and their role in perpetuating inequalities. For instance, Tony from the social enterprise noted the danger of categorising vulnerabilities as fixed and homogeneous, and therefore excluding all vulnerable households from new smart energy innovations (a symptom of neoliberal thinking that technologies will first need to be normalised in high consuming, high paying households and then trickle down), advocating instead for a more nuanced approach that examines when and how households should be included.

While this reflects a meaningful step towards addressing procedural justice, the discussions often stopped short of interrogating how neoliberalism intersects with other power systems of oppression such as racism, sexism, or ableism to entrench these vulnerabilities. For example, while participants acknowledged the novelty of their smart energy offers and the risks involved, there was limited exploration of how these offers might perpetuate broader systemic inequalities. The discussions largely centred on financial injustices —such as whether it is ethical to include all households in flexibility programs requiring upfront capital without guaranteed savings—but failed to delve into how these offers might replicate or exacerbate injustices related to other household characteristics such as ethnicity or gender. Discussions rarely considered how financial barriers intersect with other systemic disadvantages—such as unequal access to digital infrastructure, discrimination in housing markets, or cultural mistrust of institutions—to exacerbate exclusion from smart energy benefits. Similarly, the participants, rarely extended these reflections to examine

the larger structures of Whiteness and maleness that dominate and shape both energy and digital technology landscapes.

These oversights highlight a significant gap in the application of intersectionality to include power systems. While the case studies effectively engaged with user-level and institutional-level inequalities, they did not grapple with how power systems like neoliberalism, institutional racism, and patriarchal norms intersect to shape energy policy, market structures, and technological development. Participants from the charity acknowledged uncertainty about whether and how identities such as Black British ethnicity might interact with smart energy-related penalties or privileges while dealing with the case of Gill and Archie, a single-mum living with a neurodivergent son in a predominantly Black suburban neighbourhood. One reason attributed to this was that despite growing anti-racist research on energy users in the US, there is limited scholarship or practical engagement with these issues in the UK and Europe.

While the organizations demonstrated progress in addressing inequalities at the user and institutional levels, their engagement with broader power systems remains shallow. Without examining how these systems are institutionalised and perpetuated, the transformative potential of intersectionality to challenge entrenched inequalities will remain underutilised. Addressing these gaps is essential to fully integrate intersectionality as a tool for advancing justice in the energy transition.

7. Conclusion: Rewiring Justice in Smart Energy

Transitions

At the outset of this thesis, I outlined how smart energy technologies (SETs), despite being championed as a cornerstone for the UK's ambitious NetZero 2050 targets, often reinforce and exacerbate existing social inequalities. Research shows that the primary beneficiaries of these technologies remain affluent, high-income households—those already advantaged within the energy system due to their ability to afford and consume more energy. In contrast, households that are privately renting, in fuel poverty, or include elderly residents or individuals with special medical needs are less likely to own or engage with SETs, missing out on benefits like demand flexibility.

I also highlighted the broader implications of smart technologies seamlessly integrating into our daily lives, fuelling a data-driven digital economy that perpetuates inequalities across class, race, and gender. Smart energy transitions, situated at the intersection of energy and digital systems, compel us to critically examine the social justice issues they entail—especially as they profoundly reshape the UK's energy landscape.

Finally, I argued that while the widely used energy justice triumvirate—distributive, procedural, and recognition justice—effectively describes inequalities and their emergence across sociotechnical systems, it falls short of addressing the interdependent power structures that underpin energy inequalities. Moreover, it lacks the normative and prescriptive tools necessary to guide transformative and equitable energy transitions.

By introducing intersectionality to the current state-of-the-art on energy inequalities within the smart energy landscape, I sought to provide a nuanced understanding of how overlapping social identities—such as race, gender, income, disability, and migration status—interact with the vulnerabilities and opportunities created by smart energy systems. This reframing challenges traditional, single-axis approaches to vulnerability in energy policy and practice, ensuring that

diverse households and their lived experiences are not overlooked in the transition to smart and flexible energy systems. Crucially, in chapter 2, I argued that there are three ways in which an intersectional lens could provide a transformative take on the social justice implications of SETs.

Firstly, intersectionality's commitment to addressing marginalisation in neoliberal contexts aligns seamlessly with the goals of exploring injustices within the neoliberal energy landscape in the UK. It can therefore interrogate the systemic power structures—such as those rooted in market logics and institutional hierarchies—that sustain disparities. Intersectionality's ability to expose and challenge these forces provides a transformative lens to critique not just who benefits or loses from SETs, but also whose visions of the transition dominate and whose needs are marginalised. This integration would also strengthen the theoretical foundation of energy justice, making it more resistant to co-option by powerful interests and ensuring it retains its focus on dismantling oppressive structures.

Secondly, intersectionality's emphasis on fluid, dynamic vulnerability represents a shift away from traditional approaches that cast energy users as static, perpetually disadvantaged entities. Instead, it recognises the ways in which individuals and communities can move between positions of privilege and marginalization depending on context, time, and intersecting factors. This perspective aligns with critiques of energy vulnerability frameworks that overlook the market and institutional forces shaping these transitions. By reframing vulnerability as dynamic, intersectionality empowers policy and practice to focus not just on what technologies energy users should adopt but on how these technologies can adapt to serve the diverse needs of energy consumers.

Thirdly, intersectionality offers a pathway for prefigurative political action, challenging mainstream social structures and techno-managerial approaches to decision-making. This resonates with Bouzarovski and Simcock's (2023) call to replace market-driven, positivist energy methodologies with explicitly justice-oriented and co-produced alternatives. Intersectionality advocates for methodologies that are context-specific and collaborative, emphasizing the

importance of engaging with the communities most affected by energy transitions. Furthermore, its focus on the interplay of political, economic, and cultural forces highlights how systemic oppressions—patriarchy, racism, colonialism—shape energy inequalities. By directly confronting these forces, intersectionality enables a deeper, more structural critique of energy transitions, paving the way for justice-oriented solutions that move beyond surface-level reforms.

To explore how these strengths translate into the practical realm of smart energy transitions, I framed my research around the following questions:

- **RQ1:** How do the ongoing smart meter rollouts in Great Britain impact social justice, and to what extent do they address intersectional concerns?
- **RQ2:** How do organizations working with SETs in GB conceptualize and respond to the social justice implications of their initiatives, and why do they engage (or fail to engage) with intersectional praxis?
- **RQ3:** How can organizational practices be better aligned with intersectional praxis, and how might such alignment advance or hinder the transformative potential to dismantle inequalities in GB's transition to SETs?

In this final chapter, I will synthesize the findings from my data collection phases, providing a concise recap of the methodologies and insights gained. I will then briefly answer the research questions posed at the outset, framing the core themes that emerged through my analysis. Following this, I will highlight the key contributions of my thesis, emphasizing how it advances our understanding of justice within the context of smart energy technologies (SETs) and intersectionality. Finally, I will offer policy and research agenda aimed at fostering more equitable smart energy transitions and identifying pathways for future exploration in this critical area.

7.1 What happened during the three phases of data collection?

To address the research questions, I employed an exploratory qualitative research design conducted in three distinct phases. The first phase involved qualitative interviews with 11 smart energy experts drawn from diverse sectors across the UK energy landscape, including charities, policy groups, research and advocacy organizations, and industry. These interviews provided a wide range of insights into the conceptualization of social justice in the context of smart energy technologies using the smart meter rollouts as a point of departure.

My analysis revealed that SETs represent both an opportunity and a challenge for justice. While the adoption of smart technologies and market innovations promises a more sustainable and efficient energy system, current approaches have perpetuated significant injustices. From distributive inequities that exclude vulnerable households, to procedural shortcomings that marginalize their needs, and a lack of recognition for the systemic barriers they face, the transition risks deepening existing inequalities rather than resolving them.

This analysis has underscored that justice cannot be an afterthought in smart energy transitions. It must be rewired into the very foundation of policies, technologies, and market structures. However, this requires more than just better-designed technology or incremental reforms. It demands uncomfortable but necessary conversations about moral responsibility, privilege, and collective accountability in how energy is consumed and its implications for the planet. It is a task that requires urgency, collaboration, and a commitment to systemic change.

In order to achieve this, I leaned on the three-pronged framework on intersectionality that I developed. Combining a user, institutional, and power systems focussed approach, the framework served as a transformative lens for addressing inequalities in smart energy transitions. This framework brought an examination of the structural roots of inequities—such as neoliberal

market logics—and envisions pathways toward a genuinely inclusive energy system. To translate this framework into tangible, actionable strategies, I combined existing intersectional tools, adapting them to the context of smart energy transitions. I then brought this methodology into practice through the second and third phases of my research, conducting three in-depth, 8-week-long case studies with a charity, a social enterprise, and an energy distributor. These organizations were selected for their active engagement in addressing injustices with SETs and became spaces for testing and refining how intersectionality could reframe justice. By embedding this framework into their practices, I demonstrated how intersectionality can move beyond abstract critiques to actionable strategies that centre marginalized voices while transforming the energy landscape for everyone.

In phase 2, participants engaged with the core tenets of operationalizing intersectionality through workshops and self-reflection, offering insights into how these principles could transform their work on SETs. This process revealed critical opportunities for integrating intersectional social justice into organizational practices, as well as significant challenges in bridging theoretical frameworks with practical implementation. By observing and reflecting on their own practices, participants highlighted both the potential for intersectionality to address systemic inequities and the barriers that must be navigated to achieve meaningful change.

My results revealed that while the transformative potential of intersectionality—such as examining the interrelations between vulnerabilities (e.g., living in fuel poverty as an ethnic minority or having special medical needs in shared-rented housing)—remains largely untapped, engaging with its core tenets exposed structural inequalities in smart energy transitions. For instance, the embedded neoliberal logic of profit-driven competition, while fostering innovation, often sidelines justice considerations, treating them as afterthoughts or addressing them only when they align with revenue generation.

Motivations for engaging with intersectionality varied across organizations, ranging from fear of perpetuating injustices to aspirations for market advantage. Even within charities and social enterprises, where the intrinsic value of justice was emphasized, efforts often stopped short of critically interrogating systemic power structures like capitalism and racism. This highlights a critical need to move beyond surface-level engagement toward more transformative practices that address the root causes of inequality in the energy sector.

In all three organizations, I found that smart energy projects are gradually shifting focus beyond affluent households, likely driven by the progression of smart meter rollouts beyond early adopters and the increasing prevalence of demand flexibility trials. While this has led to a broader engagement with diverse household types, justice considerations remain secondary or are deemed feasible only when they enhance revenue. Organizations tended to adopt an additive approach, addressing household capabilities like income or digital literacy separately, and not reflecting on their interconnections with identities such as ethnicity or gender which is central to any intersectional analysis.

This additive approach is perpetuated by sensitivities around collecting identity data, the lack of intersectional tools, and external constraints from funders and collaborators, who prioritize quick, demonstrable inclusivity efforts over deeper, structural engagements with injustice which require time and resources. Together, these findings underscore the need for a fundamental shift toward intersectional praxis that critiques and dismantles systemic power structures, moving away from positivist methodologies.

Phase 3 centred on co-creation and dissemination, where participants developed actionable strategies to integrate intersectionality into their organizational practices. A co-creation workshop allowed participants to reflect on findings from earlier phases and collaboratively explore how intersectionality could inform both immediate and long-term goals. This participant-led approach resulted in concrete guidelines tailored to their unique contexts. The phase concluded with a public

dissemination event hosted at Citizens Advice, fostering cross-organizational dialogue and amplifying the research's broader impact.

