



E-participation in energy transitions: What does it mean? Chances and challenges within Germany's *Energiewende*

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ABSTRACT

Does e-participation generate more democratic legitimacy in the context of the German *Energiewende* through more input and procedural justice, better outputs and environmental outcomes that are accepted by the public? In recent years, many forms of e-participation have emerged, and space for experiments with visual and interactive technologies has been created. However, research evaluating e-participation technologies in energy transitions is lacking. This study uses interviews with 33 stakeholders in a planned wind farm project, combined with online survey results, to derive empirical insights into attitudes towards and preferences for e-participation. On the one hand, we observe openness towards new options for creative input and visualization-based online tools and virtual realities. On the other hand, stakeholders fear vulnerabilities and are skeptical about the efficacy of online discourse. Institutional stakeholders primarily see risks in civic participation, while citizens themselves see the benefits. Unexploited potential for creative input, deliberation, and collaborative planning could be leveraged to increase democratic legitimacy. In this context, better outputs are not synonymous with accepting outcomes, but can include changes to or even rejection of plans based on public preferences and concerns. This potential remains largely untapped, however, and requires a willingness to participate, thus calling for mobilization strategies.

1. The wicked problems of public participation in the *Energiewende*

This paper examines whether the use of innovative and creative e-participation tools in the German national energy transition, the *Energiewende*, can enhance its democratic legitimacy and so facilitate its urgently needed acceleration. The potential is there to use these tools to provide the public with better information, to create new forms of digital communication and collaboration, and to achieve higher degrees of responsiveness to public concerns. All three benefits could confer added legitimacy to the decision-making processes involved in the expansion of renewable energies. This assumption is based on the aspiration of participation in democracies to foster input for citizens, providing open, fair, reflective, and diversified decision-making processes as well as effective and common welfare-orientated outputs, here in terms of climate protection and shareholding in renewable energies (Galais et al., 2021).

But what exactly makes the process of participation democratic and how can there be more or less democracy? In a nutshell, we refer to the

concept of participatory democracy (Barber, 2014), based on the idea “that citizens are afforded an opportunity to directly participate, or otherwise be involved in the decisions that affect their lives” (Keutgen, 2021). This is built on three pillars. First, participatory democracy follows a “veto power” argument (“stakeholders have to be involved because governments are dependent on their resources”); second, it relies on a “quality” argument (“stakeholders are involved because they have specific knowledge and can enhance the quality of the problem definition or even more so the quality and innovative character of the solutions”); and third, it is rooted in a “democratic legitimacy” argument (“stakeholders have to be involved to enhance the democratic quality of decision making in modern network societies”) (Klijn, 2011).

Engendering legitimacy requires that an “interest-based logic” be at work to promote public trust in decision-making because “expressing interests in confrontation with other interests strengthens self-determination and influence.” (Zakhour, 2020). Legitimacy creation also involves civic empowerment; that is, a “process becomes legitimate by people believing it so” through “devolvement of authority onto the people” (ibid). This shift means “power to the people,” where each step

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up “the ladder of citizen participation” (Arnstein, 1969) potentially increases local acceptance of and support for a renewable project. Sharing decision-making with local citizens also achieves high levels of *energy justice*, another means for generating legitimacy (Carley and Konisky, 2020).

Increasingly, energy projects encroach on residential areas and community spaces, with growing resistance as the consequence. Decision-makers respond by increasing public participation (Hohlfeld, 2020). Here, the relationship between citizen participation and policy legitimacy is based on transparency, accountability, and responsiveness in energy planning, which can be evaluated through indicators such as public perception of fairness, support and acceptance, compliance with policy, trust in government institutions, perceived effectiveness of energy policies, transparency, and accountability of officials (Riduan, 2024).

This means that public participation has to provide early involvement, access to information, genuine interest, and joint decision-making – balancing between inclusive and effective citizen engagement (Hohlfeld, 2020; Riduan, 2024). But in energy transitions, a legitimacy gap can easily develop if the public are excluded from participation or a discrepancy arises between citizen expectations and their experience of the public participation process. Then the process is perceived as “serving an alibi function leading to insufficient citizen involvement,” with “citizens having little influence on the decision-making process and outcomes” (Hohlfeld, 2020, p.1). In contrast, we assume that high levels of (e-)participation would correlate with high levels of legitimacy (Stratu-Strelet et al., 2021).

The challenges of the energy transition in Germany currently lie primarily in the fact that expansion of renewable energies must accelerate dramatically both to achieve climate targets and to reduce dependence on fossil fuels. A major reason the expansion is not progressing as planned is community conflicts in the energy transition (Arifi and Winkel, 2021; Bues, 2020; Reusswig et al., 2016). The polarizations that emerge in the wind power debates, exacerbated by flourishing environmental populism, carry the potential to divide communities, undermine energy security, and negatively impact democratic attitudes (Beeson, 2019; Buzogány and Mohamad-Klotzbach, 2022).

Clean energy transitions create winners and losers, so it is important to make clear and visible the consequences of the transition for specific communities and socio-economic groups on the frontlines (Carley and Konisky, 2020). The inclusion of local communities via participation could be the most promising approach to doing so. However, since common instruments of public participation, e.g. town hall meetings, have not been effective in achieving participatory inclusion, opportunities for e-participation could provide better outcomes. This assumption is based on the results of various research studies on participation in energy transitions that problematize top-down decision-making and the modus of invited participation (e.g. Cuppen, 2018). Moreover, typical public participation procedures such as town hall meetings have been transformed from the original context as a form of democratic community governance into a format for self-presentation of politicians and a staple of corporate governance, marking the “death of deliberation” (Field, 2019).

Of course, not all the common instruments of public participation fail; however, studies leave the impression of a popular participation style that is primarily to inform citizens, suggesting a “real influence” on decision-making, and providing feelings of trust and comfort, but giving

no power to local communities in the end.¹ However, the idea of democratic community consent-based siting for energy infrastructure lies in a “successful design and implementation of a consent-based process that communities and stakeholders find legitimate, effective, and practical will require careful reflection and attention to procedures for operationalizing core principles of consent and addressing challenges that can undermine them” (Webler and Tuler, 2021, p.94).

In short, the process of participation has to navigate controversies while at the same time generating consensus (Tuler and Webler, 2023). The challenge in energy transitions is threefold. First, multiple standpoints must be factored into project decisions; second, an open and reflective process is needed to build a consensus in the local communities; third, the project outcome must provide both benefits for citizens and stakeholders and contributions to climate protection. These are the requirements for a democratic and “just” energy transition, and policy-makers and stakeholders believe public participation is the “silver bullet” to achieve acceptance, trust and legitimacy (Rau et al., 2012).

The result is an overemphasis on participation procedures, creating frustration and disappointment – not only with the act and effects of participation, but also with the concept of democracy itself (Bowler and Donovan, 2002; Butzlaff and Messinger-Zimmer, 2020; Quintelier and Van Deth, 2014). This demonstrates that participation is “doomed to succeed” if the democratic energy transition is to work – or in reverse: it has to fail. On this assumption, we explore procedures of e-participation cautiously, reviewing the realistic options and limits of the involvement of citizens and stakeholders considering their views.

2. E-participation in energy transitions: Research questions

In this study, we are not aiming to classify e-participation practices in energy transitions, because our focus is on describing and analyzing different forms, deficits, and understandings of participation equally. Although we are aware of the different levels of influence on citizens, we evaluate options for e-participation reflecting on the overarching policy objective of improving the processes of participation regardless of magnitudes of influence.

Though e-participation is becoming increasingly important in public decision-making processes around the world (Steinbach et al., 2019), its role in the German energy transition has been limited (Deckert et al., 2020; Mostegl et al., 2017) despite numerous participatory processes taking place in the energy transition (Chilvers et al., 2018; Pallett et al., 2019; Renn et al., 2020) (see Fig. 1). The backgrounds and contexts of transition planning processes are fundamentally very complex: decisions about specific locations, land use, habitat protection, emission controls, and distances from residential areas all need to be made (Gailing et al., 2020; Hager and Stefes, 2016). And while the population wants to have a say in this planning, the scope for taking preferences into account is small due to the various technical and legal requirements (Schweizer et al., 2016). This means that the process of public participation has been formalized into a system whereby stakeholders and the public are informed via announcements through official channels, and comments can be submitted in writing or in electronic form (Fink et al., 2021; Schroeter et al., 2016; Schweizer and Bovet, 2016).

While various options for demonstrative, directly democratic and deliberative participation exist in energy transitions (see overview in Fig. 1), we focus on the typical and popular style of representative participation based on top-down procedures such as information events

¹ See critical assumptions based on several research study results in literature: Bidwell, 2016; Burke and Stephens, 2018; Coy et al., 2021; Estévez et al., 2021; Gauthier et al., 2011; Krug and Di Nucci, 2020; Langer et al., 2018; Langer et al., 2017; Lelieveldt and Schram, 2023; Liu et al., 2018; MacArthur, 2016; Nouri et al., 2022; Pallett et al., 2019; Pires, 2023; Renn et al., 2020; Silvast and Valkenburg, 2023; Stober et al., 2021; Tuler and Webler, 2023; Wahlund and Palm, 2022.

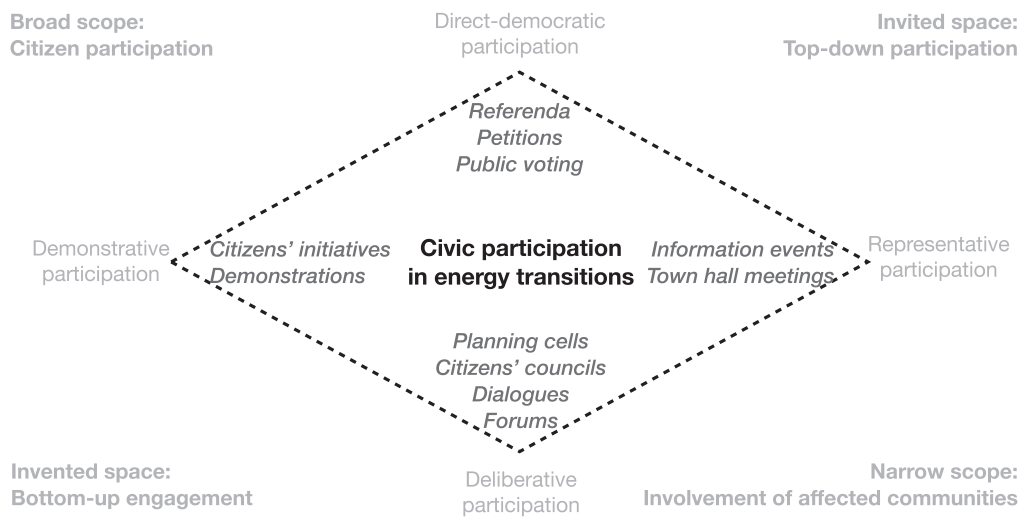


Fig. 1. Overview of modes of civic participation in energy transitions.

and town hall meetings, which aims primarily at achieving a broad scope that includes all citizens but also involves affected communities.

E-participation or virtual engagement in energy transitions is highly relevant outside of Germany (Alcaide Muñoz and Rodríguez Bolívar, 2021; Fast, 2013; Hansen and Slorer, 2023; Royo et al., 2014a; Segreto et al., 2020; von Wirth et al., 2018). The principal reasons for this are the ongoing policy efforts to strengthen the expansion of renewables, and the rise and spread of digital technologies which are transforming (public) services into digital services all over the world.

If we assume that the COVID-19 pandemic (and the resulting increase in digitalization) may have influenced individuals' levels of comfort and familiarity with, as well as the perceived risks and opportunities relating to, e-participation, we nevertheless see only limited effects when it comes to the practice of participation. The survey of the author writing about (e-)participation in the German *Energiewende* during the COVID-19 period suggests that the pandemic may have fostered the desire for real-world events rather than decreasing it (see section 3.2) (Radtke, 2023).

In theoretical terms, e-participation could play a key role in engaging the public in the planning process, because digital and interactive possibilities exist here for offering both more comprehensive representations of options and diversified access to relevant information (Berghofer, 2023; Randma-Liiv and Lember, 2022; Rodríguez Müller, 2022; Shahab et al., 2021; Shaikh et al., 2023). We define e-participation in terms of a broad understanding that follows a popular definition by Macintosh (2004, p.2) of e-democracy: “e-democracy is concerned with the use of information and communication technologies to engage citizens, support the democratic decision-making processes and strengthen representative democracy”. According to this conception, e-participation is based on the three key dimensions of information (“a one-way relationship in which government produces and delivers information for use by citizens”), consultation (“a two-way relationship in which citizens provide feedback to government”), and active participation (“a relationship based on partnership with government in which citizens actively engage in defining the process and content of policy-making”) (ibid).

In this study, we focus on the specific context of energy planning. In this regard, prior research has identified at least three additional possibilities for e-participation.

First, visualizations can be used to illustrate planning in a manner that is easier to comprehend than lengthy technical specifications (Bishop, 2019; Carvalho et al., 2012; Chin et al., 2018; Siyal et al., 2015). In the realm of energy transitions, the role of visualization of energy infrastructures is comparable to the impact of visualization in

climate change and climate protection communications (Ballantyne, 2018; Ganesh et al., 2024; Schroth et al., 2014; Sheppard, 2012; Solomon, 2024; Sterman, 2011; Tsang, 2023). Making complex research insights accessible to the public through simplification is vital in both areas (Newell et al., 2016; Perga et al., 2023; Schuster et al., 2024). Just as visualizations of intricate climate data help non-experts better understand and engage with the topic, visualization tools in energy projects—particularly when map-based—can enhance public comprehension (Rezk and Hendawy, 2024). Studies suggest that especially in public planning, visualization can support clearer communication (Franconeri et al., 2021; Metzke, 2020). In addition, strategies such as framing, storytelling, and narrative design are essential and most promising for generating meaningful, relatable messages that reach a wide audience (Badullovič et al., 2020; Coren and Wang, 2024; Fish, 2020; Jones, 2014; Moezzi et al., 2017; Moser, 2010; Moser and Dilling, 2011; Nisbet, 2009; Spence and Pidgeon, 2010; Tickell, 2002; Wang et al., 2024). Incorporating these visualization methods within planning processes—using VR, 3D models, and map-based displays—enables more comprehensive perspectives and effective communication (Fauville et al., 2020; Queiroz et al., 2023; Schroth et al., 2014; Thoma et al., 2023). Thus, visual tools in climate and energy discussions can make potential impacts and benefits tangible. By integrating critical knowledge and diverse viewpoints, these tools can advance a more participative, informed shift toward sustainable practices (Cuppen, 2018; de Looze and Cuppen, 2023; Karakislak and Schneider, 2023; Krüger, 2022; Radtke and David, 2024). In polarized discussions, such visual aids can also promote balance and understanding, offering a way to bridge the gap between scientific discourse and broader public understanding through these “connective elements” (Merzdorf et al., 2019).

