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Conceptualizing the Just Energy Transition in Rural Areas: The Case of Germany

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Abstract

Achieving the just transition in rural areas is more than a moral objective; without it, the energy transition is unattainable. A successful shift towards a new energy system rests on rural areas, which provide the land needed to host space-intensive renewable energy infrastructure. Nevertheless, rural regions risk being reduced to 'resource peripheries' serving national climate targets and urban electricity demands while lacking the economic, social, and political power to ensure just outcomes. This discrepancy between local burdens and benefits fuels rural discontent and local resistance, jeopardizing decarbonization efforts and social cohesion. Despite its importance, the just rural energy transition remains conceptually underexplored in academic debates on the spatial implications of the transition. This research, therefore, employs an exploratory empirical case study to develop a spatially conscious conceptual framework. To this end, literature-based theories on energy justice and rurality are subjected to a 'rural reality check', drawing on empirical insights gathered from seven semi-structured stakeholder and expert interviews within the case setting of Germany. The analysis reveals that existing conceptualizations require specific adaptations to capture rural realities. First, it is demonstrated that distributional, procedural, and recognition injustices are best understood as interconnecting rather than isolated dimensions. Second, additional spatial and multi-scalar justice dimensions are needed to uncover numerous points of tension and conflict, as well as underlying core-periphery dynamics. Furthermore, the research validates a newly developed, multi-dimensional framework for conceptualizing rurality in the context of the energy transition. Moving beyond simplistic socio-spatial measures of rurality, it conceptualizes rurality as a relational and temporally dynamic continuum. These cross-cutting principles are complemented by an energy-specific and a perceived rurality dimension. Ultimately, the research results suggest that avoiding spatially blind approaches to the just transition requires bridging these insights from energy justice and rurality.

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Introduction

"The energy transition will not work if rural areas are treated as charity cases. It will succeed if we recognize and reward what they actually do, serving as the key pillar for the expansion of renewables." – Participant 6[1]

"The beginning of a just energy transition is that the people on the ground are really involved in it." – Participant 4

The energy transition refers to the shift from fossil-based energy systems (largely coal, oil and gas) to lower-carbon energy resources, primarily renewable sources such as wind and solar (Yang et al., 2024). This shift is not just a technological, economic, or temporal one; it is also a fundamentally geographical process that reshapes spaces with profound social and economic consequences (Bridge et al., 2013). Furthermore, this process is not uniform; on the contrary, it has the potential to produce highly uneven developments and distributions of costs and benefits across spaces (Bridge et al., 2013), particularly affecting rural areas (O'Sullivan et al., 2020). Indeed, rural areas are at the center of the energy transition. Compared to fossil fuel-based energy systems, renewable energy technologies require significantly larger surface areas due to their lower surface power density, meaning that more land is needed to produce equivalent amounts of energy (Van Zalk & Behrens, 2018). This larger spatial footprint means that renewable energy sources, such as onshore wind, are inherently more decentralized and dispersed, consequently affecting a larger number of people (Germeshausen et al., 2025). Crucially, the large-scale deployment of renewable energy, as planned under current climate commitments, depends on access to land, which is predominantly located in rural areas. At the local level, this can manifest in the uneven siting of renewable energy infrastructure (Cowell, 2009), while at an aggregate level, the energy transition has the potential to rework (Bridge et al., 2013) or perpetuate (O'Sullivan et al., 2020) uneven socio-economic and political distributions of power, opportunity and representation.

[1] All interview quotes in this text have been translated from the original German by the author.

The energy transition unfolds against the backdrop of existing complex socio-economic systems (Hermwille et al., 2023). Within these systems, political, economic and cultural forces are distributed unevenly across geographic areas, creating places of domination, exploitation, and marginalization (O'Sullivan et al., 2020). These system dynamics are precisely captured by the 'core-resource periphery concept'. Resource peripheries are conceptualized as "places of relatively poor economic, social and political power, yet rich in resources" (O'Sullivan et al., 2020, p. 5). Strikingly, resource peripheries often coincide with places of rurality (Fischer-Tahir & Nauman, 2013), more specifically, structurally weak places of rurality (Frankenberg et al., 2025). Based on their frequent peripheral status, rural areas are vulnerable to external domination, particularly by densely populated areas (Naumann & Rudolph, 2020a). Paired with their limited capacity to influence outcomes and decision-making processes (O'Sullivan et al., 2020), this paves the way for significant injustices.

As a consequence of the outlined dynamics and the risk of being reduced to instruments of larger national and international policy goals (Salonen, 2025), the energy transition risks yielding far less positive and just outcomes for rural areas than commonly expected. For example, localized energy projects – made possible through the decentralized nature of renewables – are seen as a promising opportunity to create local benefits while tackling climate change, offering new income streams and potential for new business and job opportunities (Naumann & Rudolph, 2020a). However, decentralized systems are not more inclusive, democratic, or morally superior by virtue of the technology itself, but may replicate (Brock et al., 2021) or even worsen the exploitative and socially detrimental effects of fossil-based systems (O'Sullivan et al., 2020). This establishes the need for an active integration of energy justice principles into transition efforts. The challenge of the energy transition for rural areas is thus not just about the shift to a new energy system, but about ensuring the just distribution of societal costs, risks and benefits throughout, while rebalancing exploitative power dynamics (see Sareen & Haarstad, 2018). In fact, across Europe, rural areas are perceived as carrying a disproportionate and unjust burden of the energy transition, increasing regional discontent (Salonen, 2025). Drawing on a barometer

by the Future of Rural Energy in Europe (2021) and the Eurobarometer[2], it is evident that while 65% of rural citizens support European climate plans[3], 48% think that their national government is not doing enough to ensure a fair green transition. Furthermore, 53% of those living/working in rural areas feel that their views are often unrepresented by the local/national government, or the EU (Future of Rural Energy in Europe, 2021).

Importantly, "perceptions of, and responses to, issues of justice have significant consequences for decarbonization progress. They can slow, or even halt, decarbonization actions" as underscored by Brisbois and Cantoni (2025, p. 1). Already today, perceived injustices cause numerous points of friction and deadlocks, hindering transition efforts (Gürtler, 2023). Furthermore, those experiencing the costs or burdens of the energy transition are increasingly susceptible to right-wing populism (Bosetti et al., 2025), underscoring the vulnerability of right-wing populist parties rising in rural areas, if (perceived) burdens are not mitigated. Ultimately, what is considered just "depends on the perceptions of affected actors and on the ways costs and benefits are distributed, decisions are made, and interests are recognized." (Brisbois & Cantoni, 2025, p. 1) Ensuring a just transition for rural populations thus becomes more than a mere moral objective but a necessity for a successful transition and social cohesion.

Taken together, the critical role of rural areas, their precarious position, and the urgency of addressing both real and perceived justice concerns warrant a deeper exploration into the local realities of a just energy transition. However, as highlighted by Naumann and Rudolph (2020a, p. 10), "'the rural' and rurality, as geographic dimensions of energy, remain largely unexplored." Instead, academic debates on the spatial implications of the energy transition have focused on urban areas, resulting in the notion of 'urban energy transitions' (Naumann & Rudolph, 2020a). One of the experts interviewed for this study highlights that this focus on urban areas is not a unique phenomenon, indeed, *"[...] in many sectors, the approach is fundamentally urban-centric, leaving rural areas to be viewed somewhat as a residual category or a deviation from the norm, with an urban logic essentially being forced upon*

[2] Special Eurobarometer SP527: Commissioned by the EU Commission to measure fairness perceptions of the green transition (European Commission, 2022)

[3] The EU Green Deal

them." (Int. 7, p. 9) In line with this, the *just* rural energy transition remains fundamentally under-explored, consistent with the limited research conducted on the rural transition overall (Naumann & Rudolph, 2020a). However, given the specific characteristics and distinct positioning of rural areas within the energy system, assuming similar principles would be reductionist and analytically flawed. Out of this gap, the following research question develops:

How can the just energy transition be conceptualized for the rural context in Germany?

To tackle this research question and address a significant gap in just transition research, this thesis conducts an exploratory empirical case study. To this end, Chapter 1 outlines the methodological approach and research design, detailing the case selection, data collection, and analysis approach. Accordingly, a twofold approach is undertaken: First, Chapter 2 presents a comprehensive literature review focusing on the Three-Tenet Justice Framework (TTJF) on energy justice (distributional, procedural, and recognition justice) and complementing it with a spatial justice and a multi-scalar dimension. To pay explicit attention to the rural context, further literature is reviewed, specifically on the conceptualization of rurality, to develop a holistic theoretical framework. Second, in Chapter 3, this theoretical framework is applied to the case of Germany, drawing on insights from local stakeholders and expert interviews. By testing whether established academic theories on energy justice and rurality hold up against the lived experiences in rural areas, this application serves as a "rural reality check". Lastly, Chapter 4 presents the discussion and concluding remarks, outlining key takeaways and deep dives into the relationships between justice dimensions and the concept of rurality. Finally, the findings are placed into perspective, discussing opportunities for global transferability and identifying future research directions.

Chapter 1 – Methodological Design and Approach

Research Design

To uncover the intricate dynamics of just energy transitions in the rural context, this study employs an exploratory empirical case study design. A case study is deemed highly suitable because it allows the researcher to develop a holistic understanding of complex social phenomena and gather meaningful information about real-life events (Yin, 2017). The research is designed in two phases: desk research to develop the theoretical framework and an empirical case study to test it.

Desk Research: Theoretical Framework Development

The study relies on extensive desk research to establish the foundational theoretical framework. This involved a targeted literature search utilizing the digital library portals of the Freie Universität Berlin and the Staatsbibliothek zu Berlin (Berlin State Library), as well as academic search engines. The theoretical framework is grounded in academic literature on energy justice, spatial theory, rurality, and territories, as well as intersections with energy transition research. Key academic contributions have been published in prominent journals, including the Journal of Rural Studies, Energy Policy, and Energy Research & Social Science. The resulting theoretical framework is explicitly developed to be tested and validated through the subsequent empirical case.

Empirical Case Study: Case Selection and Setting

Germany was selected as the case setting for both theoretical and practical reasons. Germany is a major industrial nation with an ambitious, legally mandated climate target.[4] However, the energy transition strategy to reach this target produces strong regionally uneven outcomes, producing an uneven distribution of costs and benefits, especially between rural and urban areas. This context presents an ideal opportunity to investigate the just rural energy transition. Focusing on Germany was also a personal and practical choice, given the author's language proficiency, which allowed the interviews to be conducted, transcribed, and analyzed in their original German.

[4] Germany has a Net-Zero target for 2045, 5 years earlier than the EU (Climate Action Tracker, 2025)

Primary Data Collection Methodology

To capture the unique realities of the just transition in rural areas in Germany, this case study relies on primary qualitative data in the form of semi-structured interviews with both local stakeholders and experts. This approach is further motivated by the need to ensure that rural stakeholders can voice their experiences and define their injustices, rather than prescribing an urban-centric perspective, which constitutes an act of recognition justice in itself (Jones et al., 2020).

Sampling

Between January 16th and April 10th, primary data were collected through seven semi-structured interviews conducted online in German by the author (see Table 1). Despite limited time and resources, this research aimed to capture as many different views as possible. Hence, a purposive sampling method was applied to select interviewees based on their ability to represent a larger group of stakeholders. Importantly, participants were selected specifically for their strategic positions, providing them with the necessary perspective to reflect on the broader issues of the rural energy transition.

Table 1

Number of Participants and Their Representation

Number	Representation
1	Regional Municipality
2	Local Municipality
3	Project Developer
4	Civil Society
5	Representative for local action groups and regional development
6	Expert in rural economics & municipal finance
7	Expert in sustainable regional development and spatial justice

Interview Structure and Design

To ensure comparable data, all interviews shared the main topics, with dedicated questions, tailored to the person's background. The two experts received specific questions to facilitate a reflection on the conceptualization of rurality.

Questions for all interviewees (translated):

1. What does the just transition in rural areas mean to you?
2. Why is a just transition especially important in rural areas?
    a) Which injustices have you observed?
3. What makes rural areas special to you?

Additional questions for the expert interviews:

4. What are the practical implications of how rurality is defined?
5. Do you think it makes sense to develop a specific conceptualization of rurality in the context of the energy transition?
6. To what extent do you think the subjective perception of rurality plays a role?
    a) Against this backdrop, do you think it makes sense to incorporate subjective perceptions of rurality more strongly into the conceptualization of rural areas?
7. In your opinion, should "rurality" be considered in isolation or rather in relation to "urbanity"?
8. Would you describe the relationship between rurality and urbanity as a dichotomy or as a continuum?

Transcription

All interviews were transcribed using an online transcription software. To ensure validity and accuracy, the author verified all transcripts against the original audio recordings, manually correcting any transcription errors. The transcripts can be provided upon reasonable request.

Data Analysis

The data analysis was conducted in two parts: Part 1 focuses on the Local Realities of the Just Transition, while Part 2 analyzes the Conceptual Verification of Rurality.

Part 1: Local Realities of the Just Transition

For the reality check of local accounts of the just transition, the analysis draws on the thematic analysis principles of Braun & Clarke (2006), although adapting them to the present context. While adhering to their core phases of data familiarization, coding, and theme development, the approach was adapted to focus specifically on identifying and categorizing justice claims made by participants and coding them according to a predetermined theoretical framework. Thus, rather than taking a fully inductive approach, this study combines it with a deductive layer based on the theoretical framework.

Phase 1 - Data Familiarization

For data familiarization, the transcripts were imported into GoodNotes, a digital note-taking application. After a first read of the data, a second read followed, including highlights and notes on initial ideas.

Phase 2 - Open Coding of Justice Claims

Phase two entailed a systematic coding process in Excel, in which relevant data extracts were open-coded. The initial coding process entailed two iterations and was applied to all 7 data sets. This open-coding phase was conducted to identify and extract specific "justice claims" from the interviews. For this research, justice claims are understood as encompassing:

- **implicit/explicit statements** about current or past injustices, for example: "They built these turbines near us without asking."
- **visions/normative statements** about what makes an energy transition just, for example: "A just transition would mean our village owns the wind turbines, creating local value."
- **descriptive observations** about the perceived reality, even if the person is not directly impacted. For example: "You can see a clear divide; the wealthy landowners are getting richer off wind leases, while the rest have to just look at it."

The number of claims varies considerably across interviews, depending on interview length and the information shared by participants (see Table 2). A detailed breakdown of the coding process and an illustrative example are presented in the following section.

Table 2

Frequency of Justice Claims Across the Interviews

Interview	Number of claims
1	49
2	15
3	28
4	24
5	9
6	18
7	20

Note. Total number of claims 163.

Phase 3 - Applying the Coding Matrix

A key characteristic of this research design is the application of the theoretical framework to the interviews in the form of a reality check. The specific spatial and scalar justice dimensions were used as a post-interview analytical tool during the coding phase, rather than including them in the interview guide (see Data Collection). While this approach facilitates participant-driven insights, it shapes the study's explanatory scope, as the data were interpreted through these theoretical lenses retroactively, rather than probed for during the interviews.