During the workshop, I minimized my input to allow participants to lead the discussions, while carefully capturing the proceedings with enhanced recording methods to ensure no insights were missed. To conclude this phase, I organized a public dissemination event at Citizens Advice, where I facilitated cross-organizational dialogue and shared research findings.

Although each organization adopted different strategies to operationalise intersectionality within their smart energy projects, I analysed their approaches through the three-pronged intersectional framework, focusing on user, institutional, and power systems levels. By the end of the case study, organizations primarily engaged with intersectionality at the user level, leveraging it to challenge one-size-fits-all assumptions about energy users. While they had already recognised the value of intersectionality in this context, they began to identify the significance of intersecting identities—such as migration status, gender, and ethnicity—in shaping households' energy experiences. This prompted a shift in their understanding of “vulnerability” as dynamic and context-specific, leading to a greater emphasis on tailored smart energy solutions to enhance inclusivity.

For instance, in a fictional flexibility case discussed during the study (section 6.1 and Appendix H), an elderly couple, Brandon and Farrah, were offered a partially subsidised automated smart energy system with a heat pump. Initially, participants focused on the couple's age and health issues, standard markers of vulnerability in smart energy contexts. However, as the discussion evolved, they began considering other facets of the couple's social situation: their stable pension, suburban home, proficiency in English, and regular interactions with medical professionals through home visits. These factors were acknowledged as equally critical in shaping an inclusive offer.

A truly inclusive offer for Brandon and Farrah would go beyond addressing their age and health needs. For instance, it could provide personalised energy automation options, allowing them

to control heating and ventilation in ways aligned with their medical requirements while minimising disruptions to their routines, reducing their fear of losing control. The system could also include transparent, detailed, easy-to-understand cost breakdowns that leverage their proficiency in English, ensuring they remain informed and confident about their energy costs. Additionally, recognising their access to healthcare networks, the offer could incorporate collaborative features—such as data-sharing protocols with their medical advisors to optimise energy usage for health-related equipment like ventilators. By factoring in the couple’s broader social context, the offer would not only be more equitable but also empower Brandon and Farrah to engage meaningfully with the smart energy system.

Furthermore, I argued that the user-focussed approach to intersectionality was easiest to operationalise because it was closest to their practice – they already work with user personas in most projects – and so intersectionality, particularly using tools like the Web of Identity at this level was more tangible, applicable, and ‘exciting’ as several participants described. However, when it came to reflecting on intersectionality beyond the micro-level of energy user experiences, it became more complex and harder to implement.

Tailored approaches can enhance inclusivity by addressing specific needs and capabilities, but they are insufficient on their own. Intersectionality’s transformative potential lies in its ability to move beyond the micro-level to tackle systemic and institutional inequities. Without addressing the structural roots of injustice or critically examining institutional practices that embed tokenistic inclusivity, tailored interventions risk reinforcing existing inequalities. Transformative justice requires embedding intersectionality at all levels: empowering users, reforming institutions to foster accountability, and challenging the macro-level power systems that shape the energy landscape. Only by integrating all three prongs can we ensure a truly inclusive and equitable energy transition. Thus, my explorations with the organizations went beyond this towards the institutional and power systems levels.

At the meso- or institutional level, organizations acknowledged their role in perpetuating systemic inequalities through both past and current practices. Intersectional tools proved valuable in identifying blind spots, fostering deeper accountability, and shifting from tokenistic inclusivity efforts to more meaningful, household-led interventions. For the charity and the social enterprise, this involved designing long-term justice initiatives informed by intersectionality. For instance, the charity created reflective spaces to deliberately slow down decision-making, rejecting projects that engaged with justice superficially. The social enterprise focused on reforming its business model, ensuring vulnerable households could participate in pilot smart energy innovation projects by underwriting risks through financial protections offered via specific internal funds.

The energy distributor, while reflecting on their role in embedding intersectional justice within SETs, primarily sought to leverage it as a tool for operational efficiency and resource optimisation. Their reform efforts, such as incorporating intersectionality into customer support training, were closely tied to improving customer experience—a goal linked to reputational gains, Ofgem incentives, and profit maximisation. Despite these differences in approaches, all organizations recognised the need to institutionalise justice beyond short-term fixes. Each took steps towards reform that aligned with their capacities and strategic priorities, moving intersectionality from theory to actionable practices within their respective contexts.

Engagement with intersectionality at the macro level—addressing capitalism, racism, and neoliberalism—remained the most superficial during the case studies. While critiques of neoliberal logics, such as prioritizing early adopters and relying on trickle-down benefits, were common, they often stopped short of exploring how these dynamics intersect with systemic forces like racism, sexism, or ableism. For instance, financial barriers to flexibility participation were discussed often, but questions of how these barriers intersect with housing discrimination, unequal access to digital technologies, or cultural mistrust rooted in gendered and/or racial histories of exclusion remained underexplored. Tackling these intersections is essential for dismantling the structural inequalities

that perpetuate energy injustices and for reimagining the energy transition as truly inclusive and transformative – an opportunity for further academic and policy work.

7.2 Key Contributions

The central aim of this thesis—expanding our understanding of energy inequalities and critically examining the dominant frameworks shaping current discourse—is firmly situated within well-established academic debates (section 2.3). However, my focus diverges by employing intersectionality, a lens that has received relatively little attention, particularly in its application to Global North contexts and the digitalisation of energy. In this section, I outline the key contributions of this research. These contributions are intended to open critical new pathways for research and practice which are explored in the next section. By engaging with intersectionality, this thesis seeks to advance a more expansive, transformative, and justice-oriented approach for understanding and addressing energy inequalities.

A central contribution of this research is the conceptual application of intersectionality to the field of smart energy. Through the development of a novel three-pronged framework, this thesis provides a transformative lens to identify and address the root causes of smart energy injustices. In section 6.3, the framework grapples with how to ensure that flexibility benefits the diversity of energy consumers in the UK while safeguarding against institutions leveraging smart energy transitions to serve their own ulterior motives.

This framework extends the application of intersectionality beyond its theoretical roots, and advances the growing body of literature on energy justice by embedding intersectionality as a core principle for rethinking the social implications of technological innovation in the energy sector.

A second key contribution of this research lies in the practical operationalisation of intersectionality across three distinct organizational contexts, providing valuable new empirical insights. While this thesis does not directly engage with household perspectives—a limitation stemming from ethical considerations during the energy crisis—this deliberate turn towards organizations that work directly with households provided a valuable opportunity to conduct original research in a different context. This decision, which I questioned throughout the process, enabled me to explore why organizations are motivated to work with intersectionality, how they perceive it, and how they can operationalise it to create more just (smart) energy futures.

It gave me a chance to explore the development of SETs through the UK's diverse, yet interconnected and interdependent network of energy stakeholders. My research delves deeply into the motivations, constraints, and tensions that organizations face when engaging with intersectionality. I found that while all three organizations recognised the potential of intersectionality to advance justice, their motivations varied significantly. For the charity, intersectionality was primarily seen as a means to enhance their ethical commitment to inclusivity. The social enterprise viewed it as an opportunity to align their climate and social justice goals, while the energy distributor was motivated by the potential for innovation and competitive advantage. However, these motivations also revealed underlying tensions. For instance, the energy distributor's profit-driven goals often clashed with the transformative demands of intersectionality, leading to a superficial engagement with its principles. This nuanced understanding of organizational dynamics is a key contribution, shedding light on the structural and institutional barriers that can dilute intersectionality's radical potential in various settings.

This demonstrates that even among organisations already actively engaged with justice agendas, the uptake of intersectionality remains partial, fraught, and shaped by institutional constraints. In doing so, the thesis challenges assumptions that justice-oriented rhetoric necessarily translates into radical practice. It also highlights the structural and organisational frictions that dilute intersectionality's transformative potential—offering a vital foundation for future research

that seeks to engage more sceptical, less aligned, or structurally constrained actors within the energy system.

A third important contribution of this thesis is methodological: bridging the gap between intersectionality as a theory and its applications in practice. While intersectionality is widely recognised as a powerful theoretical framework, its practical implementation remains underexplored, particularly in technical and policy-driven fields like energy.

My methodology rooted in a co-design philosophy, paid attention to the needs of the three organizations and as such it allowed me to use metaphors, tools, values, fictional cases, from a broad variety of intersectional feminist research and combine them in ways which allowed these organizations (and me) to learn and explore how intersectionality could add depth to our conversations on inclusive smart energy futures. By working directly with organizations to apply intersectional tools and strategies, I demonstrated how intersectionality can inform decision-making, from policy design to community engagement.

This contribution is particularly significant given the increasing recognition of intersectionality's importance in addressing systemic inequalities related to energy injustices (Rainard et al., 2025) and calls for more second-order research in energy transitions (Fazey et al., 2018). By translating intersectional principles into practical applications, my work provides a roadmap for organizations seeking to integrate social justice into their operations without losing sight of intersectionality's radical, transformative potential. I hope that researchers and organizations engaged in energy justice will find value in the workshop design presented in Appendix F & G, adapting and building upon it to develop even more effective methods of integrating intersectionality into energy justice conversations and practices.

For example, I identified, adapted, and facilitated the application of tools such as the Web of Identities and the Intersectional Reflexivity Box to help organizations visualise and interrogate the intersecting identities (and vulnerabilities) of energy consumers. By integrating these tools into the organizational context, I transformed intersectionality from an abstract concept into an

actionable methodology, offering practical means to identify blind spots, challenge superficial “tick-box” inclusivity efforts, and foster critical reflexivity.

In guiding the use of the Web of Identities, I enabled organizations to map overlapping social identities—such as migration status, gender, and disability—and explore how these intersections shape household energy flexibility. This facilitated a more granular and dynamic understanding of consumer vulnerabilities, helping organizations rethink their approaches to inclusivity and design interventions that are both equitable and responsive. These insights were applied to reimagine smart energy-related interventions such as tailored energy advice, insulation upgrades, and retrofits. Similarly, by embedding the Intersectional Reflexivity Box into their practices, I encouraged participants to reflect critically on embedded assumptions and adopt more accountable decision-making processes. For instance, one organization re-evaluated its approach to designing demand flexibility programs, recognizing the need to incorporate the lived experiences of low-income households and address potential penalties, such as disruptions to daily routines, through more empathetic and inclusive design. This thesis demonstrates how intersectionality can be actively operationalised to inform not only SETs but also broader energy interventions, such as retrofits, tailored energy advice, community energy projects, and insulation upgrades.

A fourth contribution of this thesis lies in its identification and exploration of a critical gap in current understandings of energy justice: the limited engagement with how macro-level power systems—such as capitalism, neoliberalism, racism, and sexism—manifest and intersect with micro-level energy experiences. While participants in my case studies acknowledged the role of these systemic oppressions in shaping energy landscapes, they hesitated to directly engage with their tangible impacts on households. This reluctance often stemmed from discomfort about making assumptions regarding ethnic minority households or unease with their own limited understanding of these complex intersections – especially given there is a critical gap in research in this area.

My thesis argues that addressing this gap is essential for advancing a holistic understanding of energy justice. Without integrating an analysis of how macro-level systems like racism and neoliberalism shape energy access, affordability, and participation, smart energy transitions risk reinforcing rather than dismantling hierarchies of power and privilege.

