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Community acceptability and the energy transition: a citizens' perspective

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Abstract

Background: Every energy transition has had its winners and its losers, both economically and in terms of social justice and community cohesion. The current transition is no different given the complex, intersecting matrices of power and experience that influence the key stakeholders and actors involved. Local oppositions to the deployment of renewable energy technologies have been significantly higher than expected. In numerous instances, these oppositions have been in reaction to the disempowerment of local rights and entitlements associated with specific developments. Consequently, there is a clear need for governance structures and organisational formats that are participatory, inclusive and mindful of the lived experiences of local people. Despite the knowledge gaps and financial constraints that continue to persist, how can local communities become empowered to drive project development and meaningfully engage in the low-carbon energy transition?

Methods: This paper presents a methodology for investigating citizen perceptions of the energy transition and the kinds of roles they see themselves having in its implementation. Working with six communities across five European countries (France, Ireland, Italy, Spain, and the UK), we conducted a series of iterative cross-sectional community engagements using a mixed methods approach. In addition, a number of innovative participatory action research tools were incorporated to engage citizens in co-designing their own energy transition pathways.

Results: Participants expressed having restricted agency as citizens participating in the energy system. They also felt locked in to a limiting set of false choices as 'energy consumers' that do not translate into real or meaningful power, despite popular narratives to the contrary. The research also resulted in a co-designed characterisation tool to help local communities assess the energy democracy and citizen participation potential of a number of participatory business models.

Conclusions: Citizens remain locked out of the decision-making processes of the energy transition. We outline a more integrated approach, using co-design and participatory action research, to incorporate citizen perspectives into the planning and implementation of more appropriate business configurations. This paper presents demonstrable examples of how extended stakeholder perspectives can improve procedural justice outcomes and ensure the rollout of more equitable energy configurations into the future.

Keywords: Energy transition, Cooperative mechanisms, Transformative social innovation, Sustainable communities, Participatory business models, Citizen empowerment, Business configurations, Community development, Community energy

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Introduction

It is widely accepted that we are experiencing a profound transition in the ways we produce, consume and store energy [1]. While we have experienced numerous energy transitions in the past [2, 3], the current shift to renewable energy sources (RES) is different not least because of the diversity of drivers leading it [4]. From disambiguations around human activity and climate change to the growing awareness of a plethora of energy-related inequalities arising from our dependence on fossil fuels [5, 6], this transition is about more than just technological and political change, or even resource availability. It also involves significant social and behavioural transformations that question established historical narratives and challenge accepted understandings of democracy and economics [7, 8].

Past energy transitions were almost exclusively driven by the exploitation of a new energy resource with little consideration for social or environmental consequences. Also, they were marked by top-down, highly centralised energy systems controlled by a limited number of corporate actors [9, 10]. The current transition, in theory at least, involves numerous different cross sectorial stakeholders that are more informed by public policy and is more likely to include the social groupings directly affected than has heretofore been the case. However, given societal responses invariably require a radical reorganisation of socio-economic infrastructures in order to accommodate change, this transition will not automatically be a just one [11].

In fact, the rapid deployment of certain RES technologies has led to local opposition movements emerging in numerous countries (e.g. see [12, 13]). So much so that local communities have been described as 'low-carbon labs' in terms of social acceptance [14]. Numerous studies show that the social dimension is of equal importance to that of technology and stress the need for institutional responses that are more predisposed to participatory organisational formats [15, 16]. However, this will only occur when enough stakeholders are given the appropriate mix of policy tools, support mechanisms and financing that empowers them to drive project development and meaningfully engage in the low-carbon energy transition [17–20].

This article explores how local people can contribute to the energy transition through more meaningful and engaged processes of coproduction. It also seeks to address existing gaps in understanding between policymakers and the communities they affect. In the 'Background' section, we first outline the research that informs this paper, along with an overview of the literature. In the 'RES configurations for social/community acceptability' section, we present the key issues around promoting greater public acceptability of renewable energy projects and why those efforts have had mixed success to date. The 'Research design and methodology' section summarises the methodological approach to the research. The 'Initial findings: characterising community-orientated organisational models' section describes the characterisation tool that was coproduced with the research participants in order to deliberate on the six participatory business models presented. The 'Results: citizen perspectives of six participatory business models currently in the energy domain' section discusses the outputs from these deliberations. Finally, the 'Discussion' section concludes the paper with a discussion on limitations to the study and suggests potential areas for further research.

Background

The emphasis on justice and equality being integral to the current energy transition has found particular resonance in the 'energy democracy' movement and is central to the outlook of numerous civil society groups engaging in contested, highly localised energy projects [21, 22]. The many intersections between genuinely sustainable development and the burgeoning green economy have led to conflict or, at the very least, contested interpretations as to how they should be configured [23, 24]. Therefore, robust multisectoral coordination is needed if we are to adequately meet these challenges. There is also a need for greater involvement from the academic community to better understand the intersectional experiences and practices that facilitate just outcomes for local people [25]. This is particularly important as investment in more diverse decentralised RES energy systems are set to become more common.

How can local communities become empowered to drive project development and meaningfully engage in the low-carbon energy transition? Until recently, citizens' experience of the energy domain has been framed in terms of information gaps or information deficits [26, 27]. This has seen policies often driven by misplaced assumptions that by simply providing appropriate amounts of information, citizens will respond accordingly, switching away from negative behaviours and engaging in more ecologically sustainable practices (e.g. [28]). There is now growing awareness in policy-making circles that people rarely respond in this way. Continuing to provide lip service to or indeed ignoring citizens' perspectives of the energy system will become more costly and time-consuming and already threatens to significantly slow down Europe's energy transition [29, 30]. A sustainable energy transition will require governance structures and organisational formats that are both participatory and inclusive and which empower citizens to become full stakeholders in the process sharing in

its benefits. This approach can help shape perceptions of trust, especially when related to procedural and distributive justice. It also contributes to wider discourses on legitimacy and its role in the democratic process [31, 32]. Strengthening democratic legitimacy can help promote greater levels of social acceptability in communities that have heretofore remained sceptical of RES projects and new energy infrastructure, while also favouring RES over traditional fossil fuel configurations.

This paper presents the perspectives of citizens from six communities in five European countries: France, Ireland, Italy, Spain, and the UK. Each community is embarking on their own energy transition pathway with participants eager to identify suitable participatory business models that matched their needs. Participants were asked to consider a number of energy project configurations that offer strong citizen participation potential, while also addressing issues around energy justice [33]. Through a series of in-depth, iterative engagements, variations of the cooperative business model were considered appropriate in a majority of the configurations given the transformative potential cooperatives have for revitalising rural and urban communities [34]. The long history of the cooperative movement demonstrates a proven track record in helping local communities access the start-up capital needed to establish new businesses, create jobs, and more evenly distribute associated revenue to those most responsible for generating it. This paper demonstrates how participatory business models can bring more inclusive, deliberative approaches to the policy-making process and encourage greater citizen participation in the energy transition [35, 36]. Our approach has also been informed by the concept of (perceived) 'fairness', as noted by Gross [37], which is a significant contributing factor in facilitating or hindering citizen participation and wider social acceptability of the energy transition [38].

