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Exploring Values of Energy Justice: A Case Study of a Burgeoning Energy Community

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ABSTRACT

We increasingly see local community energy initiatives unfold to support sustainable energy transitions. The notion of energy communities may aid these initiatives as HCI researchers, practitioners, and political organizations argue for their potential benefits. However, envisionments of energy communities carry assumed expectations of a just energy future for community members. This paper presents a case study of a burgeoning energy community where diverse stakeholders reflect on their expectations of a newly established Danish energy cooperative. Through a value-sensitive design study, we identify ten values reflecting social-technical expectations of how the community may be organized and supported by technology in the future. We structure the values into three tenets of energy justice to discuss value tensions regarding the; i) distribution of energy community benefits and threats, ii) enabling energy community engagement, and iii) recognizing the energy community. Lastly, we discuss how HCI may steer technology design toward a just energy future.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in HCI**.

KEYWORDS

energy communities, energy justice, sustainable HCI, value-sensitive design, value tensions, qualitative case study

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1 INTRODUCTION

In 2020, Denmark gained its first citizen-driven energy community in Energifællesskab Avedøre (EFA) following regulatory changes at the EU level [12]. This follows increased political engagement with community energy [39], seemingly accompanying commonly acknowledged concerns of climate change and unsustainable energy infrastructures. With energy communities envisioned to play a favorable role in sustainable energy transitions [15, 48], assumed benefits include minimizing CO_2-emissions, improving social cohesion, and energy bill savings [20]. Although energy communities are gaining political and societal traction, how these are to be organized, implemented, and supported by technology is still in a formative stage [29, 34, 46, 68]. One way to organize energy communities is to envision energy communities as cooperatives where members own energy technologies and surpluses distributed in the community [30]. Yet, despite these progressive and seemingly *just* envisions of sustainable energy futures, recent scholars argue that within the conceptualization of fostering community energy is embedded an expectation that energy justice will naturally follow, without community energy initiatives fully employing *"the inherent scope of what the concept of energy justice entails"* [66, p. 8].

In HCI, we are recently starting to see work that explores the design of digital platforms supporting different forms of energy communities [10, 19, 22, 23, 37]. However, much of this research focuses on demonstrations or speculations of how energy communities may be supported by the design of interactive and innovative technology [7, 34, 68, 70]. Further, as technological infrastructures become embedded into social structures, how these technologies support communities in sustainable transitions is mostly shaped through trial-and-error [31, 34]. Thus, insights into energy communities are limited by what these have become, with a restricted focus on what they might be, and how energy may become just in such a community.

In this paper, we present a qualitative value-sensitive design (VSD) study [18] of a single, burgeoning energy community, established as Denmark's first energy cooperative association – EnergiFællesskab Avedøre (EFA) – in 2020 [12]. Due to its recent foundation, we as researchers have the opportunity to engage with the values of the energy community before new infrastructures become embedded into societal structures [31]. Through this case study, we seek to improve our understanding of community values as reflected by both members and stakeholders of this newly established energy community and how these values reflect energy justice to unfold. To do so, we draw on a conceptual investigation (desk research) and an empirical investigation (interviews, field observations, and photography) where ten diverse stakeholders reflect on their association with EFA. We analyze these data and identify ten values structured after Heffron and McCauley [25]'s three tenets of energy justice (distributional, procedural, and recognition). These values provide situated conceptualizations of energy justice in this burgeoning energy community. We discuss the identified values and possible tensions between these in their situated nature. We show opportunities for future research to provide insights on possible paths forwards to achieve energy justice.

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2 BACKGROUND

Value-sensitive design focuses on values, characterized as the breadth of what people consider important in their lives [18]. Research shows that values are important for people when engaging with energy transitions [42, 50, 60]. For instance, Milchram et al. [42] identify values relevant for smart grid technology acceptance, where smart grid technologies may support values as drivers, hinder values as barriers, or have an ambiguous effect on values. Likewise, Perlaviciute et al. [50] show that if people's individual and collective core values are reflected in an energy project, it is more likely that the project will elicit positive emotional responses, also shaping peoples' understanding of potential consequences of sustainable energy transitions [60]. Recently in HCI, scholars [4, 24, 27, 28, 34, 36, 63, 70] have also argued that values and related concepts of energy sovereignty, resilience, organization, and governance are important aspects when designing for sustainable and technology-supported communities, including energy communities.