To carry out this analysis systematically, a coding matrix was developed, grounded in the theoretical framework established in this study (see Chapter 1, Part 1 for a detailed explanation). The identified justice claims were mapped across the main elements of the theoretical framework:

First, justice claims were deductively assigned to the tenets of the Three-Tenet Justice Framework to categorize the nature of the claims raised by participants. Interview data were coded based on whether they addressed: Distributive justice, recognition justice, or

procedural justice. Importantly, a justice claim could be coded across multiple justice tenets. Second, justice claims were analyzed for their spatial characteristics and categorized across three spatial dimensions adopted from Gürtler (2023): Core-Periphery, Interterritorial, and/or Infrastructural. Lastly, drawing on an adaptation of Gürtler's scalar dimension, the analysis examined at which governance or spatial level (local, regional, national, supranational) the injustice originated and had its impact, and at which level compensation is expected. Importantly, not all claims had a spatial element and/or fit the scalar dimension. See Table 3 for an example of this study.

Table 3

Sample Coding Matrix

Data extract	Translated summary	Coded for	TTJF	Scalar	Spatial
Wir wollen natürlich schon, dass es eine gerechte Energiewende wird. Und wir wollen auch, das sind unsere Flächen, da leben unsere Bürgerinnen und Bürger. Und wir geben die her, um für den Rest der Republik Strom zu erzeugen oder eben Fossile durch andere Energien abzulösen."	*We want a just transition, we give our lands to produce electricity for the whole country or to stop using fossil energy*	1. Loss of local land for national benefit	Distributional injustice: national benefit and local burden	Original: National (governance); Consequence: Local/regional (spatial)	Core-periphery dynamic: national government dominates rural areas

Note. Example data extract from Interview 1, page 15.

Phase 4 - Searching for Patterns

During the fourth and final phase, patterns were identified within the three tenets of the TTJF. While this process was mainly data-driven, emerging themes are heavily guided by the existing spatial and scalar dimensions.

Part 2: Conceptual Verification of Rurality.

For part two of the reality check, focused on validating theoretical conceptualizations of rurality, a different methodology was applied. Rather than employing a thematic approach and coding individual segments, the interviews, primarily the expert interviews, were utilized for conceptual verification. Specifically, because the primary objective was to validate the pre-established theoretical framework on rurality based on the literature review, the analysis examined the experts' overall evaluations, proposed refinements, and limitations, and directly integrated the derived insights.

Limitations

Multiple limitations of this study must be acknowledged. Given the exploratory nature of this research, the small sample size (N=7) limits the generalizability of the findings, acknowledging that many more diverse actors are present in rural areas and across Germany. Indeed, while the case study is on Germany as a whole, the sample shows a clear geographic concentration, with a majority of participants (4/7) representing the northern and northeastern regions. The remaining interviewees provide valuable perspectives from east and central Germany; however, southern Germany, such as Bavaria, is not explicitly represented. Consequently, while the study draws conclusions relevant to the energy transition in Germany at large, the findings are shaped by this northern/northeastern focus, leaving southern perspectives underrepresented.

Furthermore, while the participants were purposefully selected, each stakeholder role was represented by only one participant. This approach prevented any within-group verification, for example, comparing two members of the civil society or two project developers, to see if they shared similar views. Lastly, because the interview analysis was conducted solely by the author, the findings are subject to individual interpretation and research bias.

Ethical Considerations

Informed consent was obtained from each participant for the recording of interviews and their use in this study. Participant anonymity was ensured throughout the research by redacting any information that could compromise confidentiality.

Chapter 2 – Energy Justice and Rurality: A Theoretical Review

This chapter outlines the first steps toward conceptualizing the just transition in rural areas. By complementing the first part on energy justice theories with a theoretical perspective of rurality in the second part, it establishes a multidimensional theoretical framework tailored to the rural context.

Part 1 – Energy Justice

The starting point of the literature review is the Three-Tenet Justice Framework (TTJF) on energy justice, elaborated by Jenkins et al. (2016). Building on earlier works by Sovacool (2014), Sovacool and Dworkin (2014), Fraser (1999, 2014), and Fuller and Bulkeley (2012), among others, Jenkins et al. (2016) developed the 'new energy justice agenda'. The TTJF distinguishes three moral dimensions: distributional justice (the distribution of burdens and benefits), recognition justice (the recognition of needs and perspectives), and procedural justice (inclusive decision-making practices and procedures).

Next to the TTJF, scholars have developed a multitude of energy justice approaches. For example, Sovacool and Dworkin (2015) outlined principles of energy justice that help evaluate whether a system is just, based on eight predefined criteria including availability, affordability, and due process. Since this framework is designed primarily as a decision-making tool for policymakers and regulators (Sovacool & Dworkin, 2015), it is deemed less suitable for exploring the context-specific inequalities of rural energy transitions. In contrast, the TTJF functions as a diagnostic tool to identify which injustices emerge, how they emerge, and whom they impact (Jenkins et al., 2016).

In more detail, distributional justice concerns the fair distribution of outcomes, opportunities (Gürtler, 2023), and, arguably, risks (Salonen, 2025), as well as associated responsibilities (Jenkins et al., 2016). Recognizing that not all good can be distributed equally (e.g. the location of renewable energy resources), distributive justice includes an argument for fair treatment (Jenkins et al., 2016). Furthermore, this dimension extends to incorporate accessibility issues such as affordable energy, thus moving beyond physical matters to include individual freedoms of choice (Jenkins et al., 2016).

Recognition justice includes both the absence of recognition of diverse vulnerabilities, rights, identities, experiences and forms of knowledge (Van Uffelen, 2022; Gürtler, 2023) as well as their misrecognition, which manifests in the "distortion of people's views that may appear demeaning or contemptible" (Jenkins et al., 2016, p. 7). Examples of recognition injustices include labelling anti-wind farm protests as 'NIMBYism',[5] dismissing them as being based on selfish interests or misinformation, or the lack of awareness among wind farm developers of local cultural identities (Jenkins et al., 2016). On the other hand, justice can be achieved by recognizing the individual needs and rights of communities while acknowledging and respecting their perspectives (Honneth, 2004).

Lastly, procedural justice concerns the equitable and non-discriminatory inclusion of local stakeholders, along with their knowledge and insights, into decision-making processes (Jenkins et al., 2016). The authors outline three mechanisms for procedural justice: local knowledge mobilization, greater information disclosure, and better institutional representation, while Todd and Zografos (2005) highlight the importance of appropriate engagement mechanisms.

Despite its widespread application, the TTJF faces notable critique. A pronounced limitation is its 'silo-sectoral' approach, especially regarding policy application, as "just policymaking requires more than a mere reflection on 'what is just'" (Van Der Kooij, 2025, p. 9). Interestingly, Jenkins herself, alongside other prominent scholars, later acknowledged that isolating the individual tenets can lead to broader systemic effects being overlooked, thus moving to a 'whole systems approach', which maps just transitions across the entire energy supply chain (Abram et al., 2022). Nevertheless, because the original TTJF remains viable for empirical research (Abram et al., 2022), it serves as an ideal foundation for this study. Since one objective of this study is to contrast rural realities with the existing TTJF, the distinct categories (distribution, procedural, recognition) serve as a necessary point of reference. Nevertheless, the TTJF has a fundamental shortcoming. While ideal for evaluating distributional, procedural and recognition injustice, it fails to account for spatial aspects -

[5] NIMBY: not-in-my-backyard

the where - of injustices. Given that the just transition in rural areas has an intrinsic spatial dimension, its absence in the TTJF presents a conceptual gap. To address this, the following section expands the theoretical framework by integrating spatial justice.

Adding a Critical Perspective – Spatial Justice

Within energy justice research, scholars have developed a multitude of critical perspectives next to the TTJF, such as restorative, cosmopolitan, and intergenerational justice (Heffron, 2020; Heffron & McCauley, 2017). Restorative justice, for instance, applies a strong temporal lens by focusing on remedying past harms and preventing future ones (Heffron & McCauley, 2017). However, these frameworks also possess distinct spatial dimensions; cosmopolitan and restorative justice often operate on a macro level, addressing geographical inequities between the Global North and South, or between resource-extracting and energy-consuming regions (Heffron, 2020). While the value of these multi-layered spatial and temporal perspectives is recognized, integrating them would have resulted in an unmanageable level of complexity. Consequently, this study narrows its scope, focusing on spatial dynamics within Germany, particularly urban–rural dynamics, rather than global or temporal injustices.

In the energy context, adopting a spatial perspective means viewing the energy transition not merely as a shift to renewable energy but as a geographical process that shapes places and economic and social activities (Bridge et al., 2013). The need to adopt this focused spatial justice perspective is supported by Banerjee and Schuitema (2023) in their case study of Irish peatlands, which highlights the importance of incorporating a spatial justice perspective when examining the just transition in rural areas. Rural areas are often subject to resource peripheralization and domination by more urbanized areas, as well as to top-down energy policies that exploit their resources rather than meaningfully involving them in decision-making processes. This risks under-recognizing or undervaluing local space-related perspectives and intangible impacts of the energy transition (Banerjee & Schuitema, 2023). Spatial justice further enables the recognition of in(justices) based on the interconnectedness with other (urban) spaces (Madanipour et al., 2021), thus making it a vital element for a differentiated view of rural realities. Ultimately, to obtain an accurate

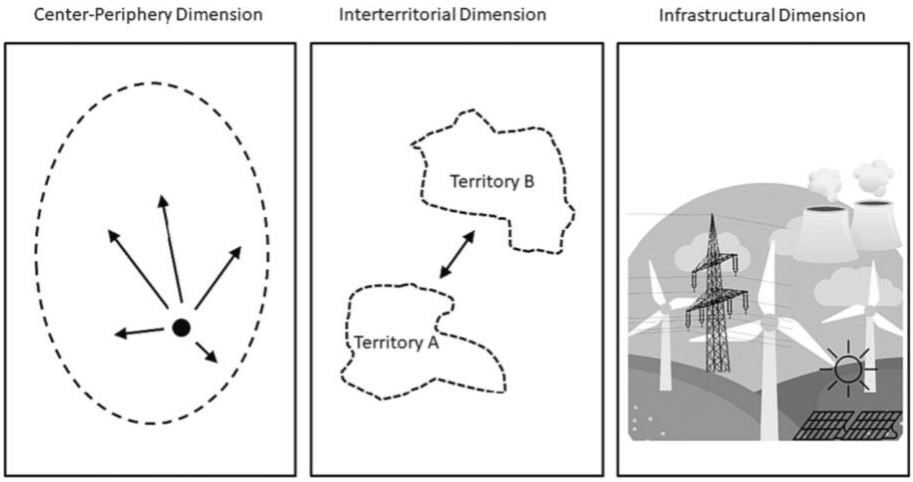
account of local realities in the rural energy transition, it is imperative to complement the existing TTJF with a spatial perspective.

Importantly, spatial justice is not to be viewed separately but rather in combination with the moral tenets of distributional, recognition, and procedural justice. The combination of spatial justice and the moral tenets can be understood as a two-way street. On the one hand, people use geography to explain why a situation is unjust, while on the other hand, they use their ideas of justice to argue how geographies should look like (Gürtler, 2023). For example, rural communities might draw on geography to highlight a distributional injustice: the concentration of wind infrastructure in rural areas compared to urban areas. Conversely, they might argue that planning laws are unjust and should be changed to limit the number of wind turbines and their distance from settlements.

Having established the importance of spatial justice as a complementary critical perspective to the TTJF, the following section draws on the notable contribution of Gürtler (2023), who developed three dimensions of spatial justice (See Figure 1).

Figure 1

Three Dimensions of Spatial Justice



Note. From Gürtler (2023).

The first structural dimension developed by Gürtler (2023) is the Center/Core-Periphery Dimension. Crucially, while Gürtler introduces this concept and highlights its importance, the boundaries between the core and the periphery are not explicitly specified. Hence,

building on the previously introduced core-resource periphery concept (see O'Sullivan et al., 2020), this study develops its own operationalization of the concept. The core-periphery dimension is understood as capturing injustices rooted in dependencies and power asymmetries, based on both spatial concentration and governance authority. The spatial core refers to densely populated urban areas with high energy demand but limited capacity for renewables. At the same time, rural peripheries are the geographical spaces targeted for the development of renewable energy, such as wind turbines. Importantly, the core also refers to where decision-making power is concentrated. This can include centralized governments, as well as private companies and investors located outside the affected rural areas.

Secondly, the Interterritorial Dimension addresses injustices perceived between different territories, such as states, regions, or cities (Gürtler, 2023). This concept focuses on inequalities or injustices between peer-level territories, such as two federal states or two neighbouring villages.

Lastly, the Infrastructural Dimension concerns the meso-level impacts of energy infrastructure, specifically addressing the question: "Which injustices are perceived between areas/places that benefit or suffer from energy infrastructure?" (Gürtler, 2023, p. 7). Importantly, this dimension focuses on intra-rural disparities, considering that not all rural areas experience the transition equally. In this regard, Gürtler's dimension is understood as differentiating between spatial realities, for example, contrasting a community (Area A) that hosts wind turbines and receives substantial financial or structural benefits, with a neighbouring community (Area B) that hosts similar infrastructure yet experiences no such value creation.

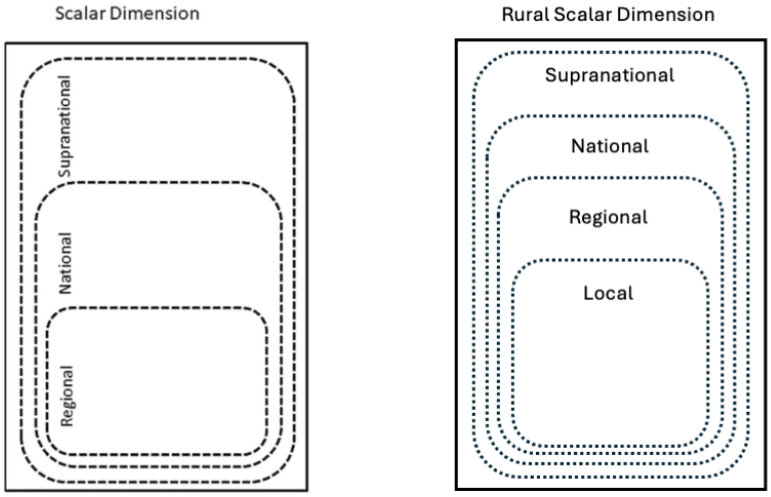
The Scalar Dimension of Justice – Combining Governance and Spatial Scales

In addition to the three outlined spatial dimensions, Gürtler also developed a scalar dimension (see Figure 2a) focusing on the vertical axis of justice claims, to address the questions: "At what scale does the injustice (allegedly) have its origin and its consequence? At what scale is the compensation of the injustice expected?" (Gürtler, 2023, p. 7) While this dimension is deemed highly useful for the present context, adding a layer of depth to the

analysis, Gürtler did not specify what 'scale' refers to. Employing the concept for this study requires clarification. At first glance, Gürtler's dimension could be interpreted as operating along one of two distinct scales: either a governance scale (like the multi-level governance framework of Hooghe & Marks (2003)) or a spatial scale. Whereas governance refers to the decision-making processes, i.e. where decisions are made and by whom (e.g. national governments or investors), spatiality refers to the physical/geographical scope of the injustice. However, in rural reality, these two concepts are equally relevant, often even intertwined, representing two sides of the same concept. For example, an injustice can originate at the national governance level, such as a nationally imposed wind target, while its consequences are felt at the local spatial level, when land is dedicated to and built up with wind turbines. For this study, Gürtler's three levels of regional, national, and supranational are complemented by a fourth, the local level, which is highly relevant for the rural context (see Figure 2b).

