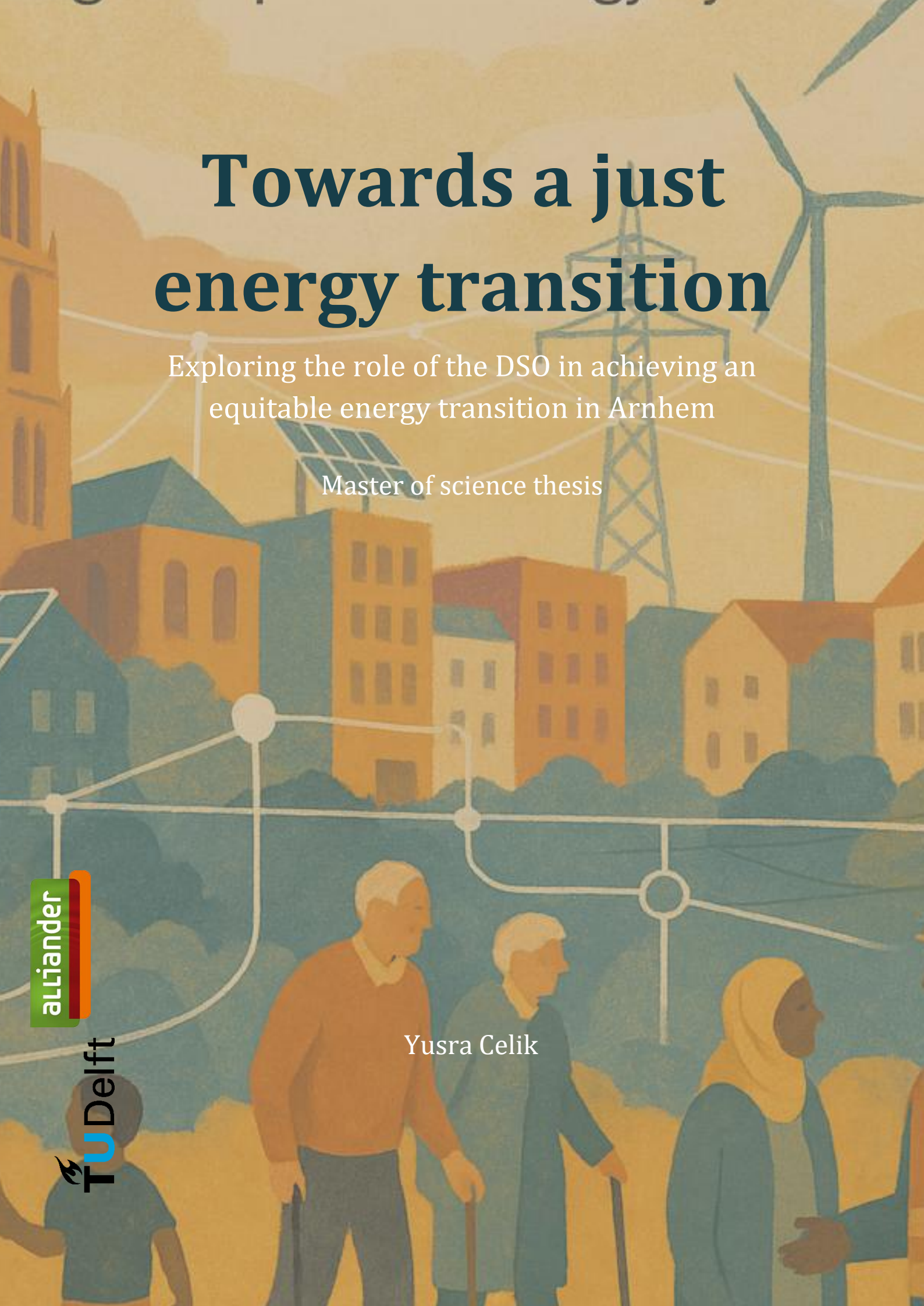
# Towards a just energy transition

Exploring the role of the DSO in achieving an equitable energy transition in Arnhem

Master of science thesis



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# Towards a just energy transition in Arnhem: Exploring the role of the DSO in achieving an equitable energy system

Master of science thesis submitted to Delft University of Technology in partial fulfilment of the requirements for the degree of

**MASTER OF SCIENCE**

in

**COMPLEX SYSTEMS ENGINEERING AND MANAGEMENT**

Faculty of Technology, Policy and Management

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To be defended in public on Augustus 26st, 2025

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16 July 2025

# Acknowledgements

After five years of studying, writing this thesis marks the final step of my academic journey—a journey filled with challenges, growth, and moments of discovery. Of all the topics I've explored during my studies, this was by far one of the most interesting and meaningful to work on.

I want to thank all four of my supervisors and advisors for their support and enthusiasm throughout this process. Your encouragement and belief in the relevance of my research made a real difference. I'm especially grateful for the opportunity to do my graduation internship at Alliander. During my time in the innovation department, I learned a lot and not just about the technical and institutional sides of the energy transition, but also about the many inspiring initiatives happening within the organization. It was motivating to see how much creativity and social commitment exists at Alliander, and how innovation can be used to build a more inclusive and future-proof energy system. A special thank you to Stijn Brouwer, my supervisor at Alliander, for your genuine enthusiasm for this topic and for your thoughtful feedback and guidance throughout the project. Thank you also to the entire innovation team at Alliander for welcoming me and supporting my work.

To Udo Pesch, my first university supervisor, thank you for your consistent support and the many regular meetings that helped me stay on track. I really appreciated your constructive feedback and the space you gave me to explore my ideas independently. And to Aad Correljé and Toyah Rodhouse, my second and external university supervisors, thank you for your valuable feedback and for helping me sharpen my thinking and writing. I'm also deeply grateful to all the respondents who participated in my interviews. Your openness, insights, and enthusiasm for the topic were truly inspiring. Many of you were so engaged that our planned short interviews turned into rich conversations going way over time, thank you for your time and willingness to think along with me. To my fellow students, thank you for the many brainstorming sessions, shared frustrations, and mutual motivation. And finally, to my family, thank you for your support throughout my entire academic career. Your encouragement has meant everything to me.

As this thesis explores inequalities in the local energy transition, I am reminded that the energy transition is not only a technical challenge, but a moral one. In the words of Nelson Mandela:

> *"As long as poverty, injustice and gross inequality persist in our world, none of us can truly rest."* — Nelson Mandela

May this thesis be a small step toward a more just and inclusive energy future.

# Executive summary

*Introduction*

The Netherlands strives to achieve carbon neutrality by 2050, but the transition to renewable energy risks deepening existing social inequalities, particularly energy poverty. In 2021, over 600,000 Dutch households experienced energy poverty, struggling to afford clean energy due to high costs and systemic barriers. Arnhem, a mid-sized city in the eastern Netherlands, exemplifies these challenges. With a high proportion of outdated housing stock and marked socio-economic disparities across its neighborhoods, Arnhem is particularly vulnerable to the uneven impacts of the energy transition. This thesis investigates how a Distribution System Operator (DSO), specifically Alliander, can contribute to a more just and equitable energy transition in Arnhem. As the operator responsible for managing and expanding the regional electricity and gas infrastructure, Alliander plays a central role in enabling access to energy by facilitating the energy infrastructure and shaping the conditions and tariffs under regulatory oversight. This research therefore explores how Alliander, in collaboration with local stakeholders such as the municipality, regulators, and civil society organizations, can help ensure that the energy transition does not leave vulnerable groups behind.

*Methodology*

To explore the role of the DSO in promoting energy justice, this study adopts a qualitative case study approach, focusing on the city of Arnhem as a representative and contextually rich site. The research is grounded in the energy justice framework, comprising distributional, recognition, and procedural justice, which provides a structured lens for analyzing fairness in energy systems. Through a qualitative case study approach, the research combines document analysis with 15 semi-structured interviews involving stakeholders from Alliander, the municipality of Arnhem, the Autoriteit Consument & Markt (ACM), and civil society. Furthermore, a comprehensive document analysis was conducted, reviewing strategic plans, regulatory frameworks, municipal energy policies, and internal reports from Alliander. This provided a foundational understanding of the institutional context and formal commitments related to energy justice. Thematic analysis was employed to interpret the data, using a hybrid coding strategy that combined deductive codes derived from the energy justice literature with inductive codes emerging from the empirical material. By integrating theoretical insights with empirical findings, this methodology provides a robust foundation for evaluating the DSO's role in shaping equitable energy outcomes and for identifying actionable strategies to enhance justice in the energy transition.

*Results*

The findings of this research reveal that while Alliander increasingly acknowledges its societal role in the energy transition, its ability to act on this awareness is constrained by a combination of regulatory mandates, a technocratic organizational culture, and fragmented internal structures. These limitations hinder its capacity to address systemic inequalities in grid access, cost distribution, and citizen participation. Furthermore, distributional injustices in Arnhem's energy transition are particularly pronounced. Grid congestion and capacity shortages disproportionately affect low-income neighborhoods, where residents face long delays in accessing sustainable technologies such as solar panels and heat pumps. The current "first-come, first-served" model for grid access for small consumers privileges early adopters which are typically wealthier households while excluding those with fewer resources. Additionally, the existing grid tariff structure is regressive: small consumers pay

significantly more per kilowatt-hour than large users, and renters often subsidize homeowners who can afford to electrify. Investment decisions based on projected demand further reinforce spatial inequalities, as affluent areas with higher adoption rates are prioritized for upgrades. Recognition and procedural injustices also persist. Vulnerable groups such as renters, migrants, and individuals with low literacy are harder to reach and often excluded from energy planning and communication. Alliander's outreach remains overly technical and inaccessible, limiting public understanding and engagement. Participation mechanisms are largely top-down and fail to incorporate local knowledge or reflect the lived experiences of marginalized communities.

Despite these challenges, the research identifies several practices and strategies. Alliander's collaboration with the Municipality of Arnhem and initiatives like the Energiebank demonstrate the potential of neighborhood-based planning and community-led energy models. Pilot projects, such as socially sensitive disconnection policies, show that targeted interventions can reduce societal costs and improve outcomes for vulnerable households. Stakeholders also support reforms to grid tariffs, including time-of-use pricing and progressive structures that better reflect actual usage and ability to pay. Such reforms could benefit up to 79% of low-income households, according to cited studies. The thesis concludes with actionable recommendations for DSOs, policymakers, and local governments to embed justice more deeply into energy infrastructure planning and governance.

*Discussion and conclusion*

The discussion highlights a central tension in Arnhem's energy transition: the need to move quickly to meet climate goals while ensuring that the transition is fair and inclusive. The findings show that when speed is prioritized without attention to justice, vulnerable groups risk being left behind. Perceptions of injustices such as exclusion from decision-making or unequal access to infrastructure can reduce public trust and hinder the legitimacy of the transition. The conclusion emphasizes that while Alliander faces regulatory and institutional constraints, it holds significant potential to act as a facilitator of energy justice. By embedding social equity into infrastructure planning, advocating for fairer tariff structures, and strengthening partnerships with local stakeholders, DSOs can help ensure that the energy transition benefits all communities.

# Contents

# Abbreviations

| | |
|---|---|
| ACM | Authority for Consumers and Markets |
| CBS | Centraal Bureau voor de Statistiek |
| DER | Distributed Energy Resource |
| DSO | Distribution System Operator |
| EV | Electric Vehicle |
| EQ | Energy Quote |
| GV | Large Consumers (Grootverbruik) |
| HEMS | Home Energy Management Systems |
| IEA | International Energy Agency |
| KV | Small Consumers (Kleinverbruik) |
| LIHC | Low Income, High Costs |
| LILLE | Low Income, Low Energy Label |
| MKB | Midden- en Kleinbedrijf (SMEs) |
| MPK | Societal Prioritization Framework (Maatschappelijk Prioriteringskader) |
| PV | Photovoltaic Systems |
| TOU | Time of use tariffs |

# 1. Introduction

## 1.1 Problem introduction

The Netherlands has set an ambitious goal to become a global leader in sustainability, adhering to international agreements like the Paris Climate Accord. The Dutch government is committed to reducing greenhouse gas emissions and transitioning to renewable energy by 2050 (IEA, 2020). However, the journey towards a sustainable future comes with its challenges. As the Netherlands transforms its energy systems, there is a growing risk that these changes might exacerbate pre-existing social inequalities, particularly for low-income households. These risks are increasingly discussed through the lens of energy justice, a framework concerned with identifying which inequalities in the energy system are unjust, and why. Energy justice encompasses three interrelated dimensions: Distributive justice (fair allocation of benefits and burdens), procedural justice (inclusive and transparent decision-making), and recognition justice (acknowledging and respecting diverse needs, values, and circumstances) (Jenkins et al., 2016). While inequality refers to differences in the distribution of resources or opportunities, injustice occurs when such differences are judged to be morally unacceptable (Pesch & Van Uffelen, 2024). Not all inequalities are necessarily unjust; for example, some may arise from individual choice or efficiency gains. Energy justice asks the critical question: which inequalities do we, as a society, consider unacceptable, and how should we address them?

One inequality that is widely recognized as unjust is energy poverty, a condition where households struggle to afford sufficient and clean energy to meet their basic needs. In the Netherlands, over 600,000 people, which translates to around 7% of households experienced energy poverty in 2021 (Martinez-Reyes et al., 2024; Mulder et al., 2021). These households are often concentrated in older, poorly insulated homes, where rising energy costs exacerbate already precarious financial situations. Without careful policy measures, the shift to sustainability could deepen divides between those who can afford green technologies such as solar panels and heat pumps and those who cannot, leaving vulnerable groups at an even greater disadvantage (Carley & Konisky, 2020). Furthermore, addressing energy poverty is not only a moral imperative but also an opportunity to accelerate the energy transition by ensuring that all households can participate in and benefit from renewable energy technologies, as shown in figure 1 (Middlemiss et al., 2020).

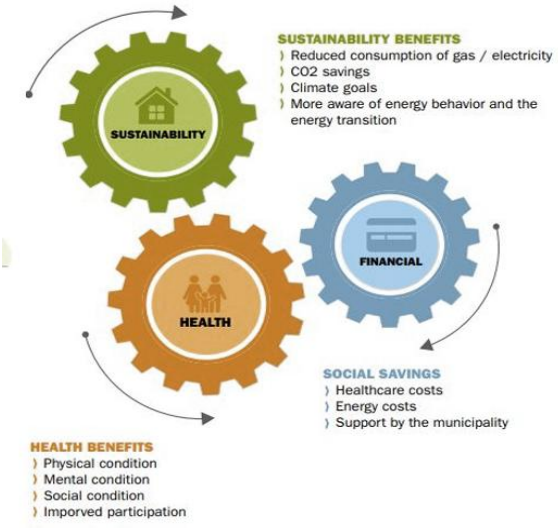


*Figure 1: Benefits of addressing energy poverty (Middlemiss et al., 2019)*

*Case study: Exploring the role of Alliander in Arnhem*

Addressing energy justice effectively requires localized, context-specific approaches. Arnhem, located in the eastern Netherlands, is particularly vulnerable due to its high proportion of older, poorly insulated homes and significant socioeconomic disparities. Low-income neighborhoods in the city face higher risks of energy poverty, with residents often unable to afford the rising costs of energy (CBS, 2023). The city's demographic diversity further underscores the need for tailored solutions that address specific community needs. Arnhem has already implemented initiatives to combat energy poverty, such as a three-year program targeting 2,500 households and allocating €9.45 million in 2024 for energy assistance (Gemeente Arnhem, 2024). Despite these efforts, energy poverty remains a pressing challenge, compounded by the lack of a cohesive national policy framework (VNG, 2018).

One of the key actors in addressing these challenges is Alliander, a leading Distribution system operator (DSO) in the Netherlands. Beyond maintaining electricity and gas grids, Alliander is actively involved in addressing network congestion which is a growing challenge due to increasing demand and decentral energy production. In doing so, it is important that solutions to grid congestion also contribute to a fair and inclusive energy transition and don't reinforce energy poverty. Alliander is committed to ensuring this by tackling energy poverty and collaborating with municipalities, non-profits, and local communities to develop innovative approaches that improve access to sustainable energy, particularly for vulnerable groups (Alliander, 2023). This thesis is conducted in the context of an internship with Alliander in order to promote an equitable energy transition in Arnhem.

*Link with COSEM program*

This thesis aligns with the CoSEM program focus on socio-technical systems design and addressing complex challenges by integrating technical, social, and policy dimensions. By examining energy poverty and equitable energy transitions, it applies principles of systems engineering, policy analysis, and institutional design. Insights from Law and Institutions support the analysis of regulatory frameworks, identifying where policies may inadvertently burden vulnerable households. The course Electricity and Gas: Market Design and Policy Issues informs the evaluation of market structures and

their impact on energy affordability and fairness. Together, these perspectives equip this research to propose integrated, just, and practical solutions for the energy transition.

## 1.2 Academic knowledge gap and societal relevance

The global transition from fossil fuels to renewable energy presents both opportunities and challenges. While advancements in renewable energy systems promise to decentralize energy production and improve social equity (Burke & Stephens, 2018; Chapman et al., 2021; Johnson et al., 2020; Khaldi & Sunikka-Blank, 2020), the shift also risks deepening existing socio-economic inequalities. Without explicit attention to energy justice, these inequalities can become injustices, particularly when they deny vulnerable groups access to basic energy needs, participation in decision-making, or the benefits of new technologies. Studies warn that this transition can disproportionately burden lower-income households, particularly through investments in expensive technologies like solar panels and heat pumps (Howe & Boyer, 2016; Newell, 2019; Yenneti et al., 2016; Zárate-Toledo et al., 2019). In the Netherlands, the Ecorys study (Schellekens et al., 2019) estimates that up to 18% of households may face unaffordable energy costs due to these transitions, with local energy poverty rates varying dramatically from 2.9% to 29.7% depending on the neighborhood (Mashhoodi et al., 2019). These trends are particularly concerning for vulnerable urban areas like Arnhem, where outdated housing stock, socioeconomic inequality, and rising grid costs make residents especially susceptible to energy poverty. Although municipalities are attempting to respond, existing local efforts often focus narrowly on energy affordability, neglecting other dimensions important to a fair transition such as accessibility to renewable technologies and inclusive decision-making processes (Clancy et al., 2017; Middlemiss et al., 2020).

At the same time, the role of DSOs in shaping a just energy transition remains severely understudied. Historically, electricity was produced centrally and delivered to passive consumers, but today's landscape is increasingly characterized by decentralized production and the rise of so-called "prosumers", which are households or businesses that both consume and produce electricity (Miller, 2023). This shift has dramatically changed grid dynamics, leading to growing network congestion and the need for substantial grid expansions. In the Netherlands alone, it is estimated that around €200 billion will need to be invested in the electricity system by 2050 to accommodate this transition (NOS, 2025). Notably, this infrastructure is collectively financed, yet not all users benefit equally. For example, wealthier households are more likely to afford solar panels and benefit from feed-in tariffs, while lower-income groups bear a disproportionate share of the system's costs without gaining comparable benefits, raising serious questions of distributive justice. Despite these developments, research and policy responses continue to emphasize technical solutions to grid congestion, such as optimization algorithms, storage, and smart grids (Powells & Fell, 2019), while largely overlooking the social and ethical dimensions of these challenges from the perspective of DSOs (Brisbois, 2020; Lovell, 2019). As central actors in the evolving energy system, DSOs are increasingly confronted with questions of fairness, inclusion, and responsibility that go far beyond their traditional technical mandates (Vadavathi et al., 2024).

Despite growing recognition within DSOs of the importance of energy justice, most operators still lack clear mandates or frameworks to act beyond their traditional technical role (Alliander, 2023). While municipalities are often tasked with addressing energy poverty, they too struggle with limited

resources and fragmented national policy frameworks (Feenstra, 2021). As a result, neither DSOs nor municipalities are currently equipped with adequate tools to systematically tackle energy justice at the local level. This fragmentation also limits opportunities for shared learning between municipalities, hampering the scalability of successful local initiatives (Kuijpers, 2021; Martinez-Reyes et al., 2024). Most literature remains focused on either municipalities or national governance, failing to explore how DSOs might operationalize justice in everyday decisions about network investments, connection priorities, or congestion management.

This gap in knowledge is not only academically significant but also socially urgent. As the energy transition accelerates, the risk of leaving vulnerable groups behind becomes more pronounced. This thesis addresses that risk by examining how DSOs despite their formal neutrality can act as facilitators of a just transition. By focusing on Arnhem, a city with high levels of energy poverty and infrastructural inequality, the research provides context-specific insights that are transferable to other urban regions. The findings offer practical guidance for DSOs, municipalities, and regulators seeking to embed justice into energy governance. In doing so, the study supports broader societal goals of climate justice, democratic participation, and equitable access to clean energy. Ultimately, this research contributes to a more socially responsive energy transition: one that not only meets climate targets but also ensures that no one is left behind.

## 1.3 Research Question

Given the gaps in understanding how Alliander can effectively contribute to a just energy transition, this study proposes the following research question: ***"What role can a Distribution System Operator (DSO) play in enabling a just energy transition at the municipal level?"***

To answer the main research question, several interconnected sub-questions are formulated. These guide the research from theoretical grounding to empirical exploration and practical recommendations:

- ***What are the key principles of energy justice, and how are they operationalized in practice?***
  *Establishes the theoretical foundation for the thesis.*
- ***Who are the key stakeholders involved in the local energy transition, and how do they envision the role of a DSO in a just energy transition?***
  *Maps relevant actors and explores their perspectives on the DSO's responsibilities.*
- ***How do issues of distributional, procedural, and recognition-based injustice manifest in Arnhem's local energy transition?***
  *Investigates how the three tenets of energy justice play out on the ground, focusing on challenges and inequalities experienced by different groups.*
- ***What institutional, regulatory, or organizational barriers limit the DSO's ability to contribute to energy justice?***
  *Explores structural constraints affecting the DSO's capacity to address energy injustices.*
- ***What strategies or practices could strengthen the DSO's contribution to a just and equitable energy transition at the local level?***
  *Generates forward-looking, actionable recommendations based on empirical findings and stakeholder perspectives.*

While many justice studies take a normative or policy-oriented lens, this thesis examines how a technical actor with limited formal power but significant infrastructural influence can enable or hinder a just energy transition. The goal of this study is to explore how a DSO can contribute to a just energy transition at the municipal level by examining their potential roles, responsibilities, and limitations through the lens of the energy justice framework.