Energy communities can be conceptualized as a form of commons, where resources are owned and managed by the community through social mechanisms and values [41]. A commons perspective benefits from understanding value tensions, as certain values may come into conflict [7, 13, 20, 28, 47]. Cila et al. [7] utilize a speculative experiment of a decentralized community energy system to showcase conflicts between the roles of blockchain and public values. Similarly, Gjorgievski et al. [20] argue goals like security and affordability may require trade-offs in energy community design, while Edens [13] shows how distribution sector operators aim to balance values in energy transition, highlighting that such tensions require explicit management. These considerations are important if viewing energy communities as socio-technical systems [29, 69].

In the realm of sustainable HCI, energy communities have seen attention as objects of design [10, 19, 22, 23, 37, 56, 70]. Community energy feedback on energy has been utilized in digital paintings [10], ambient light displays [22], smartphone apps [23, 37, 56] and communication devices [19]. However, Jensen et al. [37] found that competitive communal energy feedback is not necessarily useful for establishing community feeling. Such community aspects may lead to *"participants becoming more focused on being 'the best' in their community, thus moving the focus away from the collective feeling of 'being in it together"'* [22, p. 4]. In a remote community using a community-owned wind turbine, Simm et al. [56] found that displaying community energy production could assist changes in energy routines without financial incentives. Designing platforms for energy communities thus requires engaging with the communities themselves to ensure that designed platforms promote meaningful and just values to the communities.

Although it is commonly assumed within a Western context that fostering community energy through new and innovative technologies will also bring about energy justice [2, 25, 66], surprisingly little research has explored socio-technical configurations of values in the context of energy communities, and how these align with the notion of energy justice. Based on systematic literature reviews of European energy communities' strategies, van Bommel and Höffken [66] argue that energy justice occurs within, between, and beyond community energy initiatives, while Banerjee et al. [2] conceptualize five principles of energy justice related to temporal, geographic, socio-political, economic, and technological dimensions. However, to frame energy justice in this study, we draw inspiration from Heffron and McCauley [25]'s three tenets of energy justice, namely; *distributional* (related to the distribution of benefits and cost across all members), *procedural* (considers the ability of all members to engage and participate in decision making) and *recognition* (highlights that all individuals must be fairly represented) justice. Practical use of energy justice may be difficult to support [26], where community-level initiatives may provide further complexity in this endeavor [57]. VSD can contributes to the practical applicability of energy justice [32], translating ethical principles into technical design requirements, which recent scholarship has engaged with [6]. The values of smart grids may have positive and negative impacts on energy justice [43]. For instance, in a study of a Dutch gas controversy [45], values of trust and honesty relate to procedural justice, though their concrete implementation is limited. Related, Ransan-Cooper et al. [52] show how community energy storage can induce value tensions, which may affect the community's ability to support tenets of energy justice.

Despite the acknowledgment of the breadth of values in an energy community and their socio-technical nature, HCI has yet to synthesize these threads. We use this as an opportunity to provide novel insights into the socio-technical configurations of values in an energy community and their relation to energy justice.

3 CASE STUDY SETTING

This case study is situated in Denmark, anchored in a recently founded citizen energy community, named Energifællesskab Avedøre (short: EFA, translated: Energy Community Avedøre). Citizen energy communities are a subset of energy communities, which *"exclude medium-sized and large enterprises from being able to exercise effective control"* [5, p. 8] and are open to any other actors wanting to join. EFA was established in 2020 as an energy cooperative association, inspired by the century-old Danish cooperative movement where partners jointly invest in vital technology and collectively bargain for fair prices. In Danish law, this has a number of consequences. In the energy community i) every partner has a single vote in the decision-making regardless of their share in EFA, and ii) any surplus is to be distributed among energy community members [9]. EFA is currently governed by a consulting company working in the field of local district heating and sustainability transitions. On the board of EFA are representatives of local citizens, public institutions, private companies and the surrounding municipality.