Figure 2

Original Scalar Dimension and Adaptation for the Rural Context



Note. a: Scalar Dimension from Gürtler (2023); b: Rural Scalar Dimension adapted from Gürtler (2023).

In summary, this first part of the literature review draws on the TTJF by Jenkins et al. (2016) as its foundation. Recognizing that the energy transition unfolds across geographies, this

study includes spatial justice as an additional perspective. Furthermore, an adapted multi-scalar dimension is incorporated to capture both vertical governance and spatial levels. However, in reviewing the literature, a significant blind spot becomes apparent: the complete absence of what constitutes 'rural' within energy justice frameworks. Consequently, the existing literature offers only a partial conceptualization of the just rural transition. To address this conceptual gap and add this missing component, the following section looks deeper into conceptualizing the 'rural'.

Part 2 – Rural Areas and Rurality

The energy transition is a fundamentally spatial process with significant social, technological, and geographical implications (Bridge et al., 2013). This spatial dimension is particularly relevant for rural areas, as the energy transition dramatically reshapes their role and appearance (Lennon & Scott, 2015; Naumann & Rudolf, 2020a; Naumann & Rudolph, 2020b). However, as the review of the justice literature revealed, the 'rural' in the just rural energy transition is left undefined. This conclusion is supported by Bridge et al. (2013), stating that current discussions of the energy transition often neglect the role of space altogether or make implicit assumptions about its homogeneity.

Conceptualizing rural areas thus presents the essential next step towards broadening our understanding of the just rural energy transition. To understand rural areas in the context of the energy transition, this part shifts from the material importance of rural areas to rurality as a conceptual lens through which these spaces are interpreted. Importantly, the aim is not to establish a new universal definition of rurality but rather to propose a new analytical lens to better understand, conceptualize, and compare rural spaces in the context of the energy transition.

The Importance of Rurality

A review of the energy transition literature reveals that rurality is often treated as a self-evident concept, with limited reflection on its underlying definition (Elden, 2010; Naumann & Rudolph, 2020b). This observation is supported by Cloke (1977), arguing that, like urbanity, the term rurality is frequently used intuitively and habitually rather than being grounded in precise or consistently applied criteria. However, the way rurality is defined and measured

has significant implications for both policy and practice, and consequently for the people living in rural areas (Nelson et al., 2021). The EU defines rural grid cells as any 1 km^2 area that falls outside urban clusters, which require a minimum population density of 300 people per km^2 and a total of 5,000 residents across a group of grid cells. A region is classified as 'predominantly rural' if more than half of its population lives in these rural cells (Eurostat, n.d.). However, spatial inequalities and development trajectories within rural areas cannot be adequately addressed through simplistic categorizations of rurality alone. Despite their limitations, these measures remain the dominant approach to defining rurality (Nelson & Nguyen, 2023).

Recognizing these limitations, earlier work already moves beyond simple demographic definitions towards a socio-spatial approach. Cloke (1997), for example, incorporates labour structure, such as employment in primary rural industries and commuting outside the local authority area, to capture economic structures and spatial interdependences. More recent approaches (e.g., Nelson & Nguyen, 2023) extend this perspective by including rural services (e.g., transport, healthcare, and education), amenities (e.g., recreation, restaurants, and social infrastructure), and relational rurality (population size and density, land-use development, and remoteness).

While these socio-spatial measures of rurality are useful for broad comparisons, they remain insufficient on their own to capture the complexity of rurality, particularly in the context of the energy transition. Rather than replacing them, this study treats them as a necessary baseline for understanding rurality that must be complemented by additional analytical dimensions. This motivates a more comprehensive framework to address current shortcomings.

Reconceptualizing Rurality

Drawing on insights from various academic schools, including geography (e.g. Bridge et al., 2013; Brock et al., 2021; Elden, 2010), health (e.g. Bennet et al., 2019; Weinert & Boik, 1995), and rural studies (e.g. Cloke 1977; Walker, 2022), this section constructs a set of analytical criteria for conceptualizing rurality in the context of the energy transition: (1) Cross-cutting principles, which establish rurality on a continuum - in relation to other (urban) spaces and

as evolving over time; (2) an energy-specific dimension that situates rurality within the context of the energy system; and (3) a subjective dimension, which accounts for the individual perceptions of rurality. Together, the development of these dimensions aims to establish a more differentiated analytical approach to rurality within energy transition research.

Cross-Cutting Principles

An encompassing conceptualization of rurality relies on measuring varying degrees of rurality (Cloke, 1997), moving beyond the implicit assumption that rural areas are homogeneous and subject to the same conditions (Nelson et al., 2021). Consequently, an in-depth understanding of rurality requires evaluating the underlying characteristics that drive a specific area's rurality (Bennet et al., 2019). To capture this multidimensionality in a systematic and comparable way, rurality is best conceptualized as a continuum, rather than reducing it to a rigid rural/urban dichotomy (Ocaña-Riola & Sánchez-Cantalejo, 2005). In this regard, the scientific body agrees that a continuous measure provides a more accurate and nuanced account of reality (Ocaña-Riola & Sánchez-Cantalejo, 2005; Bennett et al., 2019; Cloke, 1997; Walker, 2022). Within this continuum, an area's position is not fixed, but determined by two variable, cross-cutting principles: relationality and temporality.

Relationality

Viewing rurality as a continuum inherently fosters a relational approach, whereby rural areas are not understood in isolation, but in relation to both other rural areas and urban areas (Walker, 2022). Rurality is thus seen as a reflection of ongoing relationships between rural and urban areas that influence flows of human, financial, and physical capital. For example, if a rural area functions as an "energy region" for a neighbouring urban center, its position on the continuum is directly shaped by its spatial interconnection.

Temporality

Lastly, rurality also possesses a crucial temporal component. For example, demographic change, which affects labour markets and residential preferences, shapes spatial structures and relations over time (Callen et al., 2006). Similarly, the energy 'transition' is, by definition, a temporal concept, referring to changes within the energy system over time

within a given space, such as a country or region (Bridge et al., 2013). Over time, these developments may change an area's position on the continuum between rurality and urbanity, underscoring the concept's dynamic properties and, consequently, the necessity for a continuous measure.

Building on the need to capture these diverse 'ruralities', this section establishes relationality and temporality as two cross-cutting principles that underpin a dynamic rural-urban continuum. This presents a first step towards a new conceptualization of rurality that accounts for spatial differentiation and overcomes the reductionist binary view.

Energy Specificity – A New Dimension

Bennett et al. (2019) highlight the context-dependency of rurality conceptualizations based on the area of work being studied. This is further reinforced by Nelson et al. (2021, p.7), who argue that "there is no single index, set of factors, or scale of analysis that is universally appropriate for describing rurality in all locations and for all purposes." Given that this research is situated in the context of the energy transition, it establishes the need for energy-specific indicators. Without incorporating energy-specific dimensions, any attempt at conceptualizing ruralities in the context of the energy transition remains fundamentally incomplete and a comprehensive account requires that ruralities be conceptualized in relation to their position within the energy system. The connection between energy and space is multidimensional; it is not simply a matter of where infrastructure is located but a dynamic relationship that actively shapes energy systems and the energy transition. As outlined by Bridge et al. (2013), the elements of the system are embedded in local contexts while simultaneously producing patterns of connection, dependency, and control across space. Take, for example, a wind turbine: it is not simply located in a rural area but might also be connected to the national and regional electricity grid, shaped by national climate targets and local planning regulations, while producing new dependencies regarding urban electricity demand.

Having outlined these connections between rurality and energy, it becomes clear that conceptualizations of rurality that fail to account for energy-related aspects remain insufficient. Hence, a comprehensive understanding of rural areas requires consideration

of factors beyond geographic or demographic characteristics, including their position within the energy system. This position can be captured through a range of indicators, such as potential for renewable energy, installed capacity, or their functional role as energy producers or consumers within supply networks (see, e.g., Ocaña-Riola & Sánchez-Cantalejo, 2005).

On a deeper level, a context-specific approach may help explain why transition-related differences occur across regions: for example, whether low levels of renewable energy development result from limited resource potential, environmental protection regulations, or local resistance. Similarly, questions such as ownership may be relevant: are wind turbines owned by local communities or external investors? While these dynamics are not exhaustive, they illustrate potential ways in which energy-related characteristics could form an analytical dimension that reveals forms of rural differentiation that, in more conventional approaches, remain invisible.

Perceived Rurality – A New Dimension

While cross-cutting principles as well as the inclusion of energy-specific indicators have been established, according to Bennett et al. (2019, p. 1986) "regardless of the definition, researchers, policymakers, media, and residents frequently ascribe particular attributes to rural and urban areas that might not be representative, inclusive, or even accurate." This observation points to the necessity of incorporating dimensions that extend beyond geographical or spatial characteristics and instead foreground the subjective and perceived nature of rurality. A review of the literature shows that this concern has long been acknowledged. For instance, Lee (1991, as cited in Weinert & Boik, 1995, p. 453) notes that for some, rural means "a place to get away from," whereas for others, it means "a place to get away to", illustrating its diverse and individual meanings. Similarly, Nelson et al. (2021, p. 16) emphasize that rurality is "based on personal perceptions and mindsets as much as it is on any single universal quantitative variable." This perspective is complemented by Gallent and Gkartzios (2019), who underline its subjective, gendered, and culturally contingent nature. Together, these insights support the inclusion of a subjective element when conceptualizing rurality. As highlighted by Bennett et al. (2019), incorporating

perspectives from rural community members, including residents, community leaders, scholars, and advocates, would thus enable a more nuanced and accurate understanding of rurality.

Rurality as a Social Construct

While these individual perceptions are vital, they do not develop in isolation, but shape and are shaped by broader social and political dynamics, highlighting the notion of rurality as a social construct. In this sense, rural spaces are shaped by community agency as well as shared lived experiences, feelings, moral values, identities, and a shared sense of the in-group and the out-group, defining who "we are" and "what we stand for" in relation to others (McQuarrie, 2017; Paasi, 2003). Chigbu (2013) goes so far as defining rural areas as spaces with a culturally defined identity. Importantly, the social construction of rurality is often bound to nature and local environments (Woods, 2003) as well as experiences of marginalization and associated collective emotions and responses (Brock, 2021; Ching & Creed, 1997). Conceptualizing rurality as a social construct is especially relevant in the context of the energy transition, given its capacity to reconfigure existing power relations between spaces while generating new patterns of spatial convergence and uneven development (Bridge et al., 2013). Effectively, the energy transition produces new landscapes, assigns new values to them, and thereby creates differentiated ruralities, resulting in what Bridge et al. (2013, p. 337) describe as "new geographies of winners and losers". Looking more closely at how power relations produce these "winners and losers" of the energy transition, close links to power and ownership are evident. Power, understood as an asymmetrical distribution of resources (Hornborg, 2001), which, in the context of the energy transition, materializes as access and ownership of land and property rights (Brock, 2021). Indeed, as highlighted by McCarthy (2025, p. 1536), "to own or control the land is a necessary condition for owning the sunlight that strikes it," or at least to benefit from the generated electricity.

Furthermore, this uneven distribution of power is a frequent cause of conflict and social resistance. Such conflicts can be understood as ecological distribution conflicts, i.e., struggles over power, inequities and unequal distributions of costs and benefits resulting

from landscape transformation (Martinez-Alier, 2002), which, in the context of the rural energy transition, are related to the development of renewable energy infrastructure. Thus, understanding rurality as a social construct helps frame how energy conflicts in rural spaces are shaped through place-based identities and broader power and ownership dynamics.

In summary, this second part expands the theoretical framework by adding a dedicated perspective on rurality. It is argued that traditional socio-spatial measures remain insufficient for understanding the complexities of the rural energy transition. Accordingly, a new analytical framework is developed, conceptualizing rurality through cross-cutting principles (relationality & temporality), as well as an energy-specific and a perceived rurality dimension.

Chapter 3 – Testing Theories Against Empirical Rural Realities

Building on the previous literature review on energy justice and rurality, the following chapter contrasts the theoretical framework with empirical insights gathered from seven semi-structured interviews. By conducting this 'reality check', this chapter examines how the theory aligns with rural realities in the context of the energy transition. In accordance with the research design, this analysis is split into two, starting with the rural realities of the just transition.

Part 1: Energy Justice in the Rural Context – A Reality Check

Many Burdens, Few Benefits – Distributional Realities

Of the 163 justice claims identified during the interviews, 55% concerned distributional issues, making this the most prominent dimension raised by participants. At its core, these claims center around the unjust distribution of burdens (primarily infrastructure and related consequences) and benefits (primarily local value creation). This core tension was captured by the representative for local action groups and regional development, stating that "*local burdens are only perceived as such as long as they fail to yield an advantage*." (Int. 5, p. 1) For rural areas, however, the burdens are perceived as plenty and the benefits as few. Based on the analysis conducted, five sub-themes of distributional justice emerge: injustices between the local and national levels; core-periphery dynamics causing both north–south and urban–rural divides; and meso- and micro-level impacts of infrastructure.

Local Realities vs. National Targets

"*We want a just transition, [...] we give our lands, the lands of our citizens, to produce electricity for the whole country or to replace fossil fuels.*" (Int. 1) This sentiment, shared by the regional municipality representative, captures a core injustice: the inequitable burden placed on rural communities based on the domination and imposition of national or even supranational agendas. The core-periphery concept precisely captures these dynamics and how distributional injustices are caused. As of now, rural areas carry the national or even global burden of the energy transition by hosting the renewable energy infrastructure that enables the phase-out of fossil fuels. In Germany, approximately 95% of electricity from onshore wind and 97% from utility-scale solar is produced in rural areas (Frankenberg et al.,

2025). Rural areas are thus shouldering the responsibility for an issue caused, primarily, by large urban areas.[6] More precisely, this burden is most often imposed on rural areas, contrary to their benefit and without adequate compensation, as infrastructure is built and electricity is exported without generating significant economic value for rural regions and those living there. Indeed, the German institutional framework often prevents the meaningful retention of financial value in rural areas. Historically, local corporate taxes were paid to the city where the energy company's headquarters were located and not where the renewable energy infrastructure was located. Furthermore, recent legislative changes[7] only apply to exclusive renewable energy operators. Consequently, diversified corporations continue to extract financial benefits from rural areas, leaving these areas undercompensated for the infrastructure they host (Frankenberg et al., 2025). For example, RWE, based in Essen, a major German energy corporation, since it also deals in energy trading, hydrogen, and gas (RWE, n.d.), is exempt from the capacity-based local tax split rule, causing most profits from renewables to leave the rural areas where the infrastructure is located and flow to urban headquarters.