## 1.4 Thesis structure

This thesis is structured to guide the reader through the theoretical, empirical, and practical dimensions of energy justice in the context of Arnhem's energy transition. Chapter 1 introduced energy justice in Arnhem and the relevance of the DSO in shaping just outcomes. It also outlined the academic gap and research questions. Chapter 2 presents the theoretical framework, focusing on the concepts of a just transition and energy justice, including its core tenets distributional, recognition, and procedural justice. It also introduces the conceptual framework used to analyze Alliander's role. Chapter 3 explains the research methodology, detailing the qualitative case study approach, data collection through interviews and document analysis, and the thematic coding process. Chapter 4 maps the local energy transition in Arnhem, identifying key stakeholders and examining how Alliander's role is perceived by institutional and community actors. Chapter 5 analyzes the energy injustice found in Arnhem and explores the institutional and organizational barriers faced by Alliander. Chapter 6 outlines strategies and recommendations for DSOs, municipalities, and policymakers to a more just energy transition. Chapter 7 discusses the broader implications of the findings and chapter 8 concludes with a summary of key insights and contributions to the energy justice literature. An overview of the thesis outline is shown in figure 2.

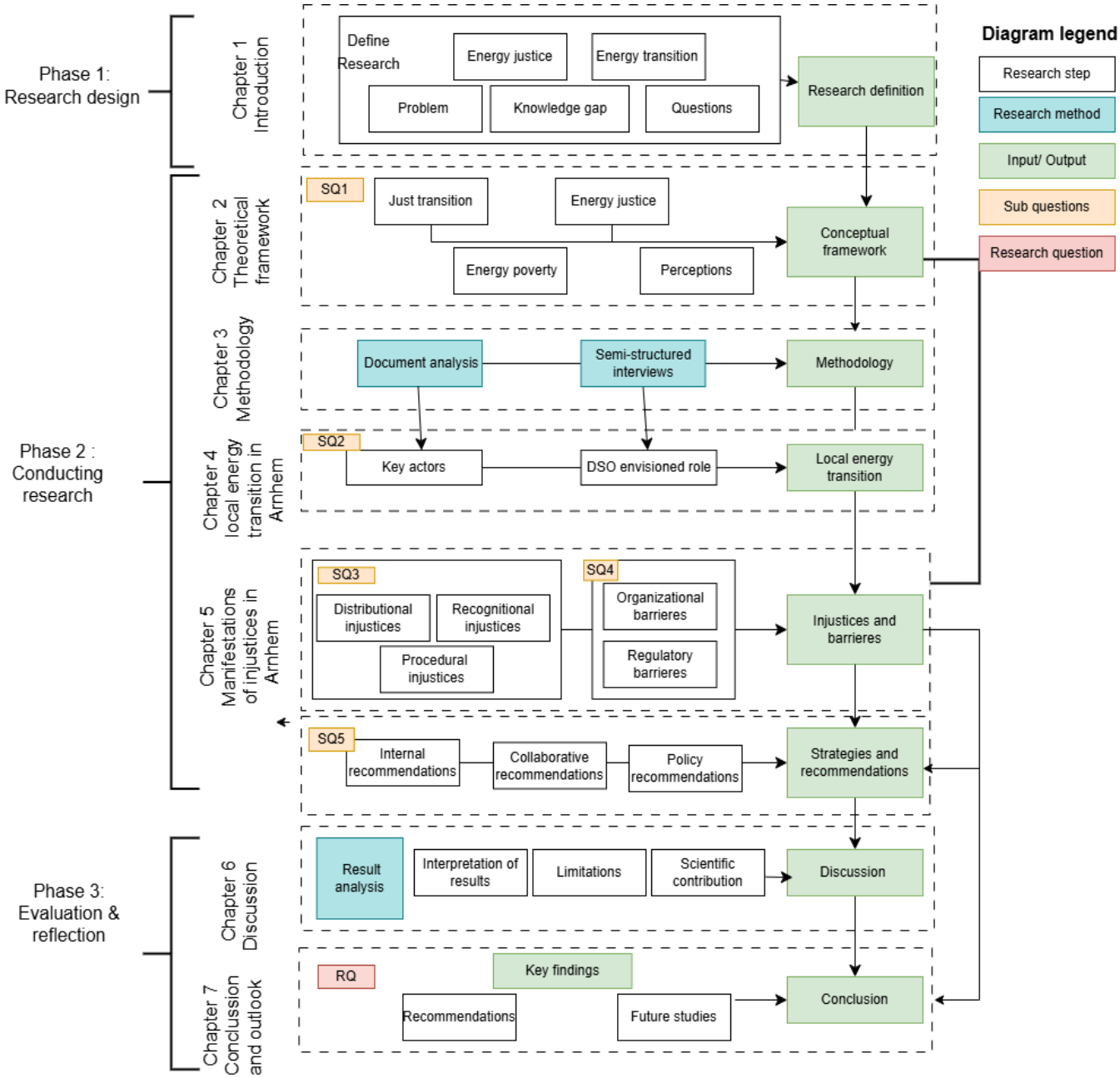


*Figure 2: Thesis outline*

# 2. Theoretical framework

This chapter outlines the theoretical lens of the study aimed to answer the first sub-question. It introduces the concept of a just transition and uses the energy justice framework to assess fairness in the energy transition. Energy poverty is discussed as a form of energy injustice within this framework. The chapter concludes with a conceptual framework that guides the analysis of Alliander's role in promoting a just energy transition in Arnhem.

## 2.1. Just transition

In striving for a sustainable future, the energy transition from fossil fuels to renewable energy sources must be not only effective but also just. As explained in chapter 1.3, an unjust energy transition can reinforce existing inequalities and disproportionately affect vulnerable populations. Therefore, a just transition ensures that the shift towards a low-carbon energy system does not disproportionately burden certain communities while privileging others (Jasanoff, 2017). The advantages of transitioning to a less carbon-intensive socio-technical system include the development of more resilient and democratic energy infrastructures, the restructuring of industries and advancements in technology, the alleviation of poverty, and the addressing of social and environmental justice issues (Wang & Lo, 2021).

The concept of a just transition has been present in discussions by activists, labor unions, and associated groups since the 1970s, with scholarly debates emerging more recently in the 2000s (Carley & Konisky, 2020). At its core, it refers to an equitable transformation of the energy system, where both the benefits and burdens of this transition are fairly distributed across different societal groups (Wang & Lo, 2021). In practice however, energy policy has often prioritized economic and technological feasibility, while overlooking critical social justice concerns (Miller & Richter, 2014). This is problematic, as the development of a new energy system inherently creates uneven outcomes. Some individuals and communities are gaining access to new opportunities, while others face exclusion or are even disadvantaged by the transition (Correljé, 2018).

Wang and Lo (2021) identify five core dimensions of a just energy transition. Economic restructuring involves transforming industries and labor markets to accommodate new green technologies. This stems from a labor point of view, where labor unions have historically fought for workers' rights in the shift towards sustainable industries. This requires policies that support workers transitioning from high-carbon sectors to low-carbon industries, ensuring fair wages and job security (Wang & Lo, 2021). Integrated framework for justice, the second dimension, addresses existing inequalities by combining environmental, climate, and energy justice in order to create a holistic approach to just transition. The third dimension focuses on socio-technical transition. This theme focuses on the deep structural changes in systems involving technologies, policies, infrastructure, knowledge, and social practices (Newell & Mulvaney, 2013). The theme highlights the need to consider social justice implications alongside technological innovations. The fourth dimension, governance, involves overcoming political and structural barriers through comprehensive governance, inclusive policy making, and the integration of local knowledge and epistemic justice approaches (Wang & Lo, 2021). Lastly, public perception and attitudes towards renewable energy technologies shape how just a transition is

perceived, highlighting the need for transparency and active citizen engagement (Bauwens & Devine-Wright, 2018; Wang & Lo, 2021).

The transition to sustainable energy involves numerous instances of injustice that policymakers may not yet fully recognize (Sovacool & Dworkin, 2015). Achieving a just transition requires active participation of diverse stakeholders, such as governmental bodies, private sector organizations, and civil society organizations. It requires the implementation of policies designed to redistribute resources in a way that mitigates the impact on vulnerable groups (Carley & Konisky, 2020). In academic literature, just transition is positioned at the intersection of energy transition and energy justice (Carley & Konisky, 2020). Moreover, the perception of justice in the energy transition plays an important role in how energy projects are accepted or contested. Pesch et al. (2017) argue that energy policies and projects often face resistance due to perceived injustices by different actors in society. When communities feel excluded from decision-making or believe that they bear a disproportionate burden, they may mobilize against energy initiatives. A prominent example is the case of carbon capture storage in Barendrecht, where Shell was awarded a tender by the Ministry of Economic Affairs (Brunsting & Mikunda, 2010). The local municipality opposed the plan, yet the ministry overruled their decision. The ensuing public opposition and media attention ultimately led to the project's cancellation. This case underscores how controversies surrounding justice can have significant repercussions, often resulting in policy reassessments only after substantial resistance has emerged. Such examples highlight the need for proactive justice considerations in energy policy to prevent backlash and ensure more equitable transitions (Floore, 2024).

This thesis aims to enhance the understanding of just transition by examining energy justice as both a conceptual framework and an analytical tool. The subsequent section will focus on the principles of energy justice and explore its significance in facilitating a just energy transition.

## 2.2. Energy justice

Energy justice has emerged as a critical framework within energy transition research, aiming to ensure fairness, social equity, and justice in energy systems (Wang, 2019; Jenkins et al., 2016). It builds upon the foundational principles of environmental and climate justice, which gained prominence in the 1980s, but focuses more explicitly on energy systems (Wang, 2019; Gonzalez et al., 2018). Sovacool et al. (2017) define energy justice as “a global energy system that fairly disseminates both the benefits and costs of energy services, and one that has representative and impartial energy decision-making responsibilities”.

Energy justice is a multifaceted concept that can be defined in different ways depending on the research focus and context. In the fields of ethics and philosophy, justice is about creating a fair and equitable society where individuals are treated with respect and dignity and have the opportunity to lead meaningful lives. Energy is a critical resource that can enhance such opportunities and capabilities for individuals to secure a better future (Sovacool, 2016). Therefore, energy justice ensures that energy policies and practices distribute both benefits and costs fairly, taking into account social equity, environmental justice, and human rights. The energy justice framework identifies various forms of injustices and the social groups affected by them (Jenkins et al., 2016). The concept of energy justice

encompasses three core principles, as shown in table 1 and described below (Carley and Konisky, 2020):

*Table 1. The three core tenets of energy justice (McCauley, et al., 2016).*

| Tenets | Evaluative | Normative |
|---|---|---|
| **Distributional** | Where are the injustices? | How should we solve them? |
| **Recognition** | Who is ignored? | How should we recognise? |
| **Procedural** | Is there fair process? | Which new processes? |

***Distributional justice***

Distributive justice concerns *where* the injustices are allocated and *how* the fair allocation of energy resources, benefits, and burdens across society can be distributed (Broto et al., 2018). It aims to ensure that all households have access to affordable, reliable, and sustainable energy services (Sovacool et al., 2017). As a core principle of energy justice, it focuses on how the positive and negative outcomes of the energy transition are distributed across social groups and geographical areas (Walker, 2009). For example, while wealthier households who invest in technologies like solar panels contribute to climate goals and benefit financially, lower-income households are often unable to participate but still pay rising grid costs (Goedkoop & Devine-Wright, 2016). Importantly, these prosumers continue to rely on the grid. For example, to feed electricity back raises questions about fair cost distribution. This dynamic highlights tensions between ecological and social justice. As Van Stam (2019) notes, decentralized systems often involve high fixed charges, limiting the ability of low-income groups to reduce their energy bills through lower consumption. Distributive justice also covers intergenerational and intragenerational equity, ensuring fair access to energy for both current and future generations (Sovacool et al., 2016). It addresses not only costs, but also freedom of choice, which can be constrained by developments such as mandatory connections to district heating systems. These systems often lock consumers into a single supplier and energy source without the ability to opt out (Van Stam, 2019).

Van Stam (2019) highlights two distinct domains within distributive justice. The spatial domain concerns how the costs and benefits of the energy system are distributed across different locations and households. It includes affordability, freedom of choice, and responsibility allocation. In this framework, affordability is determined not only by absolute costs but also by the proportion of household income spent on energy (Sovacool et al., 2016). Freedom of choice refers to the ability to choose energy providers or opt for different sources of heating. Such freedoms might be constrained, for example when municipalities impose large-scale heating networks. Responsibility allocation addresses how duties and burdens for the transition, such as infrastructure investments or emissions reductions, are divided geographically. The social domain focuses on equitable access to energy, ensuring that all households can meet basic needs regardless of income or location.

***Recognition justice***

The second core tenant of energy justice, recognition justice, is focusing on determining *who* is ignored in the energy system and *who* is responsible for delivering it. Recognition justice addresses this by focusing on identifying and addressing the exclusion, misrepresentation, or marginalization of specific social groups within energy systems and policy processes (Jenkins et al., 2016; Sovacool et al., 2017). This tenet stresses the importance of acknowledging diverse identities and experiences shaped by ethnicity, race, gender, disability, age, and socio-economic status (Sovacool et al., 2017). Failure to recognize such diversity can result in misrecognition, which manifests in three distinct ways: cultural domination, disrespect, and non-recognition (Jenkins et al., 2016). Cultural domination occurs when dominant cultural norms silence alternative worldviews; disrespect refers to the belittling of specific groups' needs or knowledge systems; and non-recognition happens when certain communities or their challenges are entirely overlooked in energy planning. While some scholars have questioned whether recognition justice deserves a place alongside distributional and procedural justice, arguing that material inequalities should take priority (Jenkins, 2019), it is increasingly acknowledged that without recognition, structural inequalities are likely to be reproduced or even deepened (Schlosberg, 2004; Fraser, 2009). An illustrative case of recognition injustice is found in the United Kingdom's link between fuel poverty and "excess winter deaths," which disproportionately affects the elderly who require more heating (Walker & Day, 2012). Similarly, in the Netherlands, low-income households are often excluded from studies and policy efforts focused on sustainable technology adoption, which typically target middle- and high-income groups (Straver et al., 2017). As a result, the perspectives, capabilities, and vulnerabilities of these groups remain underrepresented, despite their increased risk of energy poverty and transition-related burdens.

Moreover, recognition justice is also concerned with who has the opportunity to participate in and benefit from the ownership of energy systems. In many cases, marginalized populations are excluded from community energy projects due to financial barriers or a lack of access to relevant networks and information (Heffron, 2022). This raises important questions about who energy systems are being built for and who holds decision-making power over their design and implementation. As Catney et al. (2013) argue, stakeholder engagement is often too narrow, failing to capture the motivations and cultural perspectives of marginalized groups. This limits the effectiveness and inclusiveness of energy transitions. Recognition justice thus calls for meaningful inclusion of diverse communities, not merely as participants, but as co-creators of energy solutions. Only by incorporating the values, needs, and knowledge of all societal groups can energy systems be truly just and equitable.

***Procedural Justice***

Procedural justice concerns the fairness, transparency, and inclusivity of decision-making processes in energy governance. It asks critical questions such as: *Who* is involved in making energy-related decisions? *How* are these decisions made? And *to what extent* do affected communities have access, influence, and control over those processes? (Sovacool et al., 2016; Jenkins et al., 2016). According to Sovacool et al. (2016), procedural injustice arises when individuals or communities are denied meaningful participation in decisions that directly impact them. This includes not only formal opportunities to voice concerns but also whether those voices are taken seriously and whether decision-making structures allow for influence and redress. Key principles include representation, access to information, and meaningful participation. Jenkins et al. (2016) propose three mechanisms

to enhance procedural justice: mobilization of local knowledge, greater information disclosure, and improved institutional representation. Local knowledge mobilization recognizes that communities, especially Indigenous and place-based groups, hold valuable ecological, social, and cultural insights that can contribute to more context-sensitive energy policies. Information disclosure ensures transparency in terms of costs, risks, and alternatives, allowing people to make informed decisions. Institutional representation means that governance bodies must reflect the diversity of the populations they serve and be responsive to their concerns (Liebrand & Schuurman, 2022).

However, in practice, many energy transitions fall short of these principles. For instance, millions of people are displaced each year due to large-scale energy projects like hydropower dams and mining operations, often without consent or adequate compensation—violating their procedural rights (Sovacool et al., 2016). Similarly, in cities like Amsterdam, citizen participation in the heat transition has often been passive rather than empowering. While residents may be asked for input, they are rarely given decision-making power or ownership over energy solutions (Van Stam, 2019). This lack of influence and transparency can reduce public trust and undermine the legitimacy of energy policies. Devine-Wright (2007) emphasizes that when local communities are actively involved and energy systems are embedded within existing social networks, the likelihood of successful and socially accepted transitions increases. This aligns with the concept of energy citizenship, which suggests that individuals should not be seen as passive consumers but as active agents with rights and responsibilities in shaping energy futures (Beauchampet & Walsh, 2021).

### *Other energy justice tenets and frameworks*

While the three core tenets of distributive, procedural, and recognition justice provide the central analytical structure for this thesis, additional perspectives broaden the scope of energy justice and offer complementary insights.

McCauley, et al. (2016) has broadened the concept of justice and included **cosmopolitan** and **restorative justice**. Cosmopolitan justice emphasizes global interconnectedness, arguing that ethical responsibilities extend beyond national borders to consider the worldwide consequences of decisions. Restorative justice, on the other hand, focuses on addressing historical injustices by acknowledging past harm and implementing corrective measures to promote fairness and reconciliation. These perspectives are increasingly relevant in energy transitions, where past inequalities and global impacts must be considered in policy and decision-making.

To deepen the discussion on distributive justice, the **Capability Approach** and **Rawls' Maximin Rule** can be applied to provide structured ways to analyze and promote distributive justice. The Capability Approach, developed by Nussbaum (2011), shifts focus from mere income or wealth to a broader perspective on well-being, emphasizing individuals' capabilities to live meaningful lives (Knoben, n.d.). This perspective has influenced policy measures like the Human Development Index, which incorporates health, education, and income indicators to assess overall well-being (Shetty, 2023). Rawls' Maximin Rule states that social and economic inequalities should be arranged to benefit the least advantaged members of society (Rawls, 2001). This principle has been widely used in arguments for progressive taxation, where higher earners contribute more to redistribute wealth to the less

privileged (Mandle & Reidy, 2015). These theoretical perspectives highlight the necessity of structuring energy policies in a way that prioritizes fairness and minimizes disparities.

***Energy justice principles***

While energy justice is often explored through the core tenets of distributive, procedural, and recognition justice, it can also be approached through a more granular, principle-based framework. This framework outlines normative guidelines that inform what a "just" energy system should look like in practice. They provide a multidimensional perspective on justice within energy systems, addressing key concerns related to equity, participation, and sustainability (Sovacool & Dworkin, 2015). Eight widely recognized principles define this framework, as outlined in table 2. These principles function as overarching ethical guidelines that policymakers and energy authorities can use to promote just outcomes in energy decision-making.

For instance, affordability justice ensures that energy remains financially accessible to all socioeconomic groups. Measures such as targeted subsidies, income-based tariff structures, and tiered pricing can help mitigate financial barriers for low-income households. Similarly, the principle of availability justice focuses on guaranteeing universal access to sufficient and reliable energy services. In areas where energy access is limited, strategies such as grid extensions and decentralized renewable energy solutions can help bridge the gap. Intergenerational equity underscores the importance of sustainable energy policies that do not compromise the well-being of future generations. This principle supports a shift toward renewable energy investments and climate resilience measures to ensure long-term sustainability. Meanwhile, due process emphasizes the need for inclusive decision-making, ensuring that stakeholders affected by energy policies—such as local communities and environmental groups—have a voice in shaping outcomes. This can be achieved through public consultations, environmental impact assessments, and transparent governance structures.

Table 2: Energy Justice Decision-Making Tool (Sovacool & Dworkin, 2015)

| Energy justice framework | |
|---|---|
| Principle | Description |
| Availability | People deserve sufficient energy resources of high quality |
| Affordability | The provision of energy services should not become a financial burden for consumers, especially the poor |
| Due process | Countries should respect due process and human rights in their production and use of energy |
| Transparency and accountability | 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 | All people have a right to fairly access energy services |
| Responsibility | All nations have a responsibility to protect the natural environment and reduce energy-related environmental threats |
| Resistance | Energy injustices must be actively, deliberately opposed |
| Intersectionality | Expanding the idea of recognitional justice to encapsulate new and evolving identities in modern societies, as well as acknowledging how the realization of energy justice is linked to other forms of justice e.g. socio-economic, political and environmental |

## *The scope of this thesis*

Although energy justice encompasses this broad theoretical landscape, this research focuses on the three core tenets because they offer a robust, widely recognized, and operationally clear framework for evaluating fairness in energy system transformations. As Smale et al. (2023) and Sovacool et al. (2024) show, grid management can reinforce spatial, demographic, temporal, and environmental inequalities. Their findings show the need to approach grid development not just as a technical task,

but as a justice issue. Focusing on these three dimensions enables a comprehensive assessment of how Alliander can contribute to a fairer energy transition.

## 2.3 Energy poverty

Energy poverty is a form of energy injustice, characterized by insufficient access to affordable, reliable energy for basic needs (Sovacool et al., 2016). Traditionally, it is defined as a situation where households are unable to meet basic energy needs due to financial constraints, often measured through income and expenditure indicators (Sovacool et al., 2016; CBS, 2021). In the Dutch context, energy poverty is commonly identified through three approaches (TNO, 2021):

1. High Energy Quote (EQ): Energy costs exceed 10% of household income.
2. Low Income, High Costs (LIHC): Households in the lowest 25% income bracket with energy costs in the highest 50%.
3. Low Income, Low Energy Label (LILLE): Low-income households living in homes with poor energy performance (label D or lower).

While the EQ method is prevalent in international research due to its simplicity, it fails to capture households that under-consume energy to cut costs and is therefore called “hidden energy poverty.” The LILLE method, endorsed by TNO, better reflects the Dutch context by linking structural housing inefficiencies to vulnerability. According to TNO (2021), energy poverty is concentrated in urban areas, social housing, and among socioeconomically disadvantaged groups, including people with disabilities, single-parent households, and individuals with a migrant background.

Beyond these traditional indicators, recent scholarship emphasizes a broader understanding of energy poverty as exclusion from the energy transition (Finley-Brook & Holloman, 2016; Martinez-Reyes et al., 2024). Households unable to access or afford sustainable technologies, such as solar panels, electric heat pumps, or home insulation, miss out on long-term financial and environmental benefits. This creates a new layer of injustice, as these same households often contribute indirectly to the costs of grid expansion without reaping its rewards (Carley & Konisky, 2020). In this thesis, energy poverty is approached from this broader perspective. It includes not only financial hardship, but also structural exclusion from renewable energy developments. This aligns with the distributive and recognition justice dimensions of the energy justice framework, by emphasizing both the unequal allocation of benefits and burdens and the systemic marginalization of certain social groups.