Furthermore, my research revealed conflicting perspectives on the role of markets in addressing energy injustices. Some participants expressed confidence in market mechanisms as solutions, while others recognized the need for active regulatory interventions that transform the profit-first dogmas embedded in current SETs development to ensure equitable outcomes. These tensions reflect deeper questions about epistemic authority—whose knowledge is valued and who gets to shape the narrative of energy transitions. For instance, dominant voices within energy policymaking often prioritize technocratic and profit-driven solutions, sidelining community-led perspectives and the lived experiences of marginalized groups. This imbalance perpetuates a cycle where systemic oppressions remain invisible or are treated as secondary concerns.

By linking macro-level power systems to lived energy realities, this thesis highlights the transformative potential of intersectionality to uncover and address these entrenched inequities. However, achieving this requires research and practice that actively confronts challenging questions: Who benefits from smart energy transitions? Whose vulnerabilities are amplified? How do existing systems of oppression—rooted in racism, capitalism, and sexism—manifest in energy access and innovation? While these questions may be difficult to engage with, they are indispensable for creating energy futures that are truly inclusive and just. The contributions of my thesis emphasise the importance of moving beyond surface-level critiques and developing actionable strategies that centre equity at every level of the smart energy transition.

7.3 Agenda for Future Research and Policy Work

This final section synthesizes the implications of my research into a cohesive agenda, divided into two interrelated components: recommendations for policy and practice, and a forward-looking research agenda.

A recurring observation throughout this thesis has been that in order to make smart energy transitions genuinely inclusive, policymakers and practitioners must move beyond current approaches that oversimplify vulnerabilities. Current frameworks, such as the Priority Services Register, often fail to account for the intersecting identities that shape household energy experiences, since they rely on static, one-size-fits-all definitions. My findings suggest that such approaches are insufficient for addressing the dynamic and intersecting vulnerabilities experienced by diverse households. Policymakers must adopt more nuanced frameworks that account for how social identities interact with energy systems, ensuring that interventions are tailored to the specific needs of marginalised groups.

For example, flexibility markets enabled by smart energy systems must be restructured to accommodate diverse household capabilities. Households with irregular work schedules or limited digital literacy may struggle to participate in demand-response programs by gathering intersectional insights, targeted interventions, such as pre-configured automation can be developed when they are unable to actively monitor and respond to dynamic tariffs. Upfront financial incentives, such as grants or subsidies for low-income households, could enable them to access technologies like battery storage and smart thermostats, enabling meaningful participation in flexibility programs and shield them from excessive energy costs during fluctuations.

Another key insight with immediate repercussions for practice is regarding the value of smart meter data. This data when combined with tailored energy advice, holds the potential to significantly enhance energy literacy among households. Energy systems are inherently complex, but smart meters and related technologies make energy usage and costs more visible, providing

households with invaluable insights. By understanding their energy consumption patterns, the relationship between energy production and consumption, tariff structures, and price fluctuations, households can make informed decisions and better navigate demand flexibility services. However, these technologies alone are not enough to ensure equitable participation.

Tailored energy interventions play a crucial role in this process, especially for marginalized households. By considering intersectional factors such as language, cultural norms, and digital accessibility, such advice can bridge the gap between complex energy systems and household participation. For instance, multilingual platforms could deliver personalized tutorials on using smart in-home displays (IHDs) or setting automated schedules, making energy data more accessible. Similarly, community ambassadors trained in energy literacy could support households facing digital exclusion, ensuring equitable engagement with smart energy systems.

Moreover, the rich data generated by smart meters offers valuable insights for frontline organizations working closely with communities. Acting as intermediaries between households and the SETs, these organizations can design campaigns that not only enhance energy literacy but also address systemic barriers, creating pathways for greater inclusivity in energy transitions. By empowering households with knowledge and tools, smart meter data and tailored energy advice can help demystify energy systems, enabling active and equitable participation in a rapidly evolving smart energy landscape.

My thesis underscores that while smart meter data offers a wealth of insights into household energy use, leveraging it effectively requires an intersectional approach grounded in justice by design. Interventions must prioritize households and their unique circumstances, designing technology around their needs rather than imposing a one-size-fits-all framework. For instance, algorithms developed around household consumption data should not serve as the sole solution but could play a supportive role by identifying patterns specific to marginalized households, such as increased energy use driven by health-related needs or inefficient appliances. These insights must be used to empower households, enabling providers to offer tailored solutions

such as energy-saving recommendations that respect cultural preferences or subsidized upgrades for outdated devices.

Any such interventions must also ensure that transparency in data collection and usage remains central, fostering trust among communities historically excluded or mistrustful of energy institutions. By placing households at the heart of the policy design processes, it must be ensured that technology supports equitable outcomes and responds meaningfully to the lived realities of diverse energy consumers.

My thesis also demonstrates that bringing intersectionality into practice demands internal transformations within organizations. Training programs on Diversity, Equity, and Inclusion (DEI) which came up several times during the guidelines (Appendix I), must go beyond surface-level inclusivity to equip staff with the skills needed to understand and apply intersectional principles in their day-to-day work. The workshop process I have developed here can support this process, helping teams map overlapping social identities and vulnerabilities, while structured spaces for reflection and dialogue can foster critical reflexivity. Organizations must also establish clear mechanisms for collaboration across teams, ensuring diverse perspectives on social justice shape decision-making processes from the ground up.

Furthermore, evaluating the impact of intersectional energy policies and practices requires a shift in focus from simply addressing the breadth of households with intersectional identities helped to also considering the depth of the support provided. Supporting multiple households with intersecting identities is important, but the true measure of effectiveness lies in the quality and transformative nature of the help offered. Effective assistance should empower households to actively participate in the smart energy market, provide them with energy independence, and liberate them from having to choose between heating their homes and eating during cold winter nights.

This redefinition of effective help demands that funding for new smart energy projects goes beyond surface-level metrics and embraces a transformative lens of justice. Intersectional

evaluations must prioritize long-term empowerment by ensuring that projects and interventions address systemic barriers. This can be achieved through participatory evaluations that involve marginalized communities in the design and analysis of feedback mechanisms, ensuring that their lived experiences shape the criteria for success. Longitudinal studies can track the evolving impact of interventions, while intersectional audits can reveal how policies and technologies influence households with complex, overlapping identities.

By adopting these intersectional approaches, smart energy projects can not only address immediate needs but also work to dismantle structural inequalities, creating systems that genuinely transform lives and ensure justice at every level.

While this thesis offers significant insights into the application of intersectionality in energy policy and practice, it also reveals critical areas for further research. Future scholarship must deepen and expand this work, addressing theoretical, methodological, and practical gaps to advance the field of energy justice in the context of SETs.

At the theoretical level, there is an urgent need to examine how macro-level power systems—such as capitalism, neoliberalism, racism, and sexism—intersect to shape energy policies, market structures, and household inequalities. For instance, how do racial biases in housing policies compound energy poverty in marginalized neighbourhoods, or how does the maleness of the energy sector influence the design of smart technologies? These questions are critical to understanding how systemic oppressions manifest within energy systems and must be at the forefront of future research. Additionally, applying intersectionality to understand the global contexts of smart technologies, particularly encompassing resource extraction from the Global South, can shed light on how colonial legacies and structural inequalities shape these technologies.

Methodologically, this research highlights the importance of participatory and dynamic approaches to studying intersectionality in energy systems. Future studies could involve households more directly, using techniques like photo diaries or longitudinal interviews to explore how intersecting vulnerabilities evolve over time. This includes developing new tools and

frameworks that make intersectionality more accessible to practitioners while retaining its complexity and transformative potential.

For example, in the context of SETs, future studies could employ participatory techniques to explore how households navigate the complexities of smart energy technologies, such as smart IHDs, dynamic tariffs, or automated systems. Alternatively, longitudinal research could investigate how intersectional vulnerabilities—such as those shaped by income, housing type, and digital literacy—evolve over time in response to smart energy transitions. These approaches would deepen our understanding of how diverse households interact with smart energy systems while generating actionable insights for policymakers and practitioners striving to make these systems more equitable and inclusive.

Currently, much of the responsibility for representing household experiences falls on frontline organizations, which are often overstretched and under-resourced as they juggle service provision, advocacy, and crisis response. As a result, there is a growing need for academic research that works *alongside* these organizations—rather than relying on them—to carry out sustained, ethically grounded, and user-centred inquiry. Expanding primary research with energy users in this way is not only methodologically necessary but also essential for realising the full potential of a user-focused approach to intersectional energy justice.

Finally, my research underscores the importance of cross-sectoral collaboration in addressing energy justice. Smart energy transitions require the involvement of diverse stakeholders, from government agencies and energy companies to community organizations and academic institutions. By fostering collaboration across these sectors, intersectionality can be integrated into a broader range of initiatives, ensuring that its principles are applied at multiple levels.

For instance, partnerships between energy distributors and community organizations could help bridge the gap between technical expertise and lived experiences, creating solutions that are both innovative and inclusive. Similarly, academic researchers can play a vital role in providing the

theoretical and methodological foundations rooted in intersectionality needed to support these collaborations.

My research underscores the urgent need for public institutions and policy to steer smart energy transitions in a way that centres justice—not as a caveat, but as an essential prerequisite. Without deliberate and robust intervention, the risk is high that these technological innovations will replicate and amplify the systemic injustices already entrenched in our energy systems. Justice must be embedded at the core of these transitions, ensuring that they not only reduce carbon emissions but also dismantle the social and economic hierarchies that perpetuate inequality.

This thesis has demonstrated that theories like intersectionality, which embrace the complexities of humanity and celebrate the diversity of our identities, are critical to achieving this goal. At a time when so much attention in the age of AI is focused on better, cleaner, smarter technology, we must demand an equally rigorous engagement with the social dimensions of energy transitions. Technology alone cannot drive justice; it is the lens through which we apply it—one that is attuned to the intricacies of power, identity, and inclusion—that determines whether these innovations will empower or marginalise.

By combining theoretical insights with practical tools and strategies, my research not only advances the understanding of energy justice and intersectionality but also offers a tangible roadmap for fostering a more inclusive and equitable smart energy future. These contributions hopefully hold the potential to inform both academic discourse and real-world practice, ensuring that smart energy technologies truly serve both people and the planet—creating systems that are as just as they are sustainable.

Epilogue: From Research to Practice — An Intersectional Energy Justice Agenda

Since the completion of this thesis, I have been heartened to learn that one of the organisations I collaborated with during my fieldwork has begun using intersectional tools—some of which were co-developed during our engagements—to better understand the lived realities of households navigating smart energy transitions. While I cannot share the details of this study due to confidentiality agreements, I welcome contact from readers who are interested in learning more. With the organisation’s informed consent, I will be happy to provide further information.

This development offers a hopeful glimpse into the practical potential of intersectional approaches in the energy sector. It signals that the concepts, critiques, and frameworks developed here are not only of academic relevance but also resonate with practitioners striving to support households more justly and meaningfully. At the same time, it underscores the importance of treating intersectionality as a living, evolving practice—one that must be continually co-developed, tested, and refined in collaboration with those on the frontlines of energy justice.

Building on this momentum, I distil the core contributions of the thesis into a set of forward-looking priorities for future research, policy, and practice:

1. Deepen user-focused research through participatory methods. We need more ethically grounded primary research that centres households—not as data points, but as co-creators of knowledge. Participatory tools like photo diaries, storytelling, and longitudinal studies can illuminate how vulnerabilities and capabilities shift over time and space.