This narrative of rural areas being reduced to instruments of dominant (national) agendas persists across interviews. In the words of one of the experts, "*it can't be that rural areas serve as the sacrifice zones for the whole country so that others can keep profiting from the status quo.*" (Int. 7, p. 9) The other expert further questions the fairness of a system in which rural areas, meaning those actively tackling the energy transition – "*a national, federal, EU, indeed global goal*" – are actually worse off economically (Int. 6, p. 4). One exemplary root cause of transition-related injustices in rural areas in Germany is that the financial benefits intended to reward renewable energy host communities are largely diluted by the state's fiscal system. As the expert explains, when a financially struggling rural municipality generates new revenue from hosting renewable energy infrastructure, the state automatically reduces its financial support allocations (Int. 6). These dynamics outline an

[6] Cities account for around 70% of global greenhouse gas emissions (IEA, n.d.)

[7] See § 29 of the German Trade Tax Act (Gewerbesteuergesetz - GewStG). While the 2021 reform introduced a special rule distributing 90% of the trade tax based on installed capacity, this only applies to enterprises that exclusively operate renewables (Bundesministerium der Finanzen, n.d.).

example of systemic injustices originating at the national governance level with acute consequences for local realities, as national agendas are imposed on rural areas without adequate compensation mechanisms. Through these examples, it is highlighted how the institutional core (the German state) favors the interests of the spatial core (densely populated urban areas), exploiting the peripheries (rural areas) to fulfill energy transition targets. Taken together, the interviews reveal how the distributional injustice of rural areas suffering the burdens of the energy transition without fair compensation results in an acute sense of institutional betrayal.

Spatial Divide – North–South Tensions

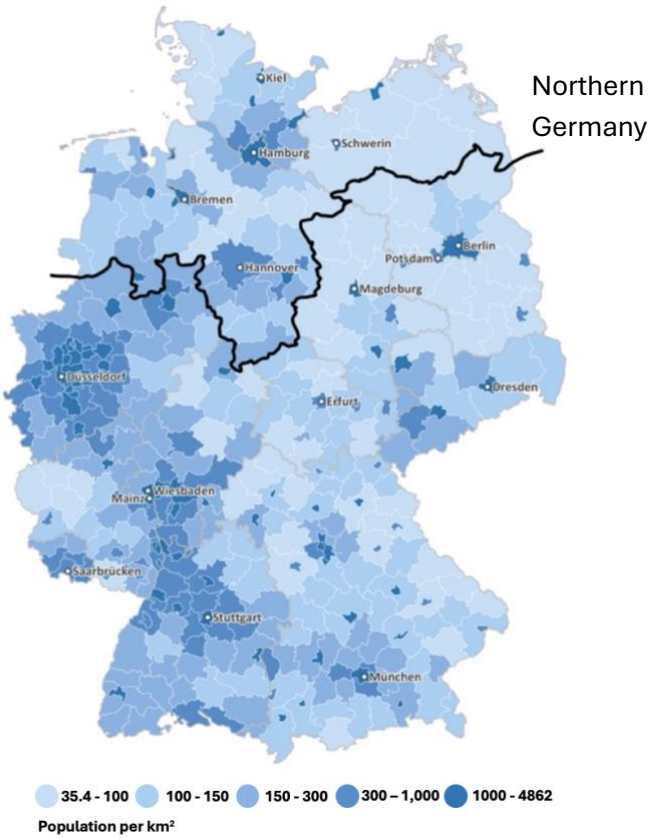
Shifting focus to the interterritorial dimension reveals a strong regional divide which, in the German context, manifests between the north/northeast and the south. In this regard, the unjust distribution of infrastructural burden between two (seemingly) peer regions is the prominent theme. Across the interviews, participants highlight an injustice which manifests as "*We in the north are overburdened and pass the electricity to the south*" (Int. 1, p. 2) or the south, particularly Bavaria not wanting the wind turbines, while the north is supposed to deliver the electricity (Int. 4). Germany's north–south conflict exemplifies that Gürtler's interterritorial and core-periphery dimensions are not always clearly distinguishable. In theory, the northern and southern regions have equal constitutional standing within the federal system. However, in the reality of the energy transition, northern/northeastern federal states are much more resource–peripheral, i.e., economically poorer, with less social and political power, yet richer in resources (particularly wind). What unfolds between these regions is a core–periphery dynamic whereby the north is dominated by the interests of the south and, as a result, suffers distributional injustices, particularly infrastructural burdens and limited value creation.

While this tension initially presents as a north–south regional conflict, a closer examination reveals that it fundamentally manifests as a structural urban–rural divide. This is specified by one of the experts, outlining that the energy transition happens contrary to the economic hotspots [predominantly located in densely populated urban settings], with strong differences between the north and south of Germany, but also east and west Germany (Int.

7). The interviewed project developer further highlights this spatial mismatch: "*We have many wind projects in the north and the east and high energy demand in the south, where large industries are located.*" (Int. 3, p. 3) These spatial asymmetries are clearly visualized when comparing demographic and wind development data: Figure 3 depicts population densities in Germany, demonstrating significantly lower population densities in the north/northeastern part of Germany compared to the heavily urbanized clusters in the south and west. In contrast, as shown in Figure 4, wind power deployment is concentrated precisely in these less densely populated regions. Most notably, Schleswig-Holstein features the highest installed capacity relative to its size (569 kW/km^2), while southern states like Baden-Württemberg exhibit one of the lowest (54 kW/km^2). Consequently, the regional divide in Germany manifests as an unequal structural burden, with low-density northern and eastern rural areas bearing the infrastructure of the energy transition, while the economic value is predominantly created in southern urban areas.

Figure 3

Population Densities in Germany

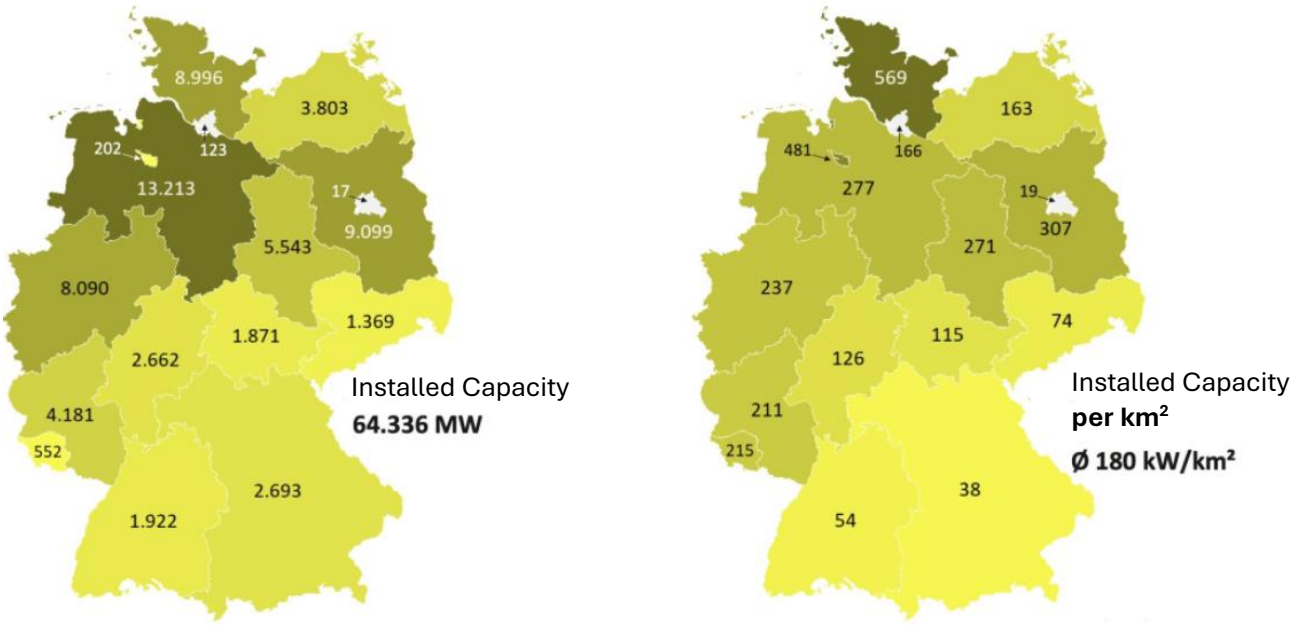


Note. Map showing population densities across Germany. Darker shading indicates higher population density, highlighting regional differences, with notably lower population densities in northern Germany.[8] Adapted from (Bundesinstitut für Bevölkerungsforschung, 2023).

[8] While there is no official administrative border for northern Germany, politically and culturally it is commonly defined along the borders of the five federal states Bremen, Hamburg, Mecklenburg-Western Pomerania, Lower Saxony, and Schleswig-Holstein.

Figure 4

Comparison of Installed Wind Power Capacity Across German Federal States



Note. Maps showing total installed wind power capacity (MW; left) and installed capacity per square kilometre (kW/km²; right). Darker shading indicates higher capacity or concentration, depicting strong differences across federal states and between the north/northeast and the south of Germany. Adapted from FA Wind und Solar (2025).

Zoning in on the Urban–Rural Conflict

The urban–rural conflict is captured in detail by one of the experts (Int. 6, p. 2): "*And all that value creation based on the development of renewables, is disproportionally, not only, but disproportionally in urban areas.*" Summing up what is witnessed and voiced across the interviews: rural areas produce the electricity and carry the infrastructural burden but do not benefit financially (Int. 3; 6; 7). Crucially, the issue extends beyond a mere absence of local benefits. Rather, structural injustices can result in active worsening of local conditions. Indeed, the massive grid expansions required to accommodate renewable energy buildup, paired with smaller local populations among whom these infrastructure costs are distributed, result in energy-exporting rural areas paying higher electricity grid fees than

urban areas (Int. 3; 2). Drawing on data provided by the Bundesnetzagentur[9], in 2024, the grid fees paid in Schleswig-Holstein were 4.56 ct/kWh higher than in Bavaria. Based on an average annual consumption of 3,500 kWh/a, this results in a price difference of 160€ per year at the expense of Schleswig-Holstein (see Bundesnetzagentur, 2024). This example further illustrates how injustices can originate at the national governance level, based on grid fee regulations and the absence of zonal pricing[10], while the consequences are witnessed at the regional or local spatial level through higher prices for consumers in rural areas. This example further demonstrates the intersection between governance scales (national government making the decision) and spatial scales (rural areas experience the consequences). Compensation, however, is expected at the national governance level, particularly through a split price zone[11], which is deemed more just, ensuring lower prices for those areas where more energy is produced and investments are needed (Int. 6).

While most of the distributional injustices between urban and rural areas center around financial resources, the interviews also reveal unjust distributions of political power. As expressed by the local municipality representative, small rural municipalities have less political leverage, highlighting direct connections to procedural justice and the unjust institutional representation of small (rural) municipalities (Int. 2).

Having explored these macro-regional and urban–rural conflicts, it is important to note that these spatial tensions do not always manifest as hostility toward cities themselves. As the regional municipal representative explained, people did not voice unfairness about those in neighbouring cities getting their electricity (Int. 1). Based on the conducted interviews, the injustices are predominantly perceived between the ‘rural’ north and the ‘urban’ south (Int. 1; 4; 6; 7).

Interterritorial Differences: Meso-Level Infrastructure Dimension

Gürtler’s infrastructural dimension concerns the spatial injustices perceived between different geographic areas that either benefit from or bear the burdens of energy

[9] German Federal Network Agency

[10] Zonal Pricing: A market design dividing an area into geographic zones, with a uniform price per zone (Vattenfall, 2024).

[11] Split price zones: Divides the national market into two or more separate bidding zones, allows for electricity prices to vary across regions, reflecting local supply and demand (Vattenfall, 2024).

infrastructure. While this meso dimension was not observable across multiple interviews, as few differences were uncovered between various areas hosting infrastructure, it helps explain critical intra-rural differences, specifically, why some rural areas benefit from hosting renewable energy infrastructure while others do not.

The interviews revealed that most municipalities face similar issues, primarily revolving around a lack of opportunities and localized value derived from renewable energy infrastructure. In fact, this infrastructure is seen as causing local burdens without providing meaningful opportunities for employment and economic development (Int. 1; 6).[12] However, one of the interviews presents an exception, showing that rural areas do not necessarily lack local value creation but are often constrained by systemic injustices. One of the experts highlights the Rhein-Hunsrück municipality[13], which generates substantial income from leasing public land for wind infrastructure, enabled by historical municipal land ownership.[14] This rare case of municipal land ownership leads to robust, infrastructure-based local value creation, thereby fostering a just transition for this specific region (Int. 6).

While Gürtler's infrastructural dimension relates to the meso effects of infrastructure, a new micro-level dimension emerged from the interviews, focusing on individual injustices arising from infrastructure.

The Intraterritorial Dimension: Proximity to Infrastructure

This newly developed dimension concerns how immediate physical proximity to renewable energy infrastructure shapes perceived injustices regarding local harms and the unequal distribution of benefits. Within this dimension, local injustices are explored in relation to the immediate physical burdens caused by energy infrastructure and the highly unequal distribution of benefits among those directly affected. This dynamic is precisely

[12] Renewable energy infrastructures like wind turbines or solar panels are not maintenance intensive and thus produce limited long-term local job opportunities in the host communities (Fabra et al., 2024)

[13] Located in the southwestern state of Rhineland-Palatinate

[14] The region's high municipal land ownership, a rarity in Germany, can be traced back to the Napoleonic era (1794–1814), forests belonging to territorial rulers were converted into state forests (Staatswald), while pre-existing communal forests (Allmende) were largely preserved and later formalized as municipal forests (Rheinland/Pfalz & Landesforsten Rheinland-Pfalz, n.d.). This structure ultimately enables today's municipalities to lease their historic land for wind energy and retain the revenue for public budgets (Rheinland/Pfalz & Landesforsten Rheinland-Pfalz, n.d.-a).

summarized in the words of a regional municipality representative: "*Whenever someone is directly affected [by the infrastructure] but doesn't benefit, they feel unjustly treated*." (Int. 1, p. 2)

At the individual level, perceived burdens are mainly based on auditory/visual burdens, the loss of nature caused by energy infrastructure, and the resulting loss of people's rural identity. Whereas most people define rurality through idyllic sceneries and nature (Int. 1; 4), energy infrastructure is perceived as destructive. Furthermore, proximity to infrastructure exposes socio-economic inequalities among neighbours who share the same physical space. As noted by the civil society representative and one of the experts, the financial benefits and physical burdens of renewable energy infrastructure are distributed highly unequally among the local population living near it. Local landowners, specifically farmers, benefit substantially from lease agreements, while the general resident population carries only the burdens due to limited investment opportunities (Int. 4; 7). The interviewed project developer adds that residents feel an explicit sense of injustice about experiencing the burdens of the infrastructure located right outside their homes, when those owning the land and earning the profits do not even reside locally and therefore do not have to live with the physical consequences of the infrastructure (Int. 3).

Ultimately, these findings demonstrate that spatial proximity alone does not explain local perceptions toward energy infrastructure. While literature on this topic remains divided, with some studies indicating that acceptance decreases with proximity (Warren et al., 2005) and others showing no (Swofford & Slattery, 2010), or opposite effects (Johansson & Laike, 2007), the empirical data here aligns closest with research suggesting that not proximity, but financial participation explained local acceptance (Hübner & Pohl, 2015). In that sense, local perceptions are not understood as a simple response to distance from infrastructure; rather, proximity is seen as evoking reactions to underlying injustices, such as the uneven distribution of local harms and benefits. This offers a potential explanation for why both general and local support for wind infrastructure remains high in Germany (FA Wind und Solar, 2024), despite instances of strong localized resistance.