EFA is engaged in a collaborative project between academia and industry, which we are associated with. In this project, different academic disciplines (energy planning and sustainable HCI) provide research related to the energy community's engagement with renewable technology (see Fig: 1 B). In this project, EFA has access to renewable technology in the form of solar photovoltaic panels on the roofs of a local high school as well as an electric vehicle charging station in front of the same school (see Fig: 1 A). The high school is also a partner in EFA, and the principal is the chairperson of EFA. Private industry is also involved in EFA (see Fig: 1 C). A local start-up company with expertise in future smart grid technology is developing smart, digital platform(s) for the energy management of EFA, while community administrators are part of

Figure 1: Energy Community Avedøre: A) The high school's electric vehicle charging station. B) The apartment complex "Store Hus" with a display showing power generated by solar photovoltaic panels. C) Waste sorting in a company involved in Energy Community Avedøre.

demonstration efforts. Thus, EFA is still in its infancy regarding efforts to manage the production and distribution of energy. The role of the authors in this project is to provide insights on human engagement in EFA, and how the digital platforms in EFA may be designed from a human-centered perspective.

The energy community in this case study is thus a fruitful arena for identifying values, and value tensions, as there have been few opportunities to rectify these among energy community stakeholders. We hope to engage stakeholders in considering how to manage such value tensions in the future and how they, in part, shape energy justice.

4 STUDY DESIGN

To help identify human-centered values of the governance of EFA and the supporting energy technology, we conducted a qualitative Value-Sensitive Design (VSD) study. VSD seeks *"to influence the design of technology early in and throughout the design process"* [17, p. 2]. In VSD's tripartite methodology, a conceptual investigation seeks to define the relevant values to be accounted for in a design. An empirical investigation elucidates understandings of values and value trade-offs in context, often utilizing social scientific methods. Lastly, a technical investigation is focused on identifying, retroactively or proactively, technical mechanisms which can support a set of values [18]. In this paper, we report on conceptual and empirical investigations related to digital platforms for energy communities in relation to the EFA case study and their role in the socio-technical system of EFA.

In our conceptual investigation, we focused our efforts on scientific literature related to energy transitions in communities. We conducted desk research [38] searching the Google Scholar and Scopus databases, utilizing keywords like "energy communities", "energy transition" and "values". We collected nine papers spanning areas of sustainable HCI, energy transitions and energy justice. These provided conceptual [42, 54], empirical [35, 37, 59] and designerly [1, 4, 40, 44] perspectives on values relevant to energy communities, enabling a breadth of conceptual perspectives on energy communities. We inductively identified values, with a basis in collected papers utilizing VSD, coding paper excerpts using NVivo. We used empirical material and project documents as preliminary guidelines for choosing and evaluating the relevance of values identified in the papers.

Our empirical investigation was conducted as a qualitative field study, including semi-structured interviews, field observations and photography. The semi-structured interviews [49] were done in situ [53], where we recruited ten stakeholders of the EFA community to reflect upon green initiatives in their community and their understanding of the EFA cooperative. Participants in our semi-structured interviews (with anonymized names and roles) are shown in table 1. All the interviews were audio recorded and transcribed, totaling 7.4 hours of data material. As part of the empirical investigation, we also analyzed three news articles describing EFA to the public [12, 21, 65].

We conducted a thematic analysis [3] of transcribed interviews and news articles. The analysis was done in three steps. First, we read material with regard to the expected values of the energy community as described by stakeholders. Second, we inductively coded the material, developing themes in multiple rounds. We reviewed and iterated upon these themes before a final iteration, where themes were named and connected to values in an abductive process [64] of defining empirical themes and conceptual values. Lastly, we structured the values into the three energy justice tenets based on our themes. We use these themes to provide empirical insights on identified values and further iteration of our conceptual investigation. In this paper, we consolidate our conceptual and empirical investigations, focusing on the values contained in the final iterations of both investigations.

Table 1: Overview of our interviewed and anonymized participants and their role in EFA.