It is also informed by energy democracy narratives that highlight the transformative potential of community-orientated energy projects to the energy transition. We recognise that energy democracy, in understanding its organisational capacity and in apprising social movements, can become contested and open to multiple interpretations [39]. However, energy democracy narratives do offer an alternative to neoliberal modes of capitalism that have largely informed the energy transition to date. An inherent assumption still predominates that society can simply switch to newer 'better' energy technologies while still maintaining unsustainable levels of economic growth and resource extraction, with all the social and political dimensions to the energy transition co-opted to fit this agenda [40–43]. We seek to move beyond the energy consumer paradigm and its appropriation of energy citizenship within overt, largely unchallenged economic frames of reference. This blurring of the two concepts has been deeply problematic and, while subject to prevailing economic logic [44], has resulted in mixed success for those policymakers tasked with developing viable, sustainable energy transition pathways for Europe's citizens. Scholars have called for more nuanced approaches that move beyond current notions of public support for the energy transition (usually framed as 'public acceptance' and typified by an accept/reject dichotomy) in order to better understand the diverse spectrum of expression, engagement, and participation that inform citizens' attitudes to energy [45]. Others have called for policymakers to adhere to the three overarching principles of effectiveness, efficiency, and legitimacy in order to instigate the profound reconfiguration of economic structures, technologies, and institutions that is needed [46]. Applying these principles will help secure greater levels of societal agreement on the direction of change. Other approaches include the establishment of new change alliances, overseeing a fairer distribution of the benefits of change and using market mechanisms to facilitate all stakeholders in the transition (ibid.). In keeping with these principles, we respond to what Sovacool et al. [47] refer to as the dearth of real academic engagement in the social dimensions to energy.

RES configurations for social/community acceptability

Public opposition is seen as a significant threat to realising the levels of renewable energy deployment foreseen in climate change mitigation policies [48]. The most commonly cited motivations are high local costs compared to perceived local benefits, an inappropriate scale of development, and limited citizen involvement in local energy planning. Other arguments presented by opponents of large-scale RES projects such as wind farms include detrimental effects to human health, biodiversity loss, landscape degradation, and negative impacts on tourism and property prices [15, 18].

While such opposition is often attributed to NIMBYism through oversimplified and perhaps lazy analyses the reality is usually more complicated [49–53]. Relationships between energy, justice, and social inclusion are important factors for communities when supporting or opposing RES projects in their area. There is broad agreement that issues of procedural, distributional, and substantive justice play a crucial role in determining the social acceptability or otherwise of energy projects [54–56]. Some of the strongest evidence for this comes from studies on local experiences and perspectives of the wind and biogas sectors in the Netherlands, Denmark, and the UK. For instance, Giddings and Underwood [57] highlight a proposed gasifier in a rural area in Devon. Despite an intensive local campaign, the proposed gasifier was refused planning permission, a decision favoured by most local people

surveyed. However, when the survey was repeated 69% of community members said they supported a smaller project that had initially been proposed by a local group for the same site, especially if control for the project rested with the community. This position was also influenced by a deep local mistrust of the developer leading the second proposal. As Huijts et al. [58] observe, 'when people know little about a technology, acceptance may mostly depend on trust in actors that are responsible for the technology, as a heuristic or alternative ground to base one's opinion on'.

Similarly, Walker et al. [19] compare the experiences of two similar rural communities in the UK, Moel Maelogan in Wales and Gamblesby in England, demonstrating not all 'community-owned' RES projects deliver the same levels of trust for local people. In Moel Maelogan, while the project was promoted as a 'best-practice' example for community energy, trust in the three wealthy landowners was decidedly low. Despite setting up the wind farm using a cooperative model they did very little to include local people in the decision-making process. In contrast, local experiences in Gamblesby were much more positive with residents actively encouraged to engage in decision-making. The more participatory approach taken in Gamblesby saw local people describe much greater levels of trust in the project. In addition, they expressed much greater levels of confidence in developing community-owned projects more generally.

These variations in experience demonstrate current approaches to RES projects do not satisfactorily address issues concerning community involvement or community benefit. This has routinely resulted in negative perceptions of fairness and justice in the communities affected. Also, the paradox whereby the very institutions tasked with providing societal stability must also become agents of transformative change was not lost on the local people residing in the six communities we engaged with [59]. While we found participants wanted a far greater say in shaping the transition to a low-carbon economy the opportunities for meaningful engagement in the transition continue to be limited by traditional corporatist arrangements that remove agency from, rather than give to, ordinary people. This runs contrary to empowerment narratives that have framed numerous RES deployments to date, while also ignoring or minimising the divergence of values of the stakeholders involved. This has culminated in a range of disputes and contestations that influence perceptions of fairness for local people and have been most clearly articulated by local opposition groups [48, 60, 61].

Gross [37] observes that perceived unfairness '*can result in protests, damaged relationships and divided communities*' and that perceptions of unfairness are '*exacerbated when winners and losers within communities are created*'. Overcoming such perceptions of injustice necessitates that RES projects be devised with community-focused structures that recognise the burdens associated with development and acknowledges the legitimacy of community members as stakeholders [62–64]. It can thus be seen that increasing the deployment of renewable energy projects requires business models and delivery schemes, which not only (1) deliver sufficient financial return for investors (providing for necessary capital), but also (2) minimise and mitigate impacts, and (3) provide for equitable distribution of financial and other benefits amongst (affected) community members. Such approaches would go a considerably long way towards minimising public opposition.

It is true to say that, as Porter [65] observes, '*the definition of a business model is murky as best*' and there are multiple meanings assigned to the term, depending on use-context [66]. Indeed, over time, there has been a change in use. Since the 1990s, Ghaziani and Ventresca [67] have noted a shift from a system model perspective of original conceptions to a plurality of use linked to value creation. Taking a value-centred view, Osterwalder and Pigneur [68] define business models as the '*rationale of how an organization creates, delivers, and captures value*'. In this perspective, the central objective of business models is the successful delivery of value propositions [69]. Frow and Payne ([70] citing Lusch 2007) posit that combining value and stakeholder concepts offers a useful means for reflecting broader market externalities. This means extending the conventional focus on customer and supplier relationships to a more inclusive consideration of stakeholders. In the case of RES developments, such an extended stakeholder perspective lends itself to achieving improved procedural justice. It also enables the configuration of such projects that ensures the adequate distribution of value such that key stakeholders are satisficied[1]. Therefore, the potential for operationalising proactive local citizen-orientated contributions to the energy transition, reflecting energy justice objectives, is still very much achievable [72–74]. This is especially true if novel business models that prioritise the values of community stakeholders equally to those already enjoyed by the energy industry are given greater priority.