Procedural Justice in Practice: Representation and Participation

Procedural justice is mainly concerned with issues of equitable and non-discriminatory inclusion of local stakeholders, as well as their institutional representation, knowledge mobilization, and respectful engagement mechanisms. In the analysis conducted, procedural justice claims were the second most frequently raised. When analyzing procedural justice claims of rural stakeholders and experts, two distinct patterns emerge. First, injustices regarding the institutional representation or participation of rural areas/rural municipalities within the national political system. Second, injustices concerning the respectful, non-discriminatory participation of all local stakeholders in local energy projects.

Institutional Representation

The main theme, spanning across the interviews, is the inadequate representation of rural municipalities at the national level. In fact, the national government is perceived as imposing its agenda on rural areas without their meaningful participation in decision-making processes. A concrete example is the regional wind targets, which bind municipalities to dedicate a certain percentage of land area to wind energy production and are perceived as an unjust process of land grabbing. As shared by the regional municipality representative: "*[because of the wind target] we had to take even more land area from the local municipalities [and dedicate it to wind production].*" (Int. 1, p. 11) These regional targets are part of the German national energy transition strategy to dedicate 2% of national land to wind energy in the medium to long-term (Bundesministerium für Wirtschaft und Energie, 2022). This process highlights a new form of land grabbing characterized by the involvement of states and top-down decision-making in the name of climate action – a phenomenon that is increasingly observed within and beyond Germany (Müller & Pampus, 2023).

Furthermore, when it comes to decision-making processes, multiple stakeholders feel underrepresented, lacking political power (Int. 2), especially compared to other (southern) structurally stronger regions (Int. 4; 1). Multiple interviewees also shed light on the consequences of procedural injustices, stating that national ad hoc decision-making

processes create uncertainty and destroy trust (Int. 1), while imposing projects from above enhances discourse of being left behind or dominated and results in resistance (Int. 7).

Drawing on the scalar justice dimension, it becomes evident that injustices related to political representation at the regional governance level originate at the national governance level. In the words of the regional municipality representative, "*The municipal level, which in fact has the expertise, is not sufficiently heard. As a result, legislation is poorly crafted and, accordingly, difficult to implement in practice.*" (Int. 1, p. 17). The quote further illustrates the interconnectedness of justice tenets, outlining how the exclusion of local stakeholders and their knowledge and insights into decision-making processes (procedural injustice) causes the individual needs and perspectives of local municipalities not to be recognized (recognition injustice). This further leads to unjust outcomes, in this case poor policy design for rural municipalities (distributional injustice). The interviewee further outlines how the incorporation of more bottom-up decision-making processes is often missing, making it difficult to influence the national government (Int. 1).

Local Participation

Local participation by those affected is seen as an essential element in achieving a just transition across all interviews. However, as stated by the representative for local action groups and regional development, the average population rarely participates in investments and benefits locally from returns (Int. 5). The most prominently stated injustices are related to unequal participation among different groups of society, based on landownership (Int. 4; 7), financial means (Int. 3; 4; 5) or education (Int. 5). Socially vulnerable groups are seen as especially prone to exclusion (Int. 4).

Additionally, participants clearly outline just participatory mechanisms. One recurring element is related to greater information disclosure, with multiple interviewees stating that the just transition needs to be a transparent process (Int. 1; 3) in which people are informed and educated about local developments (Int. 3, 4). Furthermore, early public participation in decision-making processes (Int. 1; 2), local ownership of projects (Int. 5), as well as respectful engagement mechanisms, are outlined as prerequisites for reaching participatory justice. Respectful engagement mechanisms are those in which local needs

and identities are recognized, and people are treated fairly and respectfully (Int. 3; 4 5). For project developers in particular, this could mean being approachable (Int. 3) and not taking advantage of the local population (Int. 4).

By examining local participation mechanisms, the interrelation between the justice tenets becomes evident once more. The previous examples emphasize that decision-making processes are deemed just only if they recognize local needs and perspectives (recognition justice). Further examples include villages being excluded from decision-making processes in local projects (procedural injustice), based on their size, which results in those directly affected not receiving the benefits (distributional injustice) (Int. 3) or the lack of participation of the local population (procedural injustice) based on investment possibilities in renewable energy projects leading to a uneven distribution of financial benefits (distributional injustice) between investors and the locally affected population (Int. 7). Based on these empirical examples, it is observable how procedural justice, achieved through local participation and ownership would result in distributional justice (local value creation and financial benefits.

Overlooking Rural Realities – Recognition Injustices

Lastly, recognition justice emerged as the least frequently mentioned dimension (accounting for 13% of all claims), limiting the ability to draw meaningful conclusions. Nevertheless, the interviews illustrate that recognition justice claims primarily concern a lack of recognition of rural realities by higher authorities rather than manifesting between geographic spaces.

A shared sentiment across these scalar levels indicates that national or federal governments fail to recognize the specific needs of individual regions, fostering a feeling of being overlooked and disregarded (Int. 2). This perceived lack of recognition is also evident between regions; for instance, the regional municipality representative voiced that "*they [the south] have no interest in us being compensated*" (Int. 1, p. 20), while the civil society representative perceived that Southern Germany's needs are prioritized (Int. 4).

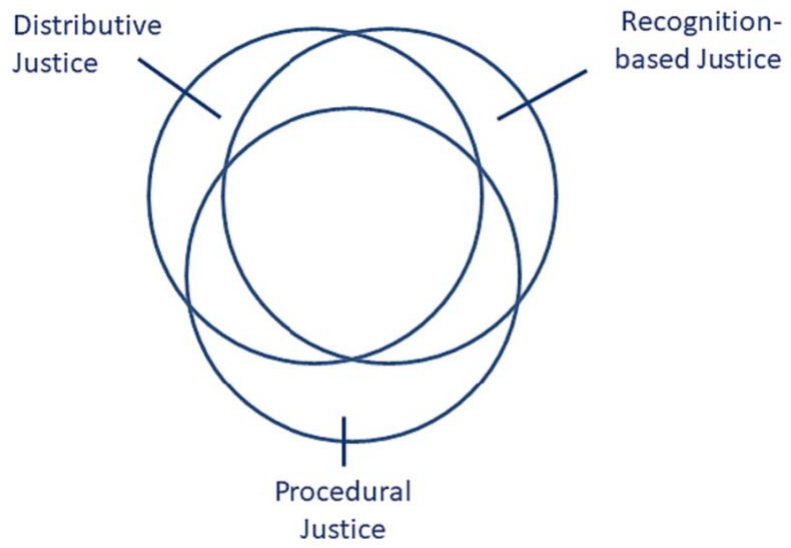
Local-level recognition justice claims were most pronounced, particularly regarding the importance of recognizing local rural identities (Int. 4; 1; 3). The project developer underscored the importance of acknowledging how the energy transition fundamentally

alters people's homes, emphasizing the need to take local worries seriously and address them accordingly (Int. 3). In this regard, the destruction of the rural idyll through the energy transition presents an area of particular concern (Int. 4; 1). In the words of one participant, "*these free rural spaces [...] this greenery, this unobstructed view, and so on, is increasingly being paved over [by wind parks]*" (Int. 4, p. 4). Overall, patterns revolve around the need to consider rural perspectives and develop context-sensitive approaches as dominant parties' needs and urban perspectives are prone to overshadowing the needs of the often-marginalized rural context (Int. 1; 7). Crucially, this requires a dual approach to recognition: first, acknowledging the unique spatial realities of rural spaces, and second, recognizing the distinct needs of the diverse groups within these spaces.

The results of the rural reality check, which contrasts justice theories with local realities, indicate that current energy justice concepts require tailoring to the unique realities of the just transition in rural areas. More specifically, the TTJF is suitable for capturing rural justice realities under two conditions: First, the three tenets (distributional, procedural, recognition) are treated as intersecting rather than mutually exclusive silos. Second, the three tenets are complemented with additional spatial and scalar justice perspectives. The analysis of the empirical interview data, in the form of the reality check, clearly indicates a relational pattern between the three tenets. Particularly strong interconnections were illustrated regarding procedural injustices, with the exclusion of local stakeholders and their knowledge from decision-making processes leading to individual needs and perspectives of local municipalities going unrecognized. This combination of injustices had further procedural consequences in the form of bad policies. Other interconnections were visible between exclusions from decision-making (procedural injustice) and the uneven distribution of both financial benefits and opportunities to profit from renewable projects. These interconnections highlight that procedural justice could have direct positive impacts on the distribution of costs and benefits. Given strong empirical support for their interconnectedness, this study conceptualizes the TTJF tenets as an intersecting Venn diagram (see Figure 5) rather than isolated silos.

Figure 5

Intersecting Dimensions of Justice



Note. From Gürtler (2023).

Furthermore, the reality check emphasizes the core-periphery dynamic as central to the injustices present in rural areas. The converging theme throughout the reality check is the vulnerability of rural areas in Germany to being exploited for their resources, in this case, primarily their capacity for renewable energy production. To understand these dynamics, the spatial and scalar dimensions are vital. Together, they outline the institutional core (the national government) and the spatial core (densely populated areas) which dominate the rural periphery. Two exemplary dynamics include the German state favoring the interests of urban areas, exploiting the rural areas to fulfill energy transition targets, and urban areas in the south exploiting rural areas in the north to meet their electricity demand. A further notable addition is the Intraterritorial Dimension, which examines the direct local harms and limited benefits that individuals perceive based on their proximity to renewable energy infrastructure.

Lastly, throughout the interviews, two justice claims emerge which challenge the traditional boundaries of the TTJF. For example, the regional municipality representative expressed how current national policy decisions compromise "*the future of our children*" (Int. 1, p. 3). What can be classified as an intergenerational or cosmopolitan justice claim, transcends

the core tenets in the closest sense, but fundamentally tackles a distributional injustice (an inequitable distribution of burdens across generations) and a recognition injustice (a lack of recognition of future generations' needs). Similarly, an account of restorative justice emerged in the project developer's depictions of past injustices, in which she described inheriting a situation of "*scorched earth*" during a project (Int. 3, p. 8). The interviewee highlighted how past exploitative and disrespectful relationships between earlier RE developers and the local population (distributional and procedural injustice) had resulted in a landscape characterized by damage and distrust that persists today and is reflected in interactions.

Part 2: Conceptualizing Rurality – A Reality Check

To continue the reality check, this section draws on the interviews conducted, primarily the expert interviews, to validate and nuance the theoretical conceptualization of rurality established in the literature review (Chapter 1, Part 2). The findings from the literature review center around three main elements: (1) Cross-cutting principles, which establish rurality on a continuous spectrum, viewed in relation to urban spaces and as evolving over time; (2) an energy-specific dimension that situates rurality within the context of the energy system; and (3) a perceived rurality dimension, which accounts for the individual and socially constructed perceptions of rurality. Rather than assuming the relevance of these literature-based concepts, the interviews serve to evaluate whether and how they meaningfully contribute to the conceptualization of rurality in the context of the energy transition. The analysis focuses on whether interviewees either explicitly or implicitly support the aforementioned principles and dimensions, propose concrete indicators or refinements, and/or highlight limitations or contextual dependencies. Ultimately, this reality check informs the inclusion and operationalization of these dimensions within the proposed framework.

Germany as Evidence of Asymmetric Energy Transitions

To carry out this reality check, the German energy transition serves as an ideal case, providing empirical evidence of how the energy transition produces spatially differentiated outcomes, particularly between rural and urban areas. The role of rural areas in this process

is closely linked to their capacity to contribute to the energy transition, which produces vastly different ruralities. As previously shown (see Figure 4), installed wind capacity varies significantly across regions, with northern Germany hosting substantially higher concentrations of wind turbines than the south.

In line with this, an active reclassification of regions by their functional role within the energy system is evident. Northern Germany, for instance, is increasingly framed as a key driver of renewable expansion, characterized by high development potential and thus targeted for further investment. While regions like the north are assigned positive value for contributing to the energy transition, regions historically dependent on fossil fuel industries are increasingly subject to the opposite process of devaluation. As Bridge et al. (2013, p. 335) note, such regions are now "scrutinized by policy makers for ways in which their carbon-intensive character might be foreclosed, mitigated or offset." To further illustrate this dynamic of asymmetric energy transitions, the well-documented example of a historical coal region, such as Lusatia[15], is introduced as a contrast to the northern context. This peripheral, sparsely populated, rural landscape, once regarded as a central driver of the German economy, with entire villages, labour markets, and regional identities structured around coal production, is increasingly reframed as a liability for the energy transition, with coal plants planned to be phased out by 2038 at the latest. This shift reflects not only an economic transformation but a deeper revaluation of space, in which previously productive regions are reclassified as transitional spaces within the energy system. For monostructured regions like Lusatia (i.e., regions dependent on a single industry), this entails profound social, economic, and structural transformations (see Matern et al. 2023). Together, these examples show how the German energy transition produces multiple ruralities, shaped by their roles within the energy system, which continuously change over time with evolving technologies and policies. Consequently, these rural dynamics cannot be captured by generic, static geographical measures alone. For example, while some regions emerge as 'green hubs' designated for renewable energy production, historical

[15] Lusatia is a region of 11,727km^2, located between Berlin and Dresden (spanning the federal states of Brandenburg and Saxony) and bordering Poland and Czechia (Matern et al., 2023).

‘carbon-intensive landscapes’ face scrutiny and phase-outs. Hence, the case of Germany is particularly useful for carrying out a reality check on the theoretical concepts required to conceptualize different ruralities. This section now turns to a detailed analysis of the interviews to evaluate how the proposed framework’s dimensions function within these rural realities, beginning with the cross-cutting principles.

The Cross-Cutting Principles in Practice

To test the validity of the theoretical cross-cutting principles, the expert interviews were analyzed to determine how the theoretical concepts apply in the real-world rural context.

The Rural–Urban Continuum: How We Define Rurality Matters

The empirical interview data strongly support conceptualizing rurality as a continuum, rejecting the rural–urban dichotomy. The core justification lies in the need to account for the heterogeneity among rural areas. As one of the experts noted, a binary categorization of rurality overlooks the divergent needs and characteristics of rural areas within a country (Int. 6). The other expert supports this necessity, emphasizing the need to move away from understanding rurality as an “*amorphous and homogeneous mass*” and instead acknowledge the diversity of rural spaces (Int. 7, p. 4). Crucially, the interviews reveal the real-world implications of how rurality is defined and measured, especially for the funding frameworks and policies that rural areas depend on. As the expert noted, it is insufficient to define rurality simply as “*everything that is not urban*”, as such an overly broad categorization would lead to undifferentiated, blanket funding approaches that risk being neither efficient nor just (Int. 6, p. 6). In this sense, definitions serve as a steering mechanism for resource allocation, influencing both the efficiency and fairness of policy interventions.