Second, complex planning content and information can be presented in a simplified virtual form, e.g. using 3D spaces, to help explain why a certain site is preferred (Onyimbi et al., 2018; Porwol and Ojo, 2019; Würstle et al., 2019). Through the implementation of digital twin concepts (for cities), new opportunities for community participation have been realized by researchers and practitioners (Abdeen and Sepasgozar, 2022; Adade and de Vries, 2023; Dembski et al., 2020; Luo et al., 2022; Schrotter and Hürzeler, 2020). Furthermore, augmented reality technology allows users to place digital objects in real-world environments (Ahmadi Oloonabadi and Baran, 2023; Goudarzania et al., 2017; Othengrafen et al., 2023; Oulefki et al., 2024; Wolf et al., 2020; Boos et al., 2023; Fegert et al., 2020; Hunter et al., 2021; Parker et al., 2015; Saßmannshausen et al., 2021). By visualizing the results of specific choices, this offers opportunities for informed co-decisions between

decision-makers, stakeholders and citizens (Barrios-O'Neill and Schuitema, 2016; Higgs et al., 2008).

Third, new interactive formats such as liquid feedback² have been used to foster better communication between citizens, stakeholders, and decision-makers (Behrens et al., 2014; Karkin and Cezar, 2024; Mariani et al., 2023; Porwol et al., 2022; Mendonca, 2023; Shin et al., 2024). Similarly, new technology is available to decision-makers that can simplify interactions with citizens by (partially) automating the collection of preferences and evaluations of the planning process with the help of artificial intelligence, machine learning algorithms, chatbots, and other Big Data tools (Borchers et al., 2024; Kim and Lee, 2012; Lega et al., 2024; Onufreiciuc, 2024; Romberg and Escher, 2024; Stodden and Nguyen, 2024; Vasilakopoulos et al., 2024). In October 2024, Google's AI company, DeepMind, introduced the "Habermas Machine," an AI-driven mediation tool designed to promote consensus in group discussions. By synthesizing diverse perspectives into suggested solutions through a two-step process—collecting initial viewpoints and then integrating feedback into AI-crafted summaries—it aims to support productive group interactions (Monti, 2024; Tessler et al., 2024).

In sum, these developments enable new means of access to the *object of participation* (e.g. in a virtual space) and new avenues for *participation input* (e.g. liquid feedback). Given the immense gap between potential design options for e-participation and real-world application contexts (Schlozman et al., 2012; Tai et al., 2020; Zheng and Schachter, 2017), the crucial question becomes why there is such a huge gap between the real possibilities and the actual use of e-participation in the *Energiewende*.

It is in this spirit that we undertook this study to survey and measure the attitudes and preferences of a representative population and its local stakeholders (see Fig. 2). Our research aim is to uncover attitudes about participation in the energy transition, looking to understand, first, why citizens do or do not take the opportunity to use participation options and, second, which instruments of e-participation are preferred. To answer these questions, we used an online survey in connection with an interview-based case study analysis of the planning for a wind energy project (community wind farm, providing financial shares for the local community). We first review theoretical perspectives and study results on participation in energy transitions, as well as international experiences with e-participation. Using this framework, we present our empirical findings based on the case study; we then discuss our most salient findings and draw conclusions for future application of e-participation to energy transitions.

3. Theoretical framework: E-planning and new technologies for e-participation

3.1. Participation as a democratic activity

To explain the underlying theoretical framework of this study, we provide a short overview of how public participation is framed in energy transitions (Abas et al., 2023). We rely on the concept of inclusive governance by Renn and Schweizer, who delineate the fundamental functions of public participation in terms of efficiency, knowledge and competence, values and fairness, and legitimization (Renn and Schweizer, 2020, p.46). We assume that generating democratic legitimacy is the ultimate and overarching objective of public participation, with legitimacy taken to mean the "compatibility of the results of governmental output with the value patterns of the relevant systems, that is, those affected by these results" (Stillman, 1974, p.32). The most

common approach for reviewing legitimacy is to differentiate between legitimacy as property, process, and perception (Suddaby et al., 2017, p.451). We refer to the concept of legitimacy from a process perspective, inspired by the process model of policy-making (Easton, 1965), divided into input, throughput, and output legitimacy (Schmidt, 2013). This allows the effects of policy-making to be evaluated either via citizen and stakeholder input in the agenda-setting phase, via the decision-making process according to quality criteria (fair, open, transparent), or via the output or outcomes of policy-making (effective and benefiting the public) (Innes and Booher, 2004; Kim and Lee, 2019; Newig et al., 2023; Papadopoulos and Warin, 2007). With regard to energy transitions, accelerating the transition process can also be a relevant outcome (Bugge et al., 2017; Lindberg and Kammermann, 2021; Skjølvold and Coenen, 2021; Trahan and Hess, 2022). This is not merely a question of speed, however, but of achieving participation in the process. Participation leads to greater acceptance of the outputs, which leads to less resistance by the public and thus more rapid implementation (Bidwell, 2016; Hyland and Bertsch, 2018; Kamlage and Nanz, 2017; Langer et al., 2018; Langer et al., 2017; Lennon et al., 2023; Liu et al., 2020; MacArthur, 2016; Ruffing and Brendler, 2024; Schroeter et al., 2016; Schweizer et al., 2016; Slee, 2015; Suskevičs et al., 2019).

We understand public participation in terms of stakeholder involvement and discourse types as put forward by Renn and Schweizer (2020), which offer more differentiated dimensions regarding main objectives and functions, types of participation, rationales, models and instruments, and stakeholders involved (see Table 1). Within this framework, we derive concrete e-participation formats and specific challenges. First, the functionalist concept aims to include the best available knowledge from experts and citizens – gained, in the context of e-participation, through online workshops, inquiries, and meetings. The crucial challenge here is how to summarize expert knowledge without over-simplifying it, and while providing citizens and stakeholders with opportunities for knowledge-sharing (Bojórquez-Tapia et al., 2022).

Second, the neoliberal concept aims to share benefits and burdens fairly by representing values and preferences in proportion to their share within the affected population. Typical formats are referenda, focus groups, and e-participation, with e-petitions and online group meetings being common examples in the context of energy transitions. The challenge here is how to involve all stakeholders equally in an online format. However, this kind of format also enables the inclusion of a broad section of the population because of the low barriers to access.

Third, the deliberative concept aims to create congruency with social and cultural values by attempting to resolve value conflicts and reach consensus through discussion and argumentation. This can take the form of group forums or online meetings. Here, the major challenge is how to include all actors and to expose, accept, discuss, and resolve differences through balanced, in-depth discourse. E-participation can increase the number of input channels and opportunities for expression for "silent" actors.

The fourth anthropological concept is based on the same goal, but aims to engage non-interested laypersons, e.g. via citizen juries and planning cells. These formats rarely take place online, but e-participation can nevertheless offer the same advantages as above. The concept aims to empower less privileged groups and individuals, e.g. through action group initiatives. E-organization tools are a highly promising format for these citizen initiatives, although the challenge of involving all citizens and stakeholders equally online remains apparent.

The final concept is a postmodern one that tries to compile the advantages of all the other concepts by using a hybrid approach to map the plurality of rationalities, e.g. through open forums, open space conferences, and panel discussions. The main challenge here is that of generating too much input. However, this concept can improve on the weaknesses of individual formats by enriching them with additional formats, including other input channels, discussion forums, and opportunities for feedback on policy solutions.

Our study adheres to the idea that participation means democratic

² LiquidFeedback is the name of a citizen input software for political opinion formation and decision-making, combining aspects of *representative* and *direct democracy* (created in 2009 by Public Software Group). We use this term as a broad description for electronic input channels that provide new opportunities to give feedback in decision-making processes.

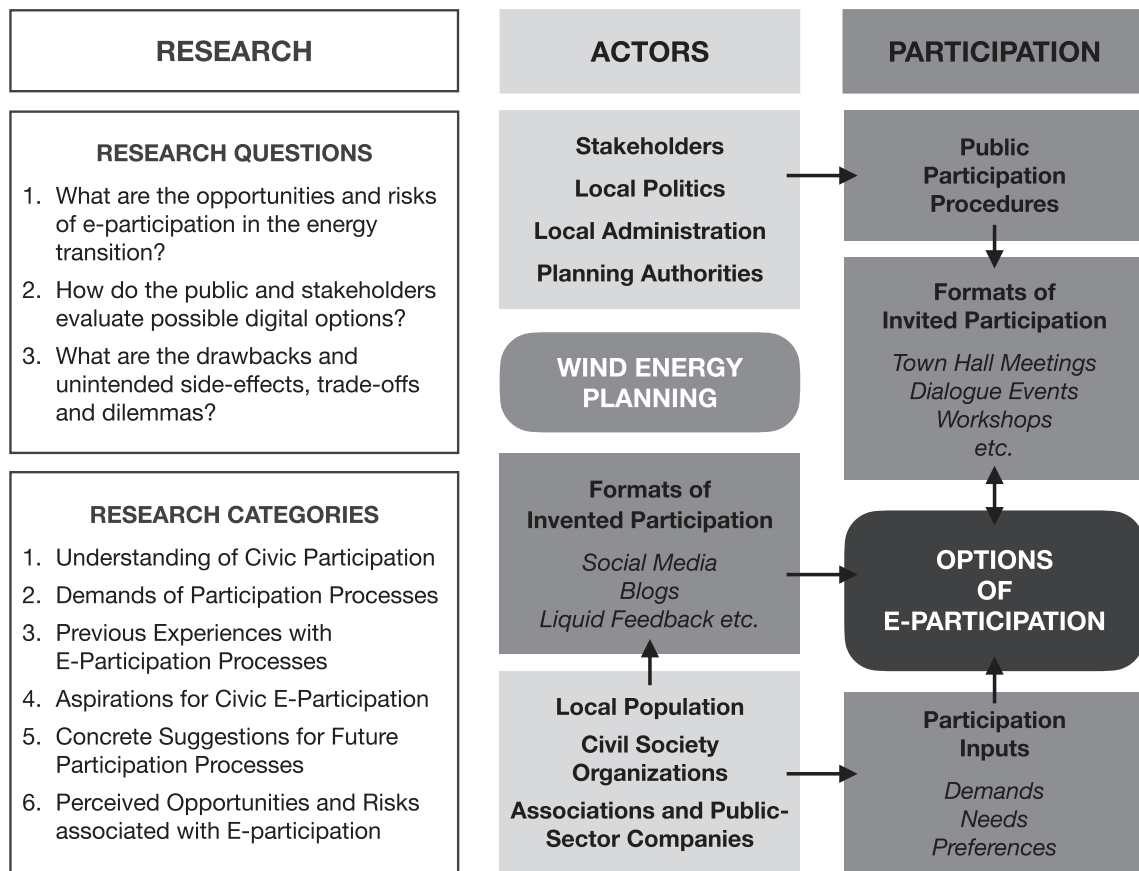


Fig. 2. Overview of the research design and contents of the study.

activity in some form, as differentiated in the concepts of stakeholder involvement provided. These are reflected in the empirical dimensions of the study, which address people's understanding of and aspirations for civic participation, their demands of and experiences with participation processes, and suggestions for and opportunities and risks associated with e-participation. A more profound underpinning of the practices, values, and attitudes towards e-participation in energy transitions remains a task for future research, however.

3.2. Participation in energy transitions

There are currently two fundamental modes of participation in the context of the *Energiewende*. There is the formal i.e. legally mandated and binding mode, and the informal i.e. voluntary and non-binding mode (Renn and Schweizer, 2020). In informal processes, decision-makers are required to publicly disclose their project plans and provide both stakeholders and citizens with a limited scope of influence (Vogt and Haas, 2015). The typical scope of citizen participation in these processes is exceedingly narrow, confined to inspecting finalized planning documents and submitting statements that will not necessarily influence the planning outcome. The scope for participation varies in other contexts within the *Energiewende*, but remains narrow as long as formal planning procedures limit participation through their underlying restrictions. However, the scope widens in the case of small-scale energy utilities (micro energy), e.g. photovoltaics or heating systems, because no public planning is necessary here. In Germany, permitting, planning, and participation requirements are the same at local, regional, state, and federal levels due to the uniform federal legislation. However, different participation procedures occur, e.g. in wind energy planning, because of the aspirations of state authorities or stakeholders (Hübner, 2020; Langer et al., 2018; Langer et al., 2017; Leibenath et al., 2016; Lienhoop,

2018; Müller and Morton, 2021). Additional informal participation is always possible, but has no legally binding effect. At the European level, the legal guidelines for public participation are set by the Aarhus Convention (in force since 2001) and the European Commission's TEN-E policy (Trans-European Networks for Energy, in force since 2022), which guarantees a high level of transparency and participation in power grid planning procedures (Fink et al., 2021; Fink and Ruffing, 2020; Fink and Ruffing, 2017; Schweizer and Bovet, 2016). Focusing on wind energy as the reference point in this study, we observe forms of public participation in every European country, but with significant differences between individual projects (Suškevičs et al., 2019).

In informal processes, it is typical for policy-makers and developers to offer participatory information events. More reciprocal formats that are higher on the "ladder of citizen participation" (Arnstein, 1969), such as planning cells and citizen councils, are rare. This is chiefly because planners fear that citizens might have preferences that complicate or prevent the implementation of their plans.³ Hence, informal participation often only starts when the planning is already in place and the scope for decision-making is very narrow, often leading to increased tension between planners and citizens.

³ Note: With the term "planners" we cover both the permitting state planning authorities and the project developers who are responsible for providing project-specific information and for the inclusion and consideration of comments by citizens and stakeholders. In the early planning stage, the state authorities are tasked with carrying out regional planning (e.g. setting locations for energy utilities), while the project developers are responsible for the concrete implementation and building process. Within the scope of state planning, public participation is regulated by law, whereas private developers and companies provide information and opportunities for participation on a voluntary basis.