Participant	Role in EFA
Eliot	Project worker
Tara	Public institution employee
Adam	Company employee
James	Citizen
Lena	Project worker
Søren	Project worker
Nicole	Citizen
Mia	Citizen
Magnus	Citizen
Melvin	Project worker

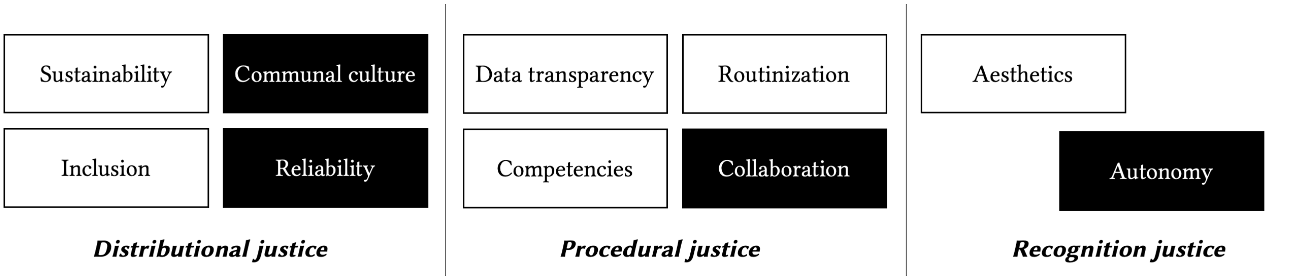

Figure 2: Framework of values categorized based on the type of energy justice [25] they are expected to contribute to by stakeholders. Values in black boxes are implicated in value tensions.

5 FINDINGS

In this section, we present values relevant to the case of EFA. These help us understand stakeholders' expectations of the technology developed to support EFA's governing an energy community according to those values. Further, values represent socio-technical conceptualizations of people's expectations of the ethics regarding how these technologies may become embedded in a social, communal context. This also serves to make value tensions between these visible. Figure 2 shows an overview of identified values.

We group identified values using the three tenets of energy justice as framed by Heffron and McCauley [25] in a framework with three ethical principles: *distributing energy community benefits and threats*, *enabling energy community engagement* and *recognizing the energy community*. These dimensions help to develop an empirically situated framework of values embedded in the socio-technical reality of a burgeoning energy community. Stakeholder apprehensions of values may overlap in different energy justice tenets due to their empirically situated nature.

5.1 Distributional Justice – Distributing Energy Community Benefits and Threats

5.1.1 Sustainability. The nature of energy communities implies a value of sustainability. The importance of sustainability became apparent in our conceptual investigation, seen in the reviewed VSD literature [1, 42, 44]. Sustainability may act as driver towards engaging with technologies in energy transitions [35, 42]. Participants in our empirical investigation similarly emphasized the promotion of sustainability by the energy community. Here sustainability is seen on an environmental, social, and economic tier, similar to the triple bottom line [14]. Sustainable benefits should be distributed throughout the energy community's diverse levels:

> "So you can have different needs as big or small community or as the individual. You want to save energy, you want to reduce the emissions, you want to, want to, for example, ensure the stability of the electrical network." (Melvin, project worker)

EFA should also promote this kind of sustainability so that other citizens might engage with it. Søren describes how the energy community might push people to *"start to talk about [...] fluffy sustainable development goal-ish"* concerns like biodiversity. Here, the benefits of EFA become distributed through multiple channels of sustainability, thereby expecting distributional justice.

5.1.2 Communal Culture. EFA should engage with the role of culture and ensure communal experiences. This value concerns *"the ways in which individuals connect to their community"* [54, p. 41], and entails engaging with the community's history [44]. Multiple HCI studies show that a lack of community feeling among energy communities is problematic for people in a busy everyday life [4, 37]. Empirically, this value was the one most often identified. Here, focus is on "anchoring" EFA initiatives among citizens, letting them take ownership and action. Adam describes how EFA *"is anchored locally, I like that, that is manageable for me"*. Energy community savings should also return to citizens:

> "The surplus [now] goes to something that is outside our community, so why should we not have, we want want to join the energy community, we would like to do this locally. We want the surplus to go to the local." (Eliot, project worker)

This might also be in the case of exchanging goods and services rather than monetary benefits, as described by Melvin. Considering communal culture as a value entails distributing surpluses, which may end up outside EFA, back to citizens inside EFA, as well as distributing EFA's anchoring among citizens.