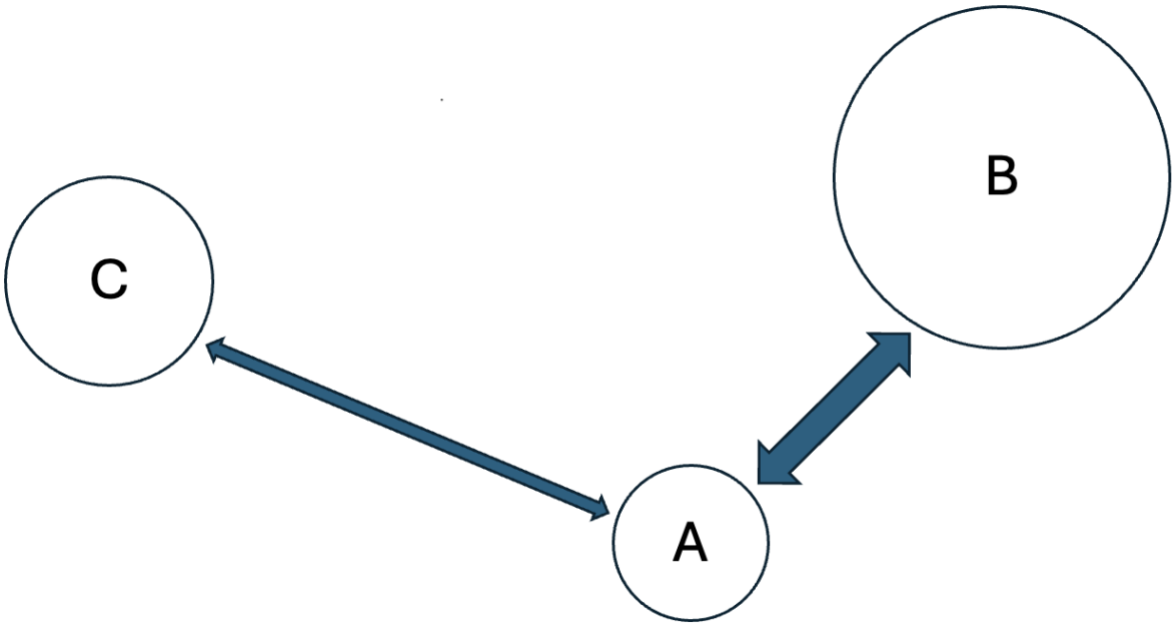
Relational Rurality – The Other End of the Scale

Based on the theory, rurality is argued to be constituted relationally, requiring a point of reference, most notably urban agglomerations, to establish its position on a broader spatial continuum. The experts confirm that viewing rurality in isolation would thus be reductionist (Int. 6), emphasizing the need to account for functional relations between spaces. This is especially important for rural areas, as spatial dynamics may differ depending on their proximity to metropolitan regions (Int. 7). From this perspective, spatiality is explained as a

“gravitational model” (Int. 6, p. 12). Figure 6 visualizes the expert’s contribution, displaying a small rural municipality ‘A’ with low population density, a densely populated urban center ‘B’ in close proximity, and a medium-sized city ‘C’ farther away. This proximity to the large urban center has a significant impact on the rural municipality, explaining patterns of attraction as well as flows of capital and people (Int. 6). This highlights that, indeed, rural areas cannot be viewed in isolation, but in relation to the other (urban) areas. Precisely because of this strong interrelatedness of spaces, understanding differences between rural areas requires consideration of the other end of the scale.

Figure 6

Visualization of Urban–Rural Relationality



Note. The graph depicts the relationship between a rural area (A), a large urban area (B), and a medium-sized city (C) as a gravitational model based on size and proximity. Created by the author.

Temporal Rurality – A Dynamic Concept

In addition, the insights from the expert interviews support the temporal component of rurality. Drawing on the region of Stuttgart[16] as an illustrative example, one of the experts highlights how spatial characteristics evolve over time, shifting an area's position along the rural–urban continuum. Specifically, the ongoing structural downturn of the automotive industry, a historic cornerstone of Stuttgart's economy, impacts municipal budgets with cascading effects for the regional economy (Int. 6). Importantly, this decline in economic strength can alter labour markets, residential patterns, and ultimately population distributions, for example, when surrounding rural municipalities experience outmigration due to declining employment opportunities. These structural changes effectively cause a shift down the continuum towards the 'rural' pole, reinforcing the idea that a static binary classification fails to capture rural realities.

As established in the literature review, relying on indicators such as population density or distance to an urban area is insufficient to capture the underlying drivers of rurality in the energy transition. Insights from the expert interviews strongly reinforce the limitations of these simplistic metrics, emphasizing that no meaningful conclusions about the needs of a region can be drawn from these surface-level spatial indicators alone (Int. 6). Instead, a more contextualized framework is required.

Energy-Specificity – Validated and Nuanced

Starting with energy specificity, both interviewees clearly recognize the importance of an energy-related dimension for developing a more differentiated understanding of rural areas and rurality. It is argued that aggregate descriptions such as "*rural areas generate 95% of renewable energy*" (Int. 6, p. 7) offer limited insight because they do not capture the highly uneven spatial distribution of production. Using Germany as an example, one of the experts highlights that, out of approximately 400 district municipalities, 10% produce more than half of the country's renewable energy, illustrating a high concentration of renewable energy infrastructure. Furthermore, the production of renewable energies is described as strongly spatially concentrated in northern and northeastern regions (Int. 6). In this regard, energy-

[16] Stuttgart is the capital of the state of Baden-Württemberg in southwestern Germany.

specific indicators are seen as vital for spatial differentiation between rural spaces and to not address the energy transition "*spatially blind*" (Int. 6, p. 8).

The other expert further adds methodological nuance by emphasizing the importance of the unit of analysis. While aggregated units such as districts can reveal regional differences, for example between northern and southern Germany or between rural and urban areas, they also risk overgeneralizing rurality at the local level. The expert illustrates this through a personal example of a region classified as highly rural and peripheral, which nonetheless contains a city with a university and strong global connections. Furthermore, for those living in the city, the energy transition and (perceived) spatial changes remain largely invisible (Int. 7). This illustrates that rurality cannot be meaningfully assessed at coarse spatial scales; instead, adopting a smaller unit of analysis, such as the individual municipality rather than a macro-region, is necessary to account for the heterogeneity within rural areas.

Both expert interviews further propose multiple energy-specific indicators for rurality. One expert foregrounds the importance of examining ownership structures, noting that renewable energy projects differ significantly depending on whether they are community-owned, locally owned, open to participation, or controlled by large external investors. Emphasis is placed on the influence on financial flows and earnings, as ownership structures shape whether economic value, tax revenues, and benefits are created locally, benefiting the local municipality, or are extracted and leave the region (Int. 7). Among other research fields, this has direct relevance for energy transition research, particularly in relation to the distribution of costs and benefits or the conditions under which local acceptance of renewable energy projects is formed or perceived as just.

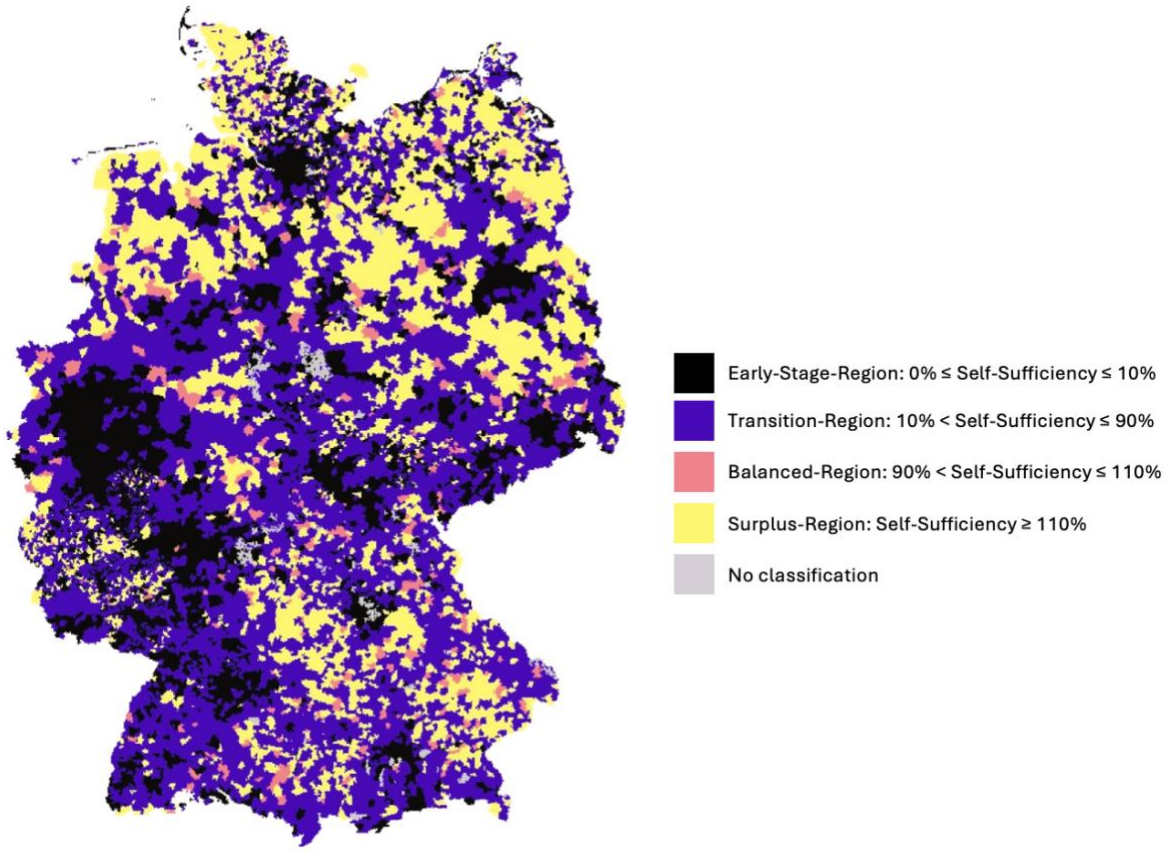
Energy Self-Sufficiency and Urban–Rural Dependencies

Self-sufficiency is proposed as an additional indicator to differentiate between rural areas, defined as the extent to which an area can meet its electricity demand through local renewable generation. This shifts the analytical focus from production alone to the relationship between production and consumption. For instance, a rural area with high installed capacity may still be highly dependent on external energy flows if local demand is

equally high, due to an energy-intensive industry. In contrast, rural areas with lower demand may achieve higher degrees of self-sufficiency despite lower overall production (Int. 6). Additionally, this indicator may capture patterns of spatial dependency. Urban areas that are not self-sufficient rely on energy imports, while rural surplus-producing regions become integrated into wider supply networks. In this sense, self-sufficiency provides a way to identify not only levels of production but also provides insight into the relational position of rural areas within the energy system. To complement this proposition, further research was consulted. A study conducted by Manske et al. (2025) in Germany, at the municipal level (11,007 units), operationalizes self-sufficiency by measuring the extent to which local demand is met by renewable generation. The results (see Figure 7) confirm the spatial concentration identified by the interviewees, with many northern and northeastern municipalities displaying surplus production. Surplus regions are shown in yellow on the map below, indicating that these regions can meet their own demand with local renewable generation. Zooming in on the case of Brandenburg and Berlin (see Figure 8), the data further illustrates how the energy transition generates new spatial dependencies between rural and urban areas. In this case, predominantly rural municipalities in Brandenburg surround Berlin, many of which are increasingly self-sufficient and thus serve as renewable energy production sites to meet Berlin's urban electricity demand (Int. 3; see also Walker, 2022). In the map, this dynamic is visualized as follows: Berlin is colored in black, indicating that it covers between 0% and 10% of its electricity demand with local renewables, whereas in the surrounding federal state of Brandenburg, numerous municipalities are colored in yellow, demonstrating that they cover their own demand by at least 110%. This relationship with a consuming urban center entails a broader transformation of rural areas in Brandenburg, affecting land use, regional perceptions, and local livelihoods, while potentially creating new land-use conflicts or urban–rural tensions (Walker, 2022). This example illustrates how rural areas can become embedded in diverse energy relations with urban areas. Consequently, a region that produces energy primarily for an external urban agglomeration represents a fundamentally different socio-spatial reality than one that is energy self-sufficient, even where population densities are comparable (see Walker, 2022).

Figure 7

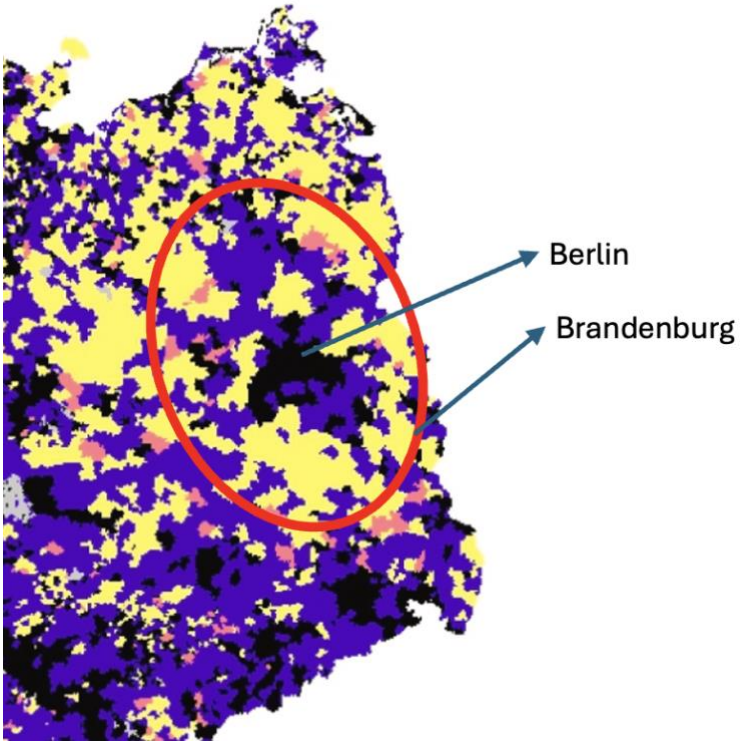
Self-Sufficiency by Renewable Generation across German Municipalities



Note. The map displays German municipalities by their rate of renewable energy self-sufficiency, categorized from early-stage to surplus-generation regions. Adapted from Manske et al. (2025).

Figure 8

Zooming in on Brandenburg and Berlin Energy Relationship



Note. The map illustrates the spatial energy relationship between Berlin's urban center and the surrounding region of Brandenburg. Adapted from Manske et al. (2025).

