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ARTICLE

Safe havens for energy democracy? Analysing the low-carbon transitions of Danish energy islands

Henner Busch · Jörg Radtke · Mine Islar

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Abstract Denmark has long been known as a pioneer in renewable energy technology development. Apart from technological leadership, Denmark has also been the home to many community-based renewable energy initiatives. Citizen involvement in local energy projects has been key to increasing and maintaining acceptance to wind, solar and biomass. Three Danish islands (Bornholm, Samsø and Ærø) have been particularly active in promoting renewables. All three have claimed the title "energy island" and two of them have established specific institutions to promote further RE projects. In this article, we investigate community energy projects on two of the islands (Samsø and Ærø) through an Energy Democracy lens. The purpose of this investigation is to understand how the development on these islands relate to the concept of Energy Democracy: we outline how democratic processes and institutions shape the development of the local infrastructure and how this development, in turn, shaped local democracy. We found that many of the features of Energy Democracy were present in the two cases. Our research highlights a number of shortcomings of the concept of energy democracy, most importantly, a certain disregard for questions of energy justice and a blindness towards questions of scale.

Keywords Energy democracy · Community energy · Energy islands · Energy justice · Renewable energy · Denmark

✉ Dr. Henner Busch · Dr. Mine Islar
Lund University Centre for Sustainability Studies (LUCSUS), Lund University, Lund, Sweden
E-Mail: henner.busch@lucsus.lu.se

Dr. Jörg Radtke
Research Institute for Sustainability, Helmholtz Centre Potsdam, Potsdam, Germany

Zusammenfassung Dänemark ist seit langem als einer der Technologieführer im Bereich der erneuerbaren Energien bekannt. Darüber hinaus gibt es in Dänemark eine große Zahl an Energiekooperativen. Bürgerbeteiligung in lokalen Energieprojekten war entscheidend, um eine breite Akzeptanz von Wind-, Solar-, und Biomasseprojekten sicherzustellen. Drei dänische Inseln (Bornholm, Samsø und Ærø) waren in der Vergangenheit besonders erfolgreich darin, Projekte mit erneuerbaren Energien durchzuführen. Alle drei Inseln haben für sich den Titel „Energieinsel" beansprucht und zwei von ihnen haben Einrichtungen geschaffen, die gezielt Projekte mit erneuerbaren Energien fördern sollen. In diesem Artikel untersuchen wir Bürgerenergieprojekte auf zwei der Inseln (Samsø and Ærø) mit Hilfe des Konzepts der Energiedemokratie. Das Ziel ist zu verstehen, wie Energiedemokratie in konkreten Fällen lebendig wird. Dabei zeigen wir wie demokratische Prozesse und Institutionen die Entwicklung lokaler Infrastruktur beeinflussen und wie sich im Gegenzug diese Entwicklung auf lokale Demokratieprozesse auswirkt. Unsere Ergebnisse zeigen, dass viele Charakteristika der Energiedemokratie auf beiden Inseln präsent sind. Unser Artikel zeigt daneben eine Reihe von Problemen mit dem Konzept der Energiedemokratie auf. Die wichtigsten beiden davon sind: erstens, eine gewisse Blindheit für Fragen der Energiegerechtigkeit und zweitens, ein achtloser Umgang mit geografischen Skalen.

Schlüsselwörter Energiedemokratie · Bürgerenergie · Energieinseln · Energiegerechtigkeit · Erneuerbare Energien · Dänemark

1 Introduction

Developing solutions to the ongoing climate crisis poses considerable challenges. In particular, we have to find drastically different ways in which we produce, transmit and consume energy (IPCC 2018, IPCC 2022). Recent years have seen an expansion of renewable energy (RE) production (REN21 2021) bringing changes to many places and regions (L. Coenen et al. 2021). Not all of these impacts are positive, resulting in environmental and social problems (Islar 2012; Islar and Busch 2016; Islar et al. 2017; Avila 2018; Guðmundsdóttir et al. 2018; Ramasar et al. 2022). These challenges will only increase in the future as growing RE production will move into increasingly contested locations. This means that we will have to direct more focus to the conflict lines that arise when RE projects are implemented. Thus, exploring new and emerging forms of energy systems, such as alternative ownership structures and governance arrangements becomes a critical task for energy researchers.

The growth in RE has also brought about a shift in the power structures of the energy sector. RE can enable new actors to become independent from big, industrial energy producers or to start feeding into the grid. In response to this change, the concept of energy democracy (ED) has emerged (Szulecki 2018). ED describes this shift and the empowerment of citizens by e.g. becoming prosumers and shareholders of energy systems (Berthod et al. 2022). Prosumers are agents who simultaneously produce and consume energy (Parag and Sovacool 2016). Oftentimes, these are households or businesses who make use of the opportunities renewable energy offer

by e.g., installing a solar panel on their roof or balcony to lower their electricity bill or make some money by feeding into the grid. Much hope is project on the concept of ED as it promises a way forward that embraces local needs and wants and, thus, leads to a mitigation of negative social and environmental aspects of RE projects (Kunze and Becker 2014).

Community energy (CE) is a particular way in which ED manifests. Loosely defined, CE refers to energy projects "by and for local people" (Walker and Devine-Wright 2008). CE goes beyond simple prosumerism as it entails a certain degree of collective action. If implemented adequately, CE projects bring about a number of benefits to local communities (Brummer 2018), such as local economic growth (Busch and McCormick 2014) or strengthened democratic processes (Islar and Busch 2016). Europe is the centre of CE development but projects have emerged all over the world from South Africa to South Korea (REN21 2019). The European Union (EU) has recognised the potential of CE and included supporting policies in the 2018 Energy Directive (European Union 2018). Despite first attempts to bring some structure to the scholarly debate (Wahlund and Palm 2022), the relationship between ED and CE remains to some degree unclear, leading to theoretical inconsistencies and redundancies.