5.1.3 Inclusion. Due to the heterogeneity of stakeholders, the ability of the energy community to promote inclusion as a value is paramount. In the reviewed VSD literature, inclusion is conceptualized as the ability of all social groups to engage with the energy transition [42, 54], where inclusion can be a driver and barrier for smart grid acceptance [42]. Standal and Feenstra [59] argue that inclusion is central for just energy transitions with equal access to participation, pointing to Norwegian energy narratives' lack of this. Inclusion was a major theme in our empirical investigation. The energy community should include everybody in participating, and ensure access to participation. As Adam describes:

> "We want something that everybody can use, regardless of which electric vehicle they buy. And that is actually it, I think with some of the other stuff, I hope it's possible to create some more open, open technology." (Adam, company employee)

This inclusion is related to both engineering and governance aspects of EFA. Multiple participants described the feeling of being able to change things, both for high school students but also citizens in general. Inclusion becomes a value serving the distribution of engagement in the energy community equally among all, and not just those with specific expertise or market powers.

5.1.4 Reliability. Energy communities may require new technologies, and as such they may pose questions of reliability. In a systematic review of smart grid research, Milchram et al. [42, p. 11] conclude that *"adoption of non-mainstream technology was seen as risky with respect to the malfunctioning of the system"*, proposing the value reliability. Considering our empirical investigation, the value of reliability became related to the automated management of energy that is part of this study's case. Such reliability is technical, with regard to energy technologies, and socio-legal structures:

> "That is actually also some of why we need technology because I do not see us living up to those commitments that are described in the electricity supply laws, if we do not have a program that can help control those flows in our system." (Søren, project worker)

Eliot similarly describes using automation to intelligently direct spare energy from the local high school to private companies during summer break. Automation may also be for private citizens. James provides an example of this in utilizing private homes as electricity storage if appropriate. This helps contextualize reliability as a value of distributional justice, to distribute excess energy equally in compliance with electricity supply laws.

5.2 Procedural Justice – Enabling Energy Community Engagement

5.2.1 Collaboration. Collaboration of value concerns the ability of the energy community to participate in energy on equal footing with established actors, as well as cooperate between actors in the energy community. Here, the energy community should be seen as equal partners in the broader energy sector [54]. This might be in the case of cooperation with grid companies, cases of which have been acknowledged by Standal and Feenstra [59]. Collaboration as a value was further described in our empirical investigation. Here, we see a focus on both collaboration between EFA and outside forces, as well as intra-community collaboration. For example, Eliot describes using local energy production to support the national electrical grid:

> "Because in peak hours it is important that we can produce some local energy, so we prevent the overall grid from becoming burdened. It could be that it can minimize investments in tranformers or whatever. So in that way, we help each other." (Eliot, project worker)

Collaboration inside the community also received attention. This could be in the case of a library volunteering to manage rental electric bikes, or the administration of EFA working together with high school students. James also stated that it was important to have joint discussions on how to manage the energy community. Thus, collaboration is situated as a value of procedural justice focused on enabling both in- and out-community members to act together.

5.2.2 Competencies. The value of competencies is concerned with making the energy community contribute to learning and development among community members. Competencies from education can be conceived as a public good [54], and has seen attention as an important factor when designing computing systems focusing on shaping competencies as part of sustainable energy-intensive practices [4, 35, 37]. Our empirical investigation shed light on this value. Competencies was especially prominent in Tara's reflections considering her role as a public institution employee:

> "So our job of course becomes, but that is of course a whole other thing, it is more pedagogical, didactic, that they [local students, ed.] learn to utilize it correctly, also inside the different natural scientific methods." (Tara, public institution employee)

Citizen Nicole similarly described the importance of being able to *"absorb some knowledge to you"* that could be acted upon. The high school in EFA also utilizes solar photovoltaic panels on the building to attract adolescents who are interested in science and the environment. Here, the building of compentencies becomes central in ensuring that EFA students and citizens can act inside the community and engage in processes herein.