Table 1

Concepts of stakeholder involvement underpinned by theoretical concepts of participation (adapted by Renn and Schweizer, 2020, pp. 54, 66, 73).

Concept of stakeholder involvement and discourse type	Main objective and function	Type of participation	Rationale	Models and instruments	Stakeholder involvement	E-participation formats and challenges
Functionalist concept	Inclusion of best available knowledge: to improve the quality of decision output	Epistemic	Representation of all knowledge carriers;	Delphi method, workshops, hearings, inquiries, citizen advisory committees	Actors	Online workshops, inquiries, meetings
Epistemic type	Representation of all knowledge carriers; integration of systematic, experiential, and local knowledge	Use experts to find valid, reliable, and relevant knowledge about the risk	Integration of systematic, experiential, and local knowledge		Scientists/researchers	<i>Challenge: Summarizing expert knowledge without over-simplifying</i>
Neoliberal concept	Agreement on causal relations and effective measures	Reflective	Informed consent of the affected population;	Referendum, focus groups, online participation, negotiated rulemaking, mediation, etc.	Actors	<i>Opportunity: Various possibilities for knowledge input</i>
Reflective type	Fair and acceptable arrangement for sharing benefits and burdens: to represent all values and preferences in proportion to their share in the affected population	Involve all affected stakeholders to collectively decide best way forward	Pareto rationality plus Kaldor-Hicks methods (win-win solutions)		Scientists/researchers	E-petitions Online group meetings <i>Challenge: Difficult to involve all stakeholders equally online</i>
Deliberative concept	Balancing costs of underprotection versus costs of overprotection in the face of uncertain outcomes	Participatory	Inclusion of relevant arguments, reaching consensus through argumentation	Discourse-oriented models, citizen forums, and deliberative juries	Actors	<i>Opportunity: Low access barriers to e-formats</i>
Participatory type	Congruency with social and cultural values: to debate the criteria of truth, normative validity, and truthfulness	Include all actors so as to expose, accept, discuss, and resolve differences			Scientists/researchers	Online forums and jury meetings <i>Challenge: Very difficult to include all actors so as to expose, accept, discuss, and resolve differences</i>
Anthropological concept	Resolving value conflicts and assuring fair treatment of concerns and visions	Participatory	Inclusion of non-interested laypersons representing basic social categories (e.g. gender, income, and locality)	Consensus conference, citizen juries, and planning cells	Actors	<i>Opportunity: More input channels and methods of expression for "silent" actors</i>
Participatory type	Congruency with social and cultural values: to engage in common sense as the ultimate arbiter in disputes (the jury model)	Include all actors so as to expose, accept, discuss, and resolve differences			Scientists/researchers	Online conferences, citizen jury meetings, planning cells <i>Challenge: Very difficult to include all actors so as to expose, accept, discuss, and resolve differences</i>
Emancipatory concept	Resolving value conflicts and assuring fair treatment of concerns and visions	Participatory	Inclusion of non-interested laypersons representing basic social categories (e.g. gender, income, and locality)	Consensus conference, citizen juries, and planning cells	Actors	<i>Opportunity: More input channels and forms of expression for "silent" actors</i>
Reflective type	Fair and acceptable arrangement for sharing benefits and burdens: to empower less privileged groups and individuals	Involve all affected stakeholders to collectively decide best way forward	Strengthening the resources of those who suffer most from environmental degradation	Action group initiatives, town hall meetings, community development groups, tribunals, and science shops	Actors	Online meetings <i>Challenge: Difficult to involve all citizens and stakeholders equally online</i>
Postmodern concept	Balancing costs of underprotection versus costs of overprotection in the face of uncertain outcomes	Reflective	Strengthening the resources of those who suffer most from environmental degradation	Action group initiatives, town hall meetings, community development groups, tribunals, and science shops	Actors	<i>Opportunity: Low barriers to entry for e-formats, manifold organization tools</i>
Hybrid design	Meeting more than one challenge (complexity, uncertainty, ambiguity): to demonstrate variability, plurality, and legitimacy of dissent	Hybrid	Acknowledgment of plural rationalities; no closure necessary; mutually acceptable arrangements are sufficient	Open forums, open space conferences, and panel discussions	Actors	Online forums, conferences, and panel discussions <i>Challenge: Too much input</i>
		Mix of epistemic, reflective, and participatory type + instrumental type (find the most cost-effective way to make			Scientists/researchers	<i>Opportunities:</i>
					Civil society	(continued on next page)

Table 1 (continued)

Concept of stakeholder involvement and discourse type	Main objective and function	Type of participation	Rationale	Models and instruments	Stakeholder involvement	E-participation formats and challenges
	Meaningful and effective integration of functions	the risk acceptable or tolerable)				Weaknesses of specific individual formats balanced by other formats

When the potential for conflict is high, other formats are introduced, such as dialogue meetings, walk-throughs, and discussions with experts (Schroeter et al., 2016). In rare cases, developers facilitate direct dialogue between planners and citizens (Komendantova and Battaglini, 2016). However, these formats are mostly used when there is already citizen resistance; only in even rarer cases are planning workshops held in which citizens are directly involved in the planning processes before the fact (Leibenath et al., 2016). As a last resort, citizens can initiate a referendum on the energy transition project (Kapeller and Biegelbauer, 2020). This is happening increasingly frequently in Germany, and in some cases has put a stop to plans.

3.3. Theoretical perspectives on participation in energy transitions

The basic assumption of modern theories of embedded democracies is that participation serves primarily to increase legitimacy and to reduce the deficits of representative democratic systems. If we conceptualize participation in an input-output process model of decision-making and policy implementation (Easton, 1965; Peter, 2008; Schmidt, 2013), it is clear that civic participation in the *Energiewende* falls short of these goals on all three levels (input, throughput, output). Issues with democratic legitimacy in participatory energy transitions can be traced back firstly to participant structures that are biased and non-representative (*input*); secondly to planning processes that are insufficiently transparent and fair (*throughput*); and thirdly to planning outcomes that largely ignore citizen preferences (*output*) (Galais et al., 2021; Sareen, 2020; Zelli et al., 2020).

Research has also highlighted the need to accelerate the exchange process between state administrations, stakeholders, and citizens. E-participation practices could promote this by fostering effective communication (Armenia and Irina, 2022), thus increasing the pace of energy transitions. E-participation strategies could help to resolve conflicts, achieve greater acceptance, collect inputs, and conduct coordination processes within set timeframes. While social philosopher Cristina Lafont's point remains true that democratic decision-making and negotiation processes need a certain time to play out, online formats can reduce the time required (Lafont, 2019). In this sense, online participation serves the vision of *democracy without a pause and replay button*, and could be a means of bringing the speed of democratic decision-making processes more in line with the speed of climate change.

Research into e-participation options that could combat the above-mentioned shortcomings in the context of environmental planning, urban development and infrastructure projects has been taking place for years (Conroy and Evans-Cowley, 2006), and various technologies and conceptual approaches have been discussed (Silva, 2010). However, while e-procedures to encourage public participation during initial planning phases – including surveys and citizen planning instruments – would be simple to put into practice, they rarely are. We therefore focus on identifying the barriers that limit the use of e-participation and the factors that reduce the potential benefits of e-participation on the three levels that frame democratic legitimacy in planning procedures for energy transitions (input, throughput, output).

3.4. Challenges for e-participation

As outlined above, e-participation offers many avenues for tackling the shortcomings of civic participation, particularly in the context of the *Energiewende*. However, e-participation itself faces numerous challenges. Here, we briefly review five.

First, there is a measurable digital divide in most digital participation practices (Sylvester and McGlynn, 2010) that potentially arises from an unequal distribution of digital literacies (Park, 2018).⁴ Since literacies extend to those needed for offline participation, the normalization thesis states that it is predominantly the people who participate online who are also active in real-world processes (Boulianne, 2009). However, there exists a small, positive average coefficient between digital media literacy and engagement in civic and political issues (Boulianne, 2018). Moreover, we recognize that social inequalities arise from differences in the competencies required to use technologies such as augmented reality

⁴ In principle, the term digital divide is defined by the question “whether people have the skills and knowledge required to make effective use of digital media and information” (Warschauer, 2009, p.1551). The basic perspective concerns the “division between people who have access and use of digital media and those who do not” (Dijk, 2020, p.1). In this narrow sense, it is about the binary view of the “haves” and “have-nots” based on the effects of the distribution of the internet at the end of the 20th century; the idea that some people “have the most powerful computers, the best telephone service and fastest Internet service, as well as a wealth of content and training relevant to their lives (...). [A]nother group of people (...) don't have access to the newest and best computers, the most reliable telephone service or the fastest or most convenient Internet services. The difference between these two groups is (...) the Digital Divide” (Noll et al., 2001, p.1). This definition describes the gap between those who have and who do not have access to computers and the internet, resulting in four successive types of access: motivational, physical, skills, and usage (van Dijk, 2006). A subsequent shift of attention from physical access to skills and usage can be observed (ibid). The digital divide was originally more oriented towards issues of digital inequality (Hargittai, 2003). Later, this view was widened by the separation between the “cans” and “cannots” (Dolan, 2016). The most common research framework refers to the user-oriented view of the “divisions in the access to and use of four phases in the adoption of digital media (motivation, physical access, digital skills and usage)”, from which four dimensions were derived concerning the questions of WHO (individuals, organizations, regions, etc.), with WHICH characteristics (income/education/age/gender, ownership/size/sector, urban/rural), HOW (access, skills, usage), and WHAT type of technology (computer, internet, phone, etc.) (Hilbert, 2011). The most important factor for empirical research is the “question of how the digital divide is defined in practice by policy makers” (ibid, p.715). Research has shown that when it comes to the “digital divide” and the internet, inequalities exist in access to and use of the medium “with lower levels of connectivity among women, racial and ethnic minorities, people with lower incomes, rural residents and less educated people” (Hargittai, 2003, p.4 f.). However, recent research not only addresses sociodemographic and socio-economic factors, but also covers personal factors, social support, types of technology, digital training, rights, infrastructure, and large-scale events, as well as a new form, the type of internet access, including two new levels of the digital divide: algorithmic awareness and data inequalities (Lythreatis et al., 2022). In this research study, we focus on stakeholders' and citizens' preferences when it comes to participating online via e-information, visualization, and interaction tools. We are chiefly interested in people's specific digital literacies concerning the use of e-planning tools in energy transitions.

(AR) and virtual reality (VR). These represent further digital literacies. Expanding the spectrum of input options therefore seems advantageous for creating democratic legitimacy, but is limited by individual literacies and user preferences (people's typical everyday e-practices).

Second, numerous studies show that online communication has deficiencies in terms of content and interactive behavior (Hanssen, 2008). Examples of this are hate speech, fake news, a lack of standards and safeguards, and a lack of moderation (Valenzuela et al., 2019). There are also often deficiencies in data protection, digital security, and response integrity, as reflected by abusive phenomena such as manipulation and trolling (Diamantopoulou et al., 2020; Vogt et al., 2014).

Third, technical hurdles can make access difficult and reduce participation opportunities and interest (Parycek et al., 2015; Susha and Grönlund, 2014). This underscores a recurrent problem with e-participation, namely that user numbers are very low and that there is often only a short period of use and no sustained activity – a pattern called the “one-click phenomenon” (Johann and Maalej, 2015; Royo et al., 2014a; Ruesch and Märker, 2012).

Fourth, e-participation requires resources, i.e. competent personnel for managing tools and processes. This creates costs for governments and stakeholders – even though these may be low compared to the cost of social resistance or judicial action (Porwol et al., 2013; Viborg Andersen et al., 2007; Vicente and Novo, 2014).

Fifth, digital technologies and digital solutions are subject to various controversies. These primarily concern privacy, surveillance, transparency, and the control of machines (Ahangama, 2023; Diamantopoulou et al., 2020; Quintero-Angulo et al., 2020; Radtke, 2022; Yakobi et al., 2020). For bodies offering e-participation services, ensuring full data protection is difficult. Because public authorities are bound by privacy policies, however, they have low ambitions when it comes to using sophisticated technologies to implement e-participation.

The potential identified by democratic legitimacy theory in the three conceptual dimensions is limited by concrete conditions in the real-world practice of participation, as discussed in the following.

3.5. Derivations from participatory action research and research gaps

Using the methodological approach of qualitative content analysis (Kohlbacher, 2006; Kuckartz and Rädiker, 2023), we strive in this paper to identify barriers to the practical implementation of (e-)participation in the *Energiewende*. Whereas the conceptual benefits of more and better (e-)participation may be evident, we have to keep in mind the social component of the issue: people shape, discuss, create or hinder the visibly “built” energy transition. We therefore need social knowledge, and planners need to have empathy for local communities (Natarajan, 2017). Good designs and comprehensive strategies for the energy transition are not enough. Acceptance of technological change requires understanding and persuasion – as well as trust. These factors are crucial for acceptance, justice and democracy in the energy transition, and represent the key to its success (E. Moula et al., 2013; Elmallah and Rand, 2022).

The long-standing tradition of Participatory Action Research is centered around the crucial challenge of connecting social theory, methodology, and the practice of participation (Borda, 2005; Reason and Bradbury, 2013). From the beginning, the goal was “the integration of the core elements in the acronym: Participation (life in society), Action (experience) and Research (knowledge creation)” (Chevalier and Buckles, 2019, p.11). Most commonly, empirical studies are about participatory mapping, whereby the analysis of actors plays the most important role (stakeholder identification, analyses of CLIP (conflict/collaboration, legitimacy, interests, power), evaluation of positions and values) (ibid, p.241ff.). In line with this, we stress the importance of the role of actors in e-participation, which essentially consists in understanding the diverse roles, connections, and partnerships (Kassen, 2020), and discovering individual capabilities (Pinto et al., 2023). E-participation research also contains theoretical perspectives, but is

predominantly oriented towards a pragmatic viewpoint, describing and analyzing approaches to solutions (technological, governance/policy models, location-based services) (Mustafa Kamal, 2009; Yusuf et al., 2014). Until now, knowledge and understanding of successful e-participation strategies and their implementation has been very limited (Wirtz et al., 2018). We aim to understand the perceptions of the stakeholders involved in energy planning and to try and identify factors that are essential to developing forward-looking e-participation tools.