2. Reform static vulnerability frameworks through intersectional audit and redesign. Existing instruments like the Priority Services Register while critical, must be restructured through intersectional audits that reveal how static categories fail to reflect lived realities. Future frameworks should be co-developed with marginalised communities and frontline workers to account for the dynamic, overlapping nature of vulnerability—shaped by factors such

as race, disability, immigration status, housing quality, and digital access. These redesigned tools should not only inform eligibility but also trigger targeted, adaptive support mechanisms.

3. Support frontline organisations without overburdening them. Academic projects must work alongside community-based organisations—sharing resources, research labour, and platforms—to reduce pressure on already overstretched actors and ensure long-term impact.

4. Reconfigure smart technologies to serve intersectional household needs. Rather than designing around an idealised, tech-savvy user, smart energy systems must incorporate flexible configurations, multilingual interfaces, offline access options, and culturally responsive features. Algorithms trained on smart meter data should be scrutinised for bias and used to identify—not stereotype—households with specific support needs. These systems must be guided by the principle of “justice by design,” where technology responds to, rather than erases, social complexity.

5. Build institutional capacity for intersectionality. Embedding intersectionality in practice requires more than training. It calls for internal transformation—critical reflexivity, cross-team collaboration, and systems of accountability that ensure equity becomes part of everyday decision-making.

Appendix A: Reinforcing or reconfiguring? Smart energy technologies and their relationship with already existing household characteristics that contribute to energy vulnerability

<i>Household Characteristics</i>	How do these characteristics contribute to energy vulnerability in the UK?	How do these characteristics improve or worsen flexibility capital?
<i>Old Age</i>	These individuals are highly vulnerable to fuel poverty due to fixed incomes, higher heating needs, and often living in energy-inefficient homes. Rising energy prices can exacerbate their situation, forcing them to ration heating, which can be dangerous to their health.	Older individuals often have fixed routines and lower adaptability, limiting their flexibility in energy consumption. They are less likely to engage with new technologies, particularly if they are digitally illiterate.
<i>Disabilities and/or special medical needs</i>	These individuals often require higher energy usage for medical equipment, heating, and comfort, making them more susceptible to energy poverty, especially as energy costs rise. This might be worsened due to austerity policies which subject them to unforeseen welfare cuts.	Households with members who have disabilities or special medical needs require consistent energy supply for medical equipment, making them less flexible in adjusting their energy use.
<i>Private renting</i>	Renters have limited control over the energy efficiency of their homes,	Might have limited financial capital as well as might require permission

	often leading to higher energy costs due to poorly insulated properties.	from the landlord to install and benefit from ICT-enabled technologies/renewable energy sources such as solar panels. Private renters in shared households are particularly vulnerable.
<i>Low-income</i>	Households with low incomes are more likely to struggle with the cost of energy, particularly in homes with poor energy efficiency. They are also more likely to experience associated cost-of-living crises such as food or education poverty.	Financial constraints make it challenging for low-income households to invest in energy-efficient technologies or adapt to dynamic pricing models, reducing their flexibility. These households might already be experiencing severe levels of energy poverty and therefore might not have the cognitive capacity to understand and engage with energy savings advice or shifting their consumption.
<i>Poor energy efficiency of housing</i>	Homes with low energy efficiency require more energy to maintain a comfortable temperature, leading to higher energy bills and increasing the risk of energy poverty.	Might not directly contribute to flexibility capital.

<i>Rural/Urban Location</i>	Rural areas often have higher energy costs due to less access to the gas grid and longer distances to services, while urban areas may suffer from high housing costs, exacerbating energy poverty in both settings.	Rural areas are often deprioritised from smart technology rollouts, reducing their participation in flexibility markets. Urban areas may face different challenges, such as higher energy costs, but have better access to technology.
<i>Pre-payment meters</i>	Users of pre-payment meters often pay higher tariffs and may face disconnection if they cannot afford to top up, making them particularly vulnerable to energy poverty.	Users of pre-payment meters are typically more aware of their energy consumption but have less flexibility due to the pay-as-you-go system, which can lead to disconnections if funds run out.
<i>Digital Literacy</i>	Lower digital literacy can prevent individuals from accessing the best energy tariffs or understanding energy-saving measures, increasing their energy costs and vulnerability to energy poverty.	Low digital literacy limits the ability of individuals to engage with smart energy technologies, reducing their capacity to participate in demand-side flexibility.
<i>Social capital</i>	Low social capital can limit access to support networks that help mitigate energy costs, such as community heating schemes or energy advice, thereby increasing the risk of energy poverty.	Households with strong social networks may have better access to information and support, potentially increasing their flexibility. Conversely, those with

		low social capital may struggle to adapt.
<i>Gender</i>	Women, particularly single mothers and elderly women, are more likely to experience fuel poverty due to lower incomes, higher rates of poverty, and often living in less energy-efficient homes.	Women, particularly in low-income or single-parent households, may face additional burdens that reduce their flexibility in energy use due to caregiving responsibilities and financial constraints.
<i>Households with young children</i>	These include higher energy consumption needs to maintain comfortable living conditions for young children, especially during cold weather, and often lower household incomes, as parents may be on reduced incomes due to childcare responsibilities. Additionally, young children are more susceptible to health risks associated with poorly heated homes, which can exacerbate conditions such as respiratory illnesses.	Households with young children have less flexibility due to the need for consistent heating and lighting, fixed schedules, making it difficult to adjust energy consumption patterns without impacting comfort and safety.

Appendix B: List of organizations within the UK smart energy landscape

Organisation	Included in	Role(s) in the smart energy system
	the	
	research	
GB Households	Yes, through secondary data	Households across England, Scotland and Wales. They communicate with energy suppliers and provide access to their homes for smart meter installations. They also pay for the costs of the rollouts through their energy bills and participate in energy flexibility trials.
Energy Suppliers	Yes	Companies responsible for selling electricity and gas to consumers. They purchase energy on the wholesale market and supply it to households and businesses, handling billing, customer service, and various other aspects of energy provision. These suppliers operate within a competitive market regulated by Ofgem, ensuring fair practices and consumer protection. They are responsible for the planning and delivery of installations, provision of smart meters and display devices. They are also responsible for offering smart energy offers and create awareness among their consumers about the benefits of the smart meter. They are also responsible for post-installation repairs.
Energy Services Companies	Yes	These companies operate as intermediaries creating new business models and financing options that can create and

		exploit new opportunities enabled by the demand side flexibility made possible by smart energy technologies.
Energy Technology Manufacturers	No	These companies produce the hardware infrastructure which is driving the smart meter rollouts and responsible for energy data flow throughout the energy landscape.
Aggregators	No	Energy aggregators act as intermediaries that enhance the flexibility and efficiency of the energy system by pooling the capacities of multiple small-scale energy users and producers. This aggregated capacity can then be sold or utilised in energy markets, providing various services to the grid, such as demand response or balancing services.
Data and Communications Company (DCC)	No	The DCC is a central organization responsible for the secure and reliable communication of data between smart meters and energy suppliers, network operators, and authorized third parties. They also provide communications hubs and management of communications and data services and ensure safeguarding of consumer data.
Distribution Network Operators (DNOs)	Yes	DNOs are companies responsible for operating the local electricity distribution networks that deliver electricity from the high-voltage transmission grid to homes and businesses in a specific geographic area. In the UK, there are 6 DNOs operating in 14 different regions. Their role in the smart energy transition is to utilise emerging smart

		data about energy consumption to better plan and operate the electricity network, ensure balance between supply and demand, and upgrade network infrastructure accordingly.
<hr/>		
National Grid	Yes, through secondary data	The National Grid operates the high-voltage electricity transmission network in England and Wales. It is responsible for the infrastructure that transmits electricity from power stations to local distribution networks, which then deliver it to consumers. In Scotland, the transmission network is managed by separate entities, but National Grid coordinates with them to ensure a unified and stable electricity system across Great Britain. In the smart meter rollouts, the National Grid has run a centralised demand flexibility trial in the Winter of 2022, and provided evidence on the benefits of large-scale demand flexibility.
Energy Advice Charities/ Independent Policy Advisors	Yes	Energy advice organisations are entities that provide information, support, and guidance to consumers regarding energy use, energy efficiency, and managing energy costs. They are directly responsible for working with vulnerable energy consumers and have provided valuable evidence based on first-hand accounts of the social justice impacts of the smart meter rollouts.

Smart Energy GB	Yes	Smart Energy GB is the national campaign for the smart meter rollout in Great Britain. It is a government-backed organization tasked with promoting and educating the public about the benefits of smart meters, aiming to ensure widespread adoption across households and small businesses.
Department for Energy Security and NetZero (DESNEZ)	Yes, through secondary data	DESNEZ is a ministerial department of the UK government established on February 7, 2023. It was formed by taking over the energy policy responsibilities from the former Department for Business, Energy, and Industrial Strategy (BEIS) as part of a cabinet reshuffle under Prime Minister Rishi Sunak's administration. As part of its 2021 NetZero Strategy for the UK, it holds the overall responsibility for ensuring a full smart meter rollout.
Ofgem	No	Ofgem (the Office of Gas and Electricity Markets) is the government regulator for the electricity and natural gas markets in Great Britain. It operates as a non-ministerial government department and is tasked with protecting the interests of consumers, promoting competition, and ensuring the reliability and security of the energy supply. It provides regulatory oversight of the smart meter rollouts ensuring both consumer protection and a timely rollout of smart meters and related services.

Appendix C: List of Statements used as provocations during Phase 1 and Interview

Questions

Statement from academic research	Source
Current energy bill rebate payments and energy price cap freeze are insufficient to support households already struggling to pay substantially higher bills due to the sheer scale of price rises.	Robinson & Simcock, 2022
Any future energy price caps should be funded via progressive taxation. For example, a windfall tax on oil and gas producers, who have made record profits due to increases in wholesale prices. Or for example, by increasing taxes on wealthier or high-income households.	
In general, funding for energy advice is insufficient for the scale of the problem (energy poverty). There is a strong case for implementing a major, nationwide program of energy advice, tailored to individual circumstances, and provided by trusted actors (e.g., local community organizations).	Bouzarovski & Simcock, 2023
Much of the technological and business-model development for DSR is taking place within the private sector - without participation from diverse consumers. In many cases it is unseen R&D within companies which involves little direct consumer engagement, intentionally focussing on the non-technophobic public who are deemed mostly to like or adopt DSR.	Calver & Simcock, 2021
Obliging or pressurizing households to adjust their consumption away from their current routine runs the risk of leaving people unable to consume sufficient levels of energy services when they are most 'needed' - with potentially problematic health and well-being consequences.	

The statements for the “What do you think?” section was picked up from a number of different academic articles, and were meant to provoke opinions, and get interviewees warmed up.

The interview questions were as follows:

- (i) Which stakeholders have benefitted most from the national smart meter rollouts?
Which stakeholders have been left behind/have not taken full advantage of the potential of smart energy technologies?
- (ii) What role (if any) do smart meters (and other smart energy technologies) have in mitigating energy poverty? How can low-income households particularly benefit from these rollouts/plans?
- (iii) What are some complementary technologies, policies or sociotechnical interventions that are essential in realizing the full potential of smart energy technologies for the most vulnerable households? and
- (iv) What roles should different energy stakeholders play in the transition to a just smart/digital energy future?

Appendix D: List of Intersectional Metaphors for Grappling with Intersectionality's Core Tenets

Identities work like an oil-water emulsion, not a salt-water solution.