Denmark is one of the pioneering countries when it comes to CE and can look back at a long history of such projects. Historically, the conditions for CE projects have been beneficial for decades (Gorroño-Albizu et al. 2019; Ruggiero et al. 2021a; 2021b). A particular development in Denmark are the community-centred energy transitions on the three "Energy Islands": Bornholm, Samsø and Ærø.

In this article, we focus on the two smaller islands, Samsø and Ærø, and the ways in which their energy transitions have brought about empowerment of citizens. While Samsø has been the object of much research in the past (Jakobsen 2008; S. E. Jørgensen and Nielsen 2014; Nielsen and Jørgensen 2015; cf. Islar and Busch 2016; Papazu 2016; Sperling 2017; Mundaca et al. 2018) and became an internationally-known success case for a low-carbon energy transition (Papazu 2018), Ærø remained mainly overlooked by scholars in the field of energy research (Wierling et al. 2018; Ruggiero et al. 2021a). Against this backdrop, this article aims to explore how CE projects create, establish and spread ED on the two Danish energy islands. Thus, we raise the following research question:

> How does Energy Democracy manifest in the cases of community energy projects on Ærø and Samsø?

Our article contributes in three ways by generating new knowledge. First, we provide a solid empirical account of how ED and CE manifest on the ground. Second, we contribute to scholarly debates on the relationship between ED and CE. Third, we conclude this article with a number of policy recommendations that aim to further the transition to more democratic RE systems in Europe.

We commence by providing a short overview of how CE featured in the scientific literature. Then, we present our main theoretical lens, ED, before outlining our Methods and Material. We will then dive into our Results on Danish Energy Islands before concluding with our Discussion and Conclusion.

2 Community energy

As outlined above, CE describes the active involvement of citizens in energy systems. CE is often discussed in relation to social and local innovation (Seyfang and Haxeltine 2012; Martiskainen 2017). The "community" in CE can manifest as community of interest (social) or community of place (local) (Busch et al. 2021). The first form is less often described in the literature (Becker et al. 2017; REN21 2019). Accordingly, many authors stress the importance of a place-based civil society context for the emergence of CE (Boon and Dieperink 2014; Mattes et al. 2015; Magnani and Osti 2016) as increasing scale necessarily leads to reduced opportunities for individual citizens to participate (Radtke 2022).

The scientific literature has identified a number of benefits that are associated with CE projects (Brummer 2018). First, many authors mention economic benefits for local communities in general (Walker and Devine-Wright 2008; Gui et al. 2017; Warbroek and Hoppe 2017; McKenna 2018). The creation of local jobs emerged as a more specific economic benefit (Walker and Devine-Wright 2008; Islar and Busch 2016; Young and Brans 2017; Akizu et al. 2018) along with increasing demand for local services (Bere et al. 2017) and additional local business tax (Nolden 2013; Busch and McCormick 2014).

Second, CE projects produce environmental benefits (Strachan et al. 2015). These can be roughly divided into a) lower emissions (often of both, pollutants and greenhouse gases) and b) behavioural change. Climate benefits from lower greenhouse gas emissions occur because CE systems are based on renewables that might replace energy production from fossil fuels (Walker 2011; Koirala et al. 2016; Moroni et al. 2016; Warbroek et al. 2018). Further research points at the behavioural change that can occur when people become part of a CE initiative (Juntunen and Hyysalo 2015; Parra et al. 2017; Akizu et al. 2018; Berka and Creamer 2018). Several author point out that this behavioural change goes beyond an altered use of energy at home and instead leads to more political engagement in regard to environmental problems (Rogers et al. 2008; Bomberg and McEwen 2012; McCabe et al. 2018).

Regardless of all these advantages, CE projects are oftentimes a source of conflict. For example, there is no guarantee that local decision-making processes are indeed democratic or fair. And even if these processes are guided by democratic principles, the conflict between opponents and proponents of CE projects can still cause serious tension in local communities (Fettke 2018).

Despite, or rather because, of the conflicts that can arise, communities can use CE projects to increase social cohesion (Haf and Parkhill 2017; Warbroek and Hoppe 2017) and strengthen local democratic processes (Islar and Busch 2016). The success of such processes is often dependent on existing social structures (Kunze and Busch 2011), conflict mediation by "local champions" (Busch and McCormick 2014; Ruggiero et al. 2014) and negotiations between different spheres of justice (see e.g. Mundaca et al. 2018 for a case of distributional vs procedural justice). Thus, successful CE project can help foster ED.

3 Energy democracy

In recent years, academic debate has increasingly discussed the concept of ED. The term originates from social movements that aim at implementing a low-carbon transition that changes both the socio-economic and the political structures of our energy systems (van Veelen and van der Horst 2018). These social movements emerged as a countermovement to the dominance of large energy companies. Examples for such counter-initiatives are campaigns for remunicipalisation of energy infrastructure like the energy grid in Berlin, Germany (Becker et al. 2015; Colell and Pohlmann 2019; REN21 2019), in Minneapolis, USA (Berthod et al. 2022) or the Spanish energy cooperative Som Energia (Angel 2021).