*Energy poverty in Arnhem's energy transition*

Arnhem faces some of the highest levels of energy poverty in the Netherlands (TNO, 2023). This includes both general energy poverty, defined as households with a low income combined with high energy costs or poor housing quality, and also the more severe subgroup of households living in homes with the lowest 15% energy performance (e.g., energy labels F and G). The TNO report shows that the occurrence of energy poverty in Arnhem increased significantly between 2020 and 2022, especially within the subgroup of low-income households residing in poorly insulated homes (Appendix B). This trend reflects a broader national pattern in which energy poverty is increasingly concentrated in urban areas with older housing stock and limited financial capacity for energy efficiency improvements (Mulder, Batenburg, & Dalla Longa, 2023). This situation illustrates how energy poverty and energy

transition dynamics intersect: while higher-income households increasingly adopt sustainable technologies, vulnerable groups risk being left behind. As Arnhem transitions toward a sustainable energy system, this raises questions about distributive fairness and the role of institutional actors in mitigating inequalities.

## 2.4 The role of perceptions on injustice

Perceptions of injustice play an important role in understanding public responses to the energy transition, as explained in section 2.1. Even when inequalities are objectively present, not everyone interprets them in the same way (Jennings, 1991). People's judgments about whether something is fair or unfair are shaped by both personal experiences and social comparisons, also known as relative deprivation (Olson & Roese, 2002). This theory suggests that individuals feel deprived when their own well-being does not align with that of others in their social reference group, especially if they believe they are entitled to more (Flynn, 2023). This highlights the importance of distinguishing between measured injustice and perceived injustice. While measured injustice concerns observable inequalities in the distribution of costs and benefits, it is the perception of injustice that more strongly motivates resistance or public action (Parris et al., 2013). For example, if energy costs rise or access to new technologies becomes limited, affected groups may only mobilize if they believe the situation violates their expectations of fairness. These expectations are rooted in shared societal beliefs about justice, which are themselves shaped by cultural context, personal values, and social roles (McCauley et al., 2019).

The complexity of defining justice in the energy transition is widely acknowledged: while it is difficult to reach consensus on what constitutes a "just" transition, perceptions of injustice are often immediate and strongly felt (Muñoz Cabré & Vega-Araújo, 2022). People tend to recognize exclusion, unequal burdens, or lack of meaningful participation as unjust, even if the broader goals of the transition are widely supported. Disagreements about who caused climate change, who suffers most, and who should bear responsibility for solutions can lead to conflict, especially in the absence of shared ethical norms (Parks & Roberts, 2006). Without a commonly accepted understanding of fairness, people may approach energy policies with a zero-sum mindset and assume that one group’s gain is another’s loss. Beliefs about justice are shaped by both individual and situational factors. Personal values, past experiences, and one’s social role (e.g., tenant, homeowner, taxpayer) all influence how people interpret the fairness of a policy or development (McCauley et al., 2019). This is especially relevant in regions where the impact of the energy transition may differ greatly depending on income, housing type, or energy access. Understanding how actors perceive distributive outcomes is therefore key to designing fair and broadly supported policies (Muñoz Cabré & Vega-Araújo, 2022).

## 2.5 Conceptual framework

This section presents the key elements and indicators of energy justice used in this research. Drawing from the energy justice literature described in section 2.3, the framework is built around the three core tenets: distributional justice, recognition justice, and procedural justice (Jenkins et al., 2016), and energy poverty treated as a distinct but related dimension. Although energy poverty formally falls under distributional justice, it is treated separately in this thesis because it represents a particularly severe and morally urgent form of inequality. While not all inequalities in energy access are inherently

unjust, energy poverty is widely regarded as unacceptable because it denies individuals the ability to meet basic needs, participate fully in society, and maintain a decent standard of living (Heffron, McCauley, & de Rubens, 2018; Pesch & Van Uffelen, 2024). Its moral urgency, and the fact that it has only been systematically mapped in the Netherlands for the past five years, justify its separate analytical focus.

Each concept is further operationalized into context-specific indicators and adapted to the role of a DSO within the energy transition in Arnhem, as shown in table 3. It focuses on how Alliander's infrastructure decisions, connection policies, and stakeholder engagement practices influence who benefits from or is burdened by the energy transition. By applying this framework, the research evaluates how justice outcomes are shaped in practice and identifies opportunities for Alliander to better support equitable energy transitions in collaboration with other stakeholders.

*Table 3: Elements and Indicators of energy justice operationalized*

| **Concept** | **Indicator** | **Operational definition to the role of a DSO** |
|---|---|---|
| **Energy poverty** | Affordability of energy services | *Refers to how tariffs and infrastructure decisions influence household energy costs.* |
| **Distributional Justice** | Access to sustainable technologies/ connection | *Refers to the availability and accessibility of grid connections and technologies for different groups.* |
| | Fair cost distribution | *Refers to how grid costs are allocated across user groups.* |
| | Freedom of choice | *Refers to the extent to which users can choose between energy systems or providers.* |
| | Inter-/intragenerational equity | *Refers to how investment decisions affect different societal groups now and in the future.* |
| **Recognition Justice** | Inclusion of marginalized groups | *Refers to whether vulnerable or underrepresented groups are considered in planning and communication.* |
| | Acknowledgement of diverse energy needs | *Refers to how different household needs (e.g., medical, linguistic, literacy) are addressed in services.* |
| | Access to ownership or participation | *Refers to the opportunities for communities to participate in or co-own energy systems.* |
| **Procedural Justice** | Access to information | *Refers to the clarity, accessibility, and timing of communication about grid-related decisions.* |
| | Meaningful participation | *Refers to the degree to which stakeholders can engage in infrastructure planning processes.* |
| | Representation in decision-making | *Refers to the inclusion of diverse societal actors in governance and decision-making structures.* |
| | Use of local knowledge | *Refers to the integration of community insights into planning and implementation.* |

# 3. Research method

This chapter outlines the methodological approach used to investigate how a Distribution System Operator (DSO), in collaboration with key stakeholders, can contribute to a just energy transition in a municipality. It begins with the overall research strategy, explaining the qualitative, exploratory single-case design, followed by the data collection methods: semi-structured interviews and document analysis. These methods are selected to capture diverse perspectives and gain in-depth insight into the practical implementation of energy justice principles.

## 3.1 Research Strategy

This research investigates how Alliander as the regional DSO can contribute to a just energy transition in the municipality of Arnhem using the full framework of energy justice (distributive, procedural, and recognition justice). It examines not only how the costs, benefits, and opportunities of the energy transition are distributed across different consumer groups and neighborhoods, but also how decision-making processes are structured, whose voices are included or excluded, and how diverse needs and identities are recognized within energy governance.

**Case study approach**

The study adopts an exploratory, single-case study design, selected for three main reasons. First, the role of DSOs in promoting energy justice remains underexplored in both academic and policy literature. There is limited empirical evidence on how distributive, procedural, and recognition justice are operationalised in DSO decision-making. Second, the research questions are open-ended, focusing on "how" and "in what ways" justice is addressed, making an exploratory approach well-suited, as it allows flexibility to refine questions as new insights emerge (Yin, 2009; McCauley et al., 2019). Third, a single in-depth case enables a detailed understanding of the socio-technical and governance dynamics that cannot be captured through broader but shallower multiple-case comparisons.

Arnhem is selected as the case because, as explained in Chapter 1, it faces some of the highest levels of energy poverty in the Netherlands and significant socioeconomic disparities, alongside acute grid congestion. These conditions create a critical context where questions of fairness, access, and participation are highly important. As Yin (2009) notes, case studies allow for intensive examination of a contemporary phenomenon within its real-world context, especially when the boundaries between phenomenon and context are blurred. Crowe et al. (2011) highlight their value in analysing socio-technical systems involving multiple stakeholders and institutional layers—precisely the complexity present in Arnhem's energy transition. This study uses a single embedded case design, meaning that while Arnhem is the sole case, multiple units of analysis such as neighbourhoods, consumer groups, and stakeholder organisations are examined within it. This contrasts with a multiple-case or collective design, which would allow for cross-case comparison but would limit the depth of contextual analysis. Because little is known about the DSO's role in energy justice, depth is prioritised over breadth.

Furthermore, a qualitative research design is implemented to analyze the roles, strategies, and responsibilities of institutional actors in shaping a just energy transition. Qualitative methods are well-suited to exploring justice because they allow for a nuanced understanding of how fairness is perceived, contested, and operationalized in different contexts. They also enable the research questions to evolve as new insights emerge (McCauley et al., 2019), making them particularly suitable for an emergent and politically charged topic like energy justice. The main qualitative research methods used in this study are semi-structured interviews with key stakeholders involved in the energy transition and document analysis of relevant policies, strategic plans, regulatory frameworks and internal reports from Alliander. In energy social science, these methods are commonly used to understand attitudes, perceptions, and decision-making processes. They allow for triangulation; cross-referencing multiple data sources to enhance reliability and validity (Sovacool, Axsen, & Sorrell, 2018).

Despite its strengths, the case study approach has limitations. One concern is the potential for bias in qualitative data collection. Researchers and participants alike bring their own perspectives and assumptions, which may color the interpretation of events. To mitigate this, careful attention will be paid to transparency in the research process, triangulation will play a key role in enhancing validity, and findings will be critically assessed in relation to other data sources. The interview data will be cross-referenced with policy texts, public reports, and academic literature. Another limitation is the limited generalizability of a single-case design. While the research focuses deeply on Arnhem, the findings are not intended to be universally representative. Instead, they aim to offer theoretical and practical insights that can inform similar cases elsewhere. The study will emphasize transferability rather than generalizability by clearly describing the context, conditions, and governance dynamics that may be present in other municipalities.

## 3.2 Data collection

The data collection was carried out as part of the researcher's internship at Alliander, which enabled direct access to key informants and documents relevant to the ongoing energy transition projects in Arnhem. Semi-structured interviews allowed for the exploration of the experiences, understandings, and priorities of stakeholders involved in or affected by grid expansion, congestion management, and sustainable heating projects. Document analysis served to complement these interviews with policy, planning, and strategic context, enabling triangulation between stated perceptions and documented practices.

### 3.2.1 Semi-structured interview procedure

Semi-structured interviews are the core method for primary data collection. This format is widely used in qualitative research due to its flexibility and ability to probe into unanticipated topics (Kallio et al., 2016; Saunders et al., 2007). It allowed for in-depth exploration of how different actors perceive and experience distributive justice in the energy transition and how Alliander's practices impact various social groups.

The interview participants were selected through purposive and snowball sampling, targeting individuals who are directly involved in grid development, energy poverty,, tariff development, or policy implementation in Arnhem. These included Alliander employees from different departments, as well as external key stakeholders like municipal policymakers and civil society representatives. In total,

15 interviews were conducted, each lasting between 45 and 100 minutes. The interviews were held individually with exception of P14 and P15, who preferred an interview together.

The interviews followed a structured process to ensure transparency:

- Participants were invited via email with an accompanying explanation of the research objectives and their role in the study.
- Informed consent was obtained from all participants, including permission to record the interviews.
- A semi-structured topic guide, based on the literature review and initial document analysis, was used to steer the conversation while allowing for thematic flexibility (appendix D).
- Interview topics include the participant's role in the energy transition, perceptions of fairness (distributive, procedural, and recognition), decision-making processes, access to sustainable energy solutions, stakeholder collaboration, and the role and responsibilities of Alliander as a DSO.

The interviews were held in person or by video call using Microsoft teams. After each interview, transcripts were created with Microsoft teams and—if participants wish—shared with them for verification (member checking), allowing them to correct, clarify, or expand upon their responses. This process not only ensures data accuracy but also strengthens the ethical integrity and trustworthiness of the research. All the interviews were held in Dutch. Table 3 shows an overview of the participants, their organization and their roles.

*Table 4: Overview of the participants and their role*

| Participant code | Institute | Role | Date |
|---|---|---|---|
| **P1** | Alliander | Program manager | April 15, 2025 |
| **P2** | Alliander | Policy advisor | April 16, 2025 |
| **P3** | Alliander | Corporate Social Responsibility | April 17, 2025 |
| **P4** | Alliander | Innovation consultant | April 18, 2025 |
| **P5** | Alliander | Regulatory consultant | April 24, 2025 |
| **P6** | Alliander | Ethics advisor | April 28, 2025 |
| **P7** | Alliander | Strategy energy systems | April 28, 2025 |
| **P8** | Energiebank Arnhem | Executive director | April 28, 2025 |
| **P9** | Alliander | Specialist public affairs | April 29, 2025 |
| **P10** | Alliander | Innovation consultant | April 30, 2025 |
| **P11** | Alliander | Strategic innovation manager | May 19, 2025 |
| **P12** | Alliander | Regional Coordinator | May 22, 2025 |
| **P13** | Alliander | Energy system consultant | May 22, 2025 |
| **P14** | ACM | Tariff designer | May 23, 2025 |
| **P15** | ACM | Tariff analyst | May 23, 2025 |
| **P16** | Gemeente Arnhem | Sustainable program manager | May 27, 2025 |

The interview questions are included in Appendix D. Responses were analyzed using qualitative content analysis, with initial codes derived from the energy justice framework, particularly focusing on distributive justice indicators such as access to infrastructure, cost burden, and perception of fairness.

### 3.2.2 Document analysis

Document analysis served as the second method of data collection, complementing the interviews by providing institutional, regulatory, and strategic context. As Bowen (2009) notes, documents offer a stable and reviewable source of information, unaffected by the dynamics of the interview process. At the same time, critical awareness was maintained regarding potential limitations, such as selective reporting or the absence of certain perspectives in publicly available materials.

The documents analyzed included a diverse range of materials. First, internal and public-facing strategic documents from Alliander were reviewed, including investment plans, annual reports, and innovation strategies. These documents provided insight into how the DSO frames its societal role and how it balances technical, financial, and social objectives. Second, municipal documents from the City of Arnhem were analyzed, most notably the Transitievisie Warmte (Heat Transition Vision), which outlines the city's neighborhood-based approach to phasing out natural gas. These were supplemented by local energy poverty reports and policy evaluations. Third, national-level publications from regulatory bodies such as the Authority for Consumers and Markets (ACM) and Netbeheer Nederland were included to understand the legal and institutional frameworks within which Alliander operates. Finally, academic and grey literature on energy poverty, energy justice, and just transition in the Dutch context was consulted to situate the case study within broader scholarly debates. Documents were collected through multiple channels: Alliander's internal intranet (accessible during the internship), public municipal portals, websites, and academic databases such as Scopus and Google Scholar. Selection criteria included relevance to the research questions, publication date (with a focus on documents from 2023–2025), and the presence of content related to energy justice, grid planning, or the role of DSOs.

The documents were coded alongside the interview data to enable thematic triangulation and to detect possible alignment or disjuncture between policy ambitions and actual stakeholder practices or experiences. These documents were analyzed thematically using the same framework developed for the interviews, allowing for direct comparison and supporting the development of triangulated findings.

### 3.2.3 Data analysis tools

The interview data were analyzed using thematic analysis, a qualitative method used to identify and interpret recurring patterns or themes within textual data (Boyatzis, 1998; Braun & Clarke, 2017). To support the analysis, the software ATLAS.ti was employed. This tool is designed to manage, code, and extract insights from unstructured data such as interview transcripts and policy documents. Interviews were conducted via Microsoft Teams, which automatically recorded and transcribed the sessions. These transcripts were reviewed and corrected for accuracy before being imported into ATLAS.ti for further analysis. The interview guide used to structure the conversations consisted of three sections: (1) Introduction, (2) Background and experience of the interviewee, and (3) Questions related to energy justice and the energy transition in Arnhem.

A hybrid coding approach was applied. Deductive codes were drawn from established theoretical concepts, including the three dimensions of energy justice, distributional, procedural, and recognition justice as well as their indicators to the role of a DSO. In parallel, inductive codes were developed

directly from the interview data to capture emerging themes and stakeholder-specific concerns. Appendix E provides an overview of the code matrix. By combining these two coding strategies, the analysis ensured both theoretical rigor and openness to new insights. Codes were grouped into broader themes and analyzed across stakeholder groups. This analytical approach enabled a rich understanding of how key stakeholders perceive the role of the DSO in achieving a just energy transition and helped identify practical challenges and opportunities in the local context of Arnhem.

# 4. The local energy transition in Arnhem

This chapter examines the current state of the energy transition in the municipality of Arnhem. Section 4.1 outlines the key actors involved in Arnhem's energy transition, including the Distribution System Operator (DSO), municipal authorities, Energiebank, and ACM. It examines how these stakeholders interact with Alliander and highlights ongoing projects that are particularly relevant from an energy justice perspective. Section 4.2 focuses on the envisioned role of the DSO in enabling a just energy transition. Drawing on stakeholder interviews, it analyzes how different actors conceptualize the responsibilities and limitations of Alliander within the local energy governance framework. This section contributes directly to answering the second sub-question of this study, which investigates who are involved and how the DSO's role is understood in the context of municipal energy transitions.

## 4.1 Key actors in the energy transition in Arnhem

Energy justice is shaped not only by policies and technologies, but also by the institutions and actors that govern them. Institutions such as regulators, municipalities, and DSOs influence how access, affordability, and participation in the energy system are distributed.

### 4.1.1 DSO: Alliander and Liander

In the Netherlands, Distribution System Operators (DSOs) are responsible for the operation, maintenance, and expansion of regional electricity and gas infrastructure. Liander operates under the publicly owned Alliander Group and is one of the largest DSOs in the country. It manages around 90,000 kilometers of electricity grid and 40,000 kilometers of gas network, serving over 3.2 million customers (Alliander, 2024).


*Figure 3: DSOs spread across the Netherlands.*

As energy demand rises and renewable sources such as solar and wind are integrated, Liander faces increasing pressure to ensure grid reliability. Historically, this was addressed through physical expansion. But today, this strategy is constrained by land scarcity, labor shortages, and permitting procedures (Verhoeven et al., 2022). Therefore, Alliander is now also responsible for developing congestion management strategies to make more efficient use of existing capacity (De Winkel et al.,

2025). This operational shift has direct implications for energy justice. DSOs, though not policymakers, are (in)directly involved in critical decisions about who gets access to the grid and how these processes are governed and communicated. For example, automated curtailment measures during periods of grid stress may disproportionately affect users depending on their proximity to transformers, unintentionally reinforcing spatial inequalities (Noorman et al., 2023).

*Alliander's value and energy justice*

Alliander has a strong institutional commitment to energy justice, grounded in the values of accessibility, affordability, and reliability. These values can be seen in Alliander's mission to achieve

> *"An energy supply system where everyone has access to reliable, affordable and sustainable energy on equal terms",*

and also by its strategic and operational decisions (Alliander, 2024, p. 20). The company's approach to energy justice is multifaceted. First, Alliander acknowledges that grid congestion and delayed connection times can exacerbate social inequality. To mitigate this, the company has implemented flexibility contracts, smart grid solutions, and time-dependent tariffs to improve demand-side efficiency and facilitate more equitable access (Alliander, 2024, pp. 40). Second, Alliander emphasizes transparency and stakeholder participation. Improved communication systems aim to ensure that customers are well-informed about grid-related issues such as delays, outages, and potential solutions. This participatory approach is key to building trust and enabling meaningful engagement from diverse societal groups (Alliander, 2024, pp. 42). Third, Alliander has recognized the risks of energy poverty and collaborates with local stakeholders to prevent disconnections and mitigate energy-related vulnerabilities. In partnership with municipal governments and organizations such as the Energiebank, the company has implemented early-warning systems and targeted interventions aimed at supporting households in payment difficulties (Alliander, 2024, pp. 112). The cause for this approach was the pilot project on the Social Disconnection Policy (Sociaal Afsluiten), conducted in collaboration with Energiebank Arnhem, which will be explained below.

*Pilot project social disconnection (afsluitbeleid)*

The pilot project on social disconnection aimed to assess and quantify the social and economic consequences of various disconnection practices for households facing payment difficulties. The results are presented in the Eindrapport Alliander Social Impact Case (Impact Institute, 2024).

The pilot project evaluated three distinct policy scenarios:

1. Regular disconnection policy: Households that do not pay their energy bills are disconnected within ten working days.
2. Non-disconnection policy: Households remain connected, with the network operator absorbing the energy costs.
3. Social Disconnection Policy (Pilot): Households are offered a new energy contract and referred to debt assistance programs instead of being disconnected.

The analysis examined the consequences of these scenarios for three stakeholder groups: affected households, the network operator (at the national level), and society at large (including public institutions). Using impact monetization techniques, the study measured welfare losses, financial

stress, and secondary societal costs such as health care and justice system expenditures. The results, based on quantified social impacts, show that the regular disconnection policy can lead to total societal costs of up to €47,000 per household, mainly due to welfare losses and stress-related health and social issues. The non-disconnection policy reduces these impacts but still incurs an average cost of €12,000. The pilot scenario, however, demonstrates the most positive outcomes: for an average cost of €7,000, households avoid energy disconnection, and both network operators and society benefit from reduced negative impacts. Therefore, the pilot illustrates that a coordinated approach involving energy providers, DSOs, and local municipalities can substantially mitigate the adverse effects of energy poverty, where households benefit from continued access to energy and reduced psychological distress and DSOs reduce financial losses.

### 4.1.2 Municipality of Arnhem

The second key actor is the municipality of Arnhem, which has emerged as a proactive actor in the national energy transition. As part of its climate strategy, Arnhem has committed to becoming energy-neutral by 2050, aligning with national and European climate goals. This ambition is embedded in the city's Sustainable Energy Agenda and further operationalized through the "Transitievisie Warmte" (Municipality of Arnhem, 2021), which outlines a phased, neighborhood-based approach to phasing out natural gas and transitioning to sustainable heating solutions. Arnhem's energy transition is guided by several key principles: prioritizing energy savings and insulation (Trias Energetica), favoring the most sustainable and locally available heat sources, and ensuring that the transition is inclusive and affordable. The municipality explicitly states that the energy transition must not exacerbate energy poverty but should instead be used as a tool to combat it (Municipality of Arnhem, 2021, pp. 24–25).