This metaphor illustrated the intersectional critique of the 'universal' subject, emphasizing that identities do not dissolve into a homogeneous whole but rather coexist dynamically, each influencing the other in unique ways. It challenges oversimplified, one-size-fits-all approaches to social justice. The first aspect of intersectional praxis is focussed on ontologies (Collins and Bilge, 2021). The intricate interplay of identities, a concept central to Kimberlé Crenshaw's seminal work (1989) is the cornerstone of understanding what it means to experience and embody intersectionality. Practitioners have used this to challenge the prevailing notion in many social justice discussions that identities like gender and race simply merge seamlessly (Salem, 2018; Yuval-Davis, 2006). Instead, they argue that these identities while overlapping in different sociopolitical contexts, retain their distinctiveness. This is evident in the intersectional feminist work on French Muslim women discussed earlier. In this case, the French state assumes that banning the wearing of headscarves is often a rational and necessary policy by referencing gender equality concerns. This implies that the underlying assumption is that all Muslim women are oppressed subjects, and that their gender identity merges with their religious identity. The policy also enforces a static 'French' identity in the process.

Bilge (2010) highlights that debates on headscarves in France often erase the nuanced agency of French Muslim women who wear the hijab. Some French feminists argue that these women assert both their rights as women resisting patriarchy and as Muslims opposing Islamophobia, thereby debunking the notion of a universally emancipated French woman (Collins & Bilge, 2021; Jeannot, 2021). Intersectional praxis reveals that the hijab can simultaneously symbolize resistance and oppression, questioning the concept of a "universal subject" in human rights discourse. This

approach values embodiment, lived experiences, and historical context, presenting identity as a complex construct shaped by locational and relational power (May, 2015; Bilge, 2016).

Whose knowledge is it anyway?

This aspect of intersectional praxis revolves around the importance of critically examining the knowledge systems that inform notions of equality and justice in society. Intersectional scholars argue that transformative justice requires more than superficial changes; it necessitates a deep interrogation of the underlying logics that perpetuate inequalities, which are often accepted as natural (Williams, 2021; Bilge, 2010; Overstreet et al., 2020). As Donna Haraway articulates, the world(s) that shape us significantly influence how we identify problems and, consequently, how we formulate solutions (Haraway, 2016).

Interrogating knowledge should involve a reflective approach to understanding the social location of knowledge. It encourages analysis at both the micro-level, concerning personal experiential learning, and the macro-level, within broader social structures (Collins and Bilge, 2021). Practitioners are urged to consider the wider contexts of knowledge production and reception, critically examining the "received logics" that underlie societal assumptions. A key aspect of this approach is confronting epistemic inequalities by questioning which forms of knowledge have been marginalized or discredited and whose knowledge is given authority (Spivak, 1988) – which is also a shared concern between intersectional praxis and other schools of thoughts, particularly decoloniality (Dunford, 2017). This scrutiny extends to factors such as access to different forms of knowledge and the channels through which individuals acquire this knowledge, such as academic training and education.

Contributors to this praxis draw attention not only to the institutional politics that shape the production of knowledge but also to how insurgent ideas are received, historicized, and engaged with. These dynamics are deeply embedded in structural relations constituted by the very forces being interrogated (Crenshaw, 2011). Additionally, this metaphor delves into the origins of social

norms, methodological rules, and philosophical expectations, questioning who authorizes these norms and whom they primarily serve. By exploring these origins, practitioners can uncover potential biases and power dynamics, leading to a more inclusive and equitable knowledge framework that better serves the diverse realities of individuals and communities (May, 2015). This critical approach to knowledge aims to break down existing power structures and promote transformative justice by challenging the foundational assumptions that uphold inequality.

The goal is to challenge and transform traditional notions of evidence, fact, and knowledge. For instance, circling back to the example of the hijab ban in France, Bilge (2010) highlights how debates around headscarves in France often fixate on a unitary and static symbolic meaning to the hijab—perceiving the hijab as a threat to secularism and gender equity. This approach disregards the voices and lived experiences of veiled women, enforcing a narrative that aligns with the views of their oppressors, thereby alienating them.

Solidarity not sameness

The third principle of intersectional praxis emphasizes solidarity among social justice movements (Tormos, 2017; Evans & Lépinard, 2019; Verloo, 2013). This approach rejects homogenizing struggles, advocating instead for a solidarity rooted in respect for differences and a shared commitment to combating systemic oppression. Solidarity here is not about sameness; it recognizes that power dynamics privilege or disadvantage different movements depending on their context. Barbara Tomlinson (2013) argues that those who misinterpret intersectionality as purely identity-focused fail to grasp which differences are most consequential. Similarly, Dean Spade (2013) critiques liberal anti-discrimination policies that ignore how race- and gender-neutral frameworks perpetuate inequality.

Lacking genuine solidarity that values diverse experiences, powerful actors may use “intersectionality” to divide movements, portraying differences as insurmountable (Jibrin & Salem, 2015). This has occurred with the “Queers for Palestine” movement, where Israel’s “pinkwashing”

sought to distract from its human rights violations by promoting LGBTQ+ rights in contrast to Palestinian laws on homosexuality. While “Queers for Palestine” stands as an example of cross-movement solidarity, backlash from Israeli media portrayed this alliance as homophobic, attempting to pit queer and Palestinian liberation movements against one another.

In the context of this example, this intersectional approach can recognise the differences between the Palestinian struggle and queer liberation, while still asserting that solidarity is necessary and possible. It encourages the recognition of both differences and commonalities among diverse groups, acknowledging their distinct ontologies and epistemologies while uniting them in the pursuit of universal access to resources, rights, dignity, and recognition. It can also combat tokenism—avoiding the superficial inclusion of marginalized groups—and thereby fostering an environment that supports transformative action.

New bottle, same old wine

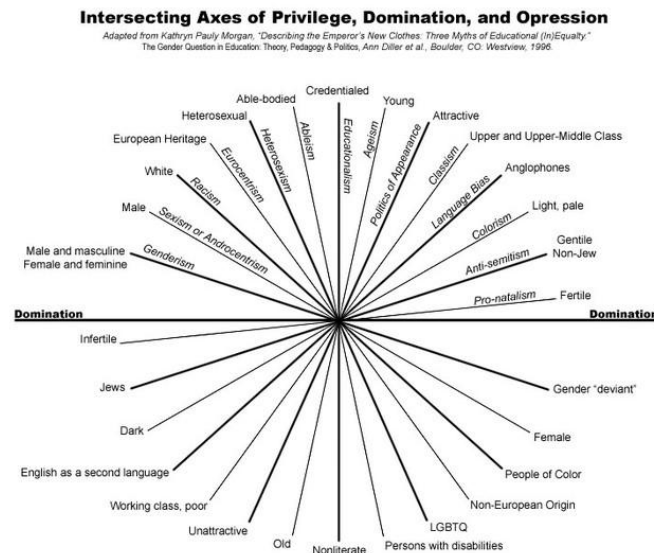
Finally, the final aspect of intersectional praxis deals directly with prefigurative politics. It involves practitioners deliberately envisioning radical and speculative futures (Collins and Bilge, 2021). It emphasizes the need to perceive historical omissions as deliberate political acts, demanding transformation, and accountability (Crenshaw, 1989; Winker & Degele, 2011; Ryan, 2019). This approach involves actively intervening in historical memory and unlearning prevailing social imaginaries.

In terms of the future, this praxis encourages the exploration of alternatives and is linked to the praxis on knowledge – it promotes perspectives that have been dismissed by dominant and hegemonic logics. By reading historical narratives against the grain, it uncovers overlooked potentials from the past, paving the way for a different trajectory ahead. This process involves zooming out and considering the wider historical trajectory, leading to a "rupture" in collective and individual consciousness. Through this rupture, oppression is denaturalized and exposed as an ongoing and systemic issue.

In essence, it involves practitioners breaking free from the confines of the past, transcend inherited oppressive structures, and actively envision transformative and liberating futures. It calls for a critical engagement with history and a deliberate openness to alternatives that challenge existing power dynamics.

Appendix E: Intersectional Tools introduced during the case studies (Sourced from: Atewologun, D. and Mahalingam, R. (2018))

The Web of Identities



The conceptual framework of the Intersectional Identity Web encapsulates a nuanced comprehension of identity construction, delineating it as a multifaceted interplay of diverse determinants, including but not limited to gender, race, and socioeconomic status. This comprehensive lens enables individuals to deconstruct and critically examine the intricate amalgamation of their various identity facets, encompassing both subordinate and dominant manifestations, thereby facilitating a deeper understanding of the complexities inherent in experiences of intersectionality.

By affording individuals the analytical tools to scrutinize the intricate interconnections among their intersecting identities, the Intersectional Identity Web furnishes invaluable insights into the nuanced dynamics shaping their lived realities. This holistic approach transcends conventional dichotomies of advantage and disadvantage prevalent in traditional diversity research paradigms,

thereby engendering a more nuanced appreciation of the multifaceted nature of human identity and the intersecting axes of privilege and oppression.

Intersectional reflexivity box for practitioners

In embarking upon the cultivation of intersectional reflexivity within the research process, researchers are tasked with embarking upon a comprehensive introspective journey, wherein they meticulously identify and articulate their own salient intersectional identities pertinent to the study under investigation. This introspection necessitates a critical examination of the various axes of privilege and marginalization that intersect within the researcher's own identity landscape, thereby illuminating the nuanced power dynamics inherent in their interactions with research participants.

Moreover, researchers are enjoined to maintain a vigilant awareness of the myriad sites where intersectional identity salience manifests throughout the research endeavour. This entails a conscientious scrutiny of how these identities may fluctuate in significance and meaning across the various stages of data collection and analysis, and how they manifest divergently within the realms of intrapersonal reflection, interpersonal engagement, and broader macro-level contexts.

Furthermore, the cultivation of intersectional reflexivity necessitates the adept management of the emotional, cognitive, and experiential dimensions that accompany heightened awareness of one's intersectional identity within the research milieu. Researchers are called upon to navigate the complex terrain of emotions, knowledge, and lived experiences that arise from this heightened awareness with sensitivity and poise, fostering an environment conducive to ethical and empathetic engagement with both data and participants.

Intersectional Identities Journal

Intersectional Journaling represents a methodological innovation within qualitative research that seeks to illuminate the intricate interplay of multiple identities through a reflexive documentation of participants' lived experiences. Departing from traditional journaling practices, Intersectional

Journaling entails participants' systematic recording of their everyday encounters and reflections pertaining to their intersecting identities. Researchers then engage in a rigorous analysis of these journal entries in conjunction with interview data, leveraging the inherent flexibility of interviews to delve into complex and nuanced issues.

This methodological approach serves to mitigate the inherent risks of biased recall by centring on the documentation of commonplace experiences rather than relying solely on memorable or exceptional episodes. By capturing the nuances of individuals' everyday interactions and reflections, Intersectional Journaling offers researchers a more holistic and nuanced understanding of the multifaceted dimensions of identity intersections. For instance, participants may be prompted to reflect on specific instances from their daily experiences, such as moments at work that prompt them to consider their identities in relation to their professional roles and social identities. By eliciting such reflections, researchers can glean valuable insights into the ways in which intersecting identities manifest in various contexts and influence individuals' perceptions, behaviours, and interactions.

Ex: 'Can you think about a time/event/episode at work today that prompted you to think of yourself as a senior (man of Chinese origin, for example)?'