One of the earliest scientific definitions of ED comes from Kunze and Becker (2014), who describe four tenets of ED:

1. Democratisation and Participation: Decision-making about energy systems should follow principles of deliberative democracy. Local involvement is essential to achieve ED. They state, "the greatest number of people directly affected by a project should hold as large a power of initiative and decision-making as is possible" (p. 9).
2. Property: ED requires new forms of public and state ownership structures of energy infrastructure. Two solutions are particularly favourable, namely, "new forms of municipal or sometimes semi-state ownership; and collective private ownership, often in the form of cooperatives" (p. 9).
3. Surplus Value Production and Employment: ED leads to increased value capturing in communities that invest in renewables. In particular, the freedom from fossil fuel imports helps mobilise funds for local investments. In addition, decentralised renewable energy systems create new jobs locally, thus, contributing further to local value capturing (p. 10).
4. Ecology and Sufficiency: ED is guided by the principle of sufficiency. It opens spaces in which the development of energy infrastructure is defined by local needs instead of profit maximisation. Thus, ED can abstain from the growth imperative of capitalism and remain within planetary boundaries (p. 11).

Since this early definition, other authors have taken up the concept of ED and provided definitions. Many reflect on the four areas of ED as outlined by Kunze and Becker (2014). Several authors understand ED as both a political ideal and a social movement that aims to increase public control over our energy systems (Burke and Stephens 2017; Szulecki 2018). Despite these attempts to put some flesh on the bones of the concept of ED, Wahlund and Palm (2022) point at a persisting "need to strengthen the conceptual foundations of energy democracy" (p. 2).

This desire to define ED in more rigorous terms is certainly justified when one looks at the very different ways in which the concept is used in the scientific literature. For example, Szulecki (2018) describes the individual prosumer as the archetypical actor of ED. This definition clearly underlines the importance of the material dimension of ED, which is captured in alternative and distributed ownership structures in the energy sector. However, it does not encompass any process

of collective decision making that mirrors the (deliberative) democracy and social movement character that e.g., Hess (2018) associate with ED.

Droubi and colleagues (2022) go even further in their criticism of the concept of ED. Their main point of criticism is that the academic debate does not acknowledge the fact that the concept's democratic principles alone will not be able to deliver on its inherent promises. They particularly, point at the shortcoming of ED to account for justice issues, a criticism that is shared by e.g. Szulecki and Overland (2020).

While there exists valid criticism of the concept, ED still retains analytical value. In this article, we do not primarily look at ED to see if it is sufficient to indeed deliver on its promises or not (as criticised above). Instead, we use it, and in particular the four tenets identified by Kunze and Becker, to systematically analyse how ED manifests in two specific settings. Put differently, we do not primarily seek to expand the existing academic debate on the virtues of concept of ED. Instead, we want to contribute with an honest empirical contribution from which me might derive theoretical reflections that can help develop the concept further. In particular, we want to shed light on the question if and how CE project constitute forms of ED. By doing so, we set the two concepts of CE and ED in conversation with other to sharpen demarcation lines in scholarly debate and increase theoretical rigour. We use Kunze and Becker's four-dimensional framework to guide our analysis because it was formative for the field (other author refer back to it) and it is—to our knowledge—the most concrete framework with clear tenets that can guide an empirical investigation better than a loosely defined concept, that reflects the ongoing development of the scholarly debate.

4 Methods and material

In this article, we focus on two island communities in Denmark that have gone to great lengths to transform parts of their local energy system towards renewables. We sampled our cases based on the fact that both had claimed the unofficial title of "Energy Island". Three islands in Denmark use this title in communication material such as promotion videos, however, we decided to exclude Bornholm from this research. We did so as Bornholm is significantly larger in size and population (Samsø 3700; Ærø 6000; Bornholm 39,500 (Danmarks Statistik 2022)). In addition, Bornhom holds special administrative and planning rights as "Regionskommune"—loosely translated "regional municipality" which grants the island extended planning authority[1].

We conducted several field visits to the two remaining islands between 2015 and 2019. We visited their respective energy centre (Samsø Energiakademi and Ærø Energi och miljøkontor) and spoke to people who were involved in the transition in the past or do so in the present. In total we conducted ten interviews with 13 informants which we recorded, transcribed and coded with the NVivo software. We turned the four tenets of ED from the theoretical framework provided by Kunze and Becker (2014) into nodes which we used to code the data. We conducted follow-up

[1] https://www.brk.dk/Om-Kommunen/tal-og-fakta/sider/regionskommunens-roller-og-opgaver.aspx.

interviews via video calls and exchanged emails to clarify specific points. We used the energy centres on the two islands as gatekeepers to gain access to the community and identify our initial interviewees. From then on, we used snowball sampling to find further informants. Our first interviews where with administrative staff and later interviews included involved citizens. We conducted five interviews each per island. Of the 13 interviewees only three were female. We aimed for an equal gender distribution but had to accept the reality that even in a Scandinavian country many key positions in CE projects are occupied by men. To complement the fieldwork data, we studied documents in different formats: official planning documents, reports, homepages, image films and documentaries. We analysed these additional data through the coding nodes from our framework.

5 Danish energy islands

Denmark has often been described as a leading country when it comes to the development of RE technology. The country's topography with 1419 islands, of which 443 are named and 78 are permanently inhabited (Ministry of Foreign Affairs of Denmark 2022), has been beneficial to the development of decentralised energy production, especially, wind power production. Wind power provided 64% of Danish electricity production in 2020 (IRENA 2021). Mey and Diesendorf (2018) link the remarkable growth in Denmark's RE sector to the government's vision of establishing the country as a "Green Winner Nation" around 2008. A beneficial policy mix and cultural characteristics have ensured that Denmark has become a spearheading country in developing CE (Ruggiero et al. 2021b). Stimulating policies included subsidies, purchase obligations and feed-in-tariffs (Busch et al. 2021).

Fig. 1 Map of Denmark with the two islands highlighted. Map created by Emma Li Johansson

In light of this national trend, it is not surprising that a number of Danish islands have established outstanding RE and CE projects. These Energy Islands are not to be confused with current plans to establish artificial islands in the North and Baltic Sea to facilitate offshore wind production (Energistyrelsen 2022). Instead, they are inhabited islands with established communities. Two of these islands stand out: Samsø and Ærø (Fig. 1). Despite being rather small islands (Samsø 3700 and Ærø 6000), both have established a number of complex CE projects and positioned themselves through branding as pioneers of RE development in general and CE projects in particular. Both islands have established information centre to promote RE technology and help citizens implement RE projects.