A central feature of Arnhem's approach is the neighborhood-based energy transition (wijkgerichte energietransitie). This strategy recognizes the diversity of Arnhem's neighborhoods in terms of building typologies, social composition, and infrastructure readiness. The municipality has identified ten promising neighborhoods where the transition to sustainable heating is considered technically and socially feasible before 2030. These include areas such as Kronenburg, Elderveld-Noord, and Hoogkamp, where pilot projects are already underway using technologies like thermal energy from surface water (TEO) and wastewater (TEA), as well as decentralized heat networks (Municipality of Arnhem, 2021, pp. 33). In these neighborhoods, the municipality collaborates closely with residents, housing corporations, and energy providers to co-develop tailored implementation plans. These plans include technical feasibility studies, financial modeling, and participatory processes to ensure local support. For example, in Elderveld-Noord, a collective heat network using wastewater heat is being developed for over 800 homes, supported by national subsidies and municipal funding (Municipality of Arnhem, 2021). In addition to technical feasibility, the municipality also prioritizes social vulnerability in its planning. In collaboration with the municipal research and statistics department, Arnhem has developed a map identifying neighborhoods at risk of or already experiencing energy poverty (figure 4). This spatial analysis highlights five priority neighborhoods where the concentration of energy-poor households is highest (Municipality of Arnhem, 2020). These areas are marked in red on the municipal energy poverty map and are given special attention in policy and project implementation. The municipality uses this data to target interventions and ensure that the energy transition contributes to social equity rather than deepening existing inequalities.

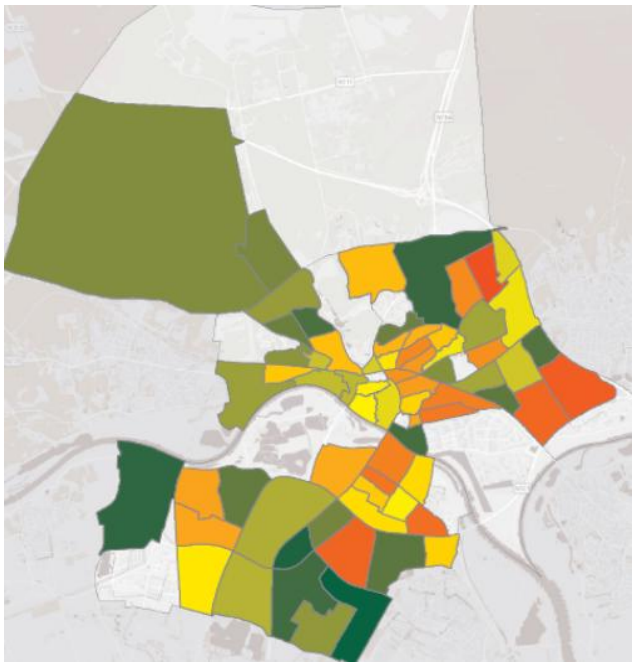

*Figure 4: Energy poverty risk map of Arnhem: Areas marked in red are given are energy poor areas (Municipality of Arnhem, 2020).*

Furthermore, the Arnhemse Transitievisie Warmte (2021) serves as a strategic roadmap for the city's heating transition. It outlines expected sustainable heating solutions for each neighborhood by 2050, based on technical studies conducted by Berenschot. These solutions include all-electric systems, hybrid heat pumps, and collective heat networks, depending on local conditions such as building density, insulation levels, and proximity to heat sources (Municipality of Arnhem, 2021, pp. 28–29). Importantly, the vision emphasizes that no single solution fits all neighborhoods. Instead, it promotes flexibility, innovation, and continuous learning. The municipality commits to updating the vision every five years and adapting its approach based on new insights, technologies, and stakeholder feedback (Municipality of Arnhem, 2021, p. 12).

Arnhem's approach is characterized by a strong emphasis on local collaboration and social inclusion. Through initiatives like the "Wijken van de Toekomst" (Neighborhoods of the Future) and the Aanjaagfonds, the municipality supports resident-led sustainability projects and ensures that vulnerable groups are not left behind. Special attention is given to affordability, choice, and the spatial implications of new energy infrastructure (Municipality of Arnhem, 2021). The municipality plays a coordinating role and works closely with energy cooperatives and housing associations to ensure that residents have a say in the design and governance of new heating systems. For example, in Hoogkamp, a local energy cooperative is co-developing a neighborhood energy system in partnership with the municipality and Alliander (Municipality of Arnhem, 2021, p. 4). Another example of this coordinating role between parties is the strategic collaboration between the Alliander and the municipality of Arnhem. This is a comprehensive initiative aimed at advancing the energy transition in Arnhem. This partnership focuses on achieving sustainability goals, particularly in housing development, while modernizing the energy supply to be future-proof and affordable for all households and businesses in Arnhem (Gemeente Arnhem & Alliander, 2024). The collaboration is designed to create experimental spaces that explore innovative approaches to energy provision from a societal perspective. This involves implementing new principles of future energy systems in practice, ensuring that

neighborhoods and business areas become not only energy-efficient but also greener and more sustainable. The initiative emphasizes the integration of social components with technical and financial aspects, considering factors such as biodiversity, climate adaptation, and spatial planning (Gemeente Arnhem & Alliander, 2024). A key aspect of this collaboration is the focus on social justice and inclusivity. The partnership aims to involve citizens and promote cooperative efforts to align local energy demand with supply, utilize energy storage solutions, and explore alternative energy carriers. This approach ensures that the benefits of the energy transition are shared equitably among all residents and businesses, fostering a sense of community and collective responsibility (Gemeente Arnhem & Alliander, 2024). The overarching goal of the collaboration is to achieve visible results by implementing new energy principles in practice. This includes minimizing unnecessary expansions and investments in the electricity network, thereby reducing the total societal costs. The partnership also aims to stimulate the local market and society by encouraging local energy generation and finding solutions for periods with low renewable energy production (Gemeente Arnhem & Alliander, 2024).

### *4.1.3.* Energiebank Arnhem

The Energiebank Arnhem is a key local initiative aimed at tackling energy poverty and promoting equitable access to energy in the city of Arnhem. Established in 2015 as an initiative by Alliander, the project is built on the principle that access to energy is a basic right that should be available to everyone, regardless of financial means (Provincie Gelderland, 2024). By combining financial assistance, personalized coaching, and practical energy-saving interventions, the Energiebank provides targeted support to low-income households while also fostering social inclusion and community engagement.

The initiative is structured around three pillars (Provincie Gelderland, 2024):

- Energy coaches offer one-on-one guidance through multiple home visits, helping residents understand and reduce their energy consumption.
- Local handyman (BuurtKlusBedrijven) implement midscale efficiency improvements like draft-proofing and radiator optimization.
- Social partners, such as appliance support services and neighborhood organizations, contribute to broader household resilience and engagement.

Financial support is also provided and tailored to household size, offering monthly discounts between €50 and €80 for a six-month period. In addition, households receive an energy-saving kit with donated materials (e.g., LED bulbs, insulation strips) and participate in a structured coaching trajectory with three home visits with small scale interventions. Each visit focuses on a different aspect of consumption—starting with heating, followed by gas use, and ending with electricity monitoring and behavioral tips. In doing so, the Energiebank addresses distributional justice by making sure that vulnerable groups also benefit from the energy transition, for example by reducing their exposure to rising energy costs and poor housing quality. It promotes procedural justice by involving participants actively in their energy decisions through coaching and empowerment, rather than relying solely on top-down measures. The program also contributes to recognition justice by working with social organizations (e.g., Humanitas, Rijnstad) to identify and reach households that may otherwise be overlooked, such as recent immigrants or people unfamiliar with the Dutch energy system.

Importantly, the Energiebank's approach is responsive to the diverse realities of energy poverty. Research shows that certain household types—such as large families and single-parent households, particularly those headed by women—are more likely to experience energy poverty due to higher energy needs and limited financial resilience (Bouzarovski, 2015; Wijzer in Geldzaken & Nibud, 2020; CE Delft, 2021). These groups often face compounded vulnerabilities, including higher living costs and reduced access to energy-efficient housing. By tailoring support to household composition and working closely with social services, the Energiebank helps address these intersecting challenges.

The Energiebank's approach has proven effective. A study by Straver et al. (2017) and findings from TNO highlight that multiple, repeated visits by trained energy coaches significantly improve indoor comfort, reduce energy use, and foster long-term behavioral change. By January 2024, over 3,100 households had been coached, exceeding the original target of 2,400 households set under the Arnhemse Aanpak Energiearmoede (Stichting Energiebank Regio Arnhem, 2024, p. 8). The initiative also trained 47 new energy coaches in 2023, many of whom were recruited from marginalized labor market groups, thereby contributing to local employment and social inclusion. Finally, the Energiebank reflects the type of collaborative governance that is central to a just energy transition. Through partnerships between Alliander, housing corporations, social welfare institutions, and volunteers, the initiative not only provides practical support but also builds trust, knowledge, and community capacity. Looking ahead, the Energiebank plans to expand its operations to additional municipalities and explore new models for providing affordable energy to vulnerable homeowners. It also aims to deepen its collaboration with neighborhood handyman services and housing corporations to address structural housing inefficiencies (Stichting Energiebank Regio Arnhem, 2024).

### *4.1.4* Housing corporations and energy cooperatives

Housing corporations like Portaal, Vivare, and Volkshuisvesting Arnhem are non-profit entities responsible for a large portion of the city's social housing stock. Their mission extends beyond providing affordable housing to include improving living conditions, reducing energy poverty, and supporting the municipality's climate ambitions (SSH Centre, 2025). This role is particularly critical given that approximately 80% of Arnhemmers experiencing energy poverty live in social housing (Gemeente Arnhem, 2024). As such, housing corporations are not only key stakeholders but also strategic partners in identifying priority neighborhoods and implementing targeted interventions. In collaboration with the municipality and organizations like the Energiebank, they help coordinate efforts such as energy coaching, insulation programs, and the deployment of neighborhood handymen (buurtklussers) to carry out small-scale energy-saving measures. By managing thousands of rental units, these corporations are uniquely positioned to implement large-scale energy-saving measures and renewable energy projects that benefit vulnerable households. Their role in electrification (e.g. heat pump installation), insulating old houses or connecting homes to heat networks can significantly shape how low-income households experience the energy transition. Yet, they depend heavily on DSO availability for grid connections and capacity. For example, the installation of heat pumps or the electrification of entire housing blocks requires sufficient grid capacity and timely connections—areas where DSOs like Liander play a gatekeeping role (SSH Centre, 2025).

Meanwhile, citizen-led energy cooperatives play an increasingly important role in Arnhem's energy transition. These cooperatives aim to decentralize energy ownership, enhance democratic participation, and retain the benefits of energy production within local communities (Kosmaci, 2022). In Arnhem and the surrounding Rijn-IJssel region, the Rijn en IJssel Energiecoöperatie represents a powerful local initiative. Its goal is to make sustainable energy a regional product by supporting energy saving measures and initiating projects that facilitate the use of locally generated renewable energy. The cooperative collaborates with both individuals and businesses, prioritizing cooperative ownership structures and the provision of clean, affordable energy for all (Kosmaci, 2022). This approach promotes not only environmental sustainability but also local economic development and social inclusion. Nationally, EnergieSamen serves as a federation for local energy communities, supporting the development of energy cooperatives and advocating for their interests. It emphasizes that citizen-led energy communities are essential for organizing sustainable and affordable energy systems that serve municipalities, businesses, and residents alike (EnergieSamen, 2024). These cooperatives often operate as community-led platforms that co-develop local solar PV installations, storage solutions, or district energy systems ("energiegemeenschappen"). However, their success depends on regulatory support and access to the electricity grid. Collaboration with the DSO is therefore essential. In Arnhem's Hoogkamp neighborhood, for instance, cooperatives are co-developing decentralized energy systems with the municipality and Alliander (Gemeente Arnhem, 2021). Such partnerships strengthen local ownership and ensure that energy users are included in decision-making processes.

#### *4.1.5 The Authority for Consumers and Markets (ACM)*

Although not a local actor, the Authority for Consumers and Markets (ACM) plays a crucial role in shaping the institutional and regulatory environment in which the energy transition in Arnhem takes place. As the national energy market regulator, ACM oversees the operations of network operators like Liander and ensures that the Dutch energy market functions fairly, transparently, and efficiently (ACM, 2024a). ACM's responsibilities include approving investment plans, setting maximum grid tariffs, issuing licenses to energy suppliers, and enforcing compliance with energy codes. These energy codes are a set of binding rules that govern access to and use of the electricity and gas networks. They are designed to promote competition, innovation, and reliability in the energy system (ACM, 2024a). In addition to regulating infrastructure and market behavior, ACM plays a key role in protecting small consumers (kleinverbruikers) which includes households, small businesses, and non-profits. These consumers typically pay a tariff per kilowatt-hour (kWh) of electricity or per cubic meter ($m^3$) of gas. Depending on the type of contract—fixed, variable, or dynamic—these tariffs may remain constant or fluctuate over time. ACM monitors whether these tariffs are reasonable and can intervene if suppliers charge excessive prices. If necessary, ACM can impose maximum tariffs to ensure affordability (ACM, 2024b). Moreover, ACM enforces seasonal protections to prevent disconnection of vulnerable households during the winter months (October 1 to April 1), except under specific conditions. This policy is grounded in Article 44 of the Dutch Gas Act, which mandates that energy must be delivered reliably and at fair rates, and that disconnection should be avoided wherever possible during colder periods (Gaswet, Art. 44).

While ACM does not directly participate in local energy projects, its regulatory decisions define the institutional boundaries within which municipalities, housing corporations, and energy cooperatives must operate. For example, current regulations prohibit DSOs from owning or operating energy

storage systems. This restriction is intended to preserve market neutrality and prevent unfair competition with commercial energy providers. However, it also limits the ability of DSOs to implement local solutions to grid congestion, such as deploying batteries in overloaded neighborhoods (Rijksoverheid, 2021). In this way, ACM acts as a structural gatekeeper: it does not design local energy strategies, but it determines what is legally and financially feasible. As such, ACM's role is both foundational and often invisible in shaping the fairness and inclusiveness of local energy transitions

## 4.2 Envisioned role of the DSO

As Sovacool et al. (2024) argue, energy infrastructures are often perceived as neutral and technical systems. However, their governance profoundly impacts outcomes of energy justice. Therefore, stakeholders were asked whether they perceive Alliander's role as limited to managing infrastructure neutrally, as traditionally expected of a DSO, or whether the DSO should actively contribute to broader societal goals.

Across all 16 interviews, there was a strong and consistent perception that Alliander's role should extend beyond the neutral management of infrastructure. While stakeholders acknowledged the DSO's legal and regulatory boundaries, they emphasized that the energy transition is no longer a purely technical challenge but is a deeply social one. As one municipal official put it,

> *"We're glad to have a strategic partnership with Alliander, but they need to invest in people who can bridge the gap between technical systems and social realities."*

This statement was echoed by multiple stakeholders who argued that Alliander's unique position between government, market, and citizens, gives it both the responsibility and the opportunity to shape a just and inclusive transition.

Furthermore, several interviewees emphasized that Alliander is no longer *"just a cable company."* Instead, they see the DSO as a key actor in the energy transition, with influence over how energy is accessed, shared, and governed. P10 described Alliander's potential as a *"facilitator and connector,"* capable of supporting local initiatives, building trust in communities, and helping shape policy frameworks. Others stressed that neutrality is no longer sufficient.

> *"If we want a fair transition, we can't hide behind the rules. We need institutions like Alliander to help change them."*

This includes advocating for fairer tariff structures, supporting collective energy systems, and ensuring that vulnerable groups are not left behind. This view was also strongly supported by external stakeholders such as Energiebank Arnhem and Gemeente Arnhem, who emphasized that even if Alliander is not formally responsible for social outcomes, it has a moral duty to act.

*Internal role and culture*

While many within Alliander support a broader societal role, some interviewees observed that the organization still operates largely from a technical mindset.

> *"They're brilliant engineers,"* one external stakeholder said, *"but they struggle to see the social side of the transition."*

This disconnect was seen as a barrier to meaningful collaboration with municipalities, housing corporations, and community groups. One external interviewee described Alliander as "unconsciously incompetent" in social engagement, noting that their models often fail to account for local realities and social dynamics. However, there are signs of change. Innovation teams within Alliander are increasingly exploring new roles, such as co-developing energy communities or experimenting with inclusive engagement strategies. These efforts suggest a growing awareness that the DSO's future lies not only in wires and transformers, but also in relationships, trust, and shared responsibility. The strategic partnership between Alliander and the Municipality of Arnhem was frequently cited as a promising example of how DSOs can co-develop justice-oriented solutions with local governments. P16 described it as a *"field lab*" for learning how to collaborate across technical and social domains, and emphasized that such partnerships are essential for navigating the complex, interdependent nature of the energy transition.

# 5. Manifestations of energy injustices in Arnhem

This chapter examines how energy injustices are experienced in Arnhem, drawing on empirical findings to highlight where inequalities emerge in the city's energy transition. Section 5.1 explores injustices within the electricity grid, including issues related to congestion, prioritization, cost distribution, and investment patterns. Section 5.2 addresses disparities in access to sustainable energy technologies and district heating, revealing how certain groups face structural barriers to participation in the transition. Section 5.3 turns to procedural and recognition-based injustices, focusing on the extent to which marginalized communities are acknowledged and included in governance processes. Section 5.4 explains the institutional, regulatory, and organizational barriers that limit the DSO on a just energy transition. The chapter concludes with a synthesis of the key findings, linking them to the broader principles of energy justice.

## 5.1 Injustices in the electricity grid

### 5.1.1 Grid congestion and capacity limitations

The Dutch electricity grid is increasingly constrained by growing demand from electrification and decentralized energy generation, as explained in chapter 4.1. These trends have led to widespread grid congestion, defined as the inability of the network to accommodate new or expanded connections due to capacity limitations. The number of parties waiting for a new grid connection reported by Alliander rose from 6,000 in June 2023 to 9,400 by March 2024 (Alliander, 2024). In some cases, applicants face waiting periods of 7–10 years (Winkel et al., 2025). Although DSOs are accelerating infrastructure upgrades, progress is constrained by a lack of technical personnel, lengthy permitting processes, and limited spatial availability (Verhoeven et al., 2022).

To date, congestion has predominantly affected the high- and medium-voltage levels, impacting large consumers and producers. However, Dutch grid operators have warned of growing delays in low-voltage networks as well, with households already experiencing connection times of 40–70 weeks in some areas (Alliander, 2024). These developments raise critical distributional and procedural justice concerns. Limited capacity may result in unequal access to the grid, often disadvantaging low-income communities. The lack of transparent allocation criteria exacerbates perceptions of unfairness, while institutional constraints limit the ability of local actors to influence prioritization

**Injustices in grid access**

Many interviewees expressed concern that grid congestion is reinforcing existing social inequalities. Wealthier households, often early adopters of sustainable technologies like solar panels and electric vehicles, have already secured grid capacity. In contrast, lower-income households (especially those in older, poorly insulated homes) are now being told that the grid is full, effectively excluding them from participating in the energy transition. Therefore, the current "first-come, first-served" principle for grid access favors those with the resources and awareness to act quickly. This approach, while administratively simple, fails to account for social vulnerability or public value. As one internal stakeholder put it,

> *"Wealthy neighborhoods that electrify early consume all available grid capacity, leaving others behind."*

Another added,

> *"We don't look at socio-economic groups when it comes to access to the grid — and that's a problem."*

As another internal Alliander interviewee noted, those who saved up to invest in sustainability are now blocked by full grids, while others who acted earlier continue to benefit. This dynamic creates a two-tiered system: one group enjoys the benefits of lower energy bills and subsidies, while the other faces rising costs and limited options. The injustice is particularly acute in neighborhoods like Geitenkamp in Arnhem (P12), where residents face both high energy burdens and limited access to grid upgrades. One internal respondent emphasized that this exclusion is not only economic but also procedural, as affected residents often lack the time, knowledge, or digital access to navigate grid connection processes.

> *"People who don't speak up or lack resources are not included*," they said.

This was echoed by external interviewees, who noted that grid congestion is not evenly distributed across regions. In socioeconomically disadvantaged neighborhoods, infrastructure upgrades are often delayed or deprioritized, while wealthier areas continue to electrify.

> *"Arnhem is a very segregated city*," one municipal official explained. *"You have very rich and very poor neighborhoods right next to each other. The small, drafty homes in working-class neighborhoods just see rising costs.".*

This disparity is not the result of intentional discrimination, but rather stems from earlier access to sustainable technologies in wealthier areas, which allowed them to secure grid capacity before congestion became widespread. Although recent policies have introduced exceptions to the first-come, first-served model, these are currently limited to statutory public services and do not address socio-economic vulnerability. The next section examines the scope and limitations of this societal prioritization framework.

### 5.1.2 Societal prioritization in congestion management

Traditionally, the allocation of grid access in the Netherlands followed a "first come, first served" model. However, during times of congestion, this approach has led to socially undesirable outcomes, such as when essential public institutions like hospitals or emergency services are unable to obtain timely grid connections because other, less critical entities (e.g., casinos or data centers) applied earlier. In response, the Authority for Consumers and Markets (ACM) introduced a new policy in April 2024 that allows for societal prioritization (ACM, 2024a). Under this framework, DSOs may give preferential access to grid capacity to applicants who fulfill key societal roles (Liander, n.d.).

The framework categorizes eligible applicants into three main groups:

- Congestion relievers: These are customers whose activities contribute to alleviating grid congestion, such as those enabling additional capacity or improving efficiency.
- Safety and emergency services: This includes organizations involved in public safety, such as fire departments, police, the military, water authorities, and emergency healthcare.
- Basic public services: This includes infrastructure and institutions related to education, drinking water, district heating, gas distribution, and housing.

Within each category, applications are ordered by the date of submission. However, applicants in higher-ranked categories are prioritized over others. It is important to note that priority status only affects the position on the waiting list and does not guarantee immediate access to capacity. Allocation still depends on the physical availability of grid infrastructure, which may require years of planning and construction (Stedin, n.d.). Furthermore, societal prioritization applies strictly to electricity consumption, not to energy feed-in, and only if the applicant's use directly supports their statutory public function. For example, while a hospital might receive priority for a new connection to operate medical equipment, it would not necessarily qualify for priority if the connection were solely intended for installing solar panels.

While the framework aims to serve the public interest, it does so through a high-level categorization that overlooks local context and nuanced societal needs (Pavlov, 2024). For instance, general practitioners (essential to local healthcare delivery) are often excluded due to administrative classifications such as SBI codes, which do not accurately reflect their societal role. Moreover, stakeholders have expressed concern that the framework's sustainability category (intended to prioritize clients making above-legal sustainability efforts) may inadvertently favor large polluters. These companies are often better positioned to formalize and finance such commitments, thereby qualifying for prioritization. In contrast, smaller actors who are already operating sustainably may not be able to demonstrate significant "improvements" or enter into binding agreements with the government, and are thus excluded from the framework despite their positive environmental impact (Pavlov, 2024). This creates a structural bias that rewards those with the capacity to showcase change, rather than those who are inherently aligned with sustainability goals. Therefore, non-priority clients may experience substantial delays without corresponding societal benefit—particularly when small priority requests displace larger, economically impactful ones (Pavlov, 2024). These findings suggest that the framework, in its current form, risks reinforcing existing inequalities rather than mitigating them.