Research design and methodology

Engaging with the six European communities, it was important for us to understand how behaviours and practices influence people's everyday lived experiences of the energy system. However, we also wanted to understand how local communities can become empowered to make a

[1]Satisficing implies decision-making which aims to meet criteria for sufficiency or adequacy—in this case, agreed by multiple stakeholders—rather than to identify (subjective) optimal solution(s) [71].

meaningful contribution to the energy transition. Consequently, we applied a mixed methods approach using a combination of qualitative and quantitative tools to discern the participants' perceptions of the energy transition and the kinds of roles they see themselves having in its implementation. Initially, we surveyed all available national[2] and European quantitative datasets relating to citizens' relationships with the energy system. We then carried out 44 in-depth semi-structured interviews with participants from across all six communities, in addition to thirteen focus groups[3,4].

The qualitative methods were particularly useful to participants looking to lend their voices to descriptions of their own lived experiences (see [75, 76]). From this, we were able to conduct a comprehensive analysis of the data that was both iterative and reflexive. The qualitative data analysis software package, NVivo[5], was used to archive and collate the project's recorded material.

When conducted reflexively and is appreciative of the intersectional lived experiences of participants, interviews and focus groups can have strong reciprocal benefits for those involved. We also wanted to develop these reciprocal benefits still further using citizen juries. This complimentary approach was central to the ethos of the project with community members invited to actively engage in the research process [77, 78]. For the citizen juries, participants were asked to consider the social impacts of the energy transition in their area and then to deliberate on the types of future energy configurations they would prefer to see being rolled out.

Analysis of the interview transcripts had certain high-level objectives while at the same time strived to be as grounded in the data as possible. As a result, transcripts were thematically analysed as a means of understanding stakeholder interactions, determining how key stakeholders define 'value', and explore 'flows' through the energy supply chain. Particular attention was made to instances emphasising values, practices, norms and influences. The interview transcripts were also coded using template analysis comprising not one but rather a group of techniques for organising and analysing data [79]. This involved creating a list of codes—the 'template'—representing themes found in the text. Some codes were defined a priori, but then subsequently refined and developed throughout the coding process, i.e. assigning codes to segments of text. As the coding process advanced, relationships between the codes became apparent, with the template subsequently structured in terms of hierarchy to denote these relationships.

Drawing from this approach, we were able to deepen community participation still further carrying out three highly-innovative participatory action research engagements, citizen juries. The citizen jury is a deliberative democracy technique that is increasingly being used to engage citizens on a range of research topics including health care [80, 81]. It has particular applicability to energy transition research where public support can at times appear contradictory [82]. This codesign approach proved to be a key contributing factor to participants making more informed assessments of the participatory business models presented in the 'Results: citizen perspectives of six participatory business models currently in the energy domain' section.

Initial findings: characterising community-orientated organisational models

This participatory process uncovered a number of important insights into people's attitudes to energy especially in relation to their everyday lived experience. We found that participants want to see meaningful change and a transition to a low-carbon RES system where they actually have real agency. Most participants did not consider this to be the case at present and all expressed a desire to move beyond the consumer empowerment narrative that is in and of itself illusory [83]. Participants also called for better access to clearer, more applicable information on the types of community-focused energy projects that they could realistically develop. This was particularly important to them, given the knowledge gaps and financial constraints experienced in most communities. Even in more affluent areas, local sustainability initiatives concerning energy were often seen as largely cosmetic. Worse still many considered such efforts marketing spin, masking a wider 'business as usual' approach driven by a systemic bias towards fossil fuels. Across all communities, access to the 'right information'

[2]In those countries where the six communities are located. As one of the five largest energy consuming countries in the EU, it was considered appropriate to also include Germany.

[3]Concurrent to the qualitative research, we also carried out a series of questionnaires in the six communities using social media, mailshots and face-to-face campaigns on the ground to reach participants. The research focus for these engagements was to understand people's attitudes and perceptions of the energy system more generally. While not directly related to the themes explored in this paper, this work did feed into the wider objectives of the project and informed the approach taken during the qualitative engagements.

[4]The gender profile of the interviewees was balanced evenly between male and females. In relation to age, they ranged across the following age groups: 18–24 (18%), 25–44 (16%), 45–64 (34%) and over 65 (5%). While occupations included farmers, professional workers, manual labourers, university students, retirees and the unemployed. For the 83 participants in the focus groups, there was a higher ratio of females to males (67% vs. 33%). Similarly, occupations ranged from home makers to professional workers, farmers to retirees and the unemployed. Age profiles varied across a range of age groups: 18–24 (17%), 25–44 (35%), 45–64 (32%) and over 65 (16%).

[5]While such software does not automate the analysis of data, it is particularly useful for coding, organising, linking and cross-referencing of collected research material.

is considered to be unavailable or only accessible through prohibitively expensive knowledge repositories or services designed for cash-rich commercial entities, not highly-motivated but under-resourced community groups. Our collaborative, iterative citizen engagement approach was particularly useful for deliberating on and assessing the types of participatory business models that could help meet these concerns, while also offering participants practical examples for more fully engaging in the energy transition.

During our 3-year engagement, we studied the potential different participatory business models (both rural and urban) can have in positively impacting the energy transition [84]. Based on citizen feedback, we selected the six participatory business models presented in this paper. They illustrate the types of citizen engagement in the energy transition that are possible when supported with appropriate policies and funding mechanisms.

Working with the communities, we first defined the typical structural characteristics common to community-led organisations. As can be seen in Fig. 1, we divided the characteristics according to (1) organisational type, (2) ownership, (3) objectives, (4) focus, (5) control, and (6) linkages. It should be noted that the characteristics are presented so as to be accessible to all research participants and to those not immediately involved in energy management and/or energy governance type activities. Using the tool's framework to identify the structural characteristics of their own organisations, community groups should be better able to establish governance structures that are more applicable to their own circumstances and commensurate to their institutional capacities. It can also help to incorporate more inclusive cooperative innovation approaches into their own RES projects, whether they are taking the lead or working with a commercial partner.

A characterisation tool was then co-created with participants to assess the potential of each community-orientated energy project in terms of its energy democracy and citizen participation potential. This was also co-designed to help active energy citizens identify the types of inclusive, organisational structures they may wish to deploy when developing their own RES project.

Using the characterisation tool

Figure 2 presents the characterisation tool used in the study to assess each participatory business models' participation potential. Co-development is extremely useful for building the social capital needed to empower participants to become more effective energy citizens and for improving community conditions at the local level [85].

Through our programme of iterative, cross-sectional community engagements, we co-devised eight indicators that matched local perspectives and expectations of what participation actually means to them. These indicators were extrapolated from the framework tool (Fig. 1) and range from issues such as local control and local ownership to the potential for infrastructural change beyond the local level.

In addition, we were able to assess each criterion in terms of five levels of citizen participation potential, ranging from: None, Little, Some, Considerable and Full (see Fig. 2). These potentialities are further indicated in the radar charts that accompany each participatory business model.