5.1 Samsø—more than just showcasing Danish technology

In 1997, the Danish Ministry of the Environment and Energy held a competition with the aim to create a Renewable Energy Island (Sperling 2017). Island communities from all over the country were allowed to run in the competition. Competitors had to submit a development plan that would outline a 10-year pathway for a local renewable energy transition. The opening of the competition coincided with the closing of the island's slaughterhouse, which destroyed some 100 local jobs. This dealt a heavy blow to local employment or as one of our informants put is: "When the decision to close the slaughterhouse became public, we thought, ok, now we can as well close down the island". The community on Samsø, thus, seized the opportunity and submitted the development plan that won the competition. It is worth noting that the goals of the community on Samsø and the national government did not align. For the locals, the Renewable Energy Island project presented an opportunity to invoke hope for a future of the community (Papazu 2016). The national government, on the other hand, sought to create a showcase island to advertise Danish technology and establish the country internationally as a "Green Winner Nation" (Mey and Diesendorf 2018, p. 113).

Shortly after winning the competition, the community on Samsø started implementing a number of RE projects. These include offshore wind, onshore wind, biomass-based district heating systems, the installation of solar panels and energy efficiency measures. By 2005, the island managed to become a net exporter of energy (Nielsen and Jørgensen 2015). As part of the plan, 11 onshore and 10 offshore wind turbines were set up. In addition, islanders set up four biomass-based district heating plants that run on locally produced straw. These plants service the more densely populated parts of the island which previously were dependent on imported fossil oil for heating.

5.1.1 Democratisation and participation

The decision-making processes around the energy transition on Samsø followed principles of democracy. All inhabitants had the opportunity to attend meetings and make their opinion heard. Decisions were, in other words, not taken by elected officials or planning authorities but rather by the people who were directly affected by the energy transition. During the years of the transition, the island community

established democratic institutions that reflect ideals of deliberative democracy. One example, for such institutions are the codified rules for upholding debate culture that define citizen meetings. The focal point for these processes is the Samsø Energy Academy, which is financed by profits from the two offshore wind turbines the municipality owns. The academy provides both, the social structures, and the physical space for decision-making for issues pertaining to the community. These issues go well beyond the island's energy transition. For example, islanders discussed and found a collective solution for the islanders' access to the internet which considerably lowered costs for local households. It is worth noting that the academy serves as a publicly funded forum for the citizens, thus embodying a collaboration of formal state institutions (municipality) and direct democracy initiatives as is characteristic for deliberative democracy. The importance of these processes for the transition process cannot be overstated. Mundaca et al. (2018) found that inhabitants perceived that the processes ensured procedural justice in the transition and Islar and Busch (2016) point out that it instilled a sense of communitarian ecological citizenship in the local population.

Our informants explained that the trope of "fælledskab" became the banner around which the community came together. "Fælledskab" (or "fællesskab" in modern spelling) describes a notion of belonging to a community that has common goals and therefore shares responsibility. Our informants translated it to the (made-up) term "community" which merges the word "community" with the word "common". Commonity has become a central element of the narrative about the energy transition on Samsø and has featured in numerous publications, presentations of the island's transition and even a TED talk held by one of members of the community, Søren Hermansen.

Previous research has underlined the importance of "transition champions" for CE projects (see e.g. Busch and McCormick 2014; Ruggiero et al. 2014; Kristjansdottir and Busch 2019) who often fulfil important intermediary functions (Hodson and Marvin 2012; Martiskainen 2017; Busch and Hansen 2021). The case of Samsø highlights that leadership and intermediation play an important role in local democratisation and participation processes. In particular, the already named Søren Hermansen played an essential role for the transition. Sperling (2017) stresses the role he played in connecting and mediating different expectations of experts, people, municipality and planning authorities.

5.1.2 Property

The property arrangements on Samsø partly mirror the ideals outlined by Kunze and Becker (2014). This is to say that alternative forms of local ownership are present. For example, the municipality owns five of the ten offshore wind turbines, external investors own three and local cooperatives own two. Local farmers own nine of the eleven onshore wind turbines, while two are owned by local cooperatives. This high degree of local ownership has increased acceptance of RE. For instance, one farmer explained to us that he used to think that wind turbines were quite ugly.

However, since owning one, he thinks differently because "every time it spins, I see the crowns[2] coming to my bank account".

Despite the decentralised ownership structure of many parts of the energy system, islanders perceived the distribution of benefits and burdens as uneven. Because of existing property structures (especially regarding land ownership), a small number of farmers profited more than others from wind turbines installed on their land. This prompted some of our interviewees to state that they would have preferred a 100% cooperative ownership model. However, the community decided to compromise in this question to be able to make progress with the projects. Previous research showed that the community accepted this inequality as the process of decision making was deemed fair (Mundaca et al. 2018).

5.1.3 Surplus value production and employment

As outlined above, the energy transition on Samsø had its beginning (at least partly) in the economic crisis that arose from the closing of the island's slaughterhouse. The community perceived partaking in the competition as a way to mitigate the loss of employment and local economic activity. This hope materialised and new jobs emerged while old ones were secured (de Waal and Stremke 2014). The community estimates that the transition created employment corresponding to 20 man-years of employment each year over the period 1998–2007 (P. J. Jørgensen et al. 2007). One of our informants explained that the prospect of increased surplus value production and employment played a key role in convincing local businesses and craftspeople of the transition. For example, he pointed out how the owner of a local plumbing company could be won over by explaining the work opportunities of setting up a new district heating system.