**Opinions on societal prioritization**

Across all interviews. there was broad support for societal prioritization as a more just and socially responsive alternative to the first-come, first-served model. Interviewees consistently emphasized that scarce grid capacity should be allocated based on social value, not merely on who applied first. This was seen as essential to ensure that critical services and vulnerable communities are not left behind in the energy transition. Commonly phrase was:

> *"In times of scarcity, it's right to prioritize what society needs most—like hospitals over casinos."*

Many interviewees argued that prioritizing hospitals, schools, and social housing over commercial or luxury developments reflects a more ethical and just use of public infrastructure. Several noted that the current system often rewards those with more resources, knowledge, and speed, while excluding those with fewer means or slower access to information. This was seen as reinforcing structural inequality, particularly for renters and residents of older, poorly insulated homes.

Furthermore, concerns were raised about the limited scope of the current framework. Although the Maatschappelijk Prioriteringskader (MPK) includes essential services, it does not extend to vulnerable residential users. Several interviewees called for expanding the framework to include energy-poor communities and social housing projects to prevent unfair distribution once congestion also affects KV on a large scale. As one external stakeholder warned:

*"If we don't change the rules, we risk locking out entire neighborhoods from the transition."*

Some internal interviewees acknowledged that informal prioritization already occurs. For instance, capacity is often reserved for housing over large industrial users, even though this is not formally permitted under current regulation:

*"We reserve capacity for housing even though the rules say we shouldn't — it's a grey area."*

Furthermore, there was a strong call for transparency and inclusivity in how prioritization decisions are made. Interviewees emphasized that the current framework, while a step forward, remains too narrow in scope of decision makers. Suggestions included involving municipalities, citizen councils, and local stakeholders in the decision-making process to ensure that diverse needs and values are represented. In particular, many argued that the list of prioritized groups should be expanded beyond essential services to include vulnerable households, energy-poor communities, and social housing projects, groups that are often disproportionately affected by grid congestion but are not currently recognized in the formal categories. At the same time, caution was expressed about overextending prioritization, as this could dilute its effectiveness. Prioritization should remain a targeted tool for managing scarcity, not a blanket policy. As one interviewee put it:

*"Prioritizing everything means prioritizing nothing—it must remain a scarcity solution."*

Finally, while DSOs were recognized as key implementers of prioritization, many (both internally and externally) stressed that decisions about who gets priority should not be made by the DSO. Instead, they should be made by democratically legitimate bodies, such as governments or regulators. DSOs should play a supporting role by providing data, technical expertise, and impact assessments. One interviewee proposed a citizens' council to help guide prioritization decisions, ensuring that diverse perspectives are represented.

A study of ACM also confirmed this broad acceptance of the societal prioritization framework among other stakeholders. The ACM (2024C) received 78 responses to its draft societal prioritization framework, with most expressing support for formalizing prioritization in law. Some called for a broader scope to include more societal functions, while others urged caution and a focus on essential services. ACM views the framework as key to addressing congestion and accelerating the energy transition. It encourages DSOs to prepare for implementation and allows early use if justified.

### 5.1.3 Injustices in the tariffs of the grid

A fair energy transition requires a thorough understanding of how energy system costs are structured and distributed. One of the most significant and often overlooked contributors to inequality in the energy transition lies in the structure of grid tariffs, particularly those charged by DSOs like Liander. These network tariffs are not paid directly to Liander but are included in the energy bills from energy suppliers (Liander, 2025). The way these costs are calculated and allocated has important implications for distributive justice.

*Composition and trends in grid tariffs*

Grid costs include the expenditures DSOs incur for constructing, maintaining, and expanding electricity and gas networks (luteijn et al., 2021). These cover infrastructure investments, operational maintenance, administrative overhead, and metering services. According to PBL (2021), grid tariffs form a substantial part of household energy bills and are expected to rise significantly through 2030 due to increased infrastructure demands linked to the energy transition.

In 2025, network costs for households are projected to rise by approximately 7% compared to 2024 (Liander, 2024). Electricity transport costs alone have increased by roughly 14%, while gas-related costs have slightly declined (Liander, 2025). These increases are largely driven by investments to address grid congestion and rising electricity demand. Additionally, one-time connection charges for new electricity connections rose by an average of 27%, following regulatory changes by ACM aimed at improving cost-reflectiveness (Liander, 2024). The FIEN+ report confirms that these trends will continue. Total grid management costs for electricity and gas are expected to increase from €9 billion in 2024 to €22 billion in 2040, with electricity accounting for the vast majority of this growth (PwC Strategy& & Netbeheer Nederland, 2024). For households, this translates into a projected annual grid fee increase of 6.7%, potentially tripling the average household's electricity grid costs by 2040—from €390 to over €1,100 per year. While higher tariffs may be justified to finance grid investments, the question arises: are these costs distributed fairly among all types of users?

<u>Distributional injustices in tariff structures across different consumers group</u>

Although all electricity users contribute financially to the maintenance and development of the electricity grid, the allocation of these costs is unevenly distributed across consumer categories. Tariff structures differ based on connection capacity and voltage level, resulting in significant variation in the relative cost burden for households, small enterprises, large commercial consumers, and industrial users. Households and other kleinverbruik (KV) users typically pay fixed annual grid tariffs, regardless of their actual consumption levels. In contrast, large consumers and industrial users—connected at higher voltage levels—benefit from tailored, capacity-based pricing structures that better reflect their actual usage and impact on the grid. When calculated per unit of electricity on average consumed, households pay up to *nine times* more per kilowatt-hour in fixed grid tariffs than large consumers. This reflects a regressive cost structure, where low-volume users pay significantly more per unit than high-volume users.

This disparity is rooted in the cascade structure of the electricity grid. Electricity is transported from high-voltage transmission networks through medium and low-voltage distribution networks before

reaching end-users. Large consumers are typically connected at higher voltage levels and thus make use of only a limited portion of the grid infrastructure. Households and other small users, however, are dependent on the entire cascade—from high to low voltage—and therefore implicitly contribute to the costs of all infrastructure layers. As grid tariffs are partly allocated based on the extent of infrastructure usage, this model results in relatively higher fixed costs for low-voltage consumers, despite their lower absolute electricity demand. While technically cost-reflective, the cascade model raises normative concerns: should small consumers, who have limited flexibility and fewer alternatives, bear a proportionally higher share of system costs?

The Autoriteit Consument & Markt (ACM) revises its tariff methodology each regulatory period. A recent court ruling led ACM to adjust its cost-recovery approach for new connections, resulting in significantly higher one-time connection fees in 2025 (ACM, 2024). While this improves transparency and cost-reflectiveness, it risks limiting access to grid-based solutions for vulnerable users, especially those living in energy poverty, social housing, or collective projects.

Distributional injustices between different households

This issue of uneven cost burdens extends even further within the kleinverbruik (KV) category itself, where significant inequalities persist between different types of households. A study by Berenschot (2023), commissioned by ACM, highlights several dimensions of these internal disparities.

Low-usage households, such as elderly individuals or residents of small apartments, pay the same fixed grid tariffs as high-usage households, despite placing considerably less demand on the network. For example, two households may have vastly different electricity use, but both incur the same fixed annual grid charge (Liander, 2025). This results in a disproportionately higher cost per unit of electricity for low-consuming households, exacerbating regressive effects. Connection types further amplify these disparities. A new single-phase 1x10A connection costs the same as a three-phase 3x25A connection, despite providing substantially different capacity (2.3 kW vs. 17.3 kW). Consequently, users requiring minimal capacity (e.g., for small dwellings or street lighting) pay significantly more per kilowatt of capacity than users with higher-capacity connections (Liander, 2025). Upgrading existing connections is comparatively inexpensive, which can lead to perceptions of unfairness among those who initially paid the full connection fee for higher capacity.

Additionally, renters—who often lack the option to install solar panels or heat pumps—effectively subsidize wealthier homeowners who electrify their homes and derive greater benefit from the grid, while paying similar or only marginally higher tariffs (Berenschot, 2023). These tariff structures inadequately reflect actual cost differences related to consumption and capacity, undermining both fairness and incentives for efficient grid use.

**Interviewee perspectives on injustices in the grid tariffs**

Interviewees expressed strong and consistent concerns about the fairness of the current grid tariff system, particularly in how costs are distributed between KV and GV, and among different types of households within the KV group. While the system is designed to be cost-reflective, many argued that it results in regressive and socially unjust outcomes. Several interviewees criticized the cascade model,

which causes small consumers to pay more per kilowatt-hour than large consumers. One interviewee explained:

> *"Small consumers pay for the entire network—from high to low voltage—while large users connect higher up and bypass much of the system. That's technically logical, but socially it's not fair."*

However, others acknowledged that the cascade model is technically fair, since users only pay for the part of the grid they actually use. This highlights a tension between technical logic and social justice.

Furthermore, many interviewees (both internal and external) pointed to the flat-rate structure for small consumers as a major source of injustice. Households with minimal consumption pay the same fixed fees as high-usage households with EVs, heat pumps, and solar panels. This was widely viewed as regressive, with lower-income households effectively subsidizing wealthier, high-consuming users. As one internal interviewee put it:

> *"The widow in Appelscha pays the same as my neighbor with a Tesla and a fully electrified house—that's not fair."*

External stakeholders, such as from the Energiebank, echoed this concern, noting that people in poverty often live in poorly insulated homes and have no control over their energy systems. Several participants acknowledged the legal and institutional constraints that limit DSOs' ability to implement socially differentiated tariffs. They emphasized that governments and regulators must take the lead in setting equitable frameworks, while DSOs should provide data and advocate for fairer policies.

### 5.1.4 Who pays when? Investment and intergenerational injustices

The energy transition requires substantial investments in electricity grid infrastructure to accommodate rapid electrification of homes, transport, and industry. In the Netherlands, DSOs are projected to invest around €8 billion annually through 2030 to reinforce and expand the grid (Netbeheer Nederland, 2024). These investments are needed to future-proof the energy system for the tripling electricity demand and increasing adoption of technologies such as solar panels, heat pumps, and electric vehicles.

Investment decisions by DSOs are predominantly driven by forecast models that predict where demand growth is expected. These models focus on technical variables such as current grid load and voltage quality, and projected technology adoption at the neighborhood level. Socioeconomic factors are intentionally excluded to avoid direct discrimination, under the assumption that demand-based investments are neutral and equitable. However, this approach has significant implications for distributional justice. Wealthier neighborhoods tend to adopt electrification technologies earlier and more extensively, leading to higher forecasted demand and prioritization for grid upgrades. Consequently, these areas receive more investment, creating a feedback loop that perpetuates inequalities, as lower-income neighborhoods with less electrification remain underinvested despite often bearing higher relative energy burdens (Winkel et al., 2025). Further compounding this issue, large-scale users such as data centers and greenhouses benefit from public infrastructure financed in

part by small users. This raises the risk of cross-subsidization, where lower-income or less resourceful households indirectly fund grid capacity expansion that primarily benefits more affluent or commercial actors (Berenschot, 2023; PBL, 2021).

Beyond neighborhood disparities, a critical dimension of injustice arises from the temporal allocation of investment costs. Large, long-term infrastructure investments benefit both current and future users. However, the financial burden is predominantly placed on present-day consumers through rising grid tariffs, while future generation consumers who will benefit from the enhanced capacity, contribute less (VEMW, 2025; SiRM, 2025).

This imbalance raises the issue of intergenerational investment injustice: early adopters and current users disproportionately bear costs for infrastructure that will be fully utilized only by future generations. Furthermore, there is a risk of overinvestment: Expanding capacity prematurely and incurring sunk costs that may not be equitably recovered (SiRM, 2025). In response, policy debates in the Netherlands have focused on the potential for intertemporal cost allocation mechanisms, such as amortization accounts or state-backed financing models. These approaches aim to spread investment costs over longer periods, enabling future users to share the financial responsibility proportionally (VEMW, 2025). However, these models remain under development and are not yet systematically embedded in Dutch regulatory frameworks, meaning the bulk of investment costs still fall on current consumers (Netbeheer Nederland, 2024).

Without such mechanisms, there is a real risk of a mismatch between investment timing and demand growth, leading to demand suppression and a vicious cycle of rising tariffs and reduced electrification. This is particularly problematic given that electrification is expected to unfold over two to three decades, while most grid investments are frontloaded in the next ten years (SiRM, 2025). A more gradual cost recovery strategy could mitigate these risks and support a more equitable and efficient energy transition.

From a distributional justice perspective, these issues challenge the intragenerational equity of the energy transition. Ensuring that both current and future beneficiaries contribute equitably to grid investments is critical to prevent structural inequalities in the transition's cost burden (Heffron & McCauley, 2017). Moreover, reliance on purely technical investment criteria risks reinforcing socioeconomic disparities, as grid expansions preferentially serve wealthier, early-adopting areas, potentially leaving vulnerable communities further behind.

**Interviewees opinion on (in)justice in investment and intergenerational equity**

Interviewees broadly acknowledged the necessity of large-scale grid investments to support the energy transition, but they also raised critical concerns about how and where these investments are made, and who ultimately benefits from them. interviewees questioned the forecast-based investment model used by DSOs, which prioritizes areas with the highest projected demand. While this method is technically neutral by excluding socioeconomic variables to avoid discrimination, it was widely seen as producing unequal outcomes. As one internal interviewee put it:

*"If you base investments only on expected demand, you'll always end up in the neighborhoods that already have the money and the tech. That's not discrimination by design, but it is by effect."*

This approach creates a feedback loop: wealthier neighborhoods that adopt solar panels, EVs, and heat pumps early are more likely to be prioritized for upgrades, while lower-income areas often with higher energy burdens are left behind. Furthermore, some participants emphasized that investment decisions should not only follow demand but also consider social value. One interviewee argued:

*"We should be investing where the need is greatest, not just where the demand is loudest."*

Furthermore, there was a strong call for greater transparency and public involvement in investment planning. Interviewees suggested that citizens, municipalities, and housing associations should have a say in where and how investments are made. Internal interviewees called for more diverse representation in decision-making bodies:

*"I'd love to see half of our investment board made up of external people."*

This aligns with broader concerns about procedural justice, ensuring that affected communities are not only informed but also empowered to shape decisions.

Also many interviewees emphasized that the energy transition must be designed with future generations in mind, not just current users. Several supported the idea of spreading infrastructure costs over time to avoid overburdening today's households. As one internal stakeholder explained:

*"We're building a system for the next 50 years. It's only fair that the costs are spread across those who will use it."*

This aligns with proposals from SiRM (2025), which advocate for amortization mechanisms and state-backed loans to distribute costs more evenly over time. However, others warned that poorly planned or excessive investments could lock in inefficiencies and saddle future generations with unnecessary debt:

*"If we overbuild now—just to meet peak demand that might never come—we're wasting money and space. And our children will be the ones paying for it."*

Moreover, intergenerational equity was framed not only in terms of cost but also access. If today's investments continue to favor already-electrified, affluent neighborhoods, the next generation in disadvantaged areas may inherit weaker infrastructure and fewer options for sustainable living.

## 5.2 Injustices in access to sustainable energy

Access to affordable and sustainable energy is a fundamental dimension of energy justice. In the Netherlands, the liberalized energy market allows households to choose their electricity and gas suppliers, which in theory enables consumers to opt for green electricity contracts if they wish to do so (Van de Bron, 2023). This has led to the perception that access to renewable electricity is equitable

and universally guaranteed. However, this market-based freedom masks a range of deeper inequalities in access to sustainable energy systems and technologies, particularly at the infrastructural and household level. Furthermore, freedom for households connected with district heating is also restricted. Section 5.2.1 examines disparities in access to sustainable energy technologies at the household level. Furthermore, section 5.2.2 addresses injustices linked to district heating systems and the limited agency of connected users.

### 5.2.1 Access to sustainable energy technologies

Although the energy market in the Netherlands allows consumers to purchase renewable electricity from green suppliers, access to sustainable energy technologies such as rooftop solar panels, home batteries, and electric heat pumps remains highly unequal. These technologies are essential for enabling households to directly participate in the energy transition and benefit from long-term reductions in energy costs and carbon emissions. However, structural barriers prevent many households from adopting them, thereby reinforcing distributional injustices within the energy system.

One of the primary barriers is income level. The initial capital investment required for sustainable technologies remains high, despite the existence of national subsidy schemes and loans. Lower-income households are often unable to afford the upfront costs, or they are excluded from financing options due to insufficient creditworthiness (CE Delft, 2021). Consequently, those who could benefit most from lower energy bills over time are frequently unable to access the technologies that would make this possible. In addition to financial barriers, housing tenure plays a crucial role. Renters, who make up approximately 40% of the Dutch housing market, have limited control over investments in their homes and often depend on landlords to initiate energy efficiency improvements or renewable technology installations (TNO, 2023). Social housing tenants, in particular, are dependent on housing corporations, whose investments in sustainability may be restricted by budgetary limitations or competing priorities. As a result, these groups are structurally disadvantaged in their ability to engage with and benefit from the energy transition. Furthermore, building type and location influence the feasibility of sustainable technology adoption For example, rooftop solar panels are less applicable in apartment complexes, particularly those with shared roofs or outdated electrical systems. Similarly, older homes with poor insulation or without sufficient space for heat pumps may require extensive renovations before such systems can be installed (RVO, 2023).

From an energy justice perspective, these constraints illustrate both distributional and recognitional injustices. Distributionally, the economic and infrastructural benefits of sustainable energy technologies are not evenly spread across the population. Recognitionally, the design and implementation of policies and programs often fail to adequately consider the structural disadvantages of certain groups—such as renters, low-income households, or residents of older buildings—thus reinforcing existing inequalities (Jenkins et al., 2016).

**Interview opinions on sustainable energy technologies**

Interviewees consistently emphasized that access to sustainable energy technologies is highly unequal across different social groups. Both internal (Alliander) and external stakeholders expressed concern that the energy transition currently favors those with financial resources, homeownership, and

technical knowledge. In contrast, renters, low-income households, and marginalized communities are often structurally excluded. A recurring theme was the limited agency of renters. Many interviewees noted that tenants are unable to make decisions about energy upgrades in their homes, even when they are motivated to participate in the transition. As one internal interviewee put it:

> *"People with money and a roof benefit from solar panels. Renters can't even decide what's on their roof."*

This sentiment was echoed by other interviewees, who emphasized that tenants often lack the agency to make energy-related decisions, even when they are motivated to participate in the transition. An external interviewee described how community-owned energy systems such as shared solar and thermal storage in Arnhem can help bridge this gap by enabling renters to benefit from local renewable energy without needing individual ownership.

Another major barrier identified was the high upfront cost of sustainable technologies. Despite the availability of subsidies, many interviewees argued that these financial incentives are not reaching those who need them most. As one internal stakeholder explained:

> *"You need €5,000 for a heat pump even after subsidy—not everyone has that."*

Others noted that subsidies often end up benefiting early adopters—typically wealthier and well-informed individuals. This is largely due to the high upfront costs of technologies like heat pumps and solar panels, combined with the fact that accessing subsidies requires digital literacy, initiative, and the ability to navigate complex application procedures. As one internal interviewee explained, although subsidies are designed to stimulate market development and support the adoption of sustainable technologies, they frequently fail to reach those with limited financial means or lower digital access:

> "*If we want people with thinner wallets to also install solar panels, we probably need a different kind of subsidy."*

External interviewees emphasized that language barriers, low literacy, and digital exclusion further prevent vulnerable groups from accessing support programs. P4 and P10 stressed that communication from energy providers is often too complex, and even highly educated individuals struggle to understand disconnection notices or subsidy applications. Another recurring theme was grid congestion, which disproportionately affects those who needed more time to save or learn about sustainable options. As P6 put it:

> *"Those who already had the means have installed solar panels and EVs. Others can't anymore."*

Several interviewees also noted that wealthier neighborhoods electrify faster, consuming available grid capacity and leaving others behind. This creates a feedback loop in which those who need support the most are last in line. Finally, some interviewees pointed out that renters, who often lack the option to install solar panels or heat pumps, indirectly subsidize wealthier homeowners. These homeowners

electrify their homes and benefit more from the grid, while renters pay similar or only slightly higher tariffs—despite having fewer options to reduce their energy bills.

### 5.2.2 Injustices in district heating

District heating (stadsverwarming) is often positioned as a key pillar of the heat transition in the Netherlands, especially in the context of phasing out natural gas (van het gas af). While it has the potential to contribute to lower carbon emissions and collective efficiency gains, its rollout raises significant concerns across all three tenets of energy justice: distributional, procedural, and recognition justice.

A core issue lies in the absence of consumer autonomy. Unlike users of individual heating systems, residents connected to district heating are typically bound to a single heat provider and have no legal right to switch suppliers or opt out (Osman, 2017; ACM, 2023). This violates fundamental principles of consumer freedom and market fairness. The monopolistic structure is codified in Dutch heat law, which treats heat provision as a regional utility rather than a liberalized market. The consequence is that households lack the ability to express environmental or financial preferences through their energy choices, which conflicts with ideals of democratic and participatory energy transitions (Sovacool et al., 2016). These constraints are particularly problematic when considering the lock-in effects associated with district heating infrastructure. Once a building is connected, switching to alternative low-carbon technologies, such as electric heat pumps or hybrid systems, becomes technically and economically unfeasible (Osman, 2017). As such, connected households may remain dependent on outdated or fossil-based heat sources for decades, even as cleaner technologies become available elsewhere.

Although the Dutch "niet-meer-dan-anders" (NMDA) principle aims to ensure that users of district heating do not pay more than users of natural gas, this benchmark is increasingly criticized. The NMDA method is based on a theoretical cost comparison rather than actual service quality, comfort, or energy performance (CE Delft, 2021). As a result, households and particularly those in older or poorly insulated buildings may face higher monthly costs without being able to reduce consumption or improve efficiency themselves. The lack of individual metering or control over consumption can further exacerbate these cost burdens (PBL, 2020). Low-income households are overrepresented in areas with district heating, particularly in post-war social housing, making the system regressive in its impact (Osman, 2017). These issues are compounded by how district heating is implemented. To ensure financial viability, municipalities often target housing corporations to secure large-scale connections without needing to negotiate with individual homeowners. This strategy, while efficient, impacts tenants that have lower incomes and limited say in the decision-making process (Diessen, 2024). In contrast, wealthier neighborhoods are more likely to transition to all-electric solutions like heat pumps and solar panels, which require more grid capacity. As a result, lower-income areas are often steered toward district heating not because it is the best option for them, but because it frees up grid space for more affluent areas (Diessen, 2024).