To translate theoretical concepts into dimensions for empirical analyses, we refer to the fundamental distinction between invited (top-down, by public and business authorities) and invented (bottom-up, by civil society) forms of participation (Kersting, 2013). Furthermore, we differentiate between reductive (low-level “tokenism,” especially informing) and extensive (medium and high-level “tokenism and citizen power”, i.e. consultation and co-decision-making) definitions and understandings of citizen participation (Arnstein, 1969).

In (wind) energy planning procedures, these two basic levels of participation are mapped first through a process of informing the affected local communities, and second through a process of meetings where conversations between citizens and representatives are held at different levels of active involvement (Leibenath et al., 2016). In this mapping, we recognize a dualism between a more deliberative type of informal consensus-seeking (i.e. planning workshops) and a more functionalist, formal type of citizen and stakeholder involvement (i.e. hearings) (Renn and Schweizer, 2020, p. 54). Both forms of participation usually take place consecutively. Forms of alibi participation can also appear in energy planning, in which participants have no right to co-decision (Langer et al., 2018).

Although the literature describes various negative factors within the practices of civic participation, in this paper we focus solely on “violations of the rules of rational discourse”. This factor draws on Habermas' ideal of a discourse based on mutual respect (Habermas, 1996). Under the umbrella term “violations of the rules of rational discourse,” we include all forms such as incivility, hate speech, insults, shouting, and other deviations from deliberative discourse.

If the benefits of e-participation are clear, the reason for the lack of implementation in practice must therefore be a social one. This leads us to our research questions: What attitudes towards new options for e-participation and experiences with previous participation practices in energy planning are perceived and described by stakeholders? What are the opportunities and risks of e-participation in the energy transition?⁵ How do the public and stakeholders evaluate possible digital options? What are the drawbacks and unintended side-effects, trade-offs, and dilemmas? How promising are the digital options ultimately? What do they really offer in practice? To answer these questions, we queried citizens and stakeholders in a concrete case study in the area of wind energy planning.

⁵ We are focusing on opportunities and risks as a code for possible solutions and challenges in their implementation. We define an opportunity in a broad sense as an option (either technological or social) for a possible function/tool/direction for e-participation, e.g. for giving feedback. This perspective is forward-looking: based on the experiences of the stakeholders interviewed, we are interested in their visions for new and creative e-applications. The risks are a synonym for the limits and barriers of these forward-looking ideas reflected through the real-world conditions of energy planning, and citizen behavior in procedures of participation and e-communication (etc.) as described by the respondents. We compare these statements and collate them into a comprehensive summary of realistic opportunities and serious limitations. This binary view is a result of the research design, which mirrors the attitudes of actors towards possible e-participation options which do not (yet) exist. We can only measure their evaluations and experiences and merge these to create a well-founded forecast for future e-participation.

4. Data basis and preliminary studies

4.1. Research design

We adopt a mixed-methods design consisting of a representative online survey and a series of stakeholder interviews. These form the empirical basis for this paper, and a qualitative analysis of the interviews forms the core of the analysis in the next section. Before we outline our results in section 4, we would like to present some key findings from this preliminary online survey. Our case study is of a single community wind farm planning project in Germany. This case enables an in-depth analysis of stakeholders' perceptions including affected local communities, public authorities, and civil society organizations. This allows us to map the full range of individual, community, and organizational perspectives on the community energy project. It covers technocratic (e.g. planning permissions), technological (e.g. appearance and noise), cultural (e.g. traditions), natural (e.g. species protection), and participatory (e.g. financial participation) aspects. The case study serves as a good representative example of wind energy planning in Germany, as it reflects the multitude of planning issues that arise and concerns expressed by local communities due to the impact on the landscape. In combination with the online survey, which covers the whole population of the federal state in which the wind farm is located, it allows us to draw a coherent empirical picture.

4.2. Online survey

In parallel to the interview series, an online survey was conducted in the German state of North Rhine-Westphalia ($n = 2826$) (Radtke et al., 2021). The survey queried respondents on their attitude towards wind power, preferred information formats, and potential options for online participation.

First, 80 % of the respondents support the expansion of renewable energies, while 61 % would like to see further expansion of wind power in their own county. About 50 % believe that wind power has a negative impact on the landscape, 19 % see the impact on the landscape as positive, and 31 % are in-between. With respect to local wind energy planning, the most important aspect for respondents when it comes to public participation is receiving comprehensive information and being actively involved. Furthermore, respondents are interested in ensuring that the revenues benefit the region, and that the electricity can be used cheaply by the local community and municipality.⁶

Second, the respondents stress the importance of receiving information during the planning process about the location, possible noise, and effects on the surrounding natural habitat (in each case 60 % marked these as "important").⁷ Less important are visualizations of the wind turbines, technical information, planned measures for the protection of animals, economic efficiency, and climate protection contribution figures. By far the most important format for dissemination is the classic information event (e.g. town hall meeting), followed by site visits, visualizations, brochures, websites or apps from the operator, and finally newspapers. Social media and radio reports are fairly insignificant. The respondents consider information from scientific sources (59 %) and from nature conservation organizations (39 %) particularly credible. All other sources are trusted much less (politicians, press

⁶ The response options to the question "What would you wish for the construction of a wind farm near your home?" were "Comprehensive information for the population" (42 %), "Active involvement of the population" (37 %), "Special consideration for citizens' interests" (30 %), "Locations far away from residential areas" (37 %), "Returns should benefit the region" (42 %), "Financial participation for the population" (30 %), "Operation by municipal energy providers" (29 %), "Utilization for affordable electricity for the municipality" (44 %).

⁷ This and the following questions were multiple choice.

reports, citizens' initiatives, wind power companies, planners).⁸

Third, when it comes to resolving substantive conflicts within the planning process, the majority would like to see voting (43 %), followed by citizen meetings and the search for solutions by experts (40 % each). In the middle are pro and con discussions (31 %), arbitration (25 %), and negotiations in the municipal council (18 %). There is hardly any support for court proceedings (10 %) or conflict resolution only among those involved (7 %). Fourth, the survey shows a clear preference for face-to-face over online formats (events with decision-makers: 41 % face-to-face versus 15 % online; with citizens: 35 % face-to-face versus 12 % online; with associations and experts: 36 % face-to-face versus 17 % online; and with politicians: 27 % face-to-face versus 9 % online).⁹

Finally, the respondents were asked whether they could envisage using an app with a visualization function if a wind farm were planned in the area. Here the results are evenly divided, with one half saying they could, the other half that they could not. This divide cannot be attributed to age: the majority (48 %) of the younger population between 18 and 29 and middle-aged people between 40 and 49 would use an app.¹⁰ However, in the other age groups (<18, 30–39 and > 49 years), only a slight majority is against using the app (nearly 50 % voted against, 40 % for using, 10 % were undecided). By contrast, there are clear differences based on education levels and occupational status, with people with lower degree qualifications and blue-collar workers less likely to prefer an app. Differences also correlate with political orientation: people with a voting preference for the left are more interested in the app than people on the right, with those on the ultra-right most strongly anti-tech.

4.3. Stakeholder interviews

Central to the empirical analysis of this paper is a series of interviews with stakeholders in a wind farm planning project in North Rhine-Westphalia ($n = 33$). Here, the operator of a pre-existing wind farm was planning a second one in the immediate vicinity, including financial participation by the local community via what is called a "community wind approach".¹¹ Across both affected communities, a total of 33 relevant stakeholders were interviewed (see table in the appendix).

The interviews were part of a research project on e-participation in both the energy transition and the city, as well as in regional planning from 2018 to 2022. Five types of stakeholders were identified and recruited from two affected municipalities where the wind farm is located:

- a) the mayors ($n = 2$).
- b) employees of the municipal, regional and federal administration ($n = 8$).
- c) local politicians from each party in the two city councils ($n = 8$).
- d) members of associations and public-sector companies ($n = 5$) and.
- e) members of civil society organizations (CSOs) ($n = 10$).

The interviews were implemented using a structured interview guide with mandatory initial and optional follow-up questions. The interviews were conducted by five interviewers via videocall between January and July of 2021, transcribed automatically with artificial intelligence and then coded manually by two coders. Three interviews had to be excluded from the analysis due to failed recordings with unintelligible transcriptions.

In pursuit of our research questions, we carried out a qualitative content analysis of each interview, deriving from our theoretical assumptions six categories that captured: 1) understanding of civic

⁸ Question of the survey: "Which source do you rate most trustworthy?"

⁹ Multiple answers were possible.

¹⁰ The ratio is not 50:50, as a third response option ("Undecided") existed.

¹¹ The planning process of the community wind farm was the subject of the research project "Creactive Citizen", which discovered opportunities for e-participation in processes of public participation in the context of urban development and the energy transition on a technical and user-oriented scale.

participation, 2) demands of participation processes, 3) previous experiences with participation processes,¹² 4) aspirations for civic participation, 5) concrete suggestions for future participation processes, and 6) perceived opportunities and risks associated with e-participation. The sub-coding of the interviews followed a deductive-inductive cycle between our theoretical assumptions and the material itself, following Kuckartz and Rädiker (2023). Table A2 lists the categories and sub-codings used to analyze the interview transcripts. In the following, we use italics to represent stakeholders and monospaced font to represent sub-codings found in the interviews. The total number of codings is represented by an $n = X$ count. PYZ gives the source for illustrative quotes. “P99; $n = 4$ ” indicates that the preceding quote was sourced from interview P99 and that four interviewees – including P99 – made similar statements in their interviews.

5. Results

5.1. Understanding of civic participation

We began by gathering a baseline of the interviewees' understanding of the term *civic participation*. We have categorized this understanding along three dimensions. First, we differentiate between *narrow* and *broad* overall conceptions, i.e. whether the interviewees' understanding is constrained to one mode of participation or extends over several modes and formats (e.g. formal/informal processes, conventional/unconventional measures of participation). Second, we differentiate between *invited* (top-down) and *invented* (bottom-up) forms of participation (Kersting, 2013). Finally, we summarize whether the interviewees' understanding of citizen participation is more *reductive* (i.e. information-only) or *extensive* (i.e. co-decision).

Overall, the interviewees' understanding of the term was heavily weighted towards a top-down, formal conception of civic participation along the lines of the formal “Öffentlichkeitsbeteiligung” [“public participation”] that is required by German law within the *Energiewende* and for land use planning in general. About half of the interviewees had a narrow understanding of participation, mentioning exclusively top-down, formal processes, whereas the other half's *broad* understanding included modes beyond strictly formal, top-down structures (“Öffentlichkeitsbeteiligung”) but was nonetheless dominated by invited modes of participation.

Almost all interviewees stressed the importance of informing the public about planning projects, thereby fostering acceptance and gathering a majority behind the project. The interviewees thus focused implicitly or explicitly on a *reductive* role for the citizenry, where individuals act as mostly passive recipients rather than co-decision-makers. The rigid legal framework of the mandatory participation process in the *Energiewende* and the consequent limits on the potential scope for co-decision-making was heavily emphasized by many interviewees ($n = 11$).

Broad bottom-up conceptions of civic participation were the exception and generally vague ($n = 5$) with one interviewee from the public sector (*type d*) listing a wide range of top-down and bottom-up formats (P26), another formulating a diffuse deliberative understanding of participation (P29), and another from a civil society association (*type e*) revealing an expansive understanding of the term by stating that different issues required vastly different forms of participation (P16). Some interviewees expressed extremely cynical or dismissive views on civic participation in general ($n = 3$). They assumed either that citizens are not interested in participation (“So, the demand for citizen

participation exists, but the citizens don't actually want to participate,” P07), that only the minority of citizens are participating (“10 percent of the citizens get involved, the rest are bystanders,” P06), or that participation is useless because of the difficulty in achieving a response (“Whether citizen participation or a citizen survey would make sense here, (...) because everyone has a different opinion. In the end, you would have 10,000 different suggestions and still not come to a consensus,” P15). This response category will be further detailed through specific pessimistic perspectives discussed below (see section 6.3).

Another critical point was *alibi participation*, meaning that officials are not believed to take citizen participation seriously (“I can't really see that the citizens' opinions are taken seriously overall. To me, these events mostly seem like either pseudo-events, or efforts are made beforehand to identify and eliminate resistance,” P14). A similar view was that citizen participation is just the fulfillment of an obligation (“In the end, all the strings had been pulled beforehand. This means that citizen participation itself was only there to fulfill the obligation. So, one did what one had to and what was necessary. But the decisions had already been made beforehand,” P01). One last standpoint reflects the polarization effect in public discourses, which is hard to handle in procedures of public participation (“It doesn't matter what you want to do or initiate today. You get the feeling that only those who are against it participate. There are rules, and if wind farms are approved, then that's valid. I think it's good that everyone participates, but it is mainly those who are against it who speak up, and they are usually personally affected. And if the wind turbine is two mountains away, then they are pretty much indifferent, so to speak,” P05). The latter point reflects the “NIMBY” phenomenon (“not in my backyard”). However, the main challenge in terms of achieving a well-balanced discussion in energy planning was how to reconcile contradictory and uncompromising viewpoints that are reluctant regarding the pros and cons of wind energy: “I would wish for it to be less ideological and approached from different perspectives, rather than having two groups facing each other where one wants to proceed and the other is completely opposed. I feel like there's no search for compromise; instead, there's an uncompromising stance. (...) There's little willingness to discuss; it's either black or white” (P06). The respondent concludes by expressing a tolerant attitude towards decision-makers and makes a kind of fatalistic point that the unsuccessful party is “standing small” (“In this kind of environment, citizen participation doesn't seem enjoyable for anyone involved. When a discussion seems hopeless – I don't necessarily blame that on the operators or organizers – but considering how people are, I can understand why they might want to minimize citizen participation to reduce anticipated trouble. Not everyone can be happy with every decision, and we must also accept certain things for the common good and for the well-being of all of us,” P06).