Part of the narrative of Samsø's energy transition centres around bringing an end to the import of fossil energy. One of our informants explained: "I calculated it and realised that we were paying around 100 MIO crowns for fossil energy per year. Instead of sending this money to Saudi-Arabia we thought that we should try to keep it here on the island". This quote shows that key actors on the island approached the transition with systemic thinking that focussed on strengthening local value chains to keep profits in the community and secure local jobs.

One last aspect must be mentioned in the context of increased economic activity on the island. As Samsø and its energy transition became a globally known brand, it turned into an attractive destination for policy tourists and researchers. Policy tourists visit places to learn about specific measures and procedures that have led to the successful implementation of political goals (Andersson and James 2018). In the European context many local governments have used green place branding (Busch and Anderberg 2015) to attract policy tourists (and researchers) who often stay in those places for a while. Samsø has catered to the needs of such visitors by using the island's Energy Academy as a space for meeting, education and exchange. Thus, the community was able to tap into new income streams that increased local surplus value production.

[2] The Danish currency is called "kroner" or "crowns".

5.1.4 Ecology and sufficiency

The energy transition on Samsø brought about benefits for the environment. First and foremost, local greenhouse gas emissions and local pollution decreased due to the fuel switch from oil to biomass (especially straw) in heating. Furthermore, electricity from solar and wind substituted imports from coal power plants on the mainland. An investigation by the Energy Academy found that the share of electric cars on Samsø was sixfold the national average in 2015. These environmental benefits raise the question if principles of ecology played a motivating role in the energy transition.

During the field work, our informants wove environmental themes into the narrative of the success of the energy island project. One of our interviewees pointed out that the islanders generally have a strong connection to nature. Nevertheless, environmental considerations were not a driving factor that contributed substantially to the success of the energy transition. Our data showed that the changes in the energy system have instilled a stronger interest in or concern about the environment in some of the inhabitants. However, previous research on the case found that the transition rather brought about a sense of *communal* than of *ecological citizenship* (Islar and Busch 2016).

There is very little indication that the transition was guided by principles of sufficiency. E.g., lowering consumption did not take centre stage on Samsø. The masterplan submitted to the competition foresaw some investments in energy efficiency measures on the household level. However, it seems that more ambitious energy efficiency measure in regard to heating and electricity consumption were only implemented about a decade after the start of the project (2008) and most energy efficiency goals communicated on the homepage of the energy academy refer to the year 2030. The community did indeed set boundaries to the expansion of the energy system (especially as regards onshore wind), but these limits were not set by a limit to energy needs but by members of the community who resisted a further expansion due to aesthetic reasons. Indeed, the island has become a net exporter of energy and the Energy Academy advertises the fact that these low-carbon energy exports render the per-head emissions of inhabitants of the island "net-negative".

5.2 Ærø—deep roots in wind and solar

The island of Ærø in the Sydfynske Øhav (South Funen Archipelago) is not only home to some 6000 people but also one of the earliest cases of wind-based CE development. The development of RE and indeed CE started with twelve citizens who got together in the 1970s to find do-it-yourself solutions to the oil crises of the time. The unifying factor between these people was the shared interest in renewable energy technology. They met at the local Folkehöjskole (public school for adult education) which hosted their group and provided the premisses to build solar panels and wind turbines using—amongst others—wood as construction material.

Banking on these early experiences with RE and CE, the community on Ærø entered the same competition as Samsø but (obviously) did not succeed. Nevertheless, the community decided to go ahead with some of the plans anyways. The construction of the solar-based districting heating system in Ærøkøbing was already under

way and a CE wind park with 23 small turbines had been standing since 1985. It is indicative of the spearheading role of Ærø that this park was Europe's biggest wind park for about two months right after its construction. Apart from the wind development Ærø also leads in solar-based district heating systems. Two systems exist in the two biggest settlements, Ærøskøbing and Marstal. The one in Marstal has attracted some international attention with TV crews coming from as far as South Korea. The plant's innovative design uses an underground water reservoir to store heat during the summer to be used in the cold months. A recent project is the e-ferry Ellen which entered service in 2019 and replaced an old fossil fuel-based ferry.

5.2.1 Democratisation and participation

It is difficult to judge to what degree the early beginnings of CE development on Ærø were democratic and participatory. The initial group of RE pioneers had a diverse composition profession-wise. A further indicator for a general openness of the group is the fact that they met in the local community college, so in a public space. However, the group exclusively consisted of men, following the general problem of gender invisibility in the energy sector (Tsagkari 2022). The problem seems to have lessened in recent years. Several of the key position in questions of CE development on Ærø are no occupied by women.

The CE projects, that existed in the last four decades on Ærø, and for which the initial group laid the foundation, display democratic and participatory decision making. The different projects (wind park, solar heating plants) all go back to grassroot initiatives by groups of citizens who together developed solution for local energy needs. Their approach bears characteristics of deliberative democracy in that open discussion and local initiatives defined the development instead of elected officials. This democratic character also becomes evident in the transition of the member-owned district heating plant in Marstal from fossil to 100% renewable sources. When the first solar collectors were installed in 1996, about 500 of the 2000 citizens attended the general assembly to learn about and vote on the new technology.

5.2.2 Property

Property arrangements on Ærø are even more in line with Kunze and Becker's ideal of ED than they are on Samsø. First, there are the district heating projects in Marstal and Ærøskøbing. Both are member-owned grids and power plants. Membership in the associations is connected to house-ownership in Marstal and Ærøskøbing. Whoever buys a house in any of the two towns must buy a share in the association and, thus, gains access to the heating grid and voting rights in the association.