5.2.3 Routinization. Throughout our conceptual investigation, the importance of digital platforms for energy complementing existing routines inside households became apparent [4, 37]. Asikis and colleagues consider this value as "*practicality and compatibility with the existing shopping process"* [1, p. 2], and utilize this value in developing a personal shopping assistant. Thereby, we conceptualized EFA as necessitating routinization. This was further confirmed in our empirical investigation. Here, routinization is related to the energy community promoting easy entrance into sustainable transitions, fitting with what community members are already doing:

> "But you could produce the electricity yourself and make it there, then it maybe also becomes easier to say to people: "Your old car, when you switch that out, then get one with a plug [an electric vehicle, ed.]". (James, citizen)

Søren also describes his project worker role in EFA as being that of removing obstacles that prevent citizens from engaging in sustainable transitions and procedures herein. Lena describes hopes of citizens *"becoming hooked"* on *"how they can change energy behavior themselves"* towards more sustainable ends.

5.2.4 Data Transparency. If data collected in energy communities are to be used constructively, a certain degree of data transparency in these is necessary. This entails understanding the impacts of energy consumption [42], making data visible for meaningful interventions [54], and showcasing information responsible for rating environmental aspects of products [1]. This shows data transparency as concerned with ensuring that users can understand and utilize this. A lack of accurate information regarding energy is problematic in the context of community energy [4, 37] and local energy production [40]. In our empirical investigation, data transparency as a value centered around the ability of members of EFA to actively understand and utilize the data throughout daily life:

> "So I think, if it [using a digital platform, ed.] is something that ordinary citizens should do, then it just requires that it is understandable, that it can be translated into something you understand." (Lena, project worker)

Public institution employee Tara describes utilizing the energy community and data herein as manifestations of the ability to act upon environmental challenges. Project worker Søren similarly describes such transparency as fostering a sense of ownership among citizens towards sustainable energy transitions. Our empirical investigation shows how data transparency serves procedural justice, focused on "full information disclosure" [25, p. 2] to support intervention.

5.3 Recognition Justice – Recognizing the Energy Community

5.3.1 Aesthetics. In our conceptual investigation, we identified the value of aesthetics. This value entails that the energy community is represented in a way that is both pleasing and respectful towards the community, thereby considering their image in energy transition [44]. Aesthetics are seen in the context of smart home householders' desires towards creating *"aesthetically pleasing and beautiful spaces"* [35, p. 9]. In our empirical investigation, aesthetics involved recognizing the history of the city of the energy community. The city's history is somewhat difficult, as it encompasses one of Denmark's biggest low-income housing associations:

> "We are in this place where people still think of it as 'a ghetto', and that means that we get a lot of bilingual students, and that means that the others do not seek us out that much. So it [EFA, ed.] also means that we, you know, actively go and work on how we can change that narrative [...]" (Tara, public institution employee)

Similarly, company employee Adam describes how *"it [EFA, ed.] is a good story, and that is also what we live off"*, influencing the company's decision to join. Aesthetics thus concerns recognizing the role and image of EFA and Avedøre in sustainable transitions and the community's historical inequalities.

5.3.2 Autonomy. Autonomy may be understood broadly as the *"Right to political, economic, cultural, and environmental self- determination"* [54, p. 40], or more narrowly as individuals' control of preferences [1]. A loss of autonomy can serve as a barrier for smart grids [42]. In our empirical investigation, autonomy was described by James as *"it is still me who can pull the plug"*, to voluntarily disengage with the digital platforms in EFA if necessary. However, EFA should also be autonomous from other communities:

> "[...] I know that we will never be able to not have to draw on something from outside, but perhaps if it works out well. But I like, I like the thought that you, mentally, could say: 'Yes, we use some power out here, but we produce it ourselves'." (Adam, company employee)

This supports the socio-technical value of autonomy. Autonomy inside EFA is concerned with all participants being able to detach from the energy community through technical means, whereas autonomy outside EFA is concerned with the community being self-sufficient regarding energy resources. Here, autonomy is concerned with recognizing the right to self-determination for both individuals and EFA.

6 DISCUSSION AND FURTHER WORK

This study has identified ten human-centered values reflecting how energy justice may unfold in a burgeoning energy community. Empirical apprehensions of these values may pose value tensions, with implications for achieving energy justice. Table 2 shows how prioritizing specific energy community values pose value tensions with implications for supporting energy justice. We now discuss implications for both values of energy justice as well as value tensions within energy justice in energy communities.

Table 2: Energy justice tenets and value tensions implicated in prioritizing a specific value of the energy justice tenet.