Results: citizen perspectives of six participatory business models currently in the energy domain

Drawing from existing RES or RES-orientated business configurations, the following six participatory business models (PBMs) highlight the types of organisation and control structures available to community-led organisations. They also suggest the transformative potential such social innovations have in altering the regulative, normative, and cultural dimensions of the energy transition [86]. While they are not entirely insulated from negative externalities, they do demonstrate how RES projects can be

CONTROL	ORGANISATIONAL TYPE	OWNERSHIP
Democratic local Inclusive local Shareholders local Public- owned National stakeholders • Cooperatives • NGOs Shareholders • National • International	Cooperative (producer) Cooperative (consumer) Social enterprise Charity Commercial company • Subsidiary • Subsidised Public-owned Hybrid	Local community (widespread) Local community (narrow) Commercial developer (local) Local authority Energy company • National • International National non-for-profit Hybrid
LINKAGE	**OBJECTIVES**	**FOCUS**
Operating with a micro-grid Linked to national grid	Profit Environmental Societal	Supply Consumption ESCO (energy savings company) – i.e. energy conservation

Fig. 1 Tool framework to identify the typical structural characteristics of community-led organisations

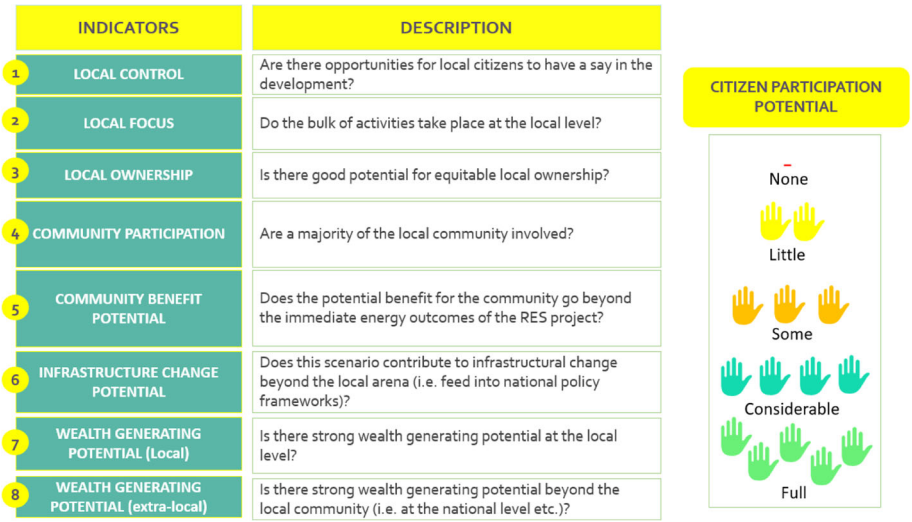

Fig. 2 Characterisation tool. Criteria used to assess each scenario's performance in terms of its energy democracy and citizen participation potential

operationalised in ways that are fairer and more equitable to those living near such developments. This is extremely important given the profound social, economic and technical transformations that are required to precipitate the energy transition. Four of the scenarios are focused on energy production, one on energy purchasing and one on financial services to stimulate regional regeneration in keeping with energy transition goals. All are focused in promoting energy conservation and, taken together, demonstrate the scope and applicability of the tool for helping community-led organisations envisage the energy transition pathway best suited to them, while remaining cognisant of locally specific, socio-environmental considerations.

PBM 1: an energy purchasing cooperative

Concerned about rising energy costs, a group of local people establish a group energy purchasing scheme to increase their collective bargaining power and negotiate more favourable energy pricing for its members. They establish a consumers' cooperative and open membership without discrimination to all residents and micro-businesses in their area. Ownership of the cooperative is directly vested in its members, each contributing equally to the capital through membership subscription. The cooperative is an autonomous organisation controlled by its members, all of whom have equal voting rights (i.e. one member, one vote) and actively participate in establishing policies and making decisions. The membership elects a management board to oversee governance of the cooperative. A general manager is appointed by and is answerable to the board, and runs the cooperative on a day-to-day basis.

The cooperative organises and acts as an energy reseller to its members. Dealing directly with the energy supply company (ESCO), which is linked to the national grid, the cooperative manages the payment and supply arrangements of its members. Members do not deal with the ESCO, but instead are invoiced directly by the cooperative. Surpluses are used to build the cooperative and to provide rebates to members in proportion with their energy purchasing. In addition, members have agreed for management to establish a number of 'easy payment' options to help financially vulnerable members remain in the cooperative. The associated societal benefits range from more money circulating in the local economy, to establishing stronger personal networks with members meeting wider societal challenges in a more coherent and equitable way (e.g. see [87]).

This community approach involves a minimal number of key stakeholders as, invariably, the relationship between the ESCO and the community is conducted through the energy purchasing cooperative. Reactions to this social innovation were quite positive, as illustrated in Fig. 3 below, with respondents recognising the operational potential for such a scheme in their area. Also, its capacity for greater local agency with regard to energy pricing and consequently, in terms of access to adequate energy supply, was seen very favourably. Rather than relying on what were perceived as unaccountable commercial entities outside their community, participants called for much greater support for capacity building especially in terms of citizen (as opposed to consumer) agency. While it can be seen as close to traditional consumer power narratives, participants did recognise the transformative potential of this PBM. They

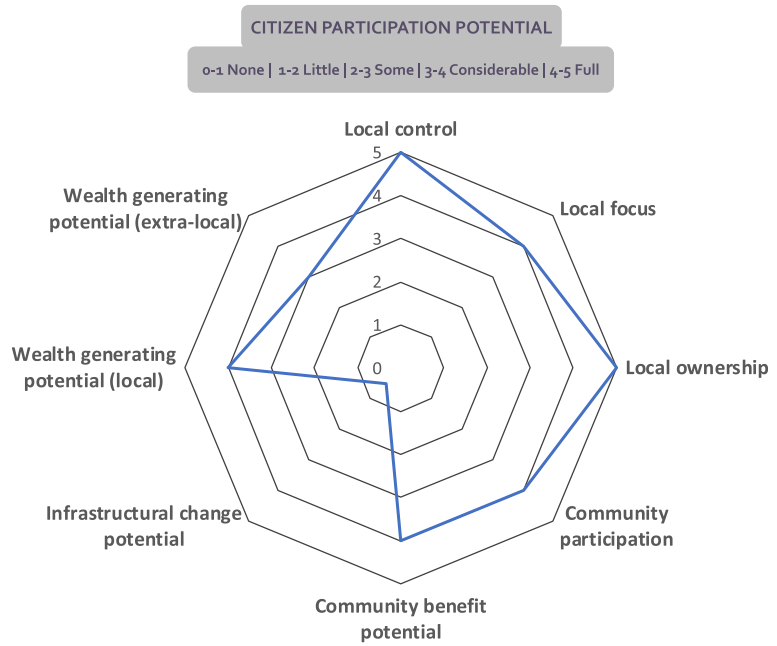

Fig. 3 Assessment of an energy purchasing cooperative

especially related to the citizen dimension of this model with its deliberative approaches to membership and social cohesion. They also noted an opportunity for further local wealth-generating potential once the project was up and running, in addition to the intangible community benefits arising from supporting energy vulnerable members in their communities. However, it was clear to every participant how this model might impact on wider infrastructural configurations, or indeed with regard to its extra-local wealth-generating potential.