Procedural justice concerns are also prominent in the context of district heating. Decisions about network expansion, tariffs, and technical standards are typically made by municipalities, housing corporations, and heat companies, with limited direct involvement from residents (Hiteva & Sovacool, 2017). Studies show that residents are often informed late in the process and are not given meaningful

opportunities to influence decisions that have long-term consequences for their energy use and housing costs (Osman, 2017). From a recognition and environmental justice standpoint, there are also concerns regarding the actual sustainability of district heating systems. While some networks are supplied with residual heat or geothermal energy, many continue to rely on fossil fuels or controversial biomass combustion. Residents often lack information about the environmental profile of their heat source and have no influence over it, creating a disconnect between personal values and imposed infrastructure (PBL, 2020).

**Interview opinions on district heating**

Interviews with stakeholders reveal that the implementation of district heating systems can introduce new forms of injustice—particularly around mandatory connection and affordability. Several interviewees raised concerns about the lack of autonomy for residents in areas where district heating is introduced. In many cases, residents are obligated to connect to the system, even if they would prefer or could afford a more efficient or cheaper alternative. As P3 noted,

> *"Some people have no freedom of choice in their energy supply, for example tenants with heat networks that are more expensive than gas."*

This lack of choice is particularly problematic when the district heating system is not cost-competitive or when service quality is poor. Other interviewees explained that residents often feel decisions are made over their heads, with little room for negotiation or input.

Another major concern is the high and inflexible cost structure of district heating. Interviewees pointed out that households on heat networks often pay the same grid fees as those with electric heat pumps and EVs, despite using significantly less electricity. This results in a double burden for low-income households: they pay for infrastructure they don't use and are locked into long-term contracts with limited price transparency. P13 and P16 emphasized that low-income households are disproportionately affected, especially in older, poorly insulated homes where heat demand is high. As P14 put it,

> *"If you already can't make ends meet, that €1,000 is a lot of money."*

Interviewees also highlighted procedural injustices in how district heating projects are planned and implemented. P11 and P16 noted that residents are often not meaningfully involved in decision-making processes. Language barriers, digital exclusion, and lack of technical knowledge further marginalize vulnerable groups.

In sum, while district heating is often promoted as a sustainable solution, the interviews and literature revealed that without careful attention to affordability, flexibility, and inclusive governance, it risks reinforcing existing inequalities and creating new forms of energy injustice.

## 5.3 Injustices in participation and recognition of diverse groups

While much of the energy transition discourse focuses on infrastructure and cost allocation, interviewees consistently emphasized that justice also depends on who is seen, heard, and included. This subchapter explores how procedural and recognition-based injustices manifest in the Dutch energy transition, including injustices in accessible information, meaningful participation, and fair representation in decision-making, as well as the systemic exclusion of those with limited resources, language skills, or digital access.

### 5.3.1 Limited accessible and understandable information

A recurring theme in the interviews was the lack of accessible, clear, and user-friendly information from grid operators like Alliander. Many participants emphasized that households, especially those in vulnerable or marginalized communities, struggle to find or understand essential information about grid congestion, connection timelines, tariffs, or disconnection procedures. Furthermore, households struggle to understand the letters sent by Alliander, containing a lot of confusion. As one interviewee of the Energiebank Arnhem admitted:

> *"Even I don't understand the disconnection letters—and I have a university degree and work in this field,"*

In addition to congestion and connection information, interviewees also highlighted the difficulty of understanding grid tariffs. The current tariff structure based on technical terms like "3x25A" or "vermogensprofiel," are complex. Many users do not understand what they are paying for, how their usage affects costs, or how tariffs might change in the future. As one internal interviewee noted:

> *"People don't know what 3x25A means, let alone how it affects their bill."*

This issue is compounded by the technical and legalistic language used in letters, emails, and websites. Several interviewees pointed out that communications are often written from an engineering or regulatory perspective, rather than with the end user in mind. This creates significant barriers for people with low literacy, limited digital skills, or language barriers—groups that are already underrepresented in the energy system. A review of Liander's website supports these concerns. While it contains detailed information on topics like grid capacity and congestion management, the structure and terminology are geared toward professionals. Information is fragmented across multiple subpages, and there is no clear, centralized explanation of what congestion means for small consumers or what actions they can take. This complexity creates a barrier to informed participation, especially for those who are already disadvantaged in the energy system.

Interviewees also criticized the reactive nature of communication. Important updates such as delays in connection, changes in tariffs, or the status of congestion in a neighborhood are not proactively shared with affected residents. Instead, users are expected to actively search for updates, which many are unable or unlikely to do. As one of the interviewees stated:

*"People in Geitenkamp don't check the Liander website every week. They just want to know when they'll get power."*

This lack of transparency and outreach may undermine trust in the system and limits people's ability to make timely, informed decisions, like whether they should invest in a heat pump or solar panels.

### 5.3.2 Meaningful participation and use of local knowledge

While some consultation mechanisms exist, interviewees consistently emphasized that meaningful participation in energy planning remains rare. Many processes are still top-down, expert-driven, and inaccessible to people with limited time, education, or confidence. This results in a participation gap, where the same vocal, well-resourced individuals dominate discussions, while the voices of renters, low-income households, and non-native speakers are largely absent. An external interviewee from the Energiebank warned:

*"It's not enough to invite people to a session. If they don't feel heard or see results, they won't come back."*

Internal interviewees from Alliander echoed this concern. One stated:

*"We don't have a real relationship with residents. Only those who actively reach out are included."*

<u>Structural barriers to participation</u>

Interviewees identified several structural barriers that limit participation:

- Time and capacity: Residents in uncertain situations often cannot afford to attend long or technical meetings.
- Language and literacy: Communications are frequently too complex or only available in Dutch, excluding non-native speakers and those with low literacy.
- Digital divide: Online-only formats exclude those without internet access or digital skills.
- Cultural mismatch: Decision-making formats often reflect institutional norms rather than community preferences.

These barriers disproportionately affect marginalized groups, reinforcing existing inequalities in who gets to shape the energy transition. As one internal interviewee noted:

*"We mostly hear from retired, highly educated men—not from single mothers or people in energy poverty."*

This participation gap is further exacerbated by a disconnect between municipalities, DSOs, and the communities they aim to serve. Research by Dorenbos & Tullemans (2025) found that in neighborhoods with high levels of energy poverty, residents' initiatives are often absent or unknown to local governments. Municipal officials frequently expressed uncertainty about whether any energy-related initiatives existed in these areas. Even when such initiatives do exist, they are often poorly connected to municipal strategies or overlooked in energy poverty policies.

Internal interviewees confirmed this disconnect. One internal Alliander staff member reflected:

> *"People who don't know how to apply for subsidies miss out—they're not even seen."*

External interviewees pointed to deeper causes, such as lack of trust, language barriers, and more urgent social issues. As one explained:

> *"We need long-term neighborhood plans—everyone is focused on the short term."*

This disconnect not only limits participation but also undermines the effectiveness of energy initiatives. Without strong local ties, even well-intentioned programs may fail to reach those most in need.

The value of local knowledge

Many interviewees stressed the importance of recognizing and integrating local knowledge into energy planning. Residents often have deep insights into neighborhood dynamics, housing conditions, and social needs, but these are rarely taken into account. An internal Alliander interviewee stated:

> *"We plan for neighborhoods without ever asking what people actually need."*

Several participants described successful pilots where neighborhoods were given a say in how grid capacity was allocated, or where local energy coaches helped tailor solutions to specific contexts. These examples show that bottom-up approaches can lead to more just and effective outcomes.

> *"In Saksen Weimar, solar energy from wealthier homes is stored and redistributed to heat poorly insulated homes. That only worked because the community was involved from the start.*

These findings underscore that meaningful participation is not just a matter of inviting people to the table, but also requires proactive, inclusive, and sustained engagement that values local knowledge as a cornerstone of just energy governance.

### 5.3.3 Representation in Decision-Making

Interviewees consistently noted that decision-making bodies in the energy sector lack diversity. Boards and advisory groups are often dominated by white, male, highly educated professionals, which leads to blind spots in understanding the needs of marginalized groups.

> *"The people designing the system don't look like the people affected by it."*

This lack of representation has concrete consequences. It affects how tariffs are designed, how infrastructure is prioritized, and how communication is framed. Several interviewees pointed out that customer personas and data models used by DSOs are often based on generalizations, which fail to capture the lived realities of renters, migrants, or people in poverty. One interviewee highlighted a striking example of gender bias in customer profile:

> *"Most of the time, the man's name is listed as the head of household. That's how the system is set up. It's not neutral—it's biased."*

This seemingly small design choice reflects deeper assumptions about household structure and decision-making power, and it can lead to exclusion of women and other household members from communication and participation. Another internal interviewee emphasized the need for more inclusive design processes:

> *"Who gets to work and decide at Alliander determines who benefits. Diversity in design teams is essential."*

External interviewees also expressed concern about the lack of representation in formal consultation processes. One participant from the Energiebank noted:

> *"I feel like a spokesperson for people who never sit at these tables."*

This underrepresentation is not just symbolic but also shapes outcomes. As one internal interviewee put it, we often act from the perspective of the legal entity, not from humanity. Some interviewees proposed concrete solutions to improve representation. One suggested the creation of a member council, similar to those used by health insurers, to ensure that both small and large users are represented in energy decisions. Others called for more collaboration with municipalities and civil society organizations to ensure that diverse voices are heard. Overall, interviewees agreed that improving representation in decision-making is essential for a just energy transition. Without it, the system risks reinforcing existing inequalities and failing to meet the needs of those most affected by rising energy costs, grid congestion, and climate policy.

### 5.3.4 Inclusion of marginalized groups and recognizing their needs

Interviewees emphasized that marginalized communities such as renters, migrants, low-literacy individuals, and people in poverty are often invisible in energy decision-making processes. These groups are rarely consulted, and their specific challenges are not adequately addressed in policy or infrastructure design.

> *"We mostly hear from retired, highly educated men—not from single mothers or people in energy poverty," one interviewee noted.*

Another added:

> *"People who don't speak up or lack resources are not included. We don't actively seek them out."*

This lack of inclusion leads to systemic blind spots in energy planning. For example, communication materials are often too technical or only available in Dutch and English, excluding non-native speakers. Several interviewees called for more inclusive outreach, such as multilingual support, simplified communication, and local presence in neighborhoods. These findings are echoed in broader research. Dorenbos and Tullemans (2025) found that municipalities often struggle to reach residents in neighborhoods with high levels of energy poverty. This difficulty is attributed to a combination of

factors, including the presence of multiple social challenges that make residents less receptive to conversations about home energy upgrades. Language barriers, particularly among residents with a migration background, further complicate communication. In addition, low levels of social cohesion in some neighborhoods make it harder to mobilize residents or build trust. The study also notes that energy poverty is increasingly affecting young households who have recently purchased older, poorly insulated homes. These households often face high mortgage costs and lack the financial means to invest in sustainability measures (Dorenbos & Tullemans, 2025).

One size doesn't fit all

Recognition injustice also manifests in the failure to account for diverse energy needs and constraints. Interviewees stressed that not all households have the same ability to shift energy use, invest in new technologies, or access subsidies. Others pointed out that medical needs, poor insulation, or shift work can limit flexibility, making time-of-use tariffs or energy-saving expectations unfair for some users.

> *"A nurse can't choose when to charge their car. A family with medical equipment can't reduce their usage."*

Interviewees called for tariff systems and infrastructure planning that reflect these differences, rather than assuming a one-size-fits-all model. They also emphasized the importance of empathetic design, where policies are shaped by real-world constraints rather than idealized consumer behavior.

> *"You can't assume everyone has an EV or flexibility—we need to design tariffs that reflect real diversity."*

Ownership and Participation: A Divided Landscape

Beyond usage patterns, interviewees highlighted a growing divide in access to ownership and participation in the energy system. Wealthier homeowners are increasingly able to invest in solar panels, batteries, and electric vehicles—becoming energy producers and benefiting from lower bills and subsidies. Meanwhile, renters and low-income households remain passive consumers, facing rising costs and limited influence. This creates a two-tiered system, where some households become energy producers and benefit from lower bills and subsidies, while others remain passive consumers with rising costs. Several participants advocated for community energy models, such as shared solar or neighborhood batteries, to democratize access. One interviewee argued:

> *"We need to move from private ownership to collective solutions—energy should be a public good."*

Others proposed energy hubs, citizen councils, and participatory budgeting as ways to give communities more control over local energy decisions. These approaches were seen as essential for building trust and ensuring that the transition reflects the values and needs of all residents. Some interviewees also emphasized the symbolic and practical importance of public ownership:

> *"I'm not sure it's desirable for solar panels to be in private hands. Maybe they should be publicly owned."*

Together, these insights highlight the need for a more inclusive and equitable energy transition—one that not only recognizes diverse needs but also redistributes power and ownership.

## 5.4 Barriers to an energy just transition for a DSO

Despite growing awareness of energy justice, DSOs face significant institutional, regulatory, and organizational barriers that limit their ability to act on these principles. Insights from internal and external interviews reveal how these barriers manifest in practice and how they shape the limits of what DSOs can do.

### 5.4.1 Bound by the rules

Although there is increasing recognition within DSOs of the importance of a just energy transition, their ability to act is tightly constrained by legal and regulatory frameworks. As explained in chapter 4, Dutch and EU regulations require DSOs to operate as neutral infrastructure providers and are required to base tariffs on cost-reflectiveness, not on social equity. While this principle is intended to ensure fairness, it paradoxically prevents DSOs from addressing existing inequalities, such as energy poverty or unequal access to sustainable technologies.

Furthermore, DSOs are also barred from participating in energy markets. They cannot own or operate energy storage, manage demand response, or directly supply energy. As one interviewee noted, these roles are reserved for market parties under EU law. This limits the DSO's ability to implement innovative, justice-oriented solutions, such as community batteries or flexible tariffs for vulnerable users. Even when DSOs identify urgent social needs, they cannot act unless explicitly authorized. As one interviewee put it:

> *"We believe that democratically elected bodies should decide on prioritization—not us."*

While separation of roles ensures democratic oversight, it might slow down or even block responsive action.

Another structural barrier is the lack of access to social or demographic data. Due to privacy laws, DSOs and regulators often do not know which households are experiencing energy poverty. As one regulatory interviewee explained, there is currently no clear overview of which households fall under energy poverty, making it difficult to design targeted interventions, even when the need is visible on the ground.

*Collaboration and governmental constraints*

As Diessen (2024) notes, DSOs rely heavily on timely and transparent communication from local governments to forecast demand and plan investments. When municipalities fail to share development plans or delay permit processes, grid operators are left lagging behind. Initiatives like the pMIEK (Programma Meerjarenverkenning Energie-infrastructuur) are promising examples of improved coordination, but the process remains slow and fragmented, especially in smaller municipalities that lack the capacity to keep up with the pace of grid investments. Although some interviewees acknowledged improvements in coordination, for example through strategic partnerships between DSOs and municipalities, these efforts remain fragmented and heavily dependent on local initiative.

One interviewee described the collaboration between grid operators and municipalities as valuable but emphasized that

> "*we must continue to work together... there is a lot of added value between grid management and the municipality."*

However, the absence of standardized procedures across municipalities means that DSOs must often rely on informal relationships and ad hoc agreements to move projects forward. Diessen (2024) stressed the importance of local presence and trust-building, noting that "being present in neighborhoods and understanding local needs is key" to effective collaboration.

### 5.4.2 Wired for infrastructure: Organizational barriers

Beyond legal and regulatory constraints, Alliander faces significant organizational barriers that limit their ability to contribute meaningfully to a just energy transition. These internal challenges ranging from culture and structure to capacity and communication shape how DSOs interpret their role and respond to societal needs.

**Technocratic culture**

Historically, the role of DSOs like Alliander was clear and relatively straightforward: build and maintain the electricity grid, and ensure that everyone who requested a connection could be connected. The system was designed around predictable, centralized energy flows, and the primary expertise required was technical, focused on engineering, safety, and reliability. In this context, social considerations were largely irrelevant to the core mission. The assumption was that access to energy was universal and equitable by default. However, this model no longer holds, as explained in Chapter 2.3. Today, not everyone can be connected immediately. Decisions must be made and communicated about who gets access first, who can afford to participate, and who is left behind. Moreover, DSOs are increasingly expected to stimulate flexibility in energy use among customers. These are not just technical questions but also social, ethical, and political.

Despite these shifts, Alliander's organizational structure, culture, and internal expertise have not fully adapted to this new landscape. The company remains largely structured around engineering excellence, operational reliability, and regulatory compliance. This has fostered a deeply technocratic culture where infrastructure is prioritized over social outcomes, as also noted by an external interviewee in Chapter 5.3.3. Innovation is often confined to technical domains, while social innovation such as inclusive participation or equitable access is seen as secondary. This culture also tends to be risk-averse, favoring stability over experimentation, which slows down the adoption of new, justice-oriented approaches. Organizational structures within DSOs often lack dedicated roles or departments focused on social equity, community engagement, or participatory design. Decision-making teams are typically composed of engineers, economists, and legal experts, with limited input from social scientists, community workers, or people with lived experience of energy poverty. This results in blind spots when it comes to understanding the needs of marginalized groups, such as renters, migrants, or low-income households. Without diverse perspectives, policies and programs risk reinforcing existing inequalities.

Even when DSOs recognize the importance of engaging with communities, they often lack the capacity, tools, or institutional support to do so effectively. Outreach tends to focus on well-organized or vocal stakeholders, while more vulnerable or less visible groups are overlooked. Engagement efforts may be short-term or symbolic, offering consultation without real influence. This undermines trust and limits the potential for co-creating solutions that reflect the lived realities of diverse energy users.

A clear example of Alliander's historically technocratic approach is its long-standing lack of engagement with housing corporations. For many years, these organisations were not considered part of Alliander's "customer base" because they did not hold contracts or pay grid fees directly; instead, contracts were held by individual tenants. As one employee noted,

"*There was no front door for housing corporations*."

This narrow definition excluded actors who could play a key role in coordinating collective energy solutions, particularly for vulnerable tenants.The absence of formal contact channels limited opportunities for coordinated investments in collective energy solutions, such as shared heat networks, rooftop solar arrays, or neighbourhood-scale insulation programmes. This gap was particularly consequential for vulnerable tenants, who often depend on their landlords for implementing energy efficiency measures and who have limited individual agency to act on rising energy costs.

However, this has begun to change. Alliander has appointed relationship managers specifically for housing corporations, marking a shift toward a more inclusive stakeholder model. While this development is still evolving, it reflects a growing awareness within the organization that enabling a just energy transition requires collaboration with intermediary institutions that represent underrepresented groups. It also signals progress in breaking down internal silos and aligning infrastructure planning with social realities.

**Internal fragmentation between departments**

Another organizational barrier within Alliander is internal fragmentation. Responsibilities for technical planning, customer service, innovation, and stakeholder engagement are often spread across separate departments with limited coordination. This siloed structure makes it difficult to deliver integrated solutions that combine technical and social dimensions. For instance, while one team may pilot a community energy initiative, others may be unaware or unable to support it due to misaligned priorities or lack of shared objectives, which is a common risk in large organizations. As a result, promising initiatives often remain isolated and fail to scale. This disconnect is particularly problematic when addressing complex, cross-cutting issues like energy poverty or equitable access, which require integrated responses across technical, social, and regulatory domains.

Moreover, organizational change within DSOs tends to be slow. Hierarchical decision-making, leadership turnover, and the absence of internal champions for justice-oriented work can stall progress. In the absence of clear mandates or incentives, teams often default to familiar, technically driven routines—even when more inclusive or equitable alternatives are available. As one interviewee noted,

*"We're good at building cables, but not at building relationships."*

This internal fragmentation ultimately hinders Alliander's ability to act cohesively and respond effectively to the multifaceted challenges of a just energy transition.

## Overview of energy injustices and barriers

Chapter 5 has revealed multiple dimensions of energy injustice in Arnhem, spanning technical grid challenges, social disparities, and procedural exclusion of marginalized groups. Table 5 provides an overview of these injustices, categorized by the energy justice framework, with concrete examples and the role of the DSO in each case.

*Table 5: Injustices found in the local energy transition in Arnhem using the energy justice framework.*

| Concept | Injustice | Examples from Arnhem / Role of the DSO |
|---|---|---|
| **Energy poverty** | Energy poverty concentrated among renters | ~80% of energy-poor households live in social housing; tenants have limited control over energy upgrades. |
| **Distributional justice** | Unequal access to sustainable technologies | Renters often cannot install solar panels or heat pumps; access depends on landlords or housing corporations. |
| | Grid capacity favors early adopters | Wealthier households secured grid access early; vulnerable groups now face delays of up to 70 weeks. |
| | Flat-rate tariffs burden low-income users | Households with low usage pay the same fixed fees as high-usage households with EVs and heat pumps. |
| | High connection fees for low-capacity users | A 1x10A connection costs the same as a 3x25A, despite offering much lower capacity. |
| | Investment logic favors demand, not need | Grid investments are based on projected demand; socio-economic data is excluded from planning. |
| | District heating limits choice and affordability | Tenants are often required to connect to expensive heat networks without alternatives. |
| | Intergenerational cost burden | Current users pay for infrastructure that will benefit future generations; risk of overinvestment. |
| **Procedural justice** | Limited participation of vulnerable groups | Participation dominated by well-informed citizens; renters, migrants, and low-literacy groups often excluded. |
| | Communication is too technical and inaccessible | Liander uses complex language in letters and online; low-literacy users struggle to understand. |
| | Symbolic participation without real influence | Residents are invited to sessions but have little say in decisions. |
| | Disconnection policy lacks social sensitivity | Standard disconnection practices can cause high societal costs; pilot shows better outcomes. |
| | No feedback to marginalized communities | Vulnerable neighborhoods are not proactively informed or consulted. |
| | Local knowledge not systematically used | Neighborhood-specific insights are rarely integrated into planning or investment decisions. |
| **Recognition justice** | Exclusion of non-standard users | Policies assume users are homeowners, digitally literate, and Dutch-speaking. |
| | Limited recognition of diverse energy needs | No consideration for medical needs, irregular work hours, or poor housing quality. |
| | Limited access to ownership and control | Energy cooperatives are often financially or legally inaccessible to low-income groups. |

| | |
|---|---|
| Cultural mismatch in communication | No multilingual or visual alternatives; digital exclusion not addressed. |
| Gender and household bias | Communications often assume a male "head of household," excluding others from decision-making. |
| Underrepresentation in decision-making | Boards and advisory groups lack diversity; perspectives of marginalized groups are missing. |

These findings demonstrate how various injustices are deeply interconnected and often reinforced by structural constraints faced by the DSO. Table 6 summarizes the institutional, regulatory, and organizational barriers that limit the DSO's capacity to address these injustices effectively. Recognizing these barriers is key to developing targeted interventions and fostering collaboration for a just energy transition.