Energy justice tenet	Value tension
Distributional justice	Prioritizing **communal culture** in distributing energy benefits and threats may come at the cost of **collaboration** with other actors and sectors, especially given EFA's local history. Prioritizing **reliability** in automated systems to ensure that flows are automatically distributed in a compliant way may come at the cost of the **autonomy** of EFA agents.
Procedural justice	Prioritizing **collaboration** in supporting actions by both in- and out-community members may come at the cost of engaging with the **communal culture**, which may not be shared by outside collaborators.
Recognition justice	Prioritizing **autonomy** in recognizing the self-determination of EFA members may come at the cost of establishing a **communal culture** based on local values.

6.1 Value Tensions in Situated Energy Justice

In this paper, the empirical insights on EFA values lead to certain values becoming implicated in value tensions, described in table 2. Others have illustrated how energy savings may provide cost savings while excluding actors based on e.g. lack of internet access [58], and energy justice in community energy may pose a tension *"between desires to extend participatory governance in energy infrastructure at a local scale with potential loss of control"* [16, p. 655]. Similarly, Cila et al. [7, p. 5] utilized an imagined energy community to identify design dilemmas, including "Private vs. Collective interests", which our research shows may come to impact procedural justice in an energy community. Here, we engage van Bommel and Höffken [66]'s wishes for holistic perspectives on community energy justice, providing a view of energy justice from expected values in a newly established energy community. Our findings provide insights on some of the challenges of establishing energy justice within energy communities. We use a socio-technical view of energy justice values to further show how tensions of energy justice are not exclusive to any single aspect of energy communities.

Our contribution provides novelty in understanding value tensions before they are embedded in social structures. Future research should proactively engage with these, due to possible diversions of stakeholder expectations influencing how energy technologies become embedded in everyday life [33, 34, 61, 62]. This entails i) identifying locally mechanisms for managing value tensions in energy communities through technical investigations, and ii) empirical investigations of appropriate value trade-offs [18]. This is salient as value tensions affect technology acceptance, e.g. online platforms [11], urban development [51], and telecare [8].

6.2 Values of Energy Justice

In our study, we identified ten values that stakeholders expect EFA to uphold. By joining conceptual values with empirical, socio-technical understandings of these, we categorized the values with regards to Heffron and McCauley [25]'s three tenets of energy justice, namely *distributional justice*, *procedural justice* and *recognition justice*. Our results show that EFA as an energy community is expected to contribute to energy justice through a multitude of values. Our findings reflect current VSD literature on energy justice [43, 45, 52], showing how energy justice may fruitfully be situated in human values of energy innovations. Yet, our case study illustrates how values, as reflected by members of a current energy community, can be synthesized into energy justice tenets to bring new ways of engaging with energy justice in energy communities.

Further, we believe that values, as reflected by our study participants, provide situated conceptualizations of energy justice specific to a burgeoning energy community, and can aid in making energy justice practically applicable. Situated conceptualizations of energy justice may aid community acceptance of energy transitions (e.g. wind energy [67]), though such conceptualizations may also conflict, as shown by this study and Simcock [55]. Insights from this study can be used to move towards designing for energy justice in energy communities in a local way. This is especially important considering the burgeoning nature of many energy communities today [29, 68]. Future research could use identified values in technical investigations to move towards design requirements to achieve energy justice situated in energy communities. We are currently utilizing the presented framework in the context of designing a big wall display to support situated conceptualizations of energy justice through technical mechanisms. One example of this is utilizing a cross-platform front-end framework to support the situated nature of inclusion to distribute EFA's benefits among citizens regardless for their chosen digital platform. Additionally, we want to highlight that due to the burgeoning nature of EFA, the identified values have yet to move from expectations to concrete practices. Future research could engage with how empirical practices in energy communities represent different values through empirical investigations [18].

7 CONCLUSION

This paper aimed to identify values of energy justice in the burgeoning energy community EFA. We applied conceptual and empirical investigations of the VSD approach to establish 10 values related to three energy justice tenets. We discussed how these values may be useful to embed localized understandings of energy justice, though their situated nature also poses value tensions, where prioritizing one value for a tenet of energy justice will mean sacrificing another tenet of energy justice. Our study focused on EFA stakeholders' expectations for the energy community. There are opportunities for future empirical and technical investigations of in situ values, value trade-offs, and design requirements for these.

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