PBM 2: a commercial wind farm project

Members of a local community decide to approach a commercial wind energy company to develop a wind farm in their area. They are already involved in local businesses and recognise a new commercial opportunity. After consulting their municipality's development plan, they approach local landowners to assess the level of local interest for such a project. They establish a Community Development Association (CDA), electing a three-person sub-committee to carry out research, liaise with community members and approach a suitable wind energy developer. The CDA is not-for-profit and voluntary. Working with the wind energy company, members of the CDA set up a local company to oversee the planning application and any community-orientated incentive schemes, a common practice in a number of EU member states. The new company is essentially a subsidiary of the commercial wind company.

Given the technical complexities, economies of scale, capital costs, and funding challenges in developing a commercial wind farm the parent wind energy company leads much of the planning application, construction and grid connection phases of the project. Electricity produced from the wind farm is fed directly into the national grid at a fixed rate, under the national Feed-In Tariff (FIT) scheme. An annual community fund is also established to finance local sporting and cultural events in the area. This fund is managed by the CDA, which also holds shares in the subsidiary company. In addition, a facility was established at the beginning of the project where local residents can purchase shares in the subsidiary company and avail of the annual dividends accruing from any profits made[6].

This model has potential to be a viable community-orientated project, especially when collective decision-making is carried out in a cohesive and positive manner [89]. However, very often the role played by local communities is a minor one, with landowners (who host the wind turbines on their properties) and those sitting on the CDA sub-committee having the most local control in this type of project. As a result, there is considerable potential for animosity or for wider community resistances to emerge. The curtailing of community agency, largely

[6]Under Danish legislation, wind developers are obliged to offer a minimum 20% community ownership of project shares prior to erecting one or more onshore wind turbines over 25 m in height [88].

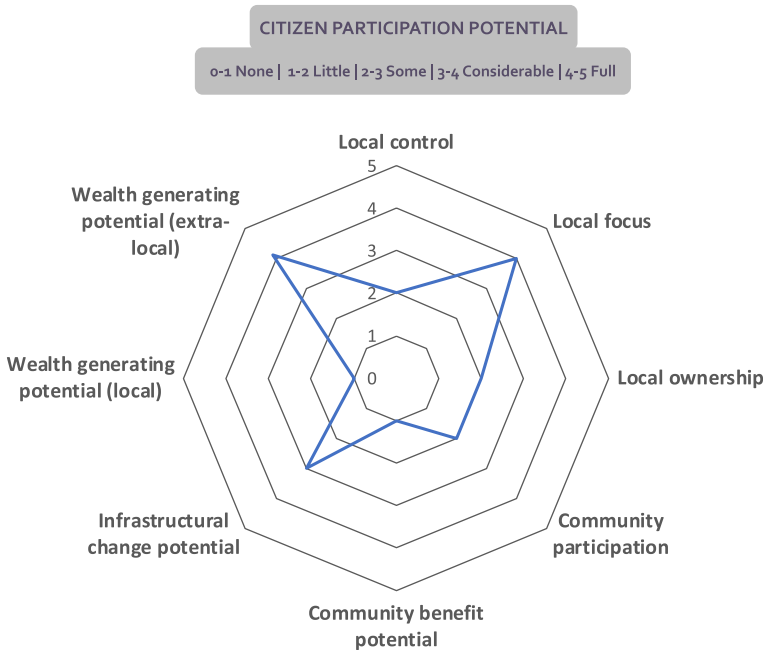

Fig. 4 Assessment of a commercial wind farm project

framed by the CDA-managed fund, also has the potential to compound grievances rather than to mollify them. While this type of project has a strong local focus, especially in geographic terms, a number of participants (from their own experience) recognised that such projects are vulnerable to being co-opted by more powerful actors. These can comprise wealthier individuals living in the area, the wind farm developer, *etc*. As a result, local control, local ownership, community participation and community benefit all scored low with participants. The project's potential for generating wealth for the local community, in the absence of clearly-defined mechanisms for citizen participation, was considered limited. Usually, it is the landowners (who directly benefit from construction and rents accruing from siting the turbines) and to those who have the financial means to make significant investments in the project that benefit the most.

Participants pointed to the absence of any substantial community benefit beyond supports for local sporting and cultural events (see Fig. 4). It was suggested local support might increase if this fund was extended to help with energy retrofits or insulation upgrades to existing housing stock in the area. As one participant put it, any negative attitude to this type of project would drop significantly if local people were able to (financially) benefit from the project even if such benefits were relatively small in terms of overall development costs. As is presented here, most participants we engaged with see the majority of profits from this type of project leaving the local area to be accumulated by individuals and businesses operating at the national or international level. Also, while they did see strong potential for infrastructural change this was not always seen in wholly positive terms, but rather as something of a burden given the perception of limited financial gains to be made locally.

PBM 3: a locally owned (hydropower) renewable energy project

A community cooperative establishes a subsidiary company to develop a hydro-electric scheme on a local watercourse, which flows into a designated national park. A key goal of the project is to supply local residents and businesses with electricity at reduced rates, in addition to generating a sustainable long-term income for the area. A portion of the annual income is put into community-orientated projects that benefit the wider community. These include providing free home insulation to energy vulnerable residents who cannot afford such upgrades and zero-interest loans to those who can. This has resulted in over half of residents in the area upgrading their dwellings to higher energy efficiency standards. Another more ambitious plan is underway to make the local village at the centre of this community carbon-neutral.

The subsidiary company leases approximately ten hectares of land, running adjacent to the river, from the

national forestry body, which owns the land. Under national legislation of the member state in question, this body is obliged to give local communities the opportunity to lease or buy national forest so long as it is for public benefit. The scheme generates enough electricity annually to power over 300 homes, with a projected income of several million euros over a projected 20-year period. Capital for the development came through a start-up grant from a national seed fund, followed by a pre-planning loan from the same agency. Additional monies were secured from a well-respected international sustainable bank and funding from national agencies tasked with supporting community projects.

This participatory business model most closely matched the expectations of participants who recognised the potential benefits for local people across a range of measures (see Fig. 5). These included its capacity to instigate significant changes to local infrastructure and the local economy, resulting in a positive impact on the lives of local people. The only measure that did not score highly, again reflecting participant perceptions, is in its extra-local wealth-generating capacity. However, this was not seen as necessarily a bad thing for most participants. The economic benefits from renewable-energy generation to the local economy include local employment creation and the subsequent ancillary business activities that emerge from services related to the project [20].

Potential shortcomings include it is very geographically specific and technically challenging. Also, it is very much reliant on government support (such as the public benefit leasing) that may not currently be available in other member states. Lack of government support at the national level [90] and at the local level [91], while not always overtly presented as such, can reflect a certain bias towards large-scale, centralised energy systems. This runs contrary to the more dispersed energy system models that community energy initiatives encourage. Having said that, it does meet many of the participants' expectations for stimulating suitable citizen participation and has good replicability potential. Participants recognised that as more community members engaged with (or were positively impacted by) the main project and its ancillary activities, there would be a correlating increase in citizen participation in the project.