In three of the five stakeholder types defined in section 3.3, the interviewees' understanding of civic participation roughly aligned with their respective role. The *employees of the municipal administration* (*type b*) expressed a very narrow, top-down and reductive, legalistic understanding wherein the administration as a neutral facilitator was obligated to adhere to strict rules and provide good information to citizens on behalf of political decision-makers. In contrast, the *local politicians* (*type c*) had a wider and more varied understanding; notably, with one exception, they were the only respondents to include political representation and elections in their conceptions of participation. Additionally, their conceptions aligned with their respective parties' position on the political spectrum. Green and social democratic politicians mentioned *bottom-up participation* more frequently and viewed the citizens' role through a more extensive lens, whereas the liberal and conservative representatives skewed more towards a narrow, top-down, reductive understanding of civic participation. This political alignment was also the case with the two *mayors* (*type a*), with the conservative mayor (P03) expressing a more formalistic understanding of civic participation whereby citizens are to be informed and possibly

¹² We included this question firstly because we wanted to assess whether the respondent was familiar with participation procedures, and secondly because we wanted to analyze the respondent's assessment of e-participation in the context of their past experiences (positive or negative).

consulted, and the politically independent mayor (P13) mentioning forms of direct democracy, albeit within a strict top-down understanding of civic participation.

The conceptions within the two categories *members of associations and public-sector companies (type d)* and *members of CSOs (type e)* involved more diverse understandings of civic participation and include the most broad and extensive definitions in general. These ranged from top-down citizen surveys (P19, P30) and co-decisions (P11) to the aforementioned deliberative conception of informal, consensus-seeking participation in the leadup to any formal planning process (P29). Remarkably, the conceptions among six out of ten *members of CSOs (type c)* were both varied and dominated by a top-down understanding of participation, while two responses could be categorized neither as top-down nor as bottom-up. One of these members (P01) was the only non-politician to include political representation in their conception of civic participation.

5.2. Demands of participation processes

We went on to assess the interviewees' demands of participation processes by collecting a list of adjectives and word-stems that reflected the interviewees' concepts of participation. Here, our findings were generally consistent with the results from the first category. For instance, informing was an adjective used by all but three interviewees a total of 63 times ($n = 27$), with related attributes such as transparent ($n = 12$), fact-based/neutral ($n = 8$) and acceptance-enhancing ($n = 13$) recurring across all the interviewee types.

The clustering along the five stakeholder types was also present in this category, but was less pronounced. We found several cases where interviewees spelled out their demands for participation processes more broadly and extensively than their respective understanding of civic participation. For instance, one *member of a CSO (type e)* stated a conception of participation that was restricted to conventional political representation, whereas their demands of participation included the wish for inclusiveness and the activation of citizens ("Every citizen needs to be actively informed. There needs to be a law about that. It's no good if the citizens only find out through a plan from the newspapers," P01). Despite one *local politician (type c)* expressing a cynical view of civic participation, the demands articulated by the group of politicians were characterized overall by descriptors such as opinion-forming, inclusive and compromise-oriented—even in the case of the above-mentioned cynic: ("And if it [the discussion between different groups] takes ten hours – we need to find a compromise," P12).

However, as previously stated, the majority of results in this category are consistent with the findings from section 4.1 in that the interviewees revealed consistent perceptions of what civic participation means to them on an individual level: a politician who expressed cynical views towards participation simply described participation as a non-realistic option in general ("No, as mentioned, that's largely impossible," P07) and a *public sector employee (type d)* who had previously implied an understanding of civic participation as a means for mediation and compromise used adjectives such as inquiring, argumentative and interest-gathering ("You'd have to have some kind of moderated neutral ground between [...] two camps," P19).

5.3. Previous experiences with e-participation processes

In our third category, we surveyed interviewees' previous experiences with participation processes with a focus on e-participation. Even if we include cases where the reported experiences were as an organizer or facilitator of top-down, formal participation processes (*mayors, employees of the municipal administration, and local politicians, types a through c, n = 14*), first-hand experience as a participant was highly limited and mostly restricted to formal processes situated in face-to-face processes; there was almost no experiencesettings.

Experience with e-participation. of any kind was almost nonexistent among the interviewees. The few exceptions were chiefly online surveys ($n = 2$) and participation in what were essentially digital town hall meetings during the COVID-19 pandemic ($n = 6$). Another exception was the use of the *Umweltprüfungsportal* ("environmental assessment portal"), a web-portal whose use is mandatory in certain authorization processes – but which was only mentioned by one interviewee. Among those who had actively taken part in civic participation processes, the majority were *members of CSOs (type e)* who had done so in a professional capacity ($n = 7$) or *local politicians (type b)* who had previous experience participating as private citizens ($n = 4$).

We found very few "participation professionals" with extensive experience in participation procedures ($n = 2$) outside of their professional involvement as organizers. However, there were reports from at least one of the affected communities of citizen-to-citizen information exchange and discourse via messaging apps and social media ("In [the community] for instance there are those big WhatsApp groups where apparently half the village or more are members," P32; $n = 6$). One participant had previously founded a discussion group for the same local community on Facebook ("Well, I founded a Facebook group on a whim six years ago. It's called 'open forum [village] controversial.' [...] After six years, it now has 1,600 members – and there are a lot of lively discussions, sometimes heated, sometimes less so," P06).

5.4. Aspirations for civic e-participation

The interviewees' aspirations for civic e-participation largely revolved around the desire for more easily digestible information online compared to offline ($n = 3$), early communication ($n = 2$), better explanation of decisions by the organizers ($n = 3$), the introduction of systematic structures for participation ($n = 3$), and a better explanation of existing avenues for participation ("I'm of the opinion that it's not that forms of participation are missing, but that you could make the existing system more popular again by explaining it in a better way," P22).

General wishes included discursivity ($n = 4$) and neutrality, i.e. that apps or platforms should be moderated by a neutral third party ($n = 4$). This wish was formulated by *members of associations and public-sector companies (type d)* and *members of civil society organizations (type e)*. A *local politician (type c)* also stated: "It's got to be built in such a way that every recipient can immediately recognize that it's neutral" (P06). Two *members of municipal administrations (type b)* wanted a more permissive legal framework, urging the legislators to give them a wider scope for involving the public in the decision-making process in ways that are not permitted by the current legal framework of the *Öffentlichkeitsbeteiligung* ("In the end, that's where the legislature comes in. It needs to set the framework," P21). Eight of the interviewees did not state any aspirations at all.

5.5. Concrete suggestions for future participation processes

When it came to concrete suggestions for future online participation, the issue of moderation reappeared (see 4.2). Several interviewees proposed that participation platforms be professionally moderated in order to curb what we have described in section 2.4 as violations of the rules of rational discourse ($n = 10$). This suggestion was present in more than half of the interviews with *members of CSOs (n = 5)*.

Other opinions revolved around the digital visualization of planned projects. This topic was actively raised by the interviewer, unless the interviewee mentioned it independently. Visualization suggestions ranged from simple 2D renderings of the project to digital aerial maps to full AR visualization by which the citizens could get a realistic image of the infrastructure built on-site via an app on their smartphone: "I imagine it something like that: You hold your smartphone up and then you see your surroundings. There, you can choose the objects – a bark

bench or a wind turbine – place it virtually and see what it would look like right there” (P01). Another idea was an audio-visual tool whereby citizens would not only be able to see the built wind turbine but also hear how much noise it would make at their current position (“You could undertake a drone flight over the landscape area for instance and then situate the [turbines] into the picture realistically. And also it would be good to make the noise level audible,” P14).

5.6. Perceived opportunities and risks associated with e-participation

In our last category, we first assessed the perceived opportunities associated with e-participation. The most frequently mentioned aspects were increased responsiveness ($n = 6$), spatial and temporal independence ($n = 4$), better visualization ($n = 6$), utilizing the creative potential of citizens ($n = 2$), and easier representation of complex information (“In comparison to previous times we’ve got a clear simplification of information gathering, that’s obvious,” P14; $n = 3$).

The issue of increased accessibility was only mentioned explicitly once, by a physically impaired interviewee (“I used to hike a lot, but I can hardly walk anymore. I couldn’t take part on-site anymore – but online, I can,” P16). However, several interviewees included the issue under the opportunity for a higher participation rate, which received the most mentions overall (“You can either reach young people personally by going to the youth club – or you can reach them online,” P01; $n = 8$). Notably, seven of the eight local politicians and one of the two mayors mentioned no additional opportunities at all.

Finally, we recorded the perceived risks associated with e-participation. One major apprehension among the interviewees was the issue of cost – either absolute costs, i.e. the financial burden on the organizers ($n = 7$), or the cost vs. benefit argument (“It would not be worthwhile. You could get those 50 people with or without an App,” P06). The former apprehension was exclusive to *municipal stakeholders* (mayors, local politicians, employees of the municipal administration, types a through c) with one exception – a *public sector employee* (“It mostly comes down to a lack of resources,” P30). The *employees of the municipal administration* (type d) were more concerned with the increased workload and feared insufficient personnel ($n = 4$). However, the issue of increased workload was also brought up by all other types of stakeholders ($n = 11$).

The issue of data security was also articulated, but only by the stakeholder types above ($n = 6$). Among *politicians* and *local administrations*, there were also concerns that too much information about a project could make it more vulnerable to failure through over discussion (“With this, you’re opening Pandora’s box,” P10; “If this information is out there, day and night, you don’t know what is going to happen,” P32; $n = 7$).

The most widespread risk associated with e-participation via a discursive platform and/or discussion forum was the threat of violations of the rules of rational discourse such as deviations from the topic ($n = 6$), shitstorms ($n = 5$), hate speech ($n = 8$), manipulation ($n = 9$) or misinformation ($n = 8$). This risk was often directly linked to negative experiences with users on social media, both first-hand and second-hand. In most cases the relationship between social media and online participation was not clear, suggesting an equally or more vague understanding of e-participation as compared with in-person civic participation.

However, it was not only users being blamed for manipulation and misinformation, but organizers of a potential online-participation process too. Some interviewees feared that the digital space would afford organizers an easier opportunity to skew public opinion in favor of the planned project by providing misleading information, steering the debate or conducting a well-presented form of bogus participation to legitimize a pre-conceived plan (alibi participation). This fear was stressed heavily by several *members of associations and public sector companies* and *CSOs*, and one *local politician* (“I’m very worried that this

could somehow be misused and that there will be participation in the end that isn’t participation at all,” P18).

There were also fears of misuse or overwhelming users with discursive online platforms, either through an information overload ($n = 4$) or insufficient digital competence ($n = 2$). However, most interviewees were generally optimistic and perceived most of these risks to be surmountable. For instance, one interviewee suggested ways to avoid anonymity and to raise the hurdle to discussions in order to curb the violations of the rules of rational discourse (“I’d be happy if a comment function didn’t exist. [...] If someone wants to make a comment, I’d like it better if they were redirected to a separate App and go into a forum there. That could stop someone from adding their two cents and maybe comment with a bit more reflection,” P26).

6. Discussion

We interviewed 33 stakeholders in a proposed wind farm project to discover opinions about e-participation in wind energy planning. We investigate attitudes across six areas related to civic participation, with particular interest in stakeholder attitudes towards e-participation. In this section, we discuss three important empirical insights emerging from our findings. First, we look at *how participation is framed and constrained by individual experience*, then at *perceived opportunities and risks of e-participation and the role of discourse*, and finally we consider the problem of *alibi participation*.

6.1. Framing civic participation

We find first that, on the micro-level, the term civic participation is primarily understood by stakeholders to mean a narrow range of formats based on invited top-down participation. Not only do local authorities and politicians express this definition, but other stakeholders also operate from this limited view. How can this reductive perception of the citizenry as passive recipients of participation be explained, when at the same time public debates about active citizens and wide-ranging formats of participation seem to seek a social consensus?

This limited understanding of civic participation by our interviewees does not seem to be shaped solely by the external realities and the legal constraints in place in their specific contexts. We suspect that our interviewees’ conception of civic participation is primarily informed by their habitual practice of engaging almost exclusively with this limited form of top-down participation and their very limited experience with more inclusive forms of civic participation. As a result, we can conclude that only type E could be called ‘citizen representatives’, the rest of the interviewees are all invested in the existing power structures. Therefore, one of your findings is that stakeholders and the affected citizenry have different ideas on civic participation, which are based on fundamentally different characteristics.

We find further evidence for this deep-rooted habitualization of participation in the language produced during our interview series. Words such as *informative*, *transparent*, *fact-based*, *neutral*, *acceptance-enhancing*, *early* and *moderated* were mentioned repeatedly by our interviewees; these correspond closely to the official understanding of *civic participation* in public planning, and all of these terms have been in common use for the better part of two decades either in the laws that regulate public participation in Germany or in the handbooks and guidelines for public participation (Ziekow et al., 2015).

On the issue of active involvement in planning by the citizenry, our stakeholder respondents primarily voiced concern over the dangers and downsides. They fear that discourse will get out of hand, and the rules of rational discourse would be violated. However, this opinion is shaped almost entirely by perceptions of discourse on social media and not by first-hand experience.

These findings show us that not only learned experience, but also impressions and inferences can inform one’s conception of civic participation, both what it could and should look like. One realm of innovation

that met with less skepticism from our interviewees than did active citizen participation is visualization. The interviewees expressed support for visualizations of planned projects, recognizing these as useful supports, but again, primarily for information delivery and dissemination, not for active involvement of the citizens in a co-design process.

Whereas these findings may paint a bleak picture for broader innovations and greater possibilities for civic participation, we need to consider them in the context of the *Energiewende*. The criteria our interviewees put forth as well as their emphasis on information is in line with the findings of numerous studies on the acceptance of renewable energies, according to which a fair, transparent and open information process is of the greatest importance in the context of energy participation (Langer et al., 2017; Rand and Hoen, 2017; Zoellner et al., 2008). We have to keep in mind that the energy transition generally and concrete projects such as wind farms specifically are very abstract and difficult to imagine for local communities, including the stakeholder groups themselves.

So, it is understandable that the stakeholders interviewed would attach great importance to comprehensive information and thorough understanding. This aligns with the results of our survey data that indicate “being informed” is valued highly among the population. The survey results show citizens attach high importance to objective and comprehensive information, especially if it comes from sources perceived as neutral, such as scientific experts. The emphasis on neutrality derives from deep distrust of the planning authorities by citizens who feel misinformed almost habitually, or not informed at all. This component of trust and distrust could also be found in our stakeholder interviews. Both stakeholders in our interviews and citizens in our survey not only put an emphasis on *what* they want most from participation – good information – but also *why* they want it – to gain trust in the planned project, its contents, benefits and drawbacks.