Temporal Variability

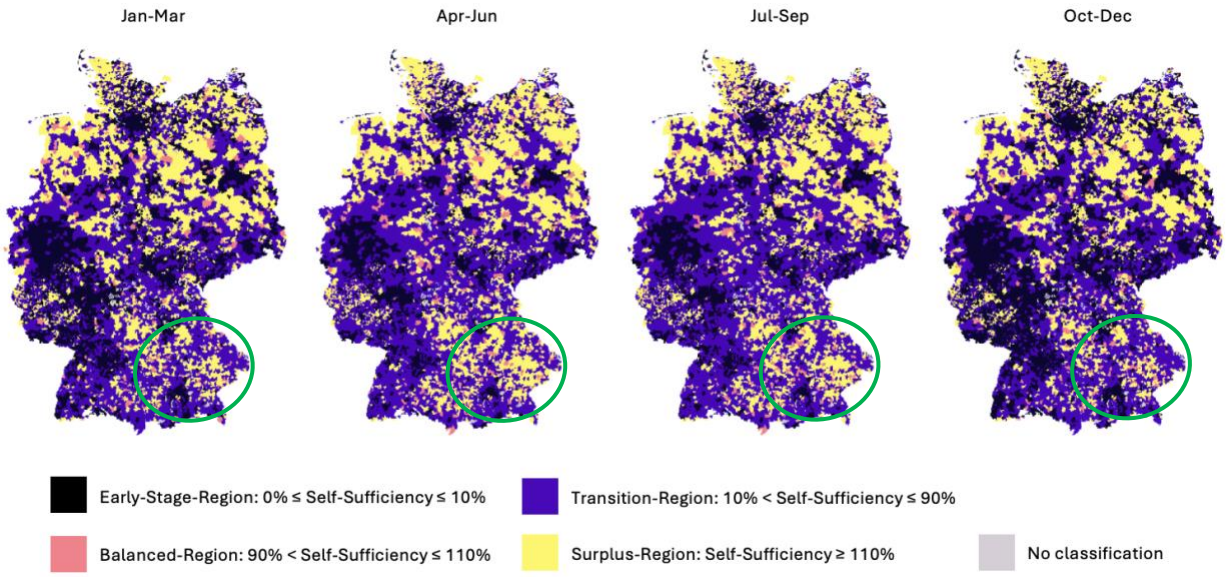
Crucially, this dataset on energy self-sufficiency highlights that energy realities are dynamic and changing, further validating the temporal cross-cutting principle discussed earlier. Looking at developments during the year (see Figure 9), in the colder, high-demand months (Jan–Mar and Oct–Dec), the yellow patches (Surplus-Regions) decrease significantly, while purple patches increase (Transition-Regions), indicating that many regions are no longer meeting their demand with local renewables. This dynamic is particularly visible in the circled area in the southern state of Bavaria.

This temporal variability aligns with the expert's observation regarding "*Dunkelflauten*", i.e., periods without sun or wind, during which previously self-sufficient regions may temporarily become dependent (Int. 6, p. 8). Together, these insights reinforce that energy-related

indicators are dynamic rather than absolute measures, highlighting the need to recognize both their analytical value and structural limitations in research and policy design.

Figure 9

Developments of Self-Sufficiency Rates During the Year



Note. The figure presents renewable energy self-sufficiency rates of German municipalities across four quarterly periods, underscoring temporal variability. Adapted from Manske et al. (2025).

In conclusion, the experts validate the inclusion of an energy-specific dimension to achieve a more nuanced understanding of rurality in the present context. Beyond reinforcing established perspectives, the empirical insights from the interviews expand and nuance the framing of this dimension. Most notably, the findings emphasize the importance of the unit of analysis and introduce self-sufficiency as a key variable, while reinforcing the cross-cutting dimension of temporality across energy-specific indicators.

Perceived Rurality – From Individual Perceptions to Shared Identities

While the need for an energy-specific dimension was clearly established, a much more critical stance is taken towards the inclusion of a perceived rurality dimension in rurality analyses. The experts' skepticism is primarily based on the methodological challenges of operationalizing subjective experiences, while the added depth that such a measure

provides is acknowledged. Both experts recognize that, given the diverse lifestyles within rural areas, which lead to diverging perceptions, a subjective dimension can capture the lived realities in ways often overlooked by structural socio-spatial data (Int. 6; 7). Consequently, considering these subjective accounts may offer valuable insights, such as the underlying drivers of support or opposition towards the energy transition.

Framing Individual Perceptions: Social Comparison and Local Decline

The interviews provide an extensive account of the factors that shape people's individual perception of rurality. Insights from the expert interviews suggest that the subjectivity of rural areas is developed through social comparison (Int. 6). More specifically, people's reference group significantly changes how individuals perceive their environment. For example, if a person's peer group largely migrated to live an urban life, they might perceive their own lifestyle as much more rural. In contrast, in previous generations, for whom outmigration was much more uncommon, the reference group shared the same environment, resulting in a less contrasted perception of their environment (Int. 6). This highlights a recurring theme, which is that rurality should be seen as a relational concept, rather than solely in absolute terms as drawn from structural data.

Next to social comparison, economic development emerges as another contributing factor. As illustrated by one of the experts (Int. 6), an area characterized by vacant housing, high unemployment, outmigration, and little community life (e.g. social clubs) can negatively impact a person's perception of rurality or foster a sense of being 'left behind.' Other potential factors emerging across both interviews include whether individuals grew up in the area or moved there, whether the rural location was a choice or a necessity, and whether people are embedded in the community or socially detached. Ultimately, these findings suggest that people living in different rural areas, perhaps even neighbours in the same village, might experience vastly different 'lived ruralities', which, if captured, foster a differentiated account of rurality.

Landscape Valuations: Productivist Landscape vs. Rural Idyll

While the previous examples depict the inherent heterogeneity within rural areas, the interview data further reveal that individual perceptions can manifest as shared group

identities, especially under the socio-political pressures of the energy transition. As previously outlined, the energy transition can produce new 'geographies of winners and losers', which ultimately manifest as spatial conflicts centred around these place-based identities. One prominent manifestation of this dynamic is the tension between the constructed identity of the "rural idyll" and the perceived destructive nature of renewable energy infrastructure. By contrasting two vastly different landscapes, the analysis illustrates how these place-based identities either mitigate or fuel local conflict. As shared by one of the experts, a study conducted in coastal marshland revealed that high levels of acceptance for the energy transition can be traced back to the shared perception that rural landscapes are inherently man-made, artificial, and engineered (Int. 7). Notably, the region is historically characterized by humans influencing and altering the landscape, primarily for agricultural purposes. This demonstrates how place-based identities of rurality develop around shared lived experiences that define what people in the marshland stand for: rurality as a productivist landscape. Crucially, based on spatial indicators such as population density, a marshland may appear identical to 'iconic' landscapes perceived as pristine or historical, such as the Schwarzwald (Black Forest). In the latter case, however, residents may define their identity around the preservation and 'untouched' nature of the landscape, leading to vastly different stances towards renewable energy developments. Indeed, as shared by the regional municipality representative and the civil society representative, identities are frequently shaped by landscapes and unbuilt environments, which in this case are characterized through small settlements, quietness, greenery and blooming nature (Int. 1; 4). In turn, the development of renewable energy infrastructure is perceived as a threat to this identity, fuelling conflict and resistance. This aligns with documented regional tensions in the Schwarzwald, where wind development projects face organized community resistance (Jauß, 2026; Koerner, 2026).

Historical Marginalization and Collective Identities

As outlined in the theory section, experiences of marginalization and associated collective emotions and responses can shape rural identities. How these past experiences shape rural identities in the energy transition today is vividly illustrated by conflicts over nuclear waste

repositories. As the civil society representative noted, the region developed a shared identity around the anti-nuclear protests that lasted for decades and heavily shaped the region's identity and what citizens stand for. Upon asking whether the region experiences strong resistance against local projects, the interviewee responded: "*No, not much. I think that's because we've been shaped by [our nuclear history] – that's the underlying context. And then [wind energy] is perceived as the better alternative [compared to nuclear]*." (Int. 4, p. 6)

Indeed, what the interviews reveal is that socio-spatial conflicts are seen as a distinctive feature of rural areas (Int. 1, 3, 7). Many of these larger territorial conflicts have been explored in the section on the rural realities of the just transition. Particularly strong in-group and out-group dynamics can be witnessed in the north–south conflict, for example, as voiced by the regional municipality representative: "*We in the north are overburdened and pass the electricity to the south*" (Int. 1, p. 2). While this statement was previously analyzed to reflect interterritorial injustices, focusing on the social construction of rurality reveals an additional layer: the articulation of a collective regional identity ("We the north"). This shared identity in response to exploitation by the 'other' (the industrial south) becomes a central part of the local construct. Importantly, as highlighted by one of the experts, "*Of course, also within rural areas there are winners and losers*" (Int. 7, p. 3). In the interviews, intraterritorial conflicts between non-landowning populations and landowning farmers (Int. 4; 7) highlight the central role of ownership structures. Precisely because the farmers own the land, they can benefit from renewable energy infrastructure, whereas the non-owning population cannot. This uneven distribution of power through land ownership manifests in in-group versus out-group dynamics, between "*the farmers*" and the "*regulars*" (Int. 4, p. 7), fuelling conflict.

Together, the examples illustrate that whether driven by past political struggles or immediate differences in land ownership, rurality is socially constructed, with numerous underlying factors shaping perceptions and identities of rurality. The resulting complexity of this dimension, however, complicates operationalization, making it less suitable for broader classifications of spaces. Indeed, the experts agree that the measure's subjectivity undermines the generalizability required to define or categorize areas. Nevertheless, the

value of such a dimension is recognized for qualitative research contexts (Int. 7), researching, for example, community acceptance of energy infrastructure. While this can be regarded as a limitation, it actually reinforces the earlier notion of 'context dependency' when conceptualizing rurality. Accordingly, it is important to recognize that no single measure can simultaneously capture the individual and shared perceptions of rurality and still facilitate aggregated classification. Nevertheless, a perceived measure of rurality remains useful as an analytical lens, as proposed in this study, or, as one expert put it, it is at least "*worth testing*" (Int. 6, p. 11).

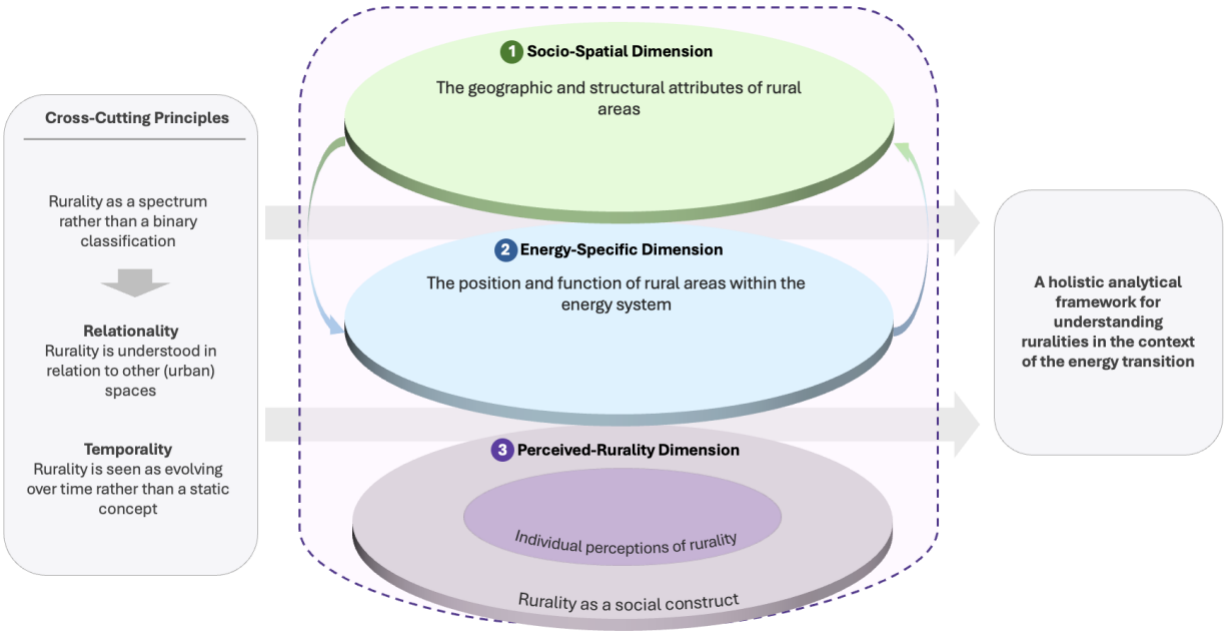
Rurality Reconceptualized – A Tested Framework

This second part of the reality check set out to validate a new approach to conceptualizing rurality for the energy transition by confronting established theories with the case of Germany, particularly through empirical insights from expert interviews. What emerges, as illustrated in Figure 10, is a validated, multi-dimensional framework for understanding ruralities in the context of the energy transition. This framework is guided by a set of cross-cutting principles that establish rurality on a spectrum – in relation to other (urban) areas, and as evolving over time. Building on these principles, the core framework is structured around three dimensions. First, the socio-spatial dimension. These conventional geographic indicators of rurality are well-established and widely applied in both academic and policy contexts and thus do not require empirical testing to serve as a baseline. This includes indicators such as population density, amenities, and land use, which remain important to retain the structural conditions of spaces. To ensure context specificity regarding the energy transition, this baseline is complemented by an energy-specific dimension. Based on the interviews and the literature, this dimension could build on indicators such as renewable energy potential, protected areas, installed capacities (Ocaña-Riola & Sánchez-Cantalejo, 2005), and self-sufficiency (Int. 6). Importantly, the relationship between the socio-spatial and energy dimension is not static but mutually constitutive, as indicated by the arrows between them. Renewable energy infrastructure, for example, reshapes spatial characteristics when wind or solar developments transform agricultural or forest land, while existing spatial conditions can constrain or enable energy

development. The third dimension, perceived reality, is conceptualized as a double-layered construct, portrayed as a frame surrounding the other two dimensions, reflecting how perceptions span and influence both socio-spatial structures and energy elements. At its core lie individual perceptions of rurality, encompassing personal experiences, narratives, and understandings. At the aggregate level, rurality is understood as a social construct, defined by shared identities, values and a collective sense of the in-group and what it stands for. In this regard, among others, social comparison, place attachment, sensitivity to landscape change, and in/out-group dynamics emerge from the analysis as potential measurement angles for perceived rurality, even if the operationalization of this dimension extends beyond the scope of this study. By carrying out this reality check and fostering the conceptualization of rurality in the context of the energy transition, this research takes an important step towards closing a key gap in the current literature, shedding light on the 'rural' of the just rural energy transition. The framework below presents an attempt to synthesize the main findings of the reality check, visualizing the concepts and underlying dynamics.

Figure 10

Analytical Framework for Ruralities in the Context of the Energy Transition



Note. Created by the author.

Discussion and Concluding Remarks

This study examined how the just energy transition can be conceptualized within rural contexts. To achieve this, an exploratory empirical case study was conducted, with Germany as the case setting. A 'rural reality check' was carried out, contrasting theories on energy justice and rurality with insights gathered from local stakeholder and expert interviews. The overarching finding of this study underscores the value of synthesizing conceptualizations of justice and rurality to obtain a contextualized understanding of the just transition in rural areas. More specifically, combining the two elements facilitates a more holistic understanding, viewing the perceptions and dynamics of the just transition in direct relation to the unique spatial context of rurality.

Expanding the Energy Justice Framework – A Contextual Approach

The rural reality check of local justice claims indicated that current justice frameworks need to be significantly adapted to the rural context. To capture the unique rural context, the Three-Tenet-Justice Framework (TTJF) was conceptualized as intersecting dimensions rather than silos to reflect interconnections and dependencies among justice tenets. One key finding was the direct effects procedural injustices can have on distributional outcomes, such as the unequal distribution of financial benefits from renewable energy. Furthermore, the results of this research provide supporting evidence that the core-periphery dynamic best explains injustices within Germany's rural energy transition. In this regard, the findings indicate that the core-periphery dimension fundamentally materializes as uneven power relations between rural areas (in the north) and urban areas (in the south). However, next to the spatial core, the national government was established as the institutional core, favoring the interests of urban areas or national/global energy transition goals. Notably, the findings supported a reconceptualization of the scalar dimension by first introducing a local level and second combining spatial and governance scales, highlighting that, in the rural context, these dimensions are heavily intertwined. Whereas researchers have developed foundational concepts in energy justice, such as the TTJF, as well as spatial and scalar justice dimensions, this research advanced the just transition literature by presenting a first demonstration of how justice theories can be tailored to rural contexts.