PBM 4: a farmer-owned biogas cooperative partnered with a district heating cooperative

A group of farmers want to find better ways of storing and disposing of animal waste from their pig-producing and other livestock enterprises. A biogas production facility is proposed, and a feasibility study conducted. At the same time, other members of the same community want to instal a combined heat and power (CHP) plant to generate electricity and provide district heating to local residents. The two groups agree to work together in developing the biogas and CHP facilities. Initial scoping surveys are carried out to gauge interest and to clarify the attitudes of local citizens. During this initial phase, the two organisations

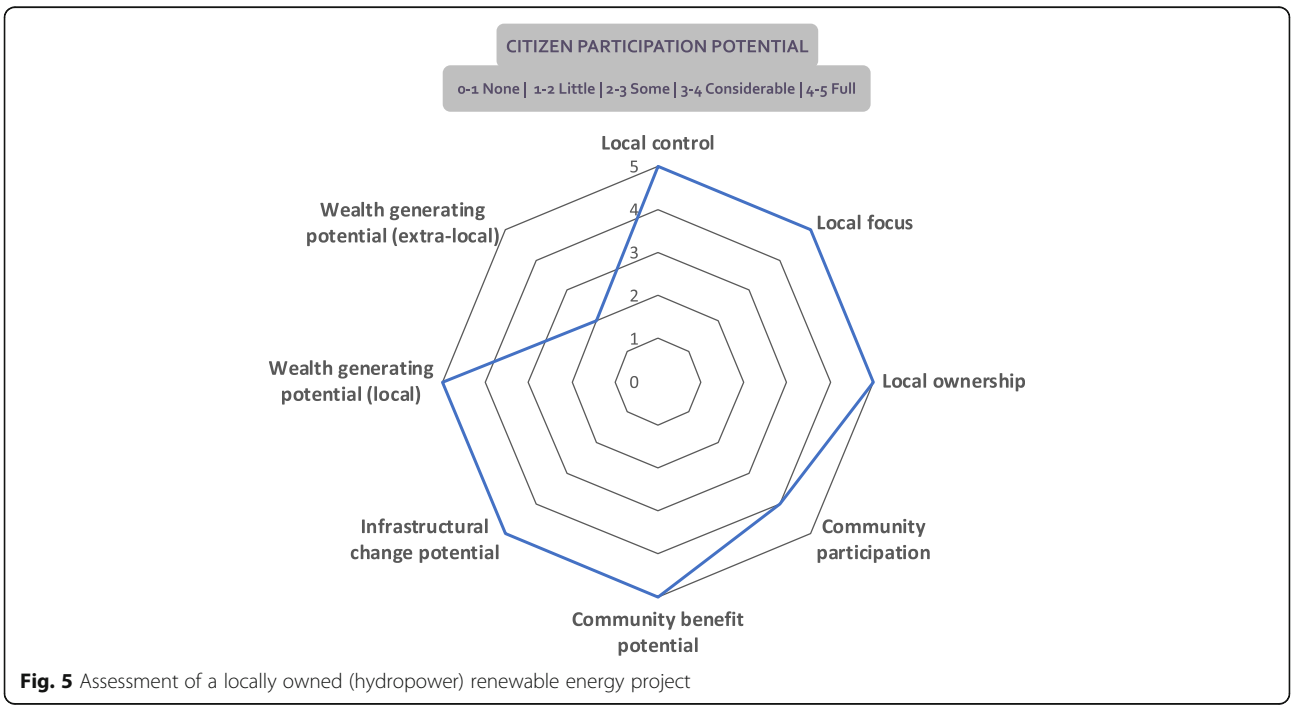

Fig. 5 Assessment of a locally owned (hydropower) renewable energy project

agree to establish two separate cooperatives. The first, the farmer-owned biogas cooperative, uses pig slurry from members' farms and a range of other organic wastes to produce methane gas. This biogas is then received by the second coop (a district heating co-operative) that runs the CHP plant supplying heat to local consumers. These include a school, a nursing home, a sports complex and a number of private homes and small businesses.

The two cooperatives are closely aligned in a number of ways with both having interlocking business relationships and shareholdings. This system allows both cooperatives to engage in long-term planning and a certain amount of strategic visioning. The biogas cooperative is governed by a board of directors, with a full-time operations manager responsible for the day-to-day running of the plant. While the CHP cooperative is organised along similar lines. The boards of the biogas and CHP cooperatives each have a minority representation from the local municipality, whose members act as administrative advisors overseeing activities and operations especially in terms of good governance. In addition, the district heating cooperative has integrated support structures for energy-vulnerable members and works closely with the local municipality to best meet the needs of those members.

There are a number of positive social, economic and environmental dimensions to this model (see Fig. 6). Similar to locally-owned RES project mentioned earlier, the potential for positive outcomes in terms of local control and ownership is strong. In Denmark, for example, Hashøj Biogas Cooperative provides gas for the local CHP plant owned by the Hashøj Kraftvarmeforsyning Cooperative. Participating farmers work together effectively sharing the risks and rewards and reducing individual investment exposure. Moreover, the arrangement adds value to farm wastes and allows them access to new markets. Actively working to resolve issues with local residents also helped generate greater goodwill in the local community [17].

Our engagements with the participants highlighted a number of notable caveats with regard to community participation. Biogas producers face considerable regulatory and social challenges compared to their natural gas rivals, with local resistance to a biogas facility being a strong possibility for many projects. Such negative externalities have led to changes in national case-law in the Netherlands, for example. Changes to the legal status of biogas plants there led to increased development delays and even the abandonment of some projects [92]. While an egalitarian approach to community participation is possible, again there needs to be very clear defining of the organisational visions and structural arrangements for both cooperatives. These must be factored into the planning from the very start so as to ensure members who potentially might be energy vulnerable are also fully considered. This would also help prevent perceptions of unfairness informing the narrative between the two cooperatives and the wider community. Having said that,

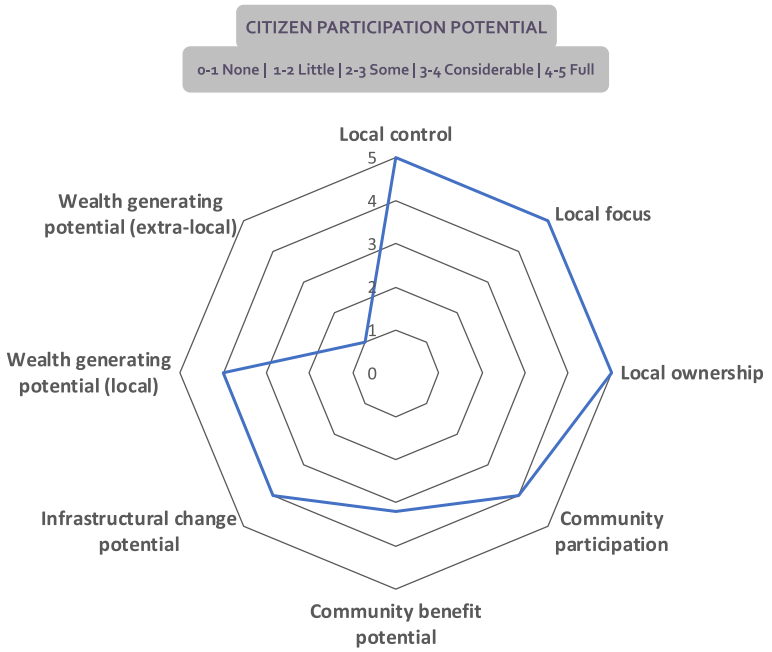

Fig. 6 Assessment of a farmer-owned biogas cooperative, partnered with a district heating cooperative

the wealth-generation potential (particularly at the local level), in addition to its capacity for infrastructural change at both the local and extra-local levels, is considerable.