This brings us back to the issue of a more active role of the citizenry in the planning processes of the *Energiewende*. Although some interviewees emphasize utilizing the creative potential of citizens, this plays a subordinate role behind the passive role of information-recipients. Against this backdrop, our survey data shows that active participation and co-planning is in fact important to citizens even though “being informed” takes higher priority even among citizens themselves. Citizens want to be actively involved in addition to being informed well, and possibilities of design options with the help of virtual (VR) and augmentative reality (AR) technologies were preferred in our survey. Therefore, the institutional stakeholders we interviewed primarily see risks in civic participation, while the actual citizens see the benefits.

This seems to be a key challenge for creating participation strategies and developing e-participation tools which serve both demands in restricted and wide-ranging applications.

Deploying VR and AR technologies in support of creative citizen participation is evaluated as potentially the most important and qualitatively significant contribution of e-participation to energy transitions (Micheletti and McFarland, 2015; Gray et al., 2024). From a conceptual point of view, this way of creative citizen input to energy planning offers great promise for fostering democratic legitimacy and energy justice (Chalal et al., 2020; Solman et al., 2021). By giving citizens options in placing wind turbines, even in designing the surroundings of wind farms, adding ideas of using local energy, and computing measures of benefits and compensation for comparison, a new means for citizens to participate and exercise influence becomes possible (Devine-Wright and Peacock, 2024; Lehmann et al., 2024; Mostegl et al., 2017).

However, given the reluctance our interviewees expressed towards e-participation and the restricted range of possibilities they were able to imagine, we suspect that stakeholder impetus to initiate these more ambitious forms of civic participation is low, despite the potential benefits and the overt need to listen to citizen demand for more active involvement as manifest in increasing public resistance. If our stakeholders from civil society are any indication, though, the reluctance to

afford citizens more input in the planning process is not limited to planning authorities.

6.2. The role of online discourse

These considerations introduce the issue of online discourse. Based on the insights of our online survey, the majority of the population wants to stay in touch with local authorities and project developers and to be convinced through real-world experiences. Based on the interviews, stakeholders read this demand to mean citizens want to be face-to-face with the people responsible for planning and implementation, and to find out whether they can trust the planners and their plans.

In a groundbreaking study on the use of wind power in Australia, Catherine Gross (2007) was able to show that trust plays the crucial role in gaining acceptance of renewable energy projects; the same has been found in Germany by Hübner et al. (2023). This indicates that citizens do not primarily seek an exchange among themselves, but want a direct line of communication to relevant stakeholders so they can ask questions, make remarks and – centrally – build trust in the project and its leaders. Here, e-participation could provide additional avenues for discursive exchange with stakeholders. However, in our interviews, stakeholder views were dominated by perceptions of risk and apprehension against e-participation. Interviewees fear violations of the rules of rational discourse and emphasize the threat of manipulation and misinformation. We note that the respondents have no experience with deliberative interactive exchange processes in the digital space.

We also discover skeptical attitudes towards online discourse in the responses to our survey. But again, apprehensions are largely formed on the basis of inferences from negative experiences with discussions on social media. Moreover, we suspect a salient characteristic of online debates may be responsible for the restrained interest in e-participation. The fact is that misinformation and conspiracy theories play a dominant role in online discourse about renewables because unverified information is spread by oppositional citizen initiatives and anti-wind power movements. This makes it ever more important to make transparent and easily accessible the facts and information basis of energy projects; citizens must know who benefits, who suffers, and what will be negatively affected – a factual basis to answer these questions is essential to meet environmental populism (Linzenich et al., 2020).

Stakeholders are very sensitive in this respect, and their distrust can be directed towards local authorities as well as towards civil society associations such as nature protection groups, where mutual distrust then prevails. However, any hopes that online offers will create more clarity is very idealistic. Even if rich information is made available online, it still has to be evaluated and assessed critically. For this reason, it can be assumed that the respondents in the survey would prefer to see scientific evaluations, while the interviewed stakeholders prefer local newspapers, which tell a comprehensive story.

6.3. Critical reflections on e-participation and alibi participation

The results of the series of interviews show that both stakeholders from civil society and some local politicians recognize the problem of *alibi participation*. The interviews repeatedly emphasize that participation must leave room to influence decisions and that people do not want to be presented with a fait accompli – a practice that has been all too common in the eyes of several interviewees.

Based on these findings, and given the overall picture conjured by the respondents, we can see the following: firstly, typical methods of informing the public are not providing people with opportunities to express their opinions in a way that has a sustained impact; secondly, due to planning and legal restrictions, the scope for influencing the siting of wind turbines is small; and thirdly, even if citizens discuss the topics of wind energy, it is difficult to find consensus. In light of this, our aim is to provide a “bigger picture” against the backdrop of current research.

To classify participation in wind energy planning, Langer et al. (2017) use the well-known concept of “ladder citizen participation” by Arnstein (1969). This consists of eight different levels of participation (manipulation, therapy, informing, consultation, placation, partnership, delegated power, and citizen control). Following a critical understanding, Arnstein considers two forms of “anti-participation” as inferior to the first step of informing – that is, manipulation and therapy. Similarly, Wulz (1986, p.153) suggests that opportunistic politicians “utilize ‘participation’ as an alibi for a negative side of their traditional role as experts, in other words, an authoritarian approach to decision making”. Transferring this to the context of wind energy planning, Langer et al. (2017, p.65) describe a form of “alibi participation” similar to that expressed in the statements given by the respondents of our study, one that “refers to those citizens who want to get involved in wind energy projects but whose participation is ineffectual because their opinions are suppressed in some way”.

They are describing a *modus operandi* in participation that means “people who want to get involved ... can only participate in a limited way and with limited effectiveness, such as pro forma participation (while participation is indeed open, the results are not considered further)” (ibid, p.70). Masser and Mory (2018, p.37) recognize the limited opportunities for participation and decision-making input afforded to the public in many cases, and conclude that it “often appears to be just tokenism” because “the results of citizens’ participation often appear to be predetermined or insubstantial, like having to choose the jewels to go with your nightwear”. Affording the public limited opportunities for participation and decision-making input is a typical characteristic of wind energy planning all over the world. Thus, Elmallah and Rand (2022) argue that there is a need to realize more procedural justice. Because perceptions of local wind farms have not changed over time for local communities, the “benefits that people experience, involvement in the planning process, and relationships with the developer, can influence responses” to wind energy (Windemer, 2023, p.1). This makes alibi participation a crucial challenge for energy transitions, because it “displays significant negative effects on the acceptance” (Langer et al., 2018, p.133). In the survey by Langer et al., respondents rate participation opportunities as the most important factor. Thus they conclude that “planners should aim for transparent and fair implementation of wind energy projects as well as the involvement of citizens in the development and planning process” (Langer et al., 2017, p.69).

The problem of alibi participation can occur in both physical and virtual spaces. In the favored format of town hall meetings, information is merely provided and enquiries are granted (Field, 2019), and a similar phenomenon is described in the context of e-participation. The insights of a study on the use of a noise app for planning a wind farm (Solman et al., 2023) show that digital information and participation opportunities can lead to frustration because many users expect more than just the transmission of data (such as, in this case, noise levels), but in reality it is not in fact possible to influence the project. This is not a form of token participation, but rather a raising of false expectations.

We conclude from these disappointed hopes that better participation opportunities are needed if users are not to resort to alternative media channels. Secondly, the process of capturing, channeling, and managing e-participation tools inevitably leads to overflows, in the sense that unintended side effects can occur. The app categorizes users into “people who always complain”, “the silent majority”, and “serious app users”, which constitutes a violation of recognition justice. It is clear that even a noise app has the potential to establish different levels of procedural justice (“perceived fairness of how and when residents can voice concerns about noise and participate in wind project operational management”), distribution justice (“perceived fairness of how the noise app redistributes the costs associated with wind turbine noise annoyance”), and recognition justice (“perceived fairness of how the noise app includes and excludes concerned residents as the ‘public’ of the noise app”) (Solman et al., 2023, p.2). For example, people’s concern about the health effects of noise is not recorded, leading to frustration and

uncertainty. The residents are not given the option to suggest alternative ideas, and expectations are raised for the creation of a timeline for solving the problem. This represents a challenge in terms of the information transmitted by the app and how it should be used to manage expectations (ibid, p.6). From this, the authors conclude that “the use of the app has implications for who is recognized as bearing the burdens of wind energy projects, and whose concerns are considered legitimate” (ibid).

The respondents of our study seem to recognize that e-participation can perpetuate or even create new problems of legitimacy and justice. Beyond this perspective on the advantages and shortcomings of e-participation tools, the stakeholders interviewed refer to the second major challenge of public participation in wind energy planning: the low rates of engagement with additional participation formats. This is not a problem that is unique to energy participation, but is true for public participation in general. Zepic et al. (2017) analyzed the low participation rates in participatory budgeting and found that citizens are in part unaware, not interested in or refuse the opportunity to participate, or the necessary prerequisites for doing so are not provided. There are very few empirical studies that examine the motivation and intention to participate in planning; two studies found that social and political aspects – mainly personal interest and social influence – have positive impacts, while constraints have negative consequences (Caetano et al., 2024; Li et al., 2020). When it comes to participation procedures in energy planning, Ernst and Shamon (2020) found evidence that many citizens are aware of participation options but very few become actively engaged in participation processes. Their reasons for involvement are based on attitudes towards renewable energy technologies, value orientation towards nature, political efficacy, personality strength, and individuals’ specific knowledge (ibid). Based on these findings, we can conclude that one crucial factor lies in the question of how and to what extent citizens are personally affected by energy planning and siting.

The third subsequent challenge for energy participation lies in the question of whether it is possible not only to motivate people but to draw critical citizens back into the participation process (question formulated by Åström and Karlsson (2016)). Paradoxically, the process of politicization through participatory planning influences residents’ critiques of official planning processes (Niitamo, 2024). The only reaction can consist in offers and tools for “listening to minority, vulnerable and NIMBY citizens” (Alonso-Cortés et al., 2024). This can be achieved by mapping the subjective viewpoints of affected persons (Hjelle and Vik, 2011), creating proposals by citizens (e-cognocracy, see Ghazinoory et al., 2024; Moreno-Jiménez et al., 2014), incorporating inclusive gamification elements (Hassan and Hamari, 2020; Marrero-Trujillo et al., 2023), or via the use of design thinking based on a process of co-production experimentation and prototyping of e-participation tools together with citizens (Mariani et al., 2023; see for wind energy development Solman et al. (2021) and for target group-specific tools for young people Juusola and Varsaluoma (2023)). Seeing as deficiencies in personal digital literacy and the lack of appropriate devices necessary to engage effectively in online sessions cannot be changed, it is all the more important to provide a broader digital scope with which to express opinions on the topics discussed in energy planning (Faganello and Luciano, 2023).

6.4. Perceived opportunities for e-participation

Though stakeholders and citizens seem to agree that they all want an easier flow of high-quality information to foster trust in the common projects of the *Energiewende*, the positive potential of e-participation as online-discourse is discounted by the interviewees, who were especially vocal in their fear of the risks. However, visualization options were a winning idea. Therefore, e-participation has great potential here, because the information can be compared and put in relation to other sources, making estimates and evaluations much better (Zheng and Schachter, 2017). In our analysis of the interviews for perceived

opportunities for e-participation, we found strongly emphasized by our interviewees the potential for increased responsiveness, spatial and temporal independence, better visualization, and easier representation of complex information. This emphasis was present despite the limited experience of interviewees with e-participation. This means that, despite limited previous experience and with few tangible ideas on how to utilize the internet for a better flow of information, the potential can still be recognized by stakeholders.

Energy companies and project developers do have the financial resources required and could theoretically act as sponsors of a participatory planning process. However, their interest in active citizen participation remains low, as they typically perceive limiting the visibility of their projects to be the best strategy for avoiding public resistance. In most cases, the developers of energy projects only offer opportunities for participation when the public and political pressure is so strong that it can no longer be ignored (Bosch et al., 2019; Elmallah and Rand, 2022; Firestone et al., 2018; Knauf and Wüstenhagen, 2023; Simón et al., 2019; Songsore et al., 2018; Wright, 2012). In these cases, participation does not offer opportunities for interaction with direct decision-makers, meaning that all trust in the proceedings has already been lost. This often results in gridlocked projects and cost overruns. Convincing project developers that early-stage, transparent and inclusive e-participation would be in their own interests as well as those of the public is vitally important to increase the acceptance of the energy transition. Moreover, the relatively small costs of e-tools compared to the costs of project delays and legal battles should be enough to convince project developers that public buy-in is a worthwhile investment. The idea pool generated through this participation can also become a resource for the company to draw on.

The surveyed stakeholders in our study fear that e-participation will perpetuate or even exacerbate existing inequalities and exclusion in wind energy planning – which is certainly true for the majority of e-participation practices (Tappert et al., 2024). However, the identified triad of targeted methods for addressing affected citizens and specific communities, providing opportunities to express and debate opinions and demonstrating the scope for influencing the siting of wind farms, while at the same time pointing out the clear limitations of participatory impacts on planning and implementation, are highly promising approaches when it comes to designing e-participation in energy transitions (see the results of the research project on which this contribution is based in Saßmannshausen et al. (2021)).

Based on these findings, the ideas for realizing an energy democracy based on fully democratic, all-inclusive and emancipatory forms of participation following the approach of agonistic democracy seem to be over-ambitious. Strangely enough, although theoretical options for civic participation exist through the channels of associative, participatory and deliberative democracy, both sides of the policy process (stakeholders and citizens) seem to show little interest in them, and it can be assumed that they would not make use of more far-reaching offers – at least unprompted. The emancipatory claims of an agonistic democracy, which are put forth to counteract the top-down formats that condemn activities to passivity through grassroots movements, seem even less likely to be realistic. The survey results show, first, that the population does not want discursive formats such as town hall meetings – be they online or in a face-to-face setting, and the interviews reveal that the understanding of public participation in energy transitions does not provide even the mental leeway for more broad and inclusive forms of participation.

At this point, it must be considered that the energy project studied here is a community wind farm, so additional options for financial participation and co-determination within the community energy company existed in comparison to conventional energy companies.