The ownership structure of the CE wind park reflects the ideal of shared ownership among the inhabitants of the island. One informant described the initial approach of the grassroot initiative when pitching the project to the municipality as follow:

"... we want them share-owned. And we don't want any private companies to

come in. So, we want them share-owned 100% and we want the shares sold to people who have a house on the island. So, we wouldn't get all of the people from the outside coming in here to do that" (interview July 2018).

In addition, shares in the wind park were first offered to those local households who were only able to afford a small number of shares. Once no further buyers for small numbers could be found, the next bigger package of shares became available and so on so that large investments could only be made after all smaller investments had already been made. A regional bank offered preferential bank loans to locals. People could use their shares in the wind park as collateral for the very loans that financed said shares. This arrangement further ensured a high degree of local ownership.

5.2.3 Surplus value production and employment

The development of CE projects on Ærø produced economic benefits to the inhabitants of the island. There are a handful of jobs related to maintaining the RE infrastructure, such as the heat grids. In addition, the community decided early on to set up the Ærø Energi- og Miljøkontor (energy and environment office). This office, which is financed through a fund and project applications, operates independently of the municipality. It provides independent advice to citizens on all questions of energy and helps implement bigger projects such as the wind CE project. In the last decades it has employed an energy advisor.

The financial benefits from the CE projects stayed on the island. As described above, only inhabitants or companies based on Ærø were allowed to buy shares in the wind CE project. The amortisation period for shares in the park was only eight years and in 2017, the park generated more than 100 MIO DKK (around 13 MIO EUR) for the 650 local shareholders on the island. Indeed, the business case for the shares was so good that the local bank issued loans for shares with only the shares as collateral. By keeping all shares in the wind park in local hands, the community ensured that surplus value stayed on the island.

Finally, policy tourism has been a beneficial factor for the local economy. Due to the dependence on ferries to get to and from the island, visitors tend to stay overnight. And while Ærø has not received quite as much international attention as Samsø, it still receives considerable numbers of people who visit the community to learn about its RE and CE projects. The projects have received recognition in the form of prizes and awards such as the EUROSOLAR European Solar Prize for the district heating plant in Marstal and the 2020 EU RESponsible Island prize for their general work on renewables. The Marstal plant received more than 3000 visitors in the period between 2013 and 2018, including from the Ukrainian government and visitors from China to New Zealand. It appears that the branding as "energy island" is effective on the European and global scale, thus boosting local value creation.

5.2.4 Ecology and sufficiency

Ecology and sufficiency have not featured as central narratives in our data from Ærø. Several informants mentioned independence from energy imports though. Our informants stressed that Ærø produces up to 140% of its electricity needs. Simultaneously, there seemed to have been consensus amongst inhabitants that renewables and energy savings are generally desirable. This sense also manifests in a number of spin-off projects that are only indirectly linked to the CE projects, such as the e-ferry, free public transport or the community-owned zero-energy house that people who are interested in experiencing island live can rent for a few months at a time.

The scale of the development of RE on Ærø is a strong indicator for a sense of sufficiency. Creating a CE wind park was not only a way to keep ownership of the island's wind resources locally but also to limit the development of wind to one central space where the turbines were set up together. Even though, there exists potential to expand wind production by setting up additional turbines at other sites on the island, the community decided against selling-out this potential to external investors. One informant even mentioned the neighbouring island of Langeland as a bad example where one can witness a rather unstructured placement of wind turbines. There, the local community accepted the bids from a range of external investors and now the island is plastered with single turbines that even face different directions, creating a rather heterogenous and disrupted landscape. On Ærø, in contrast, the community chose to not develop the remaining wind resources and stay within the community's financial capacity and willingness to develop.

6 Discussion

In the following, we discuss our results along the four tenets of Energy Democracy before highlighting a number of interesting side findings and reflections.

6.1 Democratisation and participation

A free flow of information is essential to facilitate a democratic process. In both cases, the energy centres took on the role of helping with the dissemination of information among the community. However, their roles differed slightly: on Ærø the information flows are mainly inwards oriented, whereas on Samsø they are also very much outwards oriented, which is due to their respective origins (grassroot vs state supported model). A second factor is the showcasing character of Samsø, which requires representation to the outside. This outward communication was used not only to "advertise" the island to an international audience but also to strengthen the local narrative of belonging and community. This indicates that a central forum for decision making, and dissemination of information is essential for the emergence of ED.

In both cases we observed a strong sense of belonging to and responsibility towards the local communities. This notion appeals more to principles of citizenship than democracy (see also Islar and Busch 2016). Therefore, we rather see a mani-

festation of the concept of energy citizenship than the models of democracy as used in the energy democracy frameworks. However, this does not change the fact that the CE projects led to a strengthening of local democratic processes as described above. When comparing voter turnout on the two islands in relation to the national average to see if these are only local democratic processes or if they instil a general trust in the democratic system, we found no indication for a general strengthening of institutions linked to representative democracy (Samsø: 85.2/Ærø: 82.9/Denmark: 84.6%). Spill over effects of energy democracy on the national political system and the political attitudes of the population as a whole are therefore unlikely. However, it is important to keep in mind that changes in attitudes are quite possible, for example by increasing hopes in and trust in citizen participation (Radtke et al. 2022; Radtke 2022).

A closer look at the decision-making processes on Samsø revealed an ambition of inclusivity as everyone was invited to participate in shaping the energy transition. However, it is worth to critically question who gets included in the category "everyone". Or to put it differently, whose interests did not feature prominently during the local deliberation? One should consider that Samsø is a popular tourist destination, and many people own summer houses on the island. Even though these people might have a vital interest in the way the energy landscape on the island develops, most of them did not have the possibility to attend regular in-person meetings on the island. This exclusion from the procedures raises the question if processes of local democratic deliberation necessarily lead to violations of procedural justice. We cannot answer this question conclusively within the framework of this study, but we do see the fundamental problem of the fragmentation of local communities, which manifests itself in particular in terms of origin and socioeconomic status. Following Robert Putnam (2000), the formation of bridging social capital is crucial due to these differences in social capital between different groups. Community energy projects can fulfil this task as long as they are distinctly socially inclusive, which is rather rare in many cases in Germany (Radtke 2022).