PBM 5: municipalities, universities, schools and hospitals (MUSH) energy producer

In this model, the mayor of a municipality establishes a local community-owned project with the objective of increasing the uptake of renewable energy in the area through the installation of RES systems on public-owned buildings. In addition, the municipality implements a suite of strict energy efficiency measures that these buildings must abide by. A MUSH cooperative is established with public building owners/occupiers becoming its members and investing in local renewable power generation.

After consulting with energy experts, the MUSH cooperative decides to invest in solar photovoltaic (PV) arrays mounted on the roofs of two public education institutions and a hospital. Electricity produced from each PV plant is used onsite with any excess electricity being fed directly back to the national grid. Installing PV panels on these buildings means that the energy is produced where it is needed, in complex buildings with high energy demands (usually a combination of electricity, heating and cooling). The cooperative assists its members in installing renewable energy infrastructure and supports them in their environmental, educational and community work. It is not a solely for-profit arrangement. Income from the sale of electricity is used by the MUSH coop to recoup the cost of the solar panels and a projects fund is established. The first project, an energy efficiency programme, includes insulation upgrades in a number of school and hospital buildings along with optimising and/or upgrading of existing heating systems. From these measures, the energy demand of these public buildings decreased by over 40%.

The MUSH sector is increasingly recognised as an emerging area for novel business models around energy efficiency and building retrofits, especially by ESCOs looking to leverage public funding initiatives or applicable governmental tax credits [93]. There is significant latent capacity in this area considering the amount of publicly-owned buildings in the MUSH sector across the EU. With energy efficiency standards only set to increase further over the coming years, public organisations are beginning to look for solutions that improve their energy efficiency profiles and reduce their overall energy usage [36].

Schools and universities, in particular, have sizeable institutional capacity in this regard given their role as centres of expertise, the very significant property portfolios in their possession and their commitment to civic and community engagement. The experience of Schools' Energy Co-operative, in UK[7], highlights the potential of this scenario for increasing public acceptance of RES and improving 'energy literacy' in the wider community. Securing a local, sustainable and secure energy supply (with the added benefit of boosting employment and increasing community resilience) is also an attractive prospect for a growing number of municipalities. Municipalities also very often own or manage significant property portfolios and have considerable expertise to share with emerging community-based renewable energy projects. However, this expertise can vary quite considerably. Having said that, as with universities their proximity to local populations potentially gives them a key transformative role in the decentralisation and democratisation of the energy sector.

The participants recognised the community benefits associated with this model. However, there was concern regarding the efficacy of this approach (see Fig. 7). Without clearly referenced mechanisms to ensure local community involvement such projects can end up being tokenistic or non-participatory. Since property rights *etc.* rest with the MUSH actor, mechanisms would need to be put in place whereby local people could become shareholders in the project or lease the space needed to erect their own energy installations. For instance, in the municipality of Tubbergen in the Netherlands, a MUSH community energy initiative was rejected by the local authorities. This led to many progressive pro-climate citizens becoming more sceptical of this type of model and the role played by local governments [94]. Consequently, local control is marked down while the score is higher for community participation and local ownership. These criteria still score lower than for some of the other models mentioned above. Again, participants were keen to see how supports for more vulnerable community members can be incorporated into these types of project. The wealth-generating capacity at both the local and extra-local level is strong given the size of some of the stakeholders.

PBM 6: an environmental finance service

A group of local landowners want to improve biodiversity in their area, which has also seen a steady decline in population in recent years given the limited opportunities for younger people to live and work there. In response to the land abandonment issue and the socio-economic infrastructure pressures associated with it, they decide to implement proven nature-based business models that prioritise the restoration of the self-

[7]Launched in 2014, this cooperative now owns and operates 1,76 MW of solar photovoltaic arrays installed in 48 schools across the UK

Fig. 7 Assessment of a MUSH cooperative

sustaining ecosystems that originally existed in the area. They approached a non-governmental organisation (NGO) that supports rewilding enterprises and acts as a platform and network for rewilding projects across the EU. As part of the rewilding project they also wanted to improve the energy security of local people still living in the area.

With the NGO's help, they leverage existing funding to secure loans from a European investment bank focusing on nature-based business creation and additional backing from a European capital financing facility also engaged in this area. The project involves a series of educational programmes for landowners and local residents, as well as other technical, financial and promotional supports that encourage active rewilding of land no longer in active agricultural use. In conjunction with these rewilding efforts, a greater emphasis is now placed on developing more dispersed, micro-power generation and energy configurations that have the least environmental impact. The group secures a national grant to develop these RES projects, in addition to integrating energy efficiency measures such as insulation retrofitting and solar thermal (and photovoltaic) installations on existing residential and commercial buildings into their business model.

Participant perceptions of this type of participatory business model ranged from some degree of awareness to very little (see Fig. 8). However, it does match the sentiments of a number of participants who expressed a strong desire to move away from what they consider to be weak rural economic models that encourage suburban sprawl, long-distance commuting and dormitory lifestyles for rural dwellers not working directly in the agricultural sector. While it is acknowledged that it has considerable community benefit potential, particularly beyond the energy sector, there was a degree of uncertainty as how it would contribute to the energy transition in a systemically-meaningful way. Our discussions with the participants indicated that not everyone is able to identify the (sometimes opaque) linkages between wider societal behaviour and practice, and the energy system as a whole. This can be explained by the ubiquitous nature of energy in our day-to-day lives and a tendency towards seeing energy almost exclusively in terms of technology and the infrastructural configurations it inhabits. This was very much evident in our early engagements with participants. How we configure the energy system very much depends on wider societal trends regarding behaviour and practice, as this model very much demonstrates.