*Table 6: Overview of the institutional, regulatory and organizational barriers for a DSO.*

| Barrier Type | Barrier | Description |
|---|---|---|
| **Institutional** | Strict neutrality mandate | DSOs are required to treat all users equally, which limits their ability to prioritize vulnerable groups or tailor services based on social need. |
| | Separation of roles in the energy system | DSOs cannot own or operate energy storage or supply energy, restricting their ability to support community energy solutions. |
| | Lack of access to socio-economic data | Privacy laws prevent DSOs from identifying energy-poor households, making targeted interventions difficult. |
| **Regulatory** | Cost-reflective tariff requirements | Tariff structures must reflect actual costs, preventing the implementation of progressive or socially differentiated pricing models. |
| | Prohibition on prioritizing based on social criteria | Grid access must follow "first come, first served" or limited societal prioritization, excluding broader social justice considerations. |
| | Legal limits on flexibility and innovation | Regulatory frameworks are slow to adapt, making it difficult to pilot or scale justice-oriented innovations. |
| **Organizational** | Technocratic culture | A strong focus on engineering and infrastructure leads to blind spots in social engagement and justice considerations. |
| | Internal fragmentation | Departments operate in silos, making it hard to coordinate justice-oriented initiatives across technical, legal, and social domains. |
| | Lack of social expertise | Limited presence of professionals with backgrounds in social sciences, community engagement, or equity-focused planning. |
| | Limited community engagement capacity | Outreach is often reactive, technical, and not tailored to diverse audiences, reducing trust and participation. |

This comprehensive understanding lays the groundwork for the next chapters, which will explore strategies to overcome these challenges and promote a more equitable and inclusive energy future in Arnhem.

# 6. Strategies and recommendations

This chapter presents actionable strategies to strengthen the role of a DSO in promoting a just energy transition. To effectively address the multifaceted challenges faced by the DSO, the proposed interventions are grouped into three complementary approaches: (1) policy advocacy, which targets the institutional and regulatory frameworks beyond the company's direct control; (2) internal organizational change, focusing on transforming Alliander's culture, structures, and processes to better integrate social equity into everyday operations; and (3) strategic collaboration with external stakeholders, emphasizing the importance of partnerships and ecosystem-wide engagement to co-create solutions. This framework reflects the range of approaches available to the DSO, from influencing external conditions to fostering internal transformation and cooperation, moving beyond purely technical solutions to incorporate considerations of justice more centrally.

## 6.1 Policy advocacy and lobbying for a just transition

While Alliander, as a DSO, is legally constrained in many of its actions, it holds a unique position of influence within the Dutch energy landscape. It cannot directly implement policy changes, adjust tariffs, or prioritize users based on social criteria. However, it can (and increasingly does) influence the broader policy environment through advocacy and coalition-building. This subchapter discusses key areas in which Alliander may contribute to policy advocacy to promote a more just energy transition, drawing on findings from both internal and external interviews.

*Tariff Reform*

A recurrent topic among interviewees concerned the structure of electricity tariffs and their distributional impacts. Multiple Alliander employees emphasized that the current flat-rate, capacity-based system places a disproportionate burden on small consumers and lower-income households. P1, for instance, criticized the uniformity of the fixed tariff, stating that "a villa and a small apartment pay the same," while P6 described the arrangement as "fundamentally unfair." These concerns were echoed by external stakeholders such as P8 (Energiebank) and P16 (municipality of Arnhem), who argued that flat tariffs penalize low-usage households and exacerbate regressive effects, especially as fixed network costs are projected to rise substantially in the coming years.

Time-of-use (ToU) tariffs are seen as a promising way to make grid costs fairer and reduce peak demand. Instead of paying a flat annual fee—currently around €350 and expected to rise to €638 by 2030—households would pay more during peak hours and less when demand is low. This better reflects actual grid use and could reduce the need for costly infrastructure upgrades. ToU pricing could eliminate the need for one out of four planned new substations. According to Berenschot (2024), ToU pricing could benefit about 66% of households, especially those with low or flexible energy use. It also has a redistributive effect: up to 79% of households earning under €35,000 could pay less, while higher-consuming households—often wealthier—would pay more. However, approximately 10% of low-income households—particularly those in poorly insulated homes relying on electric heating—could experience increases exceeding €200 per year. To mitigate such unintended consequences, complementary policies such as targeted compensation, building retrofits, and accessible communication tools will be essential.

Both internal and external interviewees expressed strong support for time-based tariffs as a tool to improve fairness in cost allocation. Nonetheless, several stakeholders cautioned against overly complex systems with highly granular pricing, such as quarter-hourly rates, which may be difficult for households to understand or respond to. Instead, they advocated for simpler systems with fewer tariff blocks per day. This aligns with recent political debates, where Members of Parliament raised concerns about the practical complexity of hourly variable tariffs and called for more accessible designs, such as a single daily peak tariff (Energeia, 2024).

Another suggestion from an interviewee involved introducing differentiated tariffs for essential services and vulnerable groups. For instance, essential community facilities such as healthcare centers or homeless shelters could receive lower network fees, reflecting their societal value. Vulnerable households might benefit from social tariffs—discounted rates targeted at those facing energy poverty. Several European countries have already adopted such schemes, often in conjunction with energy poverty monitoring and automatic eligibility based on income or housing status. Progressive pricing structures, whereby network tariffs increase with higher consumption levels or greater peak contributions, were also highlighted as a potential mechanism for improving distributive fairness. These models mirror progressive income taxation and aim to ensure that wealthier, high-consuming households contribute a greater share to the costs of maintaining and upgrading the grid. While administratively more complex, progressive tariffs could send stronger price signals and redistribute costs in a more equitable manner.

Beyond user-based differentiation, reforms in tariff allocation mechanisms were proposed to empower collective, neighborhood-level decision-making. One concept involves allocating a fixed amount of grid capacity to each neighborhood or postcode area, thereby encouraging local collaboration around energy use, storage, and renewable production. Such an approach could foster shared responsibility and allow communities to make their own trade-offs regarding consumption patterns, investment in flexibility, or prioritization of specific users.

Lastly, several interviewees emphasized the potential of locational incentives to improve grid efficiency and fairness. Currently, DSOs have limited financial motivation to prioritize grid upgrades in areas with high social need or to steer large users toward more grid-friendly locations. With region-based tariff, households or businesses pay higher connection fees in areas where significant grid investments have been made. This would create a spatial price signal that reflects the true cost of infrastructure development. As one internal interviewee put it:

> *“Put data centers under wind turbines in Flevoland — supply and demand balance each other out, and we avoid unnecessary grid costs.”*

By encouraging high-demand consumers—such as data centers—to locate near renewable generation can reduce the need for long-distance transmission and costly grid reinforcements. Such locational alignment not only improves system efficiency but also supports regional energy strategies. By integrating spatial incentives into tariff design and planning frameworks, DSOs can better manage congestion, reduce investment needs, and contribute to a more balanced and just energy system.
However, as Diesen (2024) notes, this model is difficult to implement fairly. For example, if a solar park

is built in one region but its electricity is consumed elsewhere, it becomes unclear who should bear the cost. A more feasible alternative may be to base tariffs on actual grid usage, which better reflects demand-side pressure without penalizing electrification in vulnerable areas.

*Expanding MKB*

Beyond tariff reform, another policy area in which Alliander can exert influence is the framework for prioritizing grid connections. The recent introduction of the Maatschappelijk Prioriteringskader (MPK) by ACM was widely welcomed by interviewees, but many argued that its current scope remains too narrow. While essential services are now given priority in grid planning and connection queues, both internal and external stakeholders expressed the need to broaden the framework to include vulnerable residential users. Interviewees such as P1 and P5 emphasized the importance of prioritizing social housing and energy-poor neighborhoods, a view echoed by municipal representatives like P16 and energy advisors such as P13. There were also calls for a more participatory process in determining local priorities. P6, for example, proposed involving citizen councils in decisions about prioritization, with technical input from the DSO. Such approaches would enhance the legitimacy and contextual relevance of grid development plans.

Additionally, interviewees suggested that large users—particularly commercial and industrial consumers—should be required to demonstrate energy-saving measures or flexibility commitments before being granted access to additional grid capacity. This “efficiency first” principle would ensure that scarce capacity is not consumed unnecessarily, while also reducing the need for disproportionate investments that drive up tariffs for all users.

*Regulatory flexibility*

Interviewees further highlighted regulatory barriers that hinder the development of collective energy solutions. Projects involving community energy, shared infrastructure, or collective ownership often face legal uncertainties or procedural hurdles. P11 pointed to the challenges encountered in initiatives like Schoonschip, where unclear regulations complicated energy sharing arrangements. Similarly, P16 noted the lack of supportive frameworks for decentralized, community-owned systems. In response, stakeholders advocated for legal and regulatory reforms that would allow DSOs to support, co-develop, or at least facilitate collective infrastructure solutions, while still maintaining their neutrality. Standardized contracts, simplified connection procedures, and the removal of restrictions on energy sharing between renters and homeowners were seen by some interviewees as essential to unlock the social potential of energy communities.

Another area where Alliander could play a policy-shaping role concerns data access and privacy regulation. While data protection remains a vital concern, many interviewees, both internal (P9, P11) and external (P8, P16), argued that the current interpretation of privacy law prevents effective collaboration between DSOs and municipalities. As a result, it becomes exceedingly difficult to identify vulnerable households in time to prevent disconnection or to offer targeted support. Several interviewees called for the development of secure, purpose-bound data-sharing protocols that would enable early intervention while safeguarding individuals' privacy. Pilot projects, governed by ethical oversight, could help demonstrate how such systems might function in practice.

*Intergenerational equity*

A final theme raised by several interviewees (e.g., P2, P5, P11) concerns the temporal distribution of grid investment costs and the principle of intergenerational equity. Concentrating the financial burden on current users, particularly through rising fixed tariffs, was seen as potentially unjust and counterproductive. Interviewees warned that poorly coordinated or premature investments risk creating stranded assets, leading to inefficient use of public and private capital and undermining public support for the energy transition. To mitigate these risks, Alliander stakeholders emphasized the need for financing mechanisms that spread infrastructure costs more evenly over time. Instruments such as green bonds or public loans could align the timing of investments with the long-term societal value they generate, easing pressure on today's users. Additionally, several interviewees advocated for investment appraisal methods that include not only technical efficiency, but also social and ecological value, ensuring that grid decisions contribute to sustainable and broadly supported outcomes.

Avoiding overbuilding was seen as key to long-term equity. Stakeholders stressed the importance of demand-side strategies—such as energy efficiency, flexible consumption, and user education—to reduce grid strain without constant expansion. Investments in decentralized and community-owned energy systems were also highlighted as a means to build resilience, empower local actors, and ensure that the energy system evolves in a way that is fair and future-proof.

## 6.2 Strategic partnership and ecosystem collaboration

In addition to internal reforms and policy advocacy, Alliander's contribution to a just energy transition in Arnhem depends significantly on its ability to collaborate effectively with other actors in the energy ecosystem. As a DSO, Alliander does not operate in isolation. Its infrastructure decisions intersect with the responsibilities of municipalities, housing corporations, civil society organizations, and residents. Strategic partnerships are therefore essential for aligning technical planning with social needs and for ensuring that vulnerable groups are not left behind in the energy transition. Interviewees from both within and outside Alliander emphasized the importance of deepening and broadening these collaborations. Internally, interviewees described Alliander's evolving role as one that must go beyond infrastructure delivery to include active engagement in local governance and social innovation. Externally, interviewees stressed that Alliander's partnerships are essential for reaching vulnerable groups and ensuring that the benefits of the energy transition are distributed fairly.

**Collaborating with municipalities and housing Corporations**

The strategic partnership between Alliander and the municipality of Arnhem was frequently cited as a promising model. P16 described this collaboration as a "field lab" for experimenting with new approaches to energy planning that integrate social, spatial, and technical dimensions. Through joint pilots, such as the Saksen Weimar project, where solar energy is shared between homeowners and renters, Alliander and the municipality are testing how decentralized, community-owned systems can reduce energy poverty and increase local resilience. However, several interviewees noted that these partnerships are not yet systematic or sufficiently scaled.

However, several interviewees noted that these collaborations are often ad hoc and not yet embedded

in Alliander's core planning processes. P13, for example, emphasized that while Alliander is involved in many promising pilots, these initiatives are rarely scaled or institutionalized. To address this, Alliander should move toward long-term, structured partnerships with municipalities and housing corporations. This means co-developing area-based strategies that integrate technical, social, and spatial planning from the outset. By aligning infrastructure investments with municipal heat transition visions and neighborhood development plans, Alliander can ensure that its grid decisions support broader societal goals.

Another key area of collaboration lies in supporting community-based initiatives. The Energiebank Arnhem, which was originally initiated by Alliander, is a powerful example of how DSOs can enable local responses to energy poverty. As P8 explained, the Energiebank's strength lies in its ability to build trust with residents—something that large institutions often struggle to do. Through coaching, material support, and neighborhood engagement, the Energiebank reaches households that are otherwise invisible in the energy system. Alliander's continued support for such initiatives through funding, data sharing, and technical assistance can significantly enhance their impact. To deepen this support, Alliander should consider creating a dedicated partnership framework for community organizations. This could include simplified funding mechanisms, access to technical expertise, and joint evaluation tools. By lowering the barriers to collaboration, Alliander can help scale grassroots innovations and ensure that they are integrated into the formal energy system.

In addition to bilateral partnerships, Alliander can also play a convening role within the regional energy ecosystem. Several interviewees (e.g., P6, P10) suggested that Alliander is well-positioned to bring together municipalities, housing associations, NGOs, and resident groups to co-create strategies for equitable energy access. Hosting regional energy justice forums, for example, would allow stakeholders to share knowledge, align priorities, and develop joint solutions. These forums could also serve as platforms for participatory governance, giving voice to communities that are often excluded from technical and policy discussions. To support these collaborative efforts, Alliander must also improve how it shares knowledge and data. As P9 and P11 noted, while Alliander holds valuable insights into grid capacity, congestion, and investment planning, this information is often inaccessible to non-technical partners. Translating technical data into actionable knowledge—through maps, dashboards, and plain-language reports—would empower municipalities and community organizations to make informed decisions and advocate for their needs.

Finally, all of Alliander's partnerships should be guided by a clear commitment to justice. This means prioritizing collaborations that serve vulnerable communities, support collective ownership models, and promote long-term sustainability. As P16 put it, "We don't just need more infrastructure—we need infrastructure that works for everyone." By embedding justice criteria into the selection and evaluation of collaborative projects, Alliander can ensure that its partnerships contribute meaningfully to a fair and inclusive energy transition.

In conclusion, strategic partnerships are not a peripheral activity for Alliander—they are central to its mission in the energy transition. By investing in long-term relationships, supporting community initiatives, convening diverse stakeholders, and centering justice in its ecosystem strategy, Alliander can help build an energy system that is not only technically robust but also socially inclusive and democratically governed.

## 6.3 Strategies for organizational change within Alliander

While Alliander operates within strict legal and regulatory constraints, meaningful contributions to a just energy transition must also come from within. Internal practices, ranging from how the company communicates, who it engages with, and the expertise it prioritizes, have a significant impact on how equitable and inclusive its role in the energy transition truly is. Several interviewees, both internal and external, emphasized that organizational change is not only possible, but essential. This section outlines practical strategies for embedding energy justice principles within Alliander's internal operations and culture.

*Rethink communication: From technical to inclusive*

A key area in need of reform is communication. As highlighted in Section 5.4, several interviewees criticized Alliander's communication practices for being overly technical, bureaucratic, and poorly attuned to the needs of diverse communities. This mode of communication creates structural barriers to participation—especially for residents with low literacy, limited digital skills, or language barriers. The technocratic nature of much of Alliander's outreach not only undermines procedural justice, by limiting opportunities for meaningful involvement, but also fails to recognize the diversity of lived experiences across Arnhem's neighborhoods. To address this, Alliander must adopt more inclusive and accessible communication strategies. One interviewee suggested developing plain-language materials and offer multilingual support tailored to local communities (including translations into commonly spoken languages such as Turkish and Arabic). Another suggestion to address information to citizens more clearly would be by expanding the use of visual tools such as infographics, animated videos, and neighborhood-specific maps. Furthermore, communication should not rely solely on digital channels. In neighborhoods with low digital access, residents should be proactively informed about grid developments, delays, or changes via SMS, WhatsApp, physical bulletins, or in-person visits. Piloting a multilingual helpdesk or chatbot could also support more equitable access to information and reduce institutional distance between the DSO and the public.

*Local presence and engagement*

Another central concern relates to the spatial and relational presence of Alliander in communities. The company already employs gebiedsregisseurs (regional coordinators), whose primary role is to align municipal and regional energy planning with grid infrastructure. While these coordinators provide valuable technical and strategic expertise to local governments, their engagement is often confined to institutional actors. As interviewees such as P10 and P16 observed, residents (especially those living in energy poverty or in areas facing infrastructure bottlenecks) remain largely excluded from these dialogues. Strengthening procedural and recognition justice requires that the role of gebiedsregisseur be reimagined and also include the role of a community facilitator. This would entail training coordinators in participatory methods, cultural sensitivity, and inclusive communication, as well as expanding their responsibilities to include structured engagement with local residents. Alliander could establish neighborhood-level energy hubs or desks in collaboration with trusted local actors such as housing associations, community centers, and organizations like the Energiebank. These hubs could serve as accessible, face-to-face contact points where residents receive tailored advice and support. In addition, Alliander should actively participate in local events—such as street markets or school fairs—to build informal relationships, foster trust, and raise awareness of energy issues. Over the long term,

a dual-track model could be adopted, in which one track maintains strategic alignment with municipalities and another focuses specifically on community facilitation, dialogue, and co-creation.

*Workforce diversity*

Few interviewees described internal culture and expertise also as critical areas requiring change. Interviewees consistently described Alliander as a technically proficient yet socially limited organization. Its internal knowledge base, while strong in engineering and regulatory matters, lacks sufficient integration of social expertise. This creates blind spots in recognizing the needs, capacities, and vulnerabilities of specific population groups. To bridge this gap, Alliander should proactively diversify its workforce by recruiting professionals with backgrounds in social work, anthropology, community organizing, or intercultural communication. Such diversity is not merely symbolic; it is essential for designing and implementing infrastructure that is both socially responsive and contextually appropriate. Furthermore, decision-making teams should also reflect the demographic diversity of the communities they serve to ensure that a wider range of experiences and perspectives inform key choices. Furthermore, meaningful organizational transformation requires structured reflection and institutional learning. Several internal interviewees described Alliander as "consciously incompetent" when it comes to social engagement—aware of its shortcomings but uncertain about how to overcome them. Good intentions, however, are not sufficient. Alliander should establish a dedicated unit for social innovation tasked with experimenting with new forms of co-creation, neighborhood-based planning, and inclusive governance. Regular cross-departmental reflection sessions could help align values, identify institutional blind spots, and share emerging practices. Internal champions of justice-oriented work should be empowered with time, visibility, and resources, and organizational silos—especially between legal, technical, and social domains—should be dismantled in favor of cross-functional collaboration and shared objectives.

*Scaling pilot projects*

Pilot projects and innovations present a further opportunity to embed justice into organizational practice. Alliander has already initiated several promising experiments—such as its policy on socially sensitive disconnection and its participation in the energy-sharing project in the Saksen Weimar neighborhood. However, as interviewees like P13 and P16 pointed out, these initiatives often remain isolated, insufficiently evaluated, and rarely scaled. A more systemic approach is needed. Pilots should be prioritized in disadvantaged or underserved areas, not only to meet urgent needs but also to test innovations under conditions of social vulnerability. These pilots must be co-designed with residents themselves, employing participatory methods such as citizen panels, workshops, or deliberative forums. Evaluation metrics should extend beyond technical feasibility to include measures of social impact, equity, and community satisfaction. Crucially, outcomes—whether successful or not—should be published transparently to facilitate learning both within and beyond the organization.

*Building the grid ethical and sustainable*

Ethical and sustainable operational practices are another vital component of just organizational change. Several interviewees, including P4 and P6, emphasized that Alliander must not only support the energy transition but embody its ethical foundations. This means planning infrastructure not solely on the basis of projected demand or pressure from vocal stakeholders, but with a view toward long-

term societal value. For example, new infrastructure could be designed as multifunctional assets—such as transformer stations that double as green spaces or community meeting areas. Investment decisions should incorporate formal social impact assessments alongside technical and financial evaluations. Moreover, Alliander should apply circular procurement principles and prioritize suppliers that adhere to high environmental and labor standards, thereby aligning its supply chain with broader goals of justice and sustainability.

**Generalizability and local specificity**

The strategies outlined in this chapter combine both generalizable approaches relevant to all Dutch DSOs and context-specific recommendations tailored to Alliander's operations in Arnhem. Section 6.1, focusing on policy advocacy and lobbying for a just energy transition, presents principles and actions that are broadly applicable across the national landscape. All DSOs in the Netherlands face similar regulatory environments and societal challenges, making coordinated advocacy for equitable policies a shared responsibility. Similarly, the emphasis on transparent data sharing and embedding justice criteria in infrastructure planning offers a blueprint for DSOs countrywide.

In contrast, Sections 6.2 and 6.3 emphasize strategies that are grounded in the particular socio-technical context of Arnhem and Alliander's organizational structure. The detailed examples of Alliander's partnerships with the municipality of Arnhem, housing corporations, and community organizations such as Energiebank Arnhem illustrate a localized "field lab" approach, which is shaped by the city's demographic diversity, social vulnerabilities, and existing governance frameworks. While these partnerships are context-dependent, the underlying lesson, which is that DSOs must engage deeply and systematically with local stakeholders to ensure socially inclusive outcomes, has clear relevance for other DSOs. The establishment of neighborhood-level engagement, the redefinition of internal roles (e.g., gebiedsregisseurs as community facilitators), and the push for internal organizational change to prioritize social expertise, reflect challenges and opportunities that resonate nationally.

Therefore, while Arnhem-specific initiatives offer concrete models and best practices, they also signal a broader imperative for DSOs across the Netherlands to adopt multi-scalar approaches: combining national policy engagement with tailored local collaboration and internal transformation. This dual focus enables DSOs to navigate the complex intersections of technical infrastructure and social justice, ensuring that the energy transition is both efficient and equitable throughout the country.