Appendix F: Key events of the participatory workshop

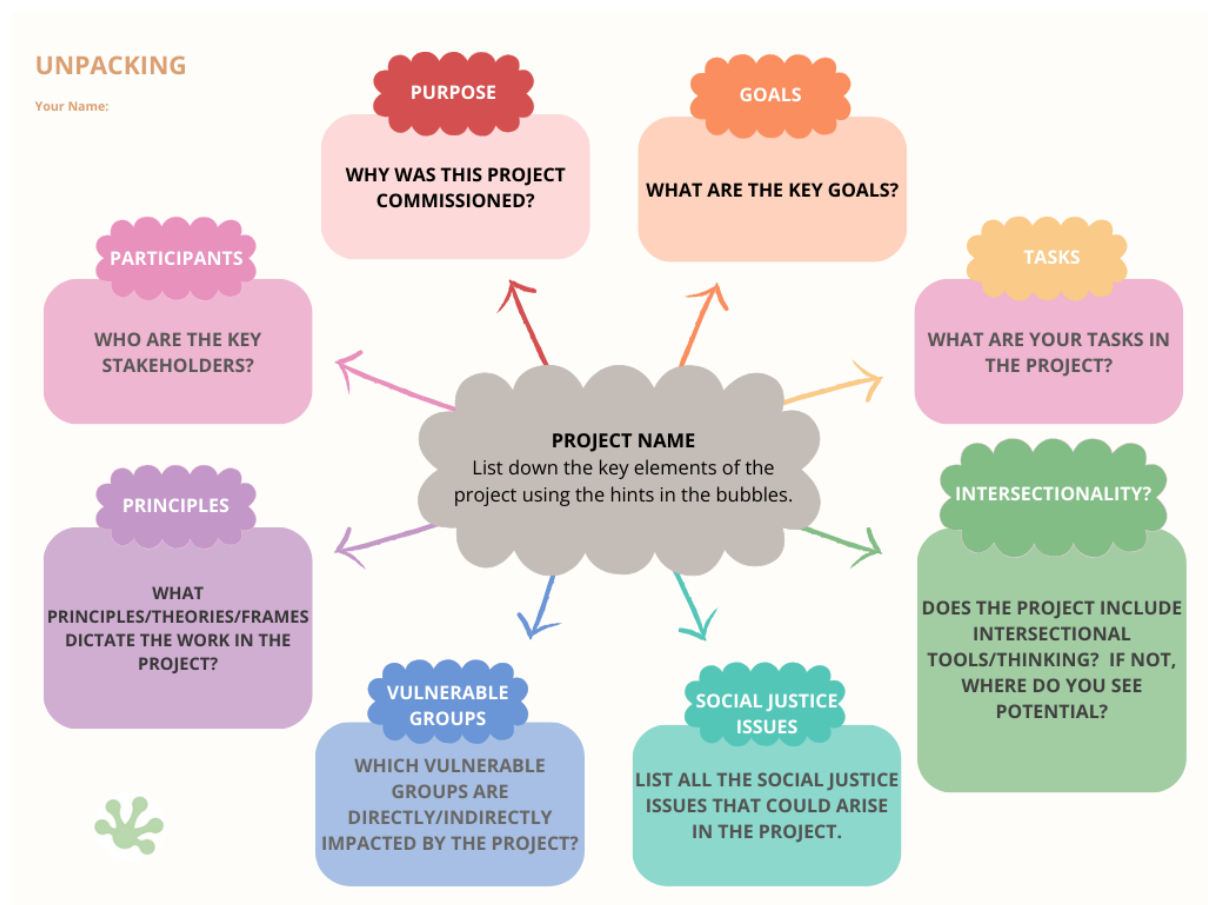
First, there was a 10-minute slot to unpack their projects. They were given a template which asked them questions about the name of the project, its goals, their role in the project (these three items were there in order to get participants to contextualise their project), the social justice issues they uncovered while working in the project, what principles/theories/methods they used to understand these social justice issues, whether or not intersectionality was a part of the project (the researcher deliberately did not define intersectionality before this exercise in order to avoid priming participants and also letting alternative definitions of intersectionality emerge from the setting).

This was key as the starting point, as it enabled participants to bring something to the case study process that they could revisit throughout the process as they learned about intersectionality and discussed its applications. In previous iterations of pilot workshops, the researcher observed that without something to unpack before diving into the sometimes-abstract concepts at the core of intersectional thinking, it was difficult to ground learnings and reflections and take away something was tangible and deeply resonated with the participants. This was explained to participants beforehand, and they were encouraged to fill in the template with as much detail as possible.

Subsequently, participants engaged in group discussions, exchanging insights and reflections on their respective projects. While some participants shared similar project experiences within their teams, cross-project dialogues ensued, stimulating inquiries and reflections, particularly surrounding consumer vulnerability in smart energy contexts.

This was followed by an impulse on intersectionality by the researcher. The impulse was about 30 minutes, with discussions encompassing the historical evolution, core principles, 4 metaphors for doing intersectionality (see Appendix D) and practical implications of intersectionality, alongside an examination of various conceptual tools and their relevance to smart energy research and development projects.

The final segment allocated 60 minutes for team-based analysis of three pre-provided case studies, each representing distinct smart energy scenarios. Participants were tasked with utilizing the Web of Identities tool to map factors influencing household flexibility capacity, guided by the researcher. While some participants demonstrated proficiency in applying the tool, others encountered challenges attributed to its novelty and minimal instructional guidance. This can be attributed to the novelty of the tool, and few instructions provided. These cases are briefly described below (see full case description in Appendix H). They were all fabricated by the researcher to stimulate discussions, but the characteristics of the households were based on the researcher's literature survey and participation in a secondment with Citizens Advice during which several informal discussions on the organisations' study on inclusivity in demand flexibility occurred.



In the concluding 30-minute segment, participants shared their experiences with the tool, elaborating on factors influencing flexibility and discussing challenges and insights gained. Crucially, participants drew immediate parallels between the case studies and their own project experiences.

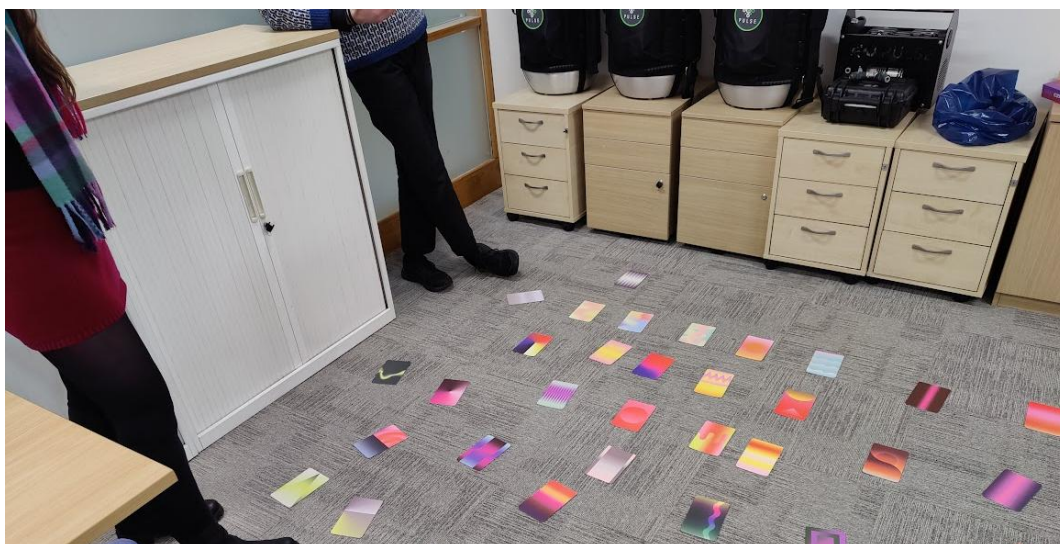
The workshop concluded with facilitator(s) expressing gratitude for participants' engagement and distributing a self-reflection template. Participants were encouraged to reflect on intersectionality-related insights gleaned from the workshop and apply them to their work experiences over a 5-week period.

Appendix G: Key events of the co-create workshop

The commencement of the 4-hour workshop featured an "emotions game" (15 minutes) employed as an icebreaker, serving to facilitate participants' recollection of the ongoing case study process. Instead of prompting discussion based on chronological events or cognitive reflections, participants were directed to navigate discourse through the lens of their emotional experiences. Recognizing the complexity inherent in articulating emotions, the researcher introduced "The Box of Emotions" as a facilitative tool. This set comprises 80 cards featuring abstract colour illustrations on one side and succinct essays detailing specific emotions on the reverse. Originating from the collaborative efforts of cultural historian Dr. Tiffany Watt Smith and graphic designer Thérèse Vandling, these cards were strategically deployed to scaffold discussion.

Participants were instructed to visually engage with the array of 80 cards, with the abstract colour sides facing upwards (refer to figure below). Following a directive to close their eyes and reflect solely on the emotions evoked by their involvement in the case study process thus far, particularly focusing on the task of applying intersectionality within the context of the smart energy transition, participants were prompted to select a card that resonated with their emotional state. Notably, participants were initially prohibited from viewing the emotion represented on the reverse side of their chosen card. Instead, they were prompted to explain the rationale underlying their selection and elucidate how the chosen card symbolically encapsulated their emotional disposition toward the case study process.

This exercise engendered substantive and insightful dialogue across all 3 instances, enabling participants to effectively articulate their aspirations and apprehensions. Importantly, the process served as a catalyst for fostering a conducive atmosphere for co-creation, facilitating participants' transition into a state of creative ideation. This was achieved through the necessity of connecting diverse emotional states to both the visual cues presented by the colour illustrations and the nuanced emotional descriptors provided on the reverse side of the cards, which often diverged significantly from participants' initial motivations for card selection.