The shift away from single-sector employment, in this case agriculture, to more diversified income streams associated with wildlife and nature-based tourism offers a number of, if sometimes indirect, benefits to both the local and national economy. For participants, access to new employment opportunities that provide greater income security and work-life balance featured highly in our community engagements. The potential for bringing about significant infrastructural change, both in terms of

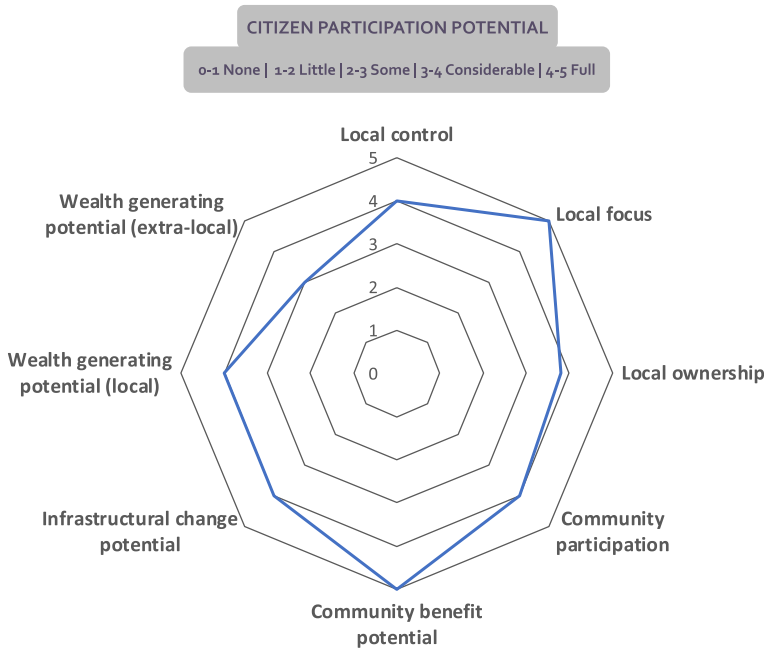

Fig. 8 Assessment of an environmental finance service

moving away from older technologies and/or practices, as well as instigating new ones, is another positive feature of this model.

Discussion

The participatory business models described in this paper have the potential to challenge traditional energy-producer and distribution system operator configurations, especially if growth in such projects reaches the critical mass needed to realise systemic change. The focus on locally orientated electricity generation—providing communities with the opportunity to invest in RES projects that integrate the social, ecological and economic imperatives of sustainable development—give each of the models merit for serious consideration. They also meet a number of the requirements participants expressed as being important, most notably in generating new employment and wealth creation opportunities for a majority of local people as opposed to just the wealthier, better-connected individuals that has traditionally been the case.

Inequalities in existing power structures, deliberate rules-based barriers to citizen participation and a lack of transparency in government decision-making will have a continued negative impact on community acceptability and the energy transition. In Brazil, for example, rules introduced early on in the decision-making process—designed to protect the existing power structures of local government by focusing on incremental policy-making—precluded participating social movements from any meaningful participation in decision-making there [95].

Clearly, the organisational structures used to engage citizens are as important as the type of tools being used. Innovations in participatory research, particularly using citizen juries that incorporate intersectional approaches in both design and implementation, have much to offer policy practitioners. This is especially true for those intent on coproducing energy transition pathways that adhere to the principles of procedural justice and consider the perspectives of ordinary citizens. How this is implemented will be crucial if it is to be successful.

This paper provides scholars with a qualitative toolkit that can unpack the conflicting positions of citizens who agree in principle to the transition to a low carbon economy, while also having more nuanced positions on the rollout of new energy infrastructure. There is now growing acceptance that utilising coproduction perspectives will be important if we are to rapidly decarbonise our energy systems in ways that are acceptable to the general public [96, 97]. Our research contributes to this growing body of work on engaged research and offers a number of key insights into how such perspectives can be incorporated into the policy cycle.

Conclusions

This paper emerged from research exploring local people's relationships with, and perceptions of, the energy system as framed by their day-to-day lived experience. Consequently, a notable contention for the local people

we engaged with was the disconnect they felt from the energy system as a whole and their perception of having very limited agency in that relationship. This socio-technical paradox occurs despite, and indeed because of, the ubiquity of energy to every facet of everyday life. In effect, energy infrastructure can appear almost invisible to many people. This awareness of a lack of agency has contributed to a growing sense of unfairness amongst local people who recognise they have very little choice as to how the transition to a low carbon energy system is to be configured. Consequently, oppositions to RES projects are often motivated by frustration and perceptions of inequity in the process.

At present, citizens quite rightly feel locked-out of decision-making and locked-in to an energy system that actively limits individual agency and staticises change. Given the existential crises of global climate change and biodiversity loss, this cannot be allowed to continue. Further research is needed on restructuring existing socio-economic frameworks so as to meaningfully engage citizens in the decision-making and implementation of what has yet to be a truly sustainable and just energy transition. Therefore, there is a very clear need to implement cooperative mechanisms that are both sustainable and empower local people to engage with those policymakers tasked with dealing with the numerous cross-sectional challenges associated with the energy transition. In this paper, we demonstrate one approach towards achieving this, using innovative participatory research methods. This approach also enables policy actors to learn from existing community-focused energy projects and accordingly to provide more equitable support in their future deployment.

We recognise limitations in the research project informing this paper. While considerable effort was made on our part to ensure interviews, focus groups and citizen juries were reflective of the six communities involved, we accept that this might not always be achievable. Also, the scope of analysis is largely limited to the energy-generation sector. As such, further participatory research needs to be applied to other key sectors contributing to the energy transition such as waste, water and transport. It should be noted that participatory methods must always consider the contextual features specific to each project if it is to be successful. Therefore, further research is also needed into exploring the impact region-specific contexts have on the energy transition.

While the EU is moving towards a more sustainable low-carbon energy system it still has some way to go. Implementing the energy transition continues to be a highly complex task for policy actors given the constant (re)negotiating of the various socio-technical systems involved. This is made more obvious when one considers the competing representations of reality, expectation and other wider societal resistances found in each member state. Providing citizens with the appropriate political, financial and business tools necessary to access a fairer segment of this continually realigning, (re)distributed resource pie—in this instance the new RES technologies at the centre of the energy transition—should be a primary task for policy actors going forward. This paper offers an example of how policy actors and others can integrate citizen perspectives of RES projects to transform citizen participation in the energy transition. In addition, the models presented here can serve as useful templates for motivated communities to begin co-designing their own RES projects, incorporating energy justice considerations into their organisational structures and accommodate the needs of the most vulnerable in their communities. While this has not been the case so far, the potential is still very much there when social innovations take equal if not primary importance over technical innovations [98–100].

Abbreviations

CDA: Community Development Association; ESCO: Energy supply company; EU: European Union; MUSH: Municipalities, universities, schools and hospitals; NGO: Non-governmental organisation; NIMBY: Not in my back yard; PBM: Participatory business model; RES: Renewable energy sources

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Authors' contributions

BL conceptualised the research, undertook fieldwork, analysed the data and wrote the manuscript. ND conceptualised the research, wrote the manuscript and supervised the research. ES conceptualised the research, undertook fieldwork and wrote the manuscript. All three authors have read and approved the final manuscript.

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Availability of data and materials

Further information is available on the ENTRUST's website (www.entrust-h2020.eu), in the form of numerous project deliverables and newsletters and other public documents. Qualitative data from interviews, workshops, *etc.* are not public in order to protect the anonymity of the project's participants.

Ethics approval and consent to participate

The authors obtained both written and oral consent from all informants, in accordance with University College Cork's Social Research Ethics Committee (SREC).

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests in the successful completion of the research and publication of this manuscript.

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