Nevertheless, an “appetite for participation” (Barber, 1984) could be awakened, additional offers could first broaden the mental range and then stimulate activity and engagement. Circling back to the notion of a *habitual* understanding of civic participation, habits can be reformed just as they were formed initially. Thus, an added democratic value through

interactive tools of e-participation in energy planning processes is still feasible if, on the one hand, usage rates are stimulated (Smith, 2012) and, on the other hand, easily accessible, low-threshold offerings are created that encourage further participation via an introduction to the individual benefits of e-participation – the “What’s in it for me?” approach.

What also has promise is the use of gamification elements, such as a lucky draw or prizes awarded for the best ideas. These elements are used in business and education and could serve to motivate citizens to use an online tool, where they can discover other options and study and share contents (Bianchini et al., 2016; Thiel and Fröhlich, 2017). This confirms some of the main findings of e-participation research (Zheng, 2017), although we assume based on our findings that mobilization through e-participation can only be achieved to a limited extent in energy transitions, especially because of the presumed low impact of participation by most citizens. The normalization thesis (Boulianne, 2009), however, may have limited validity. It is more likely that more critical citizens participate online, which discourages other citizens with positive attitudes about the energy transition from participating in discourse (Åström and Karlsson, 2016). We derive from this insight the essential need to develop models for online exchange about controversial social issues; these need to be structured in a balanced way, provide communication based on mutual respect, and at the same time have an inclusive effect, also on citizens opposing renewable energy projects without muting them or others.

6.5. A new role for intermediaries in e-participation?

Several statements by the respondents express the need for content moderation and neutrality, which is why a concept for the inclusion of neutral intermediaries (third parties) for information provision, dissemination and motivation in e-participation should be taken into account – especially given the core role that trust plays in participation formats.

Intermediaries play an important role as brokers both between officials and stakeholders in energy planning processes, and between officials and citizens as individuals or as part of organized groups, e.g. in community energy engagement initiatives (Bird and Barnes, 2014; Busch and Hansen, 2021; Cleland et al., 2012; Devine-Wright, 2012; Hargreaves et al., 2013; Lacey-Barnacle and Bird, 2018).

By fulfilling the function of neutral actors, they can serve as arbitrators and “bridge builders”, building trust within the processes of energy governance (Mattes et al., 2015; Mignon and Kanda, 2018; Moss, 2009; Putnam and Brown, 2021; Warbroek et al., 2018) because they can guarantee independence, incorruptibility, and an objective perspective on the process. As Elmallah and Rand (2022) were able to show in the context of wind energy planning, rural and neutral knowledge-sharing organizations can enable transparency and fairness, thereby reducing procedural injustices for citizens. Several examples of practices and options for enabling or including intermediaries in e-participation strategies exist, e.g. Living Labs (Cleland et al., 2012), universities (Ribaud et al., 2016), or urban civil organizations (Pina et al., 2022). However, wind energy planning is mostly a phenomenon in rural areas, which is why it could be useful to empower individuals; interested and well-informed citizens could become “middle-man” intermediaries and be “upgraded” in their role within participation procedures (e.g. arbitrating between critical citizens and project developers (Millard, 2007)). In this context, it is important to create privacy-preserving digital environments (Buccafurri et al., 2015), to open the design of e-participation channels up for citizens (Mariani et al., 2023), and not to ignore but to include social networking platforms or places of exchange (McGrath et al., 2012). Creating a sense of virtual community is crucial for generating interest in e-participation (Naranjo-Zolotov et al., 2019). Barriers to e-participation thus not only relate to the individual resources of citizens, but are also highly dependent on the question of what citizens can expect from digital devices, because

perceived advantages have an impact on citizens' willingness to engage (Mertes et al., 2022; Naranjo-Zolotov et al., 2018; Vicente and Novo, 2014; Wirtz et al., 2018).

Several studies highlight the pivotal role of trust and underscore the importance of citizen engagement in advancing democratic processes in e-participation (AlAwadhi, 2023; Alonso and Barbeito, 2016; Åström et al., 2013; Axelsson et al., 2010; Kim and Lee, 2012; Pietrzak and Takala, 2021). It is clear that trust is a particular aspect that influences whether a given citizen will participate or not (Scherer and Wimmer, 2014; Scherer and Wimmer, 2014b). Moreover, trust plays a more significant role in participation than the quality of e-government services (Abdulkareem et al., 2022). But how can trust be achieved by those responsible for energy planning and facilitation? First, it is necessary to foster a trust-building environment (Demirdoven et al., 2020).

Transparency, openness, flexibility, and accessible processes and structures are mandatory (Kim and Lee, 2012; Laurian, 2009; Moore, 2018; OECD, 2017; Robinson, 2020). However, the social context (norms, rules, and societal values) also matters (Luliano et al., 2024). External pressures can influence transparency, while the public administration style and environmental culture of local government can influence the level of interaction between officials and citizens (Royo et al., 2014b). In this regard, intermediaries can balance the weaknesses of administrative cultures, and in the best case serve as change agents (Legard et al., 2023).

In conclusion, there is a need for strategies that foster democratic engagement through pro-active configuration by project developers and public authorities involved in energy planning (Sanches and Silva, 2023). Awang et al. (2024) call for government-driven initiatives in e-participation in order to shape a digital democracy, because studies indicate that the quality and quantity of e-participation procedures depend heavily on the acceptance of the local government (Nguyen and Süß, 2023) and because government behavior is crucial for laying the groundwork for successful e-participation (Lee-Geiller, 2024). But is it possible to overcome the fundamentally limited potential of e-participation in planning caused by formal restrictions (Kubicek, 2010)? Bearing in mind the different levels of e-participation, citizens' influence is limited to a certain point (Al-Dalou and Abu-Shanab, 2013). Certain core problems of participation (low engagement, apathy, lack of trust, lack of digital skills) are not addressed by e-participation, but could be changed by a shift in mindset and culture which might be achieved through more collaboration – for example cooperation between policy-makers, tool designers and practitioners to develop strategies for the use of digital tools to facilitate more dialogue and open innovation, as indicated by Nieuwenburg (2023).

Another study by Plantinga et al. (2024) proposes a set of multiple roles and activities for public officials: legal specialists (e.g. for data protection), stakeholder managers (e.g. for designing models of collaboration with commons-based platforms), communications officials (e.g. for moderating social media conversations), and technology developers (e.g. for exploring new ways of verifying online identity). This would mean nothing less than a complete overload for local governments, especially in the rural areas where wind energy is generally established, while project developers and investors are aiming to save costs.

So what remains to be done in the area of energy planning? Based on these insights, and in light of the widespread lack of transparency and poor functioning of participatory activities via e-participation tools, Royo et al. (2024, p.65) recognize certain areas for improvement, e.g. “the way the initiatives provide feedback, allow discussion and flexibility on policy options, incorporate possibilities for offline participation, and involve a wider range of stakeholders” (see also Royo et al., 2020). With regard to renewable energies, Lucas et al. (2021) describe the paradox that, despite an increasing trend towards greater and more active participation by citizens, awareness and communication initiatives are mostly insufficient and inefficient. They therefore call for more communication and awareness campaigns. We can assert that e-participation in wind energy planning is the best option for enabling access to

high-quality information on the planning process, providing insights into and background information on climate protection and government energy policy strategies and the motivations and goals of project developers, providing viable opportunities to influence the surroundings of wind farms and the use of funds in the local community, and giving feedback and discussing with other citizens – even if all of this has no impact on planning and implementation. This seems to be a very promising approach for setting the opportunities offered by e-participation against the challenges of information asymmetry and power imbalances (Zanini et al., 2023).

7. Limitations

This study is not without its drawbacks and limitations. First, we would like to point out the limited scope of a single case study. Our in-depth analyses based on an interview series centers around a single wind farm project in Germany. There is no doubt that this affects the external validity of the study's conclusions. However, we consider this case study to be a typical example of wind energy planning, not only in Germany but also in other European countries and all over the world. The most important similarities to other wind energy projects are the conditions, issues and circumstances of the surrounding landscape – including issues relating to nature conservation – and the (negative) impact on local communities and the question of sharing benefits. At the same time, there are some features that are specific to energy policy and planning in Germany, as well as certain practices by project developers and attitudes belonging to the local population – not only towards wind energy, but also in terms of the culture around participation, public debates and negotiation processes. We can therefore observe that on the surface, wind energy planning forms part of policy and decision-making worldwide, but when analyzed in detail, numerous factors make each case a special case. However, we nevertheless argue for a widely applicable understanding of participation in wind energy planning, because for citizens, the decisive concerns are the same. Our conclusions are thus largely transferable to other contexts concerning the siting of renewables.

Second, we are aware that the research design (using an online survey and online interviews via video call) inherently introduces bias into some of our key research questions about e-participation. Specifically, the respondents of the survey and the interview subjects are clearly internet- and computer-literate enough to be comfortable filling out an online survey and/or participating in a computer-based video call. This is important because the question of accessibility is crucial for successful e-participation, yet we are only including those with technological literacy. In response to this problem, we must firstly note that we were unable to use postal/paper surveys or telephone and/or in-person interviews due to the COVID-19 pandemic. Secondly, we included a lot of older people. We assume that only some of the older population lacks internet access in Germany. Furthermore, we interviewed active stakeholders in the local communities, for which reason we can conclude that these persons are well connected both digitally and in-person locally.

Third, the case study concerns a community wind project, i.e. it is intended to offer financial participation to host community members. Previous literature has shown quite convincingly that those individuals who participate financially in wind projects have many more opportunities to engage and participate in the planning process (Elmallah and Rand, 2022; Jacquet, 2015). However, since most wind projects around the world do not offer financial participation for local community members, participation opportunities are vastly different for ‘non-community’ wind projects. In response to this issue, we must firstly observe that our respondents chiefly ignored the opportunity for financial participation. For all of them, the most decisive question relates to the siting and impact of the wind farm. This weighting of procedural justice over financial participation is in line with various studies (Langer et al., 2018; Langer et al., 2017; le Maitre et al., 2023; Lienhoop, 2018).

Secondly, due to the early phase of planning and acquiring permissions that the wind farm was in, the question of financial participation was not yet an important one for the local community (even if this seems somewhat shortsighted). Thirdly and finally, we do not assume that participation opportunities are different when compared with ‘conventional’ wind energy projects. On the one hand, these projects can also offer opportunities for participation – possibly even more opportunities (e.g. including influence over siting) – and the procedures of public participation in our case study seem to be very similar to other wind energy projects in Germany. While the project developer is very ‘participation-friendly’ in this specific case, we also found no evidence that this has a decisive influence on the respondents’ attitudes to public participation procedures and opportunities for e-participation.

8. Conclusion

The empirical foundations of our study rest on a qualitative content analysis of interviews conducted with 33 stakeholders in a regional wind farm project, augmented by results from an online survey of local citizens. Our results reveal the limitations of and opportunities for e-participation in energy transitions. While opportunities for e-participation are limited, we argue that there is unexploited potential for enabling more anticipatory, reflexive, situationally adapted and flexibly manageable forms of e-participation. There are numerous obstacles to these advantages, however.

First, there is little interest in advanced (e-)participation tools, which is primarily a reflection of a narrow-minded understanding of civic participation. Without intervention, this limited understanding would inevitably lead to low usage rates for advanced forms of participation. Rather than bemoan this fact, let it serve as a call for strategies for actively mobilizing local communities and stakeholders.

A further obstacle facing e-participation in energy transitions is the perceived trade-off between the high cost and effort of elaborate AR and VR technologies and the expected low return. Municipalities and cities in Germany have limited financial resources – although investments in digitization have been made recently due to the COVID-19 pandemic. Support from higher political levels would be needed to drive this development further, especially if small and rural communities and districts in structurally weak areas are to engage in e-participation.

This leads directly on to another problem: the motivation of public authorities and stakeholders. While participation in the *Energiewende* is desired, there is absolutely no interest in added exposure to civic unrest (Arifi and Winkel, 2021; Bues, 2020; Eichenauer and Gailing, 2022; Fuchs, 2021; Müller and Morton, 2021; Scherhauser et al., 2021; Schönauer and Glanz, 2023; Thurn-Valsassina, 2022). Cities and municipalities already avoid using participation platforms at other levels of private and civil society initiatives. However, the advantage of one-stop-

shop participation platforms has been discussed in the literature, e.g. bundling city apps (Askim et al., 2011; Wimmer, 2002). In the context of the energy transition, this could combine patterns of energy planning with urban development and infrastructure projects, since the projects are similar in terms of their mappability and designability (e.g. mobility planning).

Reflecting on public participation in wind energy planning, we can identify a fourfold dilemma concerning the input dimension (dilemma of meeting the citizens’ expectations), the content-related dimension (dilemma of bringing together citizens’ concerns and planning restrictions), the throughput dimension (dilemma of building a consensus which reflects the majority opinion), and the output dimension (dilemma of decision-making that considers all aspects of planning, climate protection, and local conditions) (see Fig. 3). Based on our findings, e-participation is the best option for meeting the challenges of the input and output dimensions, as an effective conveyance of information, visualizations and process tracking can prevent false impressions. The same is true for the output: officials and project developers can collect suggestions and opinions from citizens on issues where a possible impact is identified (e.g. use of benefits). However, e-participation has a limited effect on the throughput and content-related dimensions of negotiating e.g. the pros and cons of wind power. The respondents of the interview series are very skeptical, and even if specific e-tools for deliberation exist (Wright et al., 2010), we can only recommend supporting functions through digital devices, e.g. for a better presentation of facts, contexts, and interdependencies.

In summary, e-participation in energy transitions can be understood as an outflow of the postmodern concept of stakeholder involvement by providing a hybrid combination of participation channels (see section 2.1). E-participation is mainly used for providing information and as a way for public authorities and stakeholders to receive comments. If we take a short look at the concepts of involvement, we can conclude that the functionalist approach mainly means expert participation without citizens, which creates a gap between the views of experts and those of citizens. This is very problematic when it comes to generating a consensus in energy planning procedures. The respondents of our study desire information that is easy to understand. E-participation can help to prepare complex information in a comprehensible way. The neoliberal concept reflected in e-petitions is frequently used to express resistance, but plays no decisive role in this study. However, we assume that respondents are critical of the lack of exchange between decision-makers and citizens. Similarly, we argue that deliberative and anthropological concepts are uncommon in e-participation procedures, as extensive discussions in official forums are still exclusively a form of real-world meeting, even if a lot of informal debates can be found in online forums such as social media. The respondents see little sense in deliberation, although they recommend citizen assemblies on climate topics.