Rurality as a Multidimensional Concept

The reality check for the conceptualization of rurality supports the theoretically developed multi-dimensional framework for understanding ruralities in the context of the energy transition. The results validate the cross-cutting principles, conceptualizing rurality on a spectrum, in relation to urban areas and temporally dynamic. The empirical data further support that the three dimensions (Socio-Spatial, Energy Specific, Perceived Rurality) are similarly subject to these principles. Accordingly, socio-spatial characteristics are not stable; for example, because of regional economic decline, rural areas might experience outmigration or municipal budget shortages, affecting local realities and, in turn, perceptions of rurality. Energy-related indicators, such as self-sufficiency, were shown to be dynamic rather than absolute measures, subject to change over time. Perceptions of rurality are further understood to develop relationally through social comparison, for example, as people from rural areas compare their amenities and access to services with those of their peers living in urban areas. Additionally, the study highlighted the need to adopt a smaller unit of analysis, such as the individual municipality rather than a macro-region, to account for the heterogeneity within rural areas. Lastly, the findings supported the notion of context dependency, suggesting that no single measure of rurality can serve every purpose and that tailoring to the researcher's or policymaker's objective is necessary.

Deep Dives – Energy Justice in the Context of Rurality

Moving beyond the key findings, the following sections situate the empirical insights of this study within broader practical and theoretical debates on justice and rurality. Specifically, the discussion focuses on six key areas: questions of causality between justice dimensions, relative burdens and perceived injustices, contrasts with broader survey data, linkages between rural identities and social acceptance, the pluralities of the just transition, and an outlook beyond peripheralization toward community agency.

Causality Between Justice Tenets

A key finding of this study was the conceptualization of the three justice tenets as intersecting and mutually dependent. In this context, questions of causality constitute an important and contested area of debate within justice theory. Rather than assuming linear

causal relationships, scholars have long debated whether justice dimensions are better understood as interacting, co-constitutive, or mutually reinforcing (see e.g. Fraser, 1997; Schlosberg, 2007). Fraser (1997) argues that justice dimensions are co-constitutive, highlighting that distributive remedies presuppose cultural recognition, for instance, by presuming that everyone's needs are of equal importance. In this sense, both vicious and virtuous cycles may emerge from interactions among injustices (Fraser, 1997). In practice, relationships between justice tenets are often readily identifiable. For instance, a key finding of this study is the positive effect of procedural justice, achieved through local participation, on distributional outcomes such as community benefits. However, establishing clear causal links in the rural context remains challenging. This complexity is illustrated by the previous example by the regional municipality representative. Here, procedural injustices, namely the exclusion of local stakeholders and their knowledge from decision-making processes, result in the non-recognition of the needs and perspectives of local municipalities, with subsequent procedural consequences. However, this example raises a critical question: whether non-recognition was in fact caused by procedural exclusion, or did the exclusion prevent meaningful recognition? In other words, was the regional expertise disregarded because it was deemed insignificant, or did the decision-making structures prevent regional actors from participating and mobilizing their knowledge? Rather than a linear causal relationship, these findings suggest a reinforcing loop between justice tenets, with the precise dynamics of these interactions requiring further dedicated empirical research.

Drawing on the concept of resource peripheralization offers yet another potential explanation. From this perspective, the fundamental injustice may lie in the uneven distribution of political power, whereby actors from rural areas are structurally marginalized relative to urban actors due to deficits in economic and social capital. Such a framing links the observed dynamics to the concept of rurality, suggesting that spatial structures shape these injustices. Consequently, uncovering the root causes of injustice requires attention to the conditions shaping rurality and resource peripherality, such as lower population density or economic strength. Taken together, the findings suggest, first, that establishing causal relationships among justice tenets is a highly complex endeavour, thereby extending the

scope of this research. Second, they highlight that injustices in the energy transition require a contextualized understanding, as spatial conditions - in this case, rurality - shape how these dynamics unfold.

Understanding Relative Burdens and Perceived Injustices

The empirical realities of the German energy transition illustrate these interconnections between spatial conditions and transition-related injustices. Specifically, this is reflected in the uneven distribution of renewable energy production across Germany, with wind infrastructure heavily concentrated in the northern and northeastern regions. While north–south tensions appear to simply mirror this spatial concentration, the empirical findings suggest a more nuanced dynamic. Rather than being solely driven by the absolute burden of wind turbines' physical presence, conflict appears to be shaped by how one region's burdens are perceived relative to others. Consequently, grievances shift from a purely distributive issue to a combination of procedural and recognition injustices. More precisely, the perception that the needs and perspectives of southern states are prioritized over those of northern states, leaving northern states feeling exploited and marginalized. In this regard, the question arises: would perceptions of injustice diminish if regional differences were attributed solely to geographical factors, such as lower wind potential in the south, rather than understood as politically produced?

Contrasting Local Realities with Survey Data

Having outlined how grievances might appear as purely distributive issues, while underlying procedural and recognition injustices shape perceptions, warrants a deeper analysis of the prominence of distributional justice claims. To explore this matter, the study's insights are contrasted with broader survey data. This study's analysis revealed that the majority of justice claims (55%) center around distributional injustices. The identified justice claims primarily revolve around the unjust distribution of burdens (primarily infrastructure and related consequences) and benefits (primarily local value creation). In line with the number of claims, the distributional tenet is analyzed in greater depth compared to the procedural and recognition tenets. Despite its prominence, drawing conclusions about the relative importance of distributional justice over the other tenets would be premature. To discuss the

relative importance of the three core tenets, a well-established survey on wind energy and local acceptance, carried out in Germany (FA Wind und Solar, 2024), is consulted. The results of the survey indicate that what people deem most important when it comes to local renewable energy projects is not distributional aspects such as financial benefits. Instead, 89% of people highlight the importance of early and appropriate disclosure of information about local project developments within their own or neighbouring municipalities. With 84% of people stressing the importance of local value creation for the surrounding municipalities, and 79% the possibility of cheaper electricity contracts, the survey clearly depicts that procedural elements (greater information disclosure and appropriate engagement mechanisms) take precedence. In contrast, the findings from the rural reality check indicate that local value creation is the most important element. This raises the question of whether distributional claims are simply the most prominent in the discourse, more tangible and visible to stakeholders because they are easily quantifiable (e.g. through energy bills), rather than a reflection of their absolute importance. The results of the present study further depicted a multitude of perceived injustices regarding the uneven distribution of local benefits among the local population, for example, between landowning farmers and regular citizens, based on the lack of investment opportunities for the latter. The survey, on the other hand, shows a surprisingly low figure: just 34% of people deem it important to have personal investment opportunities in local wind projects. These inconsistencies might be explained by perceived injustices originating from social comparison, meaning that grievances are less about the absence of personal benefits and more about inequity, given the relative enrichment of farmers compared to the rest of the community.

Contextualized Injustices and the Social Construction of Rurality

Expanding on the need for a contextualized approach, the next section discusses the interconnections between people's perceptions of rurality and perceived injustices or inequalities related to the energy transition. Indeed, this debate ties back to the two-way street between space and justice, as outlined by Gürtler (2023), who argues that people's context heavily shapes their ideas of justice, and conversely, their ideas of justice shape their views about space. The research findings of this study support this interconnection,

demonstrating clear links between people's views of justice and what constitutes a just transition, and their social construction of rurality. This is demonstrated by the contrasting cases of the engineered marshlands and the pristine German Schwarzwald. In the former, rurality is viewed as a resource for humans to capitalize on, and conversely, residents display high levels of acceptance of the energy transition, perceiving wind turbines as a welcomed economic opportunity. In contrast, in the Schwarzwald, communities envision rurality as an untouched natural idyll in need of preservation. Consequently, wind infrastructure is perceived as unjust destruction of nature and incompatible with the local identity, with local opposition mobilizing through citizen initiatives. These insights are consistent with Woods (2003), who conceptualizes energy conflicts as arising from differing socially constructed identities of rurality. More precisely, the empirical examples align with Woods' (2003, p. 273) two broad perspectives on rural landscapes: On the one hand, the natura-ruralist perspective of nature as "pure, idyllic and vulnerable, [...] requiring protection from harmful human intervention" and a utilitarian, productivist perspective, whereby rurality requires "taming" to be exploitable for human economic activity. Accordingly, modern technologies, like wind turbines, are either considered "unnatural and 'out of place'" or as a normalized part of rural development. These insights add a layer of complexity to the just transition in rural areas, as local acceptance is contingent on compatibility with locally constructed identities of rurality.

Multiple Ruralities - Multiple Just Transitions

Having established that rurality cannot be reduced to a single concept, with multiple ruralities instead emerging based on divergent socio-spatial characteristics, energy realities, and perceptions, it follows naturally that a single, universal 'just transition' is an oversimplification. For instance, a wind-producing region in northern Germany and a coal-dependent region in eastern Germany present fundamentally distinct socio-spatial realities and thus different just transition pathways. Consequently, while this study revolved around the question of how to conceptualize the just transition, the empirical evidence would suggest a more precise framing: how to conceptualize just *transitions*, in the plural. Ultimately, this underscores the need to deepen the recognition dimension of the justice

framework, acknowledging multiple just transitions that reflect the multitude of rural realities and justice claims across time and space.

Beyond Peripheralization – Community Ownership

Acknowledging these pluralities requires looking beyond the conceptualization of rural areas as marginalized spaces with limited capacity to influence top-down decision-making processes. Indeed, various cases demonstrate that rurality does not per se result in peripheralization; on the contrary, local actors frequently take matters into their own hands, assuming ownership of the transition and its decision-making processes. This is reflected in the increasing number of citizen-led initiatives, such as Renewable Energy Communities, across Europe (REScoop.eu, 2026), the documented success of community land buyouts in Scotland (Murphy & Smith, 2013), and the empirical example of the Rhein-Hunsrück region. Crucially, ownership emerges as a decisive factor in the core-periphery dynamic. When communities retain ownership, they can break the cycle of marginalization and resource exploitation. As highlighted by Stephens (2019), community ownership enables a redistribution of power, with locally focused decision-making reflecting local priorities and needs. Similarly, community property rights would allow for greater control over infrastructure siting processes, thereby enabling the recognition of local concerns (Bell et al., 2005).

In addition to emphasizing the role of ownership, the outlined examples also reinforce the necessity of overcoming generalizations across spatial contexts by recognizing plural ruralities. Not every rural space is inherently peripheral or structurally dominated by external, urban agendas. Rather, as illustrated, rural areas can successfully capitalize on the decentralization of the energy transition, retaining local agency and capturing significant localized value.

From Germany to the Rest of the World – Opportunities for Transferability

This study identified resource peripheralization as a core dynamic underlying transition-related injustices in rural areas in Germany. As previously outlined, ruralities and just transition pathways are highly context-specific. Nevertheless, where the structural

dynamics observed in Germany mirror those in other national contexts, an opportunity for conceptual transferability arises.

The European Context: Shared Dynamics of Rural Peripheralization

Indeed, when looking across Europe, cases of rural peripheralization, i.e. using rural areas for their renewable capacities, dominating them for the benefit of others (national goals, urban electricity demand), are highly visible.

In Scotland, the UK Government's and the Scottish Government's energy transition and climate plans have significant implications for the Scottish Highlands and Islands. Based on the national plans, these sparsely populated, rural areas are subject to energy development to export power south to the Scottish Lowlands and on into England, given their rich renewable energy resources (wind, wave and tidal). Apart from national governments imposing their agenda on rural areas, the local communities were subject to other forms of marginalization, particularly recognition injustices. Corporate developers framed and defined the peatlands simply as a "barren wasteland", ignoring the profound emotional, ancestral, and cultural significance the places held for the local population. Ultimately, this resulted in strong local resistance and the Scottish Government's subsequent rejection of the development proposal (Murphy & Smith, 2013).

Similarly, in Wales, conflict and opposition arose around new wind farm developments due to various perceived injustices. On the one hand, rural communities were perceived as bearing local infrastructural burdens for the wider national good, without local benefits. On the other hand, citizens voiced recognition of injustices, arguing they were treated with indifference to their concerns and that their rural landscapes were not valued. These perceived injustices were further driven by an apparent 'urban bias' of the project developer and the governmental Department of Environment and Climate Change, which were seen as dominating rural spaces to serve national and urban agendas (Mason & Milbourne, 2014).

Also in the Nordic countries, rural areas suffer from resource-peripheralization, as Lawrence (2014) outlines in her case study of indigenous territories in Sweden. The core dynamic mirrors the previous cases, with rural areas being exploited to satisfy national targets and urban electricity demand. Nevertheless, the Swedish case introduces a further element of

internal colonialism, demonstrating how discourses of renewable energy and sustainability are mobilized to justify overriding indigenous land rights of the Saami. Hence, transition-related injustices are exacerbated through the historical marginalization of indigenous people, reinforcing the notion of context specificity.

Looking Beyond Europe – Global Accounts of Peripheralization

While the outlined cases closely align with the present study's findings, restricting the analysis to these contexts would reproduce a Eurocentric bias. To overcome this pitfall, this research specifically looks beyond the European context, examining cases from China and Brazil.

A Brazilian case study by Klingler et al. (2023) reveals similar patterns of domination and exploitation of rural resources in South America. In this context, the rural northeastern region serves as the site of large-scale wind and solar PV development in response to growing electricity demand, predominantly from the densely populated south and southeast, including São Paulo (Ghisi et al., 2007). However, the Brazilian case also presents crucial specificities, most notably the involvement of foreign (including European) investors and landowners involved in the privatization of prior public and common lands. This introduces a distinct dynamic of "green grabbing" whereby access and control are secured for renewable energy production, reinforcing the critical role of ownership within regional peripheralization dynamics.

Lastly, as outlined by Hu (2023), rural peripheries in China were also targeted for massive agrivoltaics (solar PV + agriculture) development. This process is driven by powerful energy corporations and state actors under the rationale of green development and inclusive rural modernization. Subsequent top-down decision-making processes resulted in large-scale land grabbing, with detrimental social and economic effects on local communities, while large energy corporations extracted the profits.

Implications and Future Directions

As depicted, insights from cases across Europe, Brazil, and China closely align with the present study's findings regarding the institutional core (national governments) and the spatial core (densely populated areas) that dominate rural peripheries. Thus, while

contextual specificities require adequate recognition, the concepts developed based on the case of Germany are likely suited to analyzing injustices in other geographical contexts.

In that case, the results of this study suggest that conceptualizing just rural energy transitions requires adapting justice theories – namely, the Three-Tenet Justice Framework with its spatial and multi-scalar additions and combining it with the rurality framework as an analytical lens.

Nevertheless, given the limited scope of this exploratory case study, further research is required to test the proposed frameworks in greater depth and across a broader range of geographical and socio-political contexts. Building on these frameworks presents an opportunity not only for advancing just transition research but also to foster spatially conscious transition policies. Ultimately, the success of the energy transition, in Germany and globally, depends on securing just futures for rural areas – the backbone of renewable expansion.

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