# 7. Discussion

This chapter reflects on the key findings of the research and situates them within the broader academic and societal context of the energy transition. It explores how the empirical results relate to the theoretical framework of energy justice and examines the implications for the role of DSO, in enabling a just energy transition at the municipal level. The discussion also addresses the tensions and trade-offs that emerge when balancing technical efficiency with social equity, and describes the importance of perceptions of justice in shaping public trust and participation. The chapter is structured as follows: Section 7.1 discusses the main results and their interpretation; Section 7.2 outlines the scientific and societal contributions of the study; Section 7.3 reflects on the limitations of the research and proposes directions for future inquiry. Finally, section 7.4 provides a reflection on this thesis as a whole.

## 7.1 Discussion of the results

This section reflects on the findings of the study, interpreting them through the lens of the energy justice framework and situating them within the broader context of the Dutch energy transition. It also addresses the inherent tensions, limitations, and lessons learned from the case of Arnhem, particularly regarding the role of Alliander as a DSO.

*Interpreting injustices*

The results show that injustices in Arnhem's energy transition are strongly interconnected across distributional, procedural, and recognition justice. Shortcomings in one dimension often reinforce others: for example, limited transparency in grid planning (procedural) excludes low-literacy or non-Dutch speakers (recognition), which in turn restricts their access to sustainable technologies (distributional). This confirms literature findings (Jenkins et al., 2016; Schlosberg, 2004) and is evident in cases such as prioritizing grid expansion in high-adoption neighborhoods while neglecting vulnerable areas.

Consistent with Section 2.4, the analysis distinguishes between inequality and injustice. Disparities only become unjust when they breach widely shared fairness norms and are recognized as such (Pesch & Van Uffelen, 2024). In some cases like regressive grid tariffs, stakeholder perceptions aligned, indicating broad normative consensus. In others cases like the "first-come, first-served" model for small consumers, interpretations diverged. Some saw it as a neutral and efficient allocation mechanism, while others viewed it as structurally privileging already advantaged households. These contested interpretations illustrate the role of social norms, institutional framing, and positionality in shaping whether an inequality is perceived as unjust. Furthermore, this research examined both measurable disparities and perceived injustice, finding that perceptions are often as influential as objective inequalities in shaping trust, engagement, and resistance. While direct resident interviews were not conducted, spokespersons and professionals working closely with affected communities consistently reported that many residents, especially in low-income areas or with limited digital access, feel disconnected from decision-making. This disconnection is driven less by formal exclusion than by inaccessible communication, digital-only processes, and top-down planning.

These perceptions are shaped by comparison. Seeing wealthier neighbourhoods electrify faster, pay lower tariffs, and access subsidies fosters a sense of relative deprivation, where the injustice lies not only in one's own disadvantage but also in others' visible gains. Such perceptions reinforce distributional grievances and can erode the legitimacy of the transition if unaddressed. This confirms the literature's view that procedural and recognition justice are essential to ensuring that technical fairness is also socially accepted (Fraser, 2009; Walker & Day, 2012). Alliander's initiatives such as regional coordinators and pilot projects are promising, but the findings suggest a need for simpler communication, multilingual outreach, face-to-face engagement, and genuine co-creation to bridge the gap between system design and lived experience. Overall, the findings confirm the literature's view that addressing injustices requires action across all three dimensions simultaneously. Isolated interventions risk perpetuating other forms of injustice, underscoring the need for integrated strategies in line with the holistic approaches advocated by Sovacool et al. (2017) and McCauley et al. (2019).

*Speed vs Justice*

Furthermore, one of the most prominent tensions emerging from this research is the conflict between the urgency of the energy transition and the need for justice and inclusivity. On the one hand, the Netherlands and Europe more broadly face a pressing need to reduce dependence on fossil fuels, particularly natural gas from Russia and domestic extraction in Groningen, which has caused significant environmental and social harm. As one interviewee noted, the motivation to move away from Russian gas and Groningen gas is strong, and therefore there is an urgent need to accelerate the energy transition. This geopolitical and environmental urgency adds pressure to accelerate the transition at all costs. However, this urgency often clashes with the slower, more deliberate processes required to ensure that the transition is fair, inclusive, and socially sustainable. Justice takes time: time to engage communities, time to design equitable policies, and time to build trust with marginalized groups. The findings from Arnhem show that when the transition is rushed, it might tend to favor those who are already well-resourced like homeowners, early adopters, and high-income households while leaving behind renters, low-income families, and those with limited digital or linguistic access.

This creates a fundamental dilemma. How can we move fast enough to meet climate and geopolitical goals without reproducing or deepening social inequalities? The answer is not necessarily to slow down the transition but to rethink how speed and justice can be aligned. For example, rapid deployment of infrastructure can be paired with targeted support for vulnerable groups. Investments in grid expansion can be guided not only by demand forecasts but also by social need. New technologies can be introduced in ways that prioritize accessibility and affordability.

*Dilemmas and trade-offs in the energy transition*

A central insight from this research is that the pursuit of a just energy transition is not a matter of simply identifying the "right" or "wrong" policy. Rather, it involves navigating a landscape of complex dilemmas, where every solution carries potential downsides. Justice in this context is not absolute, but is negotiated, contextual, and often involves difficult trade-offs between competing values such as affordability, efficiency, speed, and inclusivity. Take, for example, the case of district heating. While it is often promoted as a sustainable and collective alternative to individual gas boilers, its financial viability depends on achieving a critical mass of connected households. This often leads to mandatory connection policies, especially in social housing blocks. Yet, this obligation can undermine consumer

autonomy and disproportionately affect low-income tenants who may face higher costs without the ability to opt out. If connection were voluntary, the system might not be financially sustainable, leading to even higher prices or project failure. Thus, what appears as a procedural injustice (lack of choice), may be a necessary condition for economic feasibility.

Similarly, grid investment strategies based on projected demand are designed to be technically neutral, avoiding discrimination by excluding socioeconomic variables. However, this neutrality can produce unequal outcomes. Wealthier neighborhoods, which adopt technologies like EVs and heat pumps earlier, generate higher forecasted demand and are therefore prioritized for upgrades. This creates a feedback loop where those already ahead continue to benefit, while others fall further behind. Including social vulnerability in investment models could improve equity, but it also raises questions about fairness, feasibility, and regulatory compliance. Even well-intentioned reforms like time-of-use tariffs or dynamic pricing introduce new dilemmas. While they aim to make grid usage more cost-reflective and efficient, they can disadvantage people with inflexible energy needs, such as shift workers, families with medical equipment, or those in poorly insulated homes. Similarly, promoting electrification through subsidies benefits those who can afford upfront investments, while renters and low-income households may be left out, despite contributing equally to grid costs.

These examples show that energy justice is not a checklist of solutions, but a process of balancing competing priorities. Every intervention whether technical, financial, or institutional has ripple effects that may benefit some while disadvantaging others. Acknowledging these tensions is not a sign of failure, but a necessary step toward more thoughtful, inclusive, and adaptive policymaking. It also underscores the importance of transparency, participation, and continuous learning in the governance of the energy transition.

*Reflecting on the Bigger Picture*

Taking a step back, the findings from Arnhem reveal systemic patterns that extend far beyond the local context. The energy transition is not merely a technical transformation but is a societal reconfiguration. Decisions about where to invest, who gets grid access first, and how infrastructure is priced are inherently political. They shape who benefits from the transition and who bears its costs. While DSOs are formally tasked with neutral infrastructure provision, they are deeply embedded in these dynamics. On paper, DSOs are infrastructure providers with limited formal responsibility for social outcomes. In practice, however, their decisions have profound social implications. This creates a tension: Alliander is expected to remain neutral and cost-efficient, yet also contribute to a fair and inclusive transition. Some stakeholders argued that “DSOs can’t do anything” due to regulatory constraints. Others insisted that “DSOs must do more,” pointing to Alliander’s unique position between government, market, and society. The truth lies somewhere in between. While legal and institutional barriers do exist—such as the prohibition on owning storage or offering differentiated tariffs—DSOs still have room to maneuver. They can advocate for policy change, support community initiatives, and design infrastructure in ways that reflect social priorities. The pilot on social disconnection policy is a case in point. It shows that even within existing constraints, DSOs can innovate and collaborate to reduce harm and promote justice. The challenge is to move from isolated pilots to systemic change.

Globally, these dilemmas are echoed in other energy transitions. In the United States, utilities face scrutiny over how grid upgrades affect low-income communities. In the UK, debates around fuel poverty and heat networks mirror concerns raised in Arnhem. In the Global South, the challenge is often one of access rather than transition—but the underlying question remains: who gets to benefit from energy systems, and who is excluded? The findings from Arnhem contribute to this global conversation by showing that even in a well-resourced, highly regulated country, energy transitions can reproduce inequality if justice is not made a central concern. They also highlight the potential of DSOs to act as bridging institutions entities that connect technical systems with social realities and help translate abstract justice principles into concrete infrastructure decisions.

*The role of the DSO*

The findings also raise a strategic question about institutional responsibility: to what extent should energy justice be embedded within the mandate and daily operations of a DSO, given that this could increase costs and add layers of organisational complexity? As discussed in Chapter 4 and in the literature (Brisbois, 2020; Lovell, 2019), DSOs operate under a mandate focused on technical reliability, safety, and regulated cost-efficiency, with limited authority to redistribute costs or directly address socio-economic inequalities. Expanding their role could enable more equitable outcomes, such as prioritising connections in vulnerable areas or adjusting tariffs to support low-income households, but may also challenge regulatory neutrality and risk shifting the financial burden onto all consumers.

Alternatively, municipalities, with their democratic legitimacy and proximity to residents, may be better placed to address recognition and procedural justice. Yet, as seen in Arnhem, their capacity to influence grid-related distributional outcomes is limited without close cooperation from the DSO. This raises the possibility that a hybrid model, in which the DSO integrates justice considerations into technical planning while municipalities and other actors lead on social outreach and co-creation, may offer a more balanced approach. The results do not point to a single “correct” allocation of responsibility; rather, they suggest that the effectiveness of any model will depend on context-specific factors such as regulatory flexibility, local capacity, and the strength of inter-organisational collaboration.

## 7.2 Scientific contribution

This thesis contributes to the academic and practical understanding of energy justice by exploring the role of DSOs in shaping equitable energy transitions at the municipal level. Through a case study of Arnhem and the activities of Alliander, the research offers insights that are relevant to scholars, policymakers, and practitioners alike.

**Scientific Contribution**

This thesis contributes to the growing academic discourse on energy justice by empirically and conceptually extending the role of DSOs in shaping just energy transitions at the municipal level. While most existing literature focuses on governmental policies, market mechanisms, or citizen initiatives, the role of DSOs has remained underexplored in energy justice debates. This thesis addresses this gap by conceptualizing the DSO not only as a technical actor but also as an institutional gatekeeper that can either enable or hinder justice outcomes through infrastructure choices, tariff design, and stakeholder engagement. This thesis enriches the operationalization of energy justice by providing a

detailed, context-specific indicator framework for evaluating justice in the Dutch municipal context and to the role of a DSO. It adapts abstract justice concepts into actionable indicators—such as grid access, cost distribution, freedom of choice, recognition in planning, and participatory governance—thereby advancing methodological tools for future empirical research on energy justice at the local scale.

**Societal Contribution**

Beyond its academic contributions, this thesis offers important insights into urgent societal challenges related to energy poverty, infrastructural inequality, and public trust in the energy transition. With over 600,000 households facing energy poverty and widespread delays in grid access, the societal stakes of equitable energy governance are high. By centering the experiences of vulnerable groups in Arnhem and amplifying their exclusion from sustainable technologies, affordable energy, and decision-making processes, this study brings justice concerns to the forefront of infrastructure policy.

Furthermore, while focused on Arnhem, the findings are transferable to other Dutch municipalities facing similar tensions. The research offers context-sensitive yet generalizable lessons on how localized energy justice can be co-produced through meaningful collaboration between DSOs, municipalities, civil society, and regulators. In this way, the thesis contributes to an emerging model of participatory, socially responsive energy governance that supports both climate goals and social inclusion.

**Practical Contribution**

From a practical perspective, this thesis offers actionable recommendations and strategic insights for DSOs, policymakers, and local governments seeking to operationalize energy justice. These contributions are particularly timely given the rapidly increasing urgency of grid congestion and public concerns over rising network tariffs and energy inequality.

For DSOs like Alliander, the research identifies several concrete entry points to strengthen their role as agents of justice:

- Invest in organizational capacity for justice-oriented planning: Create cross-disciplinary teams that integrate social science insights, citizen engagement, and data-driven equity analysis into network planning.
- Improve transparency and fairness in connection procedures: Develop and communicate clear criteria for grid access prioritization that include socio-economic and spatial equity considerations.
- Advocate for differentiated tariff models: In collaboration with ACM and municipalities, explore time- and location-based tariff structures that protect low-income users while enabling flexibility and investment.
- Strengthen partnerships with local actors: Work closely with municipalities, housing corporations, and energy cooperatives to align infrastructure planning with social policy goals, particularly in vulnerable neighborhoods.

For municipalities, the research underscores the importance of coordinated governance and strategic use of their convening power. Municipalities can:

- Strengthen their coordination roles by facilitating integrated transition planning across electricity and heating domains. This includes aligning technical, financial, and social

objectives across different levels of government and sectors, and ensuring that the specific needs of various residential and commercial user groups are adequately represented in long-term infrastructure strategies.

- Institutionalize participatory planning processes, ensuring that co-creation with residents, particularly from underrepresented groups, is embedded in early-stage infrastructure design and policy development. Build internal capacity to critically engage with DSOs and market actors, using justice-based indicators to evaluate proposed investments, planning frameworks, and community impacts.

For national regulators and policymakers, particularly ACM and the Ministry of Economic Affairs and Climate Policy, this research signals a need to revisit the institutional design of the energy system:

- Reconsider the strict separation between market actors and public infrastructure. Allowing DSOs to temporarily own or facilitate community batteries or smart technologies in underserved areas could significantly accelerate just outcomes.
- Revisit existing tariff structures to enhance affordability and flexibility. As explained in chapter 5.1.3, the current energy tariff model is regressive and undermines distributive justice in the energy transition. Regulators should explore the implementation of progressive, time-of-use, and location-sensitive tariff schemes that better reflect users' ability to pay, promote efficient grid use, and reduce the financial strain on vulnerable groups.
- Scale up and institutionalize successful pilot projects, such as the social disconnection policy, and embed these practices into national energy poverty strategies.

Taken together, these practical recommendations support a shift from reactive, compliance-driven infrastructure development toward proactive, justice-oriented governance. They offer a roadmap for how DSOs and their partners can serve not only as stewards of technical systems, but also as facilitators of social equity in the energy transition.

## 7.3 Limitations and future research

This research has aimed to explore the role of the DSO in enabling a just energy transition in Arnhem, but like any study, it comes with its limitations. One of the most significant is that not all relevant actors were included in the empirical work. While the interviews covered a broad range of institutional stakeholders—from Alliander and the municipality to ACM and civil society—some key voices were missing. In particular, housing corporations and local NGOs, which are deeply involved in the practical implementation of energy measures and often work closely with vulnerable households, were not interviewed. Their absence means that certain operational and community-level insights may not have been fully captured. Furthermore, the study did not include direct conversations with residents themselves. Although several interviewees spoke on behalf of communities or shared their impressions of how residents experience the energy transition, these are still second-hand interpretations. Without first-hand accounts, it is difficult to fully grasp how people perceive fairness, exclusion, or participation in their own words. This is especially relevant in neighborhoods where energy poverty is most acute, and where trust in institutions may already be fragile. Finally, the study was conducted during a period of ongoing policy change. Several developments such as the introduction of societal prioritization frameworks and reforms to grid tariffs were still in motion at the

time of writing. As a result, the findings reflect a particular moment in time and may not capture the full impact of these changes as they unfold.

Looking forward, there is a clear need for future research to build on these findings in several ways. First, by including the perspectives of residents, especially those living in energy poverty or in neighborhoods facing grid constraints, researchers can gain a deeper understanding of how justice is experienced on the ground. This could involve ethnographic studies, participatory action research, or community-based surveys that capture lived experiences, perceptions of fairness, and barriers to participation. Second, engaging more systematically with housing corporations, energy cooperatives, and NGOs would help to fill in the picture of how justice is negotiated and implemented in practice. Future research could examine how these organizations interpret and apply energy justice principles, and how their roles evolve in response to changing regulatory and infrastructural conditions. Third, future studies should consider expanding the scope to include justice across the entire energy value chain, from raw material extraction to end-use. This broader lens would allow researchers to examine global and intergenerational dimensions of energy justice, including labor conditions, environmental impacts, and supply chain ethics. Finally, it would be valuable to follow justice-focused projects over time, such as community energy pilots, tariff reforms, or inclusive planning models, to see how effective they are, whether they can be scaled up, and what unintended effects they might have.

## 7.4 Reflection

Looking back on the entire research process, I can confidently say that the methodological choices I made were largely effective in achieving the goals of this thesis. The qualitative, single-case study design allowed for a deep and context-rich exploration of energy justice in Arnhem, and the internship at Alliander provided unique access to stakeholders and internal documents that would have otherwise been difficult to obtain. This embedded position not only facilitated data collection but also helped build trust with participants, resulting in candid and insightful interviews.

At the outset, I expected the single-case design to yield findings that were primarily transferable rather than generalizable, as stated in Chapter 3. I assumed the results would be strongly tied to Arnhem's local context and its governance structures, socio-economic profile, and specific stakeholder constellation. Yet, the final analysis revealed that most recommendations apply well beyond Arnhem. This is largely because DSOs operate under national regulation and maintain consistent technical practices across their service areas, meaning that many observed dynamics and proposed strategies have relevance for other municipalities. The only truly localized element was the set of actors interviewed. This realization has shifted my view of the DSO's role. Initially, I saw the DSO primarily as a technical operator whose influence on justice was limited by its mandate. Through this research, I came to see that the DSO, even within regulatory constraints, can meaningfully shape fairness outcomes—especially in how it allocates scarce grid capacity, communicates with diverse communities, and collaborates with local actors. I learned that energy justice in infrastructure planning is not just a municipal responsibility, nor solely a DSO's task, but emerges from coordinated action across multiple actors. This insight has deepened my understanding of the socio-technical nature of the energy transition and will inform how I approach similar challenges in the future.
If I were to repeat the research, I would retain the single-case design but incorporate comparative elements earlier, such as engaging stakeholders from other municipalities or DSOs, to test the

general applicability of findings from the outset. I would also prioritize direct engagement with residents, especially those experiencing energy poverty, to capture lived experiences more authentically. While institutional stakeholders provided valuable insights, the absence of resident voices is a gap that future research should address.

Ultimately, this thesis has not only deepened my academic understanding but also strengthened my commitment to shaping energy systems that are both technically sound and socially just.

# 8. Conclusion

This thesis set out to explore the role of a Distribution System Operator (DSO) in enabling a just energy transition at the municipal level, using the city of Arnhem and the network operator Alliander as a case study. The research was guided by the central question:

***What role can a DSO play in enabling a just energy transition at the municipal level?***

To answer this, the study examined how principles of energy justice—distributional, procedural, and recognition-based—manifest in local energy systems, and how infrastructural decisions, tariff structures, and stakeholder engagement practices influence equity outcomes. The research also investigated the institutional and organizational barriers that limit the DSO's ability to act on justice concerns, and identified strategies that could strengthen its contribution to a fairer energy system. This research addressed five sub questions to explore the role of the DSO in a just energy transition.

*Sub-question 1: What are the key principles of energy justice, and how are they operationalized in practice?*

First, the thesis showed that energy justice is not only about fair distribution of costs and benefits (distributional), but also about inclusive decision-making (procedural) and the recognition of diverse needs and identities (recognition). These principles were operationalized through indicators such as access to infrastructure, affordability, participation, and representation. The framework provided a structured lens to evaluate how justice is embedded—or absent—in infrastructure planning, tariff design, and stakeholder engagement.

*Sub-question 2: Who are the key stakeholders in Arnhem's energy transition, and how do they envision the DSO's role?*

Second, the research identified a diverse set of stakeholders involved in Arnhem's local energy transition, including Alliander, the Municipality of Arnhem, the Authority for Consumers and Markets (ACM), Energiebank Arnhem, housing corporations, and civil society organizations. While Alliander is formally tasked with neutral infrastructure provision, most stakeholders emphasized that this neutrality is no longer sufficient. They envisioned the DSO as a facilitator and connector: An actor that bridges technical systems with social realities. Alliander's strategic partnerships and pilot projects were seen as promising, but stakeholders also called for deeper engagement, more inclusive communication, and structural change within the organization.

*Sub-question 3: How do issues of distributional, procedural, and recognition-based injustice manifest in Arnhem's local energy transition?*

Third, the study found that energy injustices in Arnhem manifest in multiple, interconnected ways. Distributional injustices include unequal access to grid capacity, regressive tariff structures, and investment decisions that prioritize demand over need. Procedural injustices are evident in the limited accessibility of information, symbolic participation mechanisms, and the exclusion of marginalized groups from decision-making processes. Recognition injustices arise from the failure to acknowledge diverse energy needs, such as those of renters, migrants, or people with medical conditions. These

injustices are particularly pronounced in low-income neighborhoods and among residents with limited digital or linguistic access.

*Sub-question 4: What institutional, regulatory, or organizational barriers limit the DSO's ability to contribute to energy justice?*

Fourth, the research revealed that Alliander's ability to address these injustices is constrained by a combination of institutional, regulatory, and organizational barriers. Regulatory mandates enforce strict neutrality and cost-reflectiveness, limiting the DSO's ability to prioritize vulnerable groups or experiment with differentiated tariffs. Internally, a technocratic culture and fragmented organizational structure hinder cross-functional collaboration and the integration of social expertise. These constraints reduce the DSO's capacity to engage meaningfully with communities and to embed justice into infrastructure planning.

*Sub-question 5: What strategies or practices could strengthen the DSO's contribution to a just and equitable energy transition at the local level?*

Finally, the thesis identified three key strategies to strengthen the DSO's role in a just energy transition: policy advocacy, collaboration, and organizational change. DSOs can promote equitable tariffs, regulatory flexibility, and data-sharing to support vulnerable groups. Partnerships with municipalities and grassroots initiatives help align infrastructure with social needs, as seen in Alliander's work in Arnhem. Internally, DSOs must simplify communication, diversify staff, and foster cross-department collaboration. Embedding social learning and ethical impact assessments ensures decisions reflect long-term societal value. Together, these practices enable DSOs to move beyond neutrality and actively support inclusive, community-centered energy transitions.

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