Related to the previous point, we would like to highlight the question of gender equality. Previous research has shown that non-male people are underrepresented in local energy projects in general (Tsagkari 2022) and CE projects in particular (Radtke 2016). The early beginnings of CE development on Ærø were no exception to this as the original group that started wind and solar projects consisted exclusively of men. Fortunately, this male dominance is not as pronounced anymore. Even though the majority of our interviewees were men (ten male vs three female) there are clear indications towards increased gender-balanced in the two cases. Several of the key positions related to CE development on Ærø are now held by women and the staff of the energy academy on Samsø has a very balanced gender composition. This is not to say that everything is fine, but these changes point towards an encouraging trend on the two energy islands which will hopefully increase participation of currently underrepresented groups in the future.

6.2 Property

Both cases showed high levels of local ownership. Our data showed that this local ownership was instrumental for creating acceptance for RE projects on the islands. At the same time, the cases also show the limits of local ownership in three ways.

First, there are certain projects, especially big-scale wind, and here in particular offshore wind, that require investments that local communities are often unable to mobilise on their own. This means that communities must find strategies that ensure that local resources are not sold to investors who dictate the terms of the deals. Ærø and Samsø show how local cohesion and decision-making can help address this challenge. This in turn has implications for ED as it shows that a socially split polis will not be able to withstand the pressures of market forces. This also throws into question the assumption that individual prosumers are indeed archetypical actors of ED as claimed by e.g. Szulecki (2018).

Second, the question of how local people (and in particular poorer households) can participate in reaping the benefits of CE projects becomes essential. The example of Ærø shows what communities can achieve if they find (local/regional) financial institutions that are willing to cooperate and provide preferential loans to local households.

Third, despite the advantages of local ownership, our findings reveal that CE models cannot automatically be characterized as fairer or better. Rather, we found that traditional resource management models can also form inclusive social arrangements and in turn that an uncritical application of local ownership models can reproduce existing inequalities. We therefore argue that ED scholars should critically consider the "local trap" problem when applying ED frameworks.

6.3 Surplus value production and employment

Local ownership (see above) did ensure that a considerable share of surplus value production stayed with the island communities. We found that different parts of the energy sector are addressed by CE projects on the islands, which in turn has implications for local employment. In both cases this concerns electricity and heat, in parts also the transport sector (e.g., e-ferry on Ærø as well as LNG ferry to Samsø with plans to switch to local biogas and public procurement of electric vehicles), where future goals are ambitious, as Samsø fully plans to phase out fossil fuels in transport.

For Samsø, employment effects are a bit clearer and have been calculated for the first decade of the CE development (see above). For Ærø, employment effects are less tangible. The district heating plants on the island do indeed provide jobs but these jobs would also have been there if the plants had continued to run on fossil fuels. Nevertheless, some clear employment effects materialised through the energy office and the tourists that come to visit the island for its energy projects. To really give justice to the question of employment, one would also have to investigate the nature of the jobs that were created (and lost). However, our data is not sufficient to draw more sophisticated conclusions than to diagnose a moderately positive impact.

6.4 Ecology and sufficiency

Our data shows that the CE projects on the islands have produced positive environmental effects. As described above, environmental themes became part of the narrative about Samsø. On Ærø, we found a number of spill-over projects such as the E-ferry. Nevertheless, ecology was not the guiding principle for the CE development on the islands. We found indication of sufficiency in both cases, where a further expansion of RE projects was stopped by the communities even though further project were possible and promised to be profitable. In essence, the communities did not sell out their remaining renewable energy resources to investors. This seems to be in line with a superficial reading of the ED framework's conceptualisation of sufficiency. However, the motivation behind a stop is different. The end point of the development was set by the communities' sense of aesthetics and not by the fact that their energy needs were met by the existing projects.

This notion of sufficiency raises a further critical point, namely, scale. Forms of local energy democracy, in contrast to central planning, might produce results that are better for the community. However, they might produce problems for other places. For example, if communities with high potential for RE production decide to focus on the tenet of sufficiency and only produce the energy *they* need, how will poor tenants, in, say, Copenhagen's Nordvest gain access to cheap and more sustainable energy? This raises the question of global climate justice. Do communities with high RE potential not have a duty to produce more energy than what they need themselves to bring down greenhouse gas emissions for all? However, this phenomenon is exactly what happened both on Samsö and Ärö where the full potential of RE production was not utilised because local communities decided (for good reasons) against it. Therefore, we question whether sufficiency should be a primary guiding principle of community energy transitions. This, in turn, highlights the question of which point of reference we take when discussing energy democracy? Does ED manifest on the local, regional or national scale or on all of them? Much of the research on ED has been remarkably silent on this point.

6.5 Island exceptionalism

Based on our empirical evidence, we conclude that islands communities must be viewed as exceptional communities. This is because they are often comparatively closed and homogeneous communities where people know each other very well, which in turn enables direct communication. In addition, our data showed that a second feature of island communities played out to the advantage of RE and CE development. The distinct geographical borders of islands along with a mentality of islanders that favours independence and self-sufficiency made it easier for key actors to communicate the advantages of CE projects. In the case of Samsø, the outflow of a substantial amount of money for fossil fuels *from the community* to *outside of the community* became a convincing argument in times of economic hardship. In the case of Ærø, our informants stated that the oil crises of the 1970s marked the beginning of CE development on the island. It is not surprising that the island communities chose to pursue an path towards increased energy independence and

self-sufficiency when the overwhelming majority of all good and services must be imported by ferries.