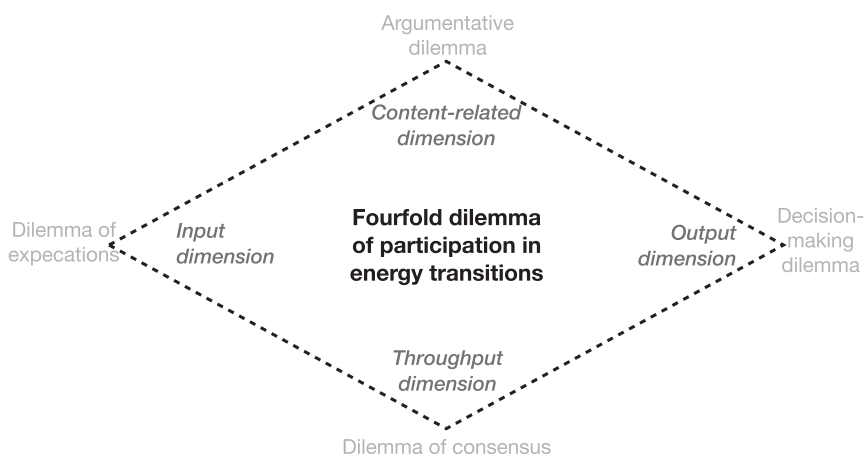


Fig. 3. The fourfold dilemma of participation in energy transition.

Finally, the emancipatory approach is reflected in energy transitions via the typical citizen initiatives of community energy, which can form a part of public participation. Here, e-participation plays a minor role, but projects do use e-organization tools (note: this topic was not a part of this study). Based on these findings, we can conclude firstly that e-participation in energy transitions is used in a low-threshold way to inform local communities and gather comments. Secondly, outflows of e-deliberation are almost non-existent in official participation procedures, mainly because deliberation is not a fixed component of public participation. Stakeholders do not believe that an open and reflective mode of negotiating energy planning is feasible due to the limitations imposed by strict regulations and requirements. As a consequence, the functionalist and neoliberal modes of participation are the most widespread and meaningful forms of involvement. This means fewer opportunities for establishing participation practices as democratic activities, as the level of legitimacy that can be achieved is already limited by the participation approaches that are used. Thus the manifold opportunities for communication, information processing, visualization and interaction offered by state-of-the-art technologies currently remain unexploited – but this may change in the future. We can categorize e-participation in wind energy planning according to three levels of e-participation and derive policy recommendations (Stratu-Strelet et al., 2021) (see Table 2). First, concerning the macro level – which we associate with officials responsible for top-down participation procedures – we recognize a need for more orientation towards citizens' needs, establishing motivation campaigns, and putting more emphasis on inclusive e-participation procedures (e.g. oriented towards specific groups). Second, on the micro level of individual e-participation usage, we recommend creating new e-participation opportunities (offering more types of access, e.g. with AR, VR, and 3D technologies), more diversity within tools (e.g. mapping and systemizing the concerns of different users), and, in particular, providing incentive structures through more effectiveness with regard to outcomes and the influence on benefits. Third, we draw a line between the technological level and the typical combination style of public participation in wind energy planning. Within these contexts, a simple mode of e-participation as a back-up option has to meet the requirements of straightforward and intuitive handling, be able to translate complex planning and technology issues into comprehensible terms, and provide smart, low-threshold feedback options, which can automatically compare feedback and comments with the envisaged plans made by officials.

Based on these insights, we conclude that advanced online participation technologies can increase the diversity and strength of civic input, improve the democratic quality of decision-making processes, and produce outputs that are more oriented towards the public good and better reflect the preferences of majorities (see also Radtke, 2023). Citizens could contribute their creativity, recognize causes and laws in correlations within the application contexts of technology, and exercise their power of judgment over “right and wrong” – three significant elements of democratic input in strongly technocratic planning procedures (Andersen and Silvast, 2023; Butzlaff, 2023; Castellani and Gerrits, 2024; Kleinhans and Falco, 2022; Leichenko and O'Brien, 2024; Turnhout et al., 2020).

More research is necessary to discover the far-reaching possibilities of e-participation in energy transitions, and especially to answer the question of whether the idea of digital democracy as a way to re-establish the role of citizens in decision-making and redefine the relationship between citizens and the state is an illusion, or whether there are indications that this could succeed (Deligiaouri, 2015). There are only a few studies that investigate processes in wind energy planning, and “fewer still that uncover the factors that make those processes more or less fair” (Elmallah and Rand, 2022, p.9). Moreover, less is known about e-participation processes than other participation formats. While we agree with the statement by the authors that the “creation of participation, information provision, and decision-making structures that respond to resident concerns about wind farm construction” is key to fair planning, we are skeptical about the possible extent of improvements. The stakeholders we interviewed see various risks relating to participation, and we have to bear in mind that there are probable negative consequences associated with the participation process (due to frustration, leading to opposition), as Schönauer and Glanz (2023) have shown.

Solman et al. (2023) argue that research should encourage the affected public to actively participate in decisions about how and where such digital devices are deployed. Wind farm operators could explore or experiment with how such devices can offer citizens alternative ways of addressing their concerns and participating in decision-making, thus promoting digitally supported governance. The prospects for greater fairness could increase in future if solutions are not predetermined and the local community opens up to alternative views on the matter. We are critical in our evaluation of this, as it is clear that digital devices do not change the fact that certain aspects of the planning and operation of

Table 2

Overview of empirical findings on e-participation in energy transitions classified by the central concepts of stakeholder involvement and public participation and perspectives/levels of e-participation, including key challenges (adapted by Renn and Schweizer, 2020, pp.54, 66, 73; Stratu-Strelet et al., 2021, p.5).

Concept of stakeholder involvement	Functionalist	Neoliberal	Deliberative	Anthropological	Emancipatory	Postmodern
Typical modes of e-participation in energy transitions and preferences of citizens and stakeholders: insights from empirical research	Typical mode of expert participation <i>without</i> citizens Gap between expert views and citizens' views Respondents desire easy-to-understand information	Typical mode of participation <i>for</i> citizens Frequently used to express resistance Respondents criticize lack of exchange between decision-makers and citizens	Uncommon mode of participation <i>for</i> or <i>without</i> citizens Almost never used in energy planning Respondents see little sense in deliberation	Uncommon mode of participation <i>for</i> or <i>without</i> citizens Almost never used in energy planning Respondents recommend citizen assemblies on climate topics	Typical forms of citizen initiatives (= community energy) Can form a part of public participation E-participation plays a minor role, e-organization tools primarily used	Typical combination of formats for providing information, facilitating dialogue, and receiving comments by stakeholders and citizens in energy planning participation E-participation mainly used for information provision + receiving comments
Three perspectives and levels of e-participation in energy transitions	E-government/macro/democracy level - Legitimacy - Effectiveness & efficacy - Voice & accountability		Citizen/empowerment/micro level - Usage by individuals (what services are available?) - Skills (digital literacy) - Access to services - Knowledge, intentions, preferences, interests			Technological/infrastructure/ <i>meso</i> level - Infrastructure - Affordability - Usage by government
Policy recommendations	More orientation towards citizens' needs, motivation campaigns, inclusive procedures for specific groups		Creation of new e-participation opportunities (types of access), diversity within tools, incentive structures through more effectiveness in terms of outcomes and influence on benefits			Simple and intuitive handling, translation of complex issues, smart feedback options

energy facilities are not intended to be influenced by citizens. As long as this remains the case, offers of e-participation amount to mere token participation. The situation can only be altered if more influence is possible, and in a way that does not harm decision-makers and project developers. We can identify some possibilities here for realizing decisions by citizens, particularly concerning the design of the environment of energy facilities and how profits can be invested in local communities. The new Renewable Energies Act in Germany has mandated since 2023 that profits from renewable energy projects be allocated to the affected communities (within a radius of 2500 m). The municipalities must use the funds for the common good – and suggestions from citizens could be collected in this context. Many citizens desire affordable local electricity rates, which can only be achieved by municipal or willing private-sector energy providers. E-participation offerings can thus only have a limited influence on the dimensions of output and outcomes, but they can bring about improvements in input and procedural fairness. As Solman et al. rightly note, it is primarily in the procedural aspects of capturing, channeling, and managing input by citizens that e-participation tools can achieve significant improvements.

The future of democratic innovations in e-participation within energy transitions holds significant potential for fostering deeper citizen engagement. Experimental frameworks, such as democratic labs and slow planning, offer promising avenues for developing participatory approaches that prioritize deliberation and community input (Asenbaum and Hanusch, 2021; Dobson and Parker, 2024). These methods advocate a shift away from rapid, top-down decision-making toward a more inclusive model, which respects local context and community-driven insights (Coşkun et al., 2024; Healey et al., 2008; Heyik et al., 2024; Opitz, 2024). Nonetheless, typical challenges in e-participation persist, such as ensuring genuine inclusivity and overcoming power imbalances that can hinder meaningful collaboration (Bennett et al., 2022; Levelt and Tan, 2023). To address these issues, innovations like participatory budgeting or e-budgeting could be employed, allowing citizens to actively contribute to local decisions,

from prioritizing investments to suggesting infrastructure enhancements in energy transitions (Pulkkinen et al., 2024; Tseng et al., 2024). These models encourage citizen empowerment and shift the focus from tokenistic participation to substantive involvement, with communities playing an active role in shaping policy outcomes (Saradín et al., 2023; Wilson and Tewdwr-Jones, 2020).

For e-participation to make a sustainable impact, it must go beyond gathering input to building structured channels that embed citizen insights into actual planning outcomes (Helbing et al., 2023). By gradually integrating such democratic innovations, public authorities and stakeholders can work toward a more equitable, participatory, and resilient approach to planning that aligns with the goals of energy democracy and energy justice in future energy transitions.

CRedit authorship contribution statement

Jörg Radtke: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Table A1

List of interview participants and interview dates.

No.	Type	Sector of Society	Location	Year
P01	Citizens' Initiative for Construction Stop of the Local Wind Farm	Members of Civil Society Organizations (CSOs)	City A	2021
P02	Head of the Local Department of Planning	Employees of the Municipal Administration	City A	2020
P03	Mayor	Mayors	City B	2021
P04	Representative of the Free Voters Party and Local Village Association	Local Politicians / Members of Civil Society Organizations (CSOs)	City B	2021
P05	Local Highland Club	Members of Civil Society Organizations (CSOs)	City B	2021
P06	Representative of the Green Party	Local Politicians	City A	2021
P07	Representative of the Liberal Party	Local Politicians	City A	2021
P08	Representative of the Christian Democratic Union	Local Politicians	City A	2021
P09	Local Citizens' Club	Members of Civil Society Organizations (CSOs)	City B	2020
P10	Representative of the Free Voters Party	Local Politicians	City A	2021
P11	Head of the Local Department of Business Development	Employees of the Municipal Administration	City A	2021
P12	Representative of the Green Party	Local Politicians	City B	2021
P13	Mayor	Mayors	City A	2021
P14	Friends of the Earth Germany	Members of Associations and Public-Sector Companies	Region A	2021
P15	Local Highland Club	Members of Civil Society Organizations (CSOs)	City A	2021
P16	Nature And Biodiversity Conservation Union	Members of Associations and Public-Sector Companies	Region A	2021
P17	Local Homeland Club	Members of Civil Society Organizations (CSOs)	City A	2021
P18	Representative of the Christian Democratic Union	Local Politician	City B	2021
P19	Tourism Association	Members of Associations and Public-Sector Companies	Region B	2021
P20	Head of the Regional Department of Culture	Employees of the Regional Administration	Region A	2021
P21	Head of the Regional Department of Planning	Employees of the Regional Administration	Region B	2021
P22	Representative of the Social Democratic Party	Local Politician	City A	2021
P23	Citizens' Initiative for Construction Stop of the Local Wind Farm	Members of Civil Society Organizations (CSOs)	City B	2021
P24	Regional Heritage Association	Members of Associations and Public-Sector Companies	Region A	2021
P25	Local Highland Club	Members of Civil Society Organizations (CSOs)	City B	2021

(continued on next page)

Table A1 (continued)

No.	Type	Sector of Society	Location	Year
P26	Photographer of the Local Countryside	Members of Civil Society Organizations (CSOs)	Region B	2021
P27	Head of the County Department of Planning	Employees of the County Administration	Region A + B	2021
P28	Head of the Regional Department of Planning	Employees of the Regional Administration	Region A	2021
P29	Storyteller of Local Place Identity Project	Members of Civil Society Organizations (CSOs)	Region B	2021
P30	Energy Agency of the Federal State	Employees of the Federal Administration	Federal State	2021
P31	Head of the Department of Planning	Employees of the Municipal Administration	City B	2021
P32	Representative of the Social Democratic Party	Local Politician	City B	2021
P33	Project Developer of the Wind Farm	Members of Associations and Public-Sector Companies	Region A + B	2021

Table A2

Overview of the research categories of the qualitative data analysis.

Research Categories (Deductive)	Sub Categories (Deductive-Inductive)
Understanding of Civic Participation	invited participation (top-down) invented participation (bottom-up) formal participation informal participation narrow conception broad conception reductive understanding extensive understanding
Demands of Participation Processes	informing transparent fact-based/neutral acceptance-enhancing early moderated inclusive activating opinion-forming compromise-oriented inquiring argumentative interest-gathering
Previous Experiences with E-Participation Processes	online surveys digital town hall meetings <i>Umweltprüfungsportal</i> ("environmental assessment portal") citizen-to-citizen via social media
Aspirations for Civic E-Participation	more easily digestible information early communication better explanation of decisions better explanation of avenues for participation systematic structures for participation discursivity
Concrete Suggestions for Future Participation Processes	neutrality moderation 2D renderings maps AR-visualization audio-visual simulation
Perceived Opportunities and Risks associated with E-participation	increased responsiveness temporal independence better visualization utilizing citizens' creative potential better representation of complex information increased accessibility higher participation rate costs/cost v. benefit increased workload/insufficient personnel temporal independence over-discussion threats of violations of the rules of rational discourse overwhelming the users bogus participation

Data availability

The data that has been used is confidential.

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