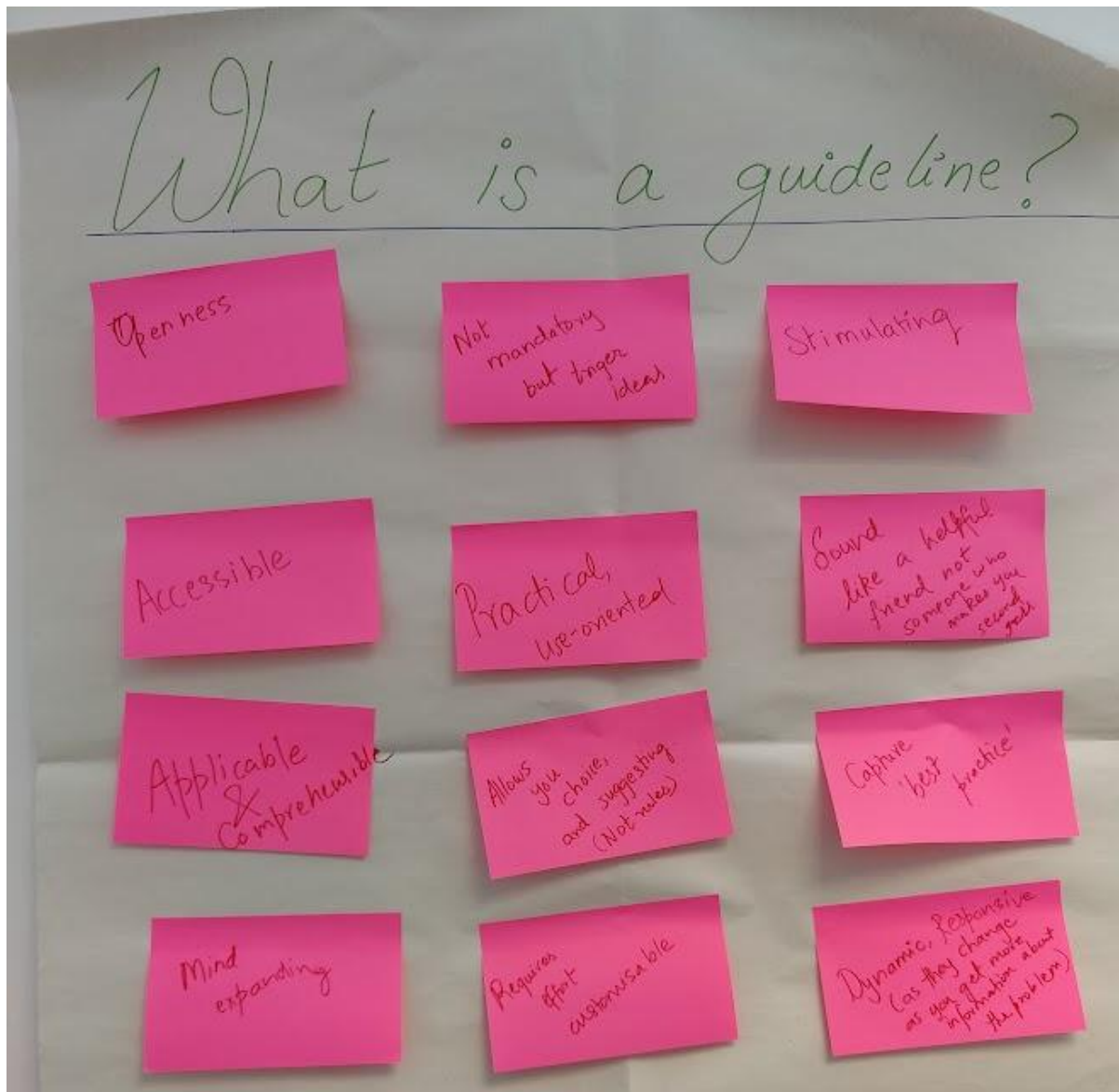


Following the icebreaker activity, the facilitator proceeded to unveil the structured framework for collaborative guideline development. Participants were explained that they would be guided through a systematic process wherein they collectively generated ideas pertaining to the essential constituents of the guidelines, delineated along the lines of "*We must/want to/shall aspirations, while concurrently ensuring alignment with core values through immediate interventions?*". Thus, discourse predominantly revolved around elucidating aspirations, delineating values, and identifying immediate interventions as pivotal focal points.

Having clarified the expectations for the day, the workshop proceeded to cultivate consensus among participants regarding the defining characteristics of the guidelines. Given that the decision-making process for case study involvement was chiefly spearheaded by select representatives from each case study, it was imperative to foster inclusivity, ensuring equitable participation from all attendees, not solely the designated representatives. To this end, participants were encouraged to engage in reflective deliberation concerning the scope of the guidelines. Subsequently, participants were allotted approximately 5 minutes to encapsulate their insights on post-it notes.

Following this individual brainstorming phase, a plenary discussion ensued, facilitated by the researcher, wherein participants collectively synthesized their perspectives on the characteristics of the envisaged guidelines (30 minutes). These deliberations were documented on

a poster by the facilitator (refer to figure below), serving as a visual record of the consensus-building process.



The subsequent segment of the workshop was dedicated to an in-depth exploration of core values to be embedded into the guidelines (30 minutes). Recognizing the imperative for the case study organizations to ensure alignment between the integration of intersectionality principles into their existing practices and the overarching organizational values, this session sought to elucidate and prioritize values deemed integral to each organization's ethos. Given the distinct work culture and stakeholder dynamics characterizing each of the three participating organizations, it was

paramount to acknowledge and accommodate the unique value systems underpinning their operations.

Participants were tasked with individually selecting a subset of values from a comprehensive list¹¹ provided by the researcher. From this catalog, each participant identified and deliberated upon five values of personal significance, explaining the definitions ascribed to these values and articulating their perceived importance within the organizational context. Subsequently, through a collaborative process of dialogue and negotiation, participants endeavored to converge upon a shared understanding of the essence and significance of each identified value. The researcher also prompted a discussion on which values were currently being prioritized and which ones overlooked. All values were listed on a poster by the facilitator.

Upon attaining consensus regarding the interpretation and significance of each value, a dot-voting mechanism was employed to discern the six most important values to be enshrined within the forthcoming guidelines (see figure below). This method facilitated the democratic selection of values, ensuring alignment with both the collective ethos and the priorities of the participating organizations.

¹¹ List of values is available at: <https://brenebrown.com/resources/dare-to-lead-list-of-values/>

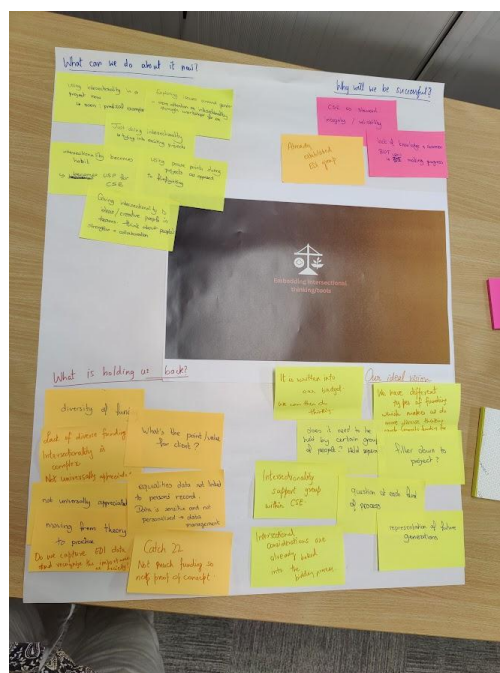


The penultimate phase of the workshop entailed in-depth deliberations aimed at synthesizing the outcomes of the initial workshop and one-on-one consultations, thereby engendering the development of both aspirational goals and strategic intervention points within current organizational practices, essential for the comprehensive formulation of the guidelines. Drawing upon predefined aspirations derived from an analysis of the preceding results, the

researcher encouraged discussions in a 1-2-4 format, with participants also encouraged to supplement them with any additional aspirations deemed pertinent.

Following an extensive discussion (30 minutes) on these aspirations, outcomes were methodically synthesized into key focal points by the researcher. Subsequently, a collective group discussion ensued (45 minutes), each aspiration serving as a focal point, with an exploration based on the following dimensions: (i) the conceptualization of an ideal state, envisaging the ultimate manifestation of the aspiration; (ii) anticipation of challenges and impediments likely to impede progress, (iii) identification of unique organizational strengths poised to surmount challenges and facilitate achievement of the aspiration; and (iv) delineation of incremental interventions that organizations could implement immediately, utilising the concept of leverage points—strategic intervention junctures within systems wherein minor modifications yield maximal impact (refer to figure below).

Finally, anchored by the overarching organizational values, aspirational goals, and strategic intervention points, the guidelines aimed at supporting intersectional practice were crafted (refer to the comprehensive list of guidelines outlined in Appendix I).



Appendix H: Energy Flexibility Case Texts

Gill (33) and Archie (11)

Gill, a 33-year-old single mother, lives in the working-class suburbs of a large city. She and her 11-year-old son, Archie, live in a compact 50-square-meter flat within a social housing complex with mostly Black British families like themselves. Their lives are shaped by unique circumstances, particularly Archie's neurodivergence, which necessitates his attendance at a nearby school tailored to cater to children with additional needs.

Archie's neurodivergent condition brings about challenges in his daily life. He frequently grapples with sensory overload, often feeling overwhelmed by excessive stimuli. His heightened sensitivity to light compounds his struggles, making the world outside their small flat a daunting place. To cope with these challenges, Archie has found solace in the realm of technology. His refuge is a designated computer corner within their home, where he immerses himself in video games. Remarkably, these digital adventures offer him a therapeutic escape, helping him manage some of the symptoms associated with his condition.

Gill, on the other hand, maintains a stable income, primarily through contractual work with short-term contracts. Gill is also expecting a second child and is currently 4-months pregnant. The nature of her employment coupled with their unique energy needs bring with them financial uncertainties - particularly in times of high energy prices. One technology that is crucial for their lifestyle is their smart electricity pre-payment meter. To ensure uninterrupted access to power, they must diligently top up the meter online every month. Failure to do so would result in an impending disconnection, creating significant disruptions to their daily life. Their energy provider believes this pre-payment option is the most feasible way of managing their energy bills because it gives them control over how much energy they consume (by controlling how much they pay for it), and thereby prevents them from going into severe debt due to high energy prices.

Recent economic challenges, particularly a sharp rise in the cost of living, have taken a toll on Gill's ability to meet their financial obligations. Juggling essential expenses such as groceries, rent, and energy bills has become increasingly demanding. As the spring season approaches, Gill is faced with a difficult decision. She contemplates cutting back on their energy usage for a couple of months to save money they'd usually spend on topping up the meter, hoping that the exorbitant prices will eventually blow over. However, Gill is concerned that this would disrupt their daily routines and pose unique challenges for Archie, and she is well aware of the risk of losing power if they can't cut back enough. But given the gravity of the crisis, she's seriously considering it.

Brandon (72) and Farrah (68)

Farrah, a 68-year-old woman, and her husband Brandon, aged 72, live in a semi-detached house in a tranquil rural area. However, their relatively idyllic life is marked by unique challenges. Brandon, in particular, grapples with mobility issues stemming from arthritis, which have significantly limited his ability to move around. He uses an electric wheelchair, both indoors and outdoors, to maintain his independence.

In contrast to Brandon's health struggles, Farrah enjoys better overall well-being. She shoulders the responsibilities of managing the household, from day-to-day chores to caring for Brandon's complex needs. Despite having adequate heating in their home, Farrah occasionally battles chest infections during the colder months. At times, her breathing difficulties become severe, necessitating the use of an in-home ventilator to provide the respiratory support she requires. Both Brandon and Farrah also need hot water to manage pain throughout the year.

Financially, the couple relies on a stable state pension. This pension, while sufficient to cover their basic costs of living and energy bills, revealed its limitations during the harsh winter that saw energy prices triple. The soaring expenses left them with little margin for comfort.

Recognizing the vulnerability of elderly residents like Farrah and Brandon, their energy network operator and a local advisory service for the elderly have been advocating for the installation of a smart energy system in their home. Paired with a heat pump, this system promises not only to shield them from escalating energy costs but also to grant them enhanced control over their energy consumption.

The proposed installation would be overseen by the energy operator, with the government contributing partial subsidies to make it more accessible. However, Brandon and Farrah would be required to cover the remaining costs through instalments, which would be added to their future energy bills. The system boasts the ability to be more cost-effective as the heat pump would prove to be the cheapest option for space heating during periods of excess wind energy. It would also monitor household appliances, ensuring energy efficiency, and stand ready to alert local emergency health services in the event of a medical emergency.

Despite the myriad advantages of this proposal, Brandon and Farrah find themselves hesitant to embrace it fully. Their reluctance is fuelled by multiple factors, including the fear of losing agency over their energy choices, a lack of understanding regarding the system's intricate workings, a reluctance about complex technology, and the uncertainty surrounding their ability to repay the costs associated with the heat pump.

Abdul (35) and Sarah (33)

Abdul, aged 35, and Sarah, aged 33, embarked on a journey to the United Kingdom three years ago, seeking asylum due to challenging circumstances in their home country. After a prolonged period of uncertainty, they were granted asylum, offering them a glimmer of stability in their lives. Their family was further enriched with the addition of their 18-month-old child, Samir.