6.6 The way forward

Summarising our results, we have been able to identify how the four tenets of ED (democratisation and participation; property; surplus value production and employment; and ecology and sufficiency) materialise in our two cases. We also identified a number of hurdles, barriers and counteracting trade-off effects. On the one hand, we have been able to show that the essential internal community aspects and principles in community energy projects are essential if energy democracy goals are to be achieved (Goedkoop and Devine-Wright 2016; Van Der Schoor et al. 2016; Hicks and Ison 2018; Koirala et al. 2018; Kooij et al. 2018; Broska 2021; Dóci 2021). On the other hand, and in line with existing research, we found that energy democracy cannot be thought of without the fundamental principles of energy justice, which requires equally and equitably distributed access, fair and open processes, and the recognition of all parts of local communities (Goedkoop and Devine-Wright 2016; Forman 2017; van Veelen 2018; van Bommel and Höffken 2021; Hanke et al. 2021; Stewart 2021; Droubi et al. 2022; Tarhan 2022). Democracy is impossible without trust in its institutions (due decision-making process, compliance of the law) that produce generally superior outcomes compared to authoritarian systems. The normative concept of energy justice aims at ensuring both a fair process (procedural justice) and outcome (distributional justice). Thus, it ensures that the very foundations of democracy are upheld by energy project. Based on this research, we advocate for a stronger engagement of ED scholars with questions of energy justice.

This is a critical issue with community energy in general. There have also been challenges on the two islands to provide participation to decision making and access to local energy services equally and equitably to all members of the communities. Finally, also in line with the research findings of international CE research, we could show that promotion of social innovation (Hewitt et al. 2019) and new forms of redistribution of benefits (Norbu et al. 2021) on the two islands could exploit potentials to establish better and wider accesses to cheap and green energy, heat and mobility. While we share some of the criticism of the concept of community energy (Rommel et al. 2018; Kumar and Taylor Aiken 2021), we see democratic potentials in the community model rather than in the local energy model (Patrick Devine-Wright 2019), which is why creative solutions for equity-oriented energy and mobility concepts should continue to be developed.

7 Conclusion

In this paper, we have investigated how ED manifests in island communities in Denmark. We found that, on the one hand, conditions of community energy exist as they do elsewhere in the world. This concerns primarily the tenets of property and surplus value production and employment. This is because the energy infrastructures and related issues of energy use and energy economy are hardly changeable, despite their

local embeddedness (Baxter et al. 2020). However, regarding the other two tenets of ED, democratisation and participation and ecology and sufficiency, we showed that, first, differences between individual projects occur and some drawbacks and trade-off effects are present. In this particular case of islands, this concerns mainly two aspects: the concept of energy self-sufficiency is only conceivable in an abstract closed space but in order to achieve a global energy system that includes all citizens and sectors (and couples energy with transport, for example), this approach is too short-sighted. Therefore, other factors need to be included that link the different needs and spatial conditions of regions. This can lead to the problem that some regions can feel that they are forced to become "energy suppliers", whereas urban areas, for example, would primarily obtain energy, but make fewer contributions to the input into the energy system themselves. These disparities and subsequently perceived inequalities can only be resolved through comprehensive energy transition governance strategies, as well as by building broadly based narratives of sustainability that go beyond a vision of an energy self-sufficient island community. This also touches on the second problematic aspect we can identify regarding the goal of sufficiency and energy self-sufficiency in connection with democratisation and participation: community energy systems can only work in a democratic way if they can offer participation to the whole community and if the benefits and burdens are distributed equally. In the two cases, the boundaries of the local communities are somewhat unclear as there are many stakeholders that do not live permanently in the place but have vacation homes here. These parts of the community "from outside" are already more separated from the locally rooted parts of the population and the separation can be reinforced by community energy initiatives that do not include all people affected equally.

Therefore, we argue, community energy objectives should be less about "localism" and more about overarching cosmopolitan attitudes and values (see also Patrick Devine-Wright 2009). Otherwise, already existing lines of conflict ("cleavages") between the global values of cosmopolitanism and communitarianism risk being exacerbated (de Wilde et al. 2019). One must not only take the local place attachments and identities into account (Patrick Devine-Wright 2009, 2013; Manzo and Devine-Wright 2013), but these regional attitudes must be taken up and actively developed further in order to avoid creating "happy islands of energy self-sufficiency" in the truest sense of the term. Thus, different place attachments and climate change attitudes need to be brought together through unifying stories, promoting shared thinking and co-creating strong narratives (P. Devine-Wright and Batel 2017).

Based on these findings, we propose a number of policy recommendation. First, we suggest that funding programs for community energy systems by the European Commission take a more holistic approach leading to community energy governance that is planned and implemented in a participatory and collaborative way across regions. Second, we suggest linking energy systems across sectors and raising awareness for a holistic understanding of energy systems that does not stop at geographical, technical, and socio-political borders. Third, socially inclusive community energy strategies must link different areas such as cities and rural areas, islands, and mainland, as well as mountainous and low-lying regions, by pursuing joint projects through partnerships and mutual exchange. In this context, one-

sided ways of thinking and attitudes must be overcome to meet the overall demands of energy and climate justice in terms of distribution, process and recognition. In conclusion, we therefore advocate that community energy should not be understood exclusively as bottom-up projects, but that balancing and connecting elements should be injected into communities and systems through targeted socially inclusive and exchange strategies. National and regional governments as well as EU institutions should therefore help different intermediary organisations (e.g., energy agencies or NGOs like REScoop) to create connections for and provide strategies to local initiatives.

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