The path to stability was far from smooth for Abdul and Sarah, primarily due to their uncertain residential status and their intermediate-level proficiency in English. These challenges made it

difficult for them to secure and maintain stable employment. Presently, Abdul works as an electrical technician, while Sarah is employed at a large supermarket, both striving to provide a better future for their family.

Sharing a privately rented household with two other individuals, who also hail from migrant backgrounds, Abdul and Sarah's living arrangements are diverse and dynamic. Their landlord possesses a strong sense of environmental responsibility and is keen on introducing innovative energy technologies to the household. Among the planned upgrades is the installation of a smart energy system designed to automate certain energy-related tasks, such as space heating during nighttime hours. Looking ahead, the landlord envisions adding rooftop solar panels to harness the abundant sunlight that graces the property. These measures are driven by the belief that energy savings can be realized if the tenants are willing to embrace the guidance of the smart energy system and adapt their energy consumption habits.

Abdul and Sarah, however, are grappling with a mixture of worries and apprehensions regarding these planned changes. Their primary concern revolves around the potential loss of autonomy in their daily routines, which could affect crucial aspects of their child's life, such as fixed mealtimes and pre-bed bath schedules. The prospect of automation encroaching on these personal aspects raises anxiety within the family.

Additionally, they have been informed about the collection of energy consumption data by the smart system, which triggers concerns stemming from their background and experiences. Their wariness of technology-based surveillance and data collection adds another layer of unease to the situation. Another source of worry arises from the potential for conflicts with their fellow residents in the shared household. Each individual in the house follows distinct work patterns, habits, and preferences. Previous disputes have already arisen, such as disagreements regarding temperature control, with one resident objecting to Abdul and Sarah's practice of occasionally leaving a window open during winter nights due to overheating indoors.

Appendix I: List of guidelines

Guidelines developed by the charity

- (i) We must find evidence of the positive effects of embedding intersectionality into our work.
- (ii) We want to find ways of innovatively incorporating intersectional tools in our work and set positive examples for others in the energy sector to follow.
- (iii) We want to build internal and external consensus around doing intersectionality through examples from our own work and celebrate it as a USP.
- (iv) We must work towards long-term regenerative energy solutions which avoid harm by accounting for both planetary boundaries and deeply rooted societal inequalities.
- (v) We must actively avoid reinforcing structural inequalities through our work.
- (vi) We want to build more time within our project lifecycles to reflect as a team on our learnings about systemic social inequalities.
- (vii) We strive to be informed by a diverse range of voices.
- (viii) We are supported by a funding and project management approach which allows for time and resources that embed intersectional social justice considerations in our work.
- (ix) We proactively identify and engage with groups whose views and needs may not be acknowledged or fully understood.
- (x) We must adapt our activities and internal processes based on our engagement and understanding of the needs of underrepresented groups.
- (xi) We want to leave space in our practice for ‘asking the other question’.
- (xii) We want to recognise the intersectionality that affects the people and communities we work with and allow it to shape our strategy.
- (xiii) We want to commit to intersectionality by aligning our internal EDI principles to the external work we carry out.
- (xiv) We want to reflect on the unique strengths and perspectives, privileges and penalties within the diverse identities of our workforce and bring intersectionality into our everyday practice.

Guidelines developed by the social enterprise

- (i) We apply intersectional thinking and tools when we evaluate our products/services to improve what we offer and make it more useful to the communities we work with.
- (ii) We share and celebrate the experience of applying intersectionality and its positive impact across our team to help us learn collectively.
- (iii) We challenge ourselves to spot opportunities to apply intersectional tools to make our work more inclusive and therefore, truly collaborative.
- (iv) We take responsibility to help each other understand and embed intersectional thinking into our practice.
- (v) We must use intersectional tools and mindset while working with at least three external collaboration partners to build positive evidence of its benefits.
- (vi) We envision working through at least one example of successfully implementing intersectionality and generating insights with the new Hub Board.
- (vii) We will work collaboratively with communities while being conscious of the diversity within them (breadth) and while ensuring that our commitment to working together goes beyond just scratching the surface (depth).
- (viii) We will strive towards the expectation that every Hub project lead/member should be able to articulate how they have embedded intersectionality into their work.
- (ix) We will ensure that our work with communities goes beyond just 'signposting' towards helping with concrete actions.
- (x) We will strive never to put those we work with at a disadvantage or risk.
- (xi) We will check that the resources we have (time and money) are not disproportionately invested in certain groups, unless for a pilot that will benefit a larger section of society.
- (xii) We will continually challenge ourselves, our colleagues, and our partners on our definitions of vulnerability and inclusion.

Guidelines developed by the energy distributor

- (i) We want to provide services to our customers through innovation by ensuring different categories of consumers – both included and excluded – are at the heart of our work to truly ensure that the energy transition is fair for all.
- (ii) We want to incorporate intersectional tools into our projects to look in depth into how they might privilege and penalise vulnerable consumers.
- (iii) We want to encourage our SMTs to develop an intersectional mindset through sharing success stories that drive/improve performance.
- (iv) We want to make clear distinctions between the consumer vulnerability work and the EDI work within our organisation – and how they engage with intersectionality.
- (v) We will ensure that we do not shy away from engaging with complexity when it comes to understanding consumer vulnerability and always go the extra mile – all projects must ask who is included, who is excluded, why and what the risks might be.
- (vi) We will not use the lack of knowledge as an excuse to not engage with critical thinking around intersectionality – we will ask for help from colleagues, from business and external experts.
- (vii) We take responsibility in creating a central subject matter expertise on intersectionality – engaging both the EDI and consumer vulnerability teams. We also want to ensure that the knowledge on practicing intersectionality is easily accessible across the company and beyond.
- (viii) We must use intersectional tools and mindset while working with our customer support team so that we can better understand the identities of our customers and how they impact their energy use, thereby improving our service.
- (ix) We want to make it easily accessible for all customers to engage with smart solutions and take advantage of the flexibility market – to do this, we want to have clear communication and processes together with our external partners.

(x) We want to use an intersectional mindset to develop a critical understanding of whether we are working with the right stakeholders with the right interests - and whether this choice may be leaving certain types of consumers behind.

Appendix J List of Codes

Indexing (Step 1): Broad Codes

1. Smart energy technologies
2. Intersectionality
3. Organizational roles in smart energy transitions
4. Justice frameworks in energy systems
5. Vulnerable smart energy consumers
6. Barriers to inclusion in SETs
7. Energy policies and regulations
8. Procedural justice in energy transitions
9. Distributive justice in energy systems
10. Recognition justice and marginalized identities
11. Technological innovation in smart energy
12. Public perceptions of SETs
13. Energy flexibility and consumer behaviour
14. Institutional practices and governance
15. Consumer engagement strategies
16. Climate and energy policy intersections
17. Energy infrastructure and digitalization
18. Social equity in energy access
19. Market-driven approaches to energy systems
20. Energy crisis and its impacts on vulnerabilities

Open Coding (Step 2): Descriptive Codes

1. Structural injustices in energy systems
2. Definitions of energy vulnerability
3. Intersectionality in practice

4. User engagement with smart energy technologies
5. Energy supplier and distributor roles
6. Limitations of current justice frameworks
7. Institutional accountability in SETs
8. Consumer perspectives on smart meters
9. Digital literacy and energy access
10. Neoliberal logics in energy markets
11. Financial barriers to energy flexibility
12. Community-level energy initiatives
13. Smart meters and demand-side flexibility
14. Policy responses to energy inequalities
15. Climate justice and energy justice intersections
16. Social determinants of energy vulnerability
17. Marginalized group representation in energy policies
18. Data privacy and consumer trust in smart technologies
19. Gendered experiences in energy transitions
20. Intersectional impacts of energy efficiency schemes
21. Ethnic disparities in energy system engagement
22. Challenges in implementing inclusive energy interventions
23. Energy affordability and access challenges
24. Procedural barriers in energy governance
25. Role of regulatory bodies like Ofgem
26. Stakeholder collaborations in energy justice
27. Role of funding in shaping SET outcomes
28. Consumer rights in smart energy transitions
29. Knowledge gaps in energy justice frameworks

30. Intersectional critiques of energy transitions
31. Charities and frontline support during energy crises
32. Technological barriers to inclusivity
33. Historical inequalities in energy systems
34. Consumer empowerment through smart technologies
35. Role of AI and ML in energy management
36. Short-termism in policy measures
37. Policy gaps in addressing intersectional inequalities
38. Temporal vulnerabilities in energy transitions
39. Institutional Practices of Intersectionality
40. Organizational Motivations to Engage with Intersectionality
41. Digital and physical infrastructure gaps
42. Role of grassroots organizations in energy justice
43. Community trust in energy transitions
44. Outreach strategies for inclusivity
45. Cultural barriers and energy transitions

Axial Coding (Step 3): Analytical Codes

1. Institutional barriers to intersectional justice
2. Social determinants of energy vulnerability
3. Inefficiencies in customer engagement
4. Intersectionality as a design principle
5. Energy suppliers' role in procedural justice
6. Power dynamics in smart energy transitions
7. Intersectional impacts of digital divides
8. Epistemic authority in smart energy transitions
9. Institutional agency in shaping/contesting epistemic authority

10. Role of intersectionality in demand-side flexibility
11. Structural inequities in energy policy design
12. Transformative justice approaches in SETs
13. Intersectional analysis of smart energy benefits
14. Consumer empowerment in digital energy systems
15. Historical context of energy inequalities

Selective Coding (Step 4): Core Themes

1. Emerging strategies for operationalizing intersectionality in energy systems
2. Barriers to intersectional engagement in smart energy practices
3. Institutional power dynamics in smart energy transitions
4. Role of digitalization in exacerbating energy inequalities
5. Transformative justice frameworks for SETs
6. Consumer-centric approaches to smart energy policy
7. Intersectional critiques of energy market structures
8. Role of institutions in shaping equitable energy futures

Appendix K: Excerpt from Field Notes: My first day on my secondment at Citizens Advice

I arrive at the office early in the morning, where I am greeted by a staff member who gives me a brief tour of the workspace. At 10 a.m., I join the energy team meeting, sitting quietly as introductions are made. The team comprises 28 members, 24 of whom are attending online. I introduce myself as a researcher and briefly explain my interest in observing their work on energy justice and smart technologies. As I observe, I notice the team's use of a consultation tracker, an impressive tool that not only logs the advice provided to various stakeholders but also functions as a calendar. I learn that their clients include government departments, industry leaders, policy makers, and the general public, reflecting the wide-ranging impact of their work.

The meeting has a distinctly research-driven focus. I observe how research questions are often commissioned externally but are always designed with consumer interests in mind. It strikes me that their impartiality is a cornerstone of their operations, even as they navigate funding from diverse sources, including significant contributions for research projects like grid migration.

One part of the meeting that catches my attention is the discussion of an upcoming Demand Flexibility Scheme. I hear team members exchanging ideas about how qualitative research methods can be used to examine its implications, and I make a note to follow up with specific team members involved. The conversation reveals concerns about the use of smart meter data and how it should be managed responsibly.

During lunch, I sit with a few team members and observe that conversations are mostly informal and friendly. Later, I attend a smaller meeting on smart technology and heat decarbonization. I listen as participants brainstorm research ideas, reflecting on the role smart technologies might play in promoting heat pumps and improving energy efficiency. The discussion highlights their commitment to standing out through consumer-focused, evidence-based research. Throughout the day, I am struck by the team's thoughtful approach to inclusivity, especially their work with the EDI group. I note a presentation on making energy work more accessible, both internally and externally, and consider how this could align with my research focus.

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