Future pathways to mainstreaming community energy

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Abstract

The UK energy sector has been one of large-scale centralised energy production by big companies, with households seen as passive consumers of energy at the end of wires. The development of renewable energy technologies, such as solar photovoltaics (PV), signals greater potential for small-scale energy production. Such change provides the opportunity for households and communities to become active consumers and producers of energy, as well as for energy service providers to support integration of renewable technologies. Drawing on data from a community energy study, the paper shows how community energy projects can be test beds for developing new business models, leading to empowerment and democratisation as important stepping stones to mainstream community energy. The paper adds to existing knowledge about these challenges by developing possible future pathways to mainstream community energy: top-down; bottom-up; and hybrid. These pathways' potential contribution to decarbonising the energy sector is considered, with implications for policy, regulation and new business models.

1 Introduction

The UK energy system is at a point of change. New ways are needed for the sector to tackle climate change and to meet the UK Government's legal obligation to reduce carbon emissions by 80% of 1990 emissions by 2050 (Department for Business, Energy & Industrial Strategy, 2013). Existing fossil-based sources of energy are produced largely on demand, so they are able to cope with consumer demand fluctuations (Helm, 2015). However, the energy landscape faces pressure from increased demand arising from the electrification of transport and heat and a shift to intermittent renewable energy sources. These trends are leading to capacity constraints and load management issues (Habib et al., 2015; Sivarum, 2018). The greater integration of intermittent and distributed energy sources, and the increased demand from electric vehicles (EVs) and heat, will require new sources of energy flexibility to balance demand and supply (Schuller et al., 2015; Yu et al., 2016). A recent BEIS and Ofgem (2017) report on energy flexibility, recognised the need for flexible local markets that can support decentralised generation. Community energy could play a vital role in these local energy markets but is far from becoming the mainstream source of energy production.

Although the need for flexible local markets is now recognised (BEIS and Ofgem, 2017), the current regulatory framework continues to create challenges for decentralised and distributed forms of energy generation. The framework is not designed to support the unpredictable and inflexible nature of local renewable energy. Existing market

arrangements, known as the British Electricity Trading and Transmission Arrangements (BETTA), are intended to support conventional large-scale energy production and penalise sources that are unable to guarantee specified output levels (Woodman and Baker, 2008). Coupled with the removal in April 2019 of Feed-in-Tariffs, these restrictions have led community energy groups to seek lucrative new business models and partnerships. However, to go beyond the 228 community energy organisations in existence in 2017 in England, Wales and Northern Ireland (Community Energy England, 2018) and mainstream community energy, new pathways need to be found to support this growth. This paper addresses this issue by considering the role community energy can play in the future of the energy system and the pathways for it to become mainstream.

Community energy projects could be considered niche innovations. Theories such as Strategic Niche Management (SNM), Transition Management (TM) and the Multi-Level Perspective (MLP) indicate how such niche innovations can become mainstream. SNM suggests that sustainable innovations can be developed in technological niches or protected spaces, giving time and space for them to sufficiently mature and contribute to 'broader societal change towards sustainable development' (Schot and Geels, 2008, p. 537). TM focusses on directing long-term change in socio-technical systems, such as the energy sector (Meadowcroft, 2009). The MLP frames transitions as emerging through alignment and interaction at three different levels: technological niche, socio-technical regime and socio-technical landscape (Geels, 2011, 2005, 2002).

Niche innovations can have either a competitive relationship, in which the existing regime is replaced; or a symbiotic relationship, where problems within the regime are

tackled (Geels and Schot, 2007). As this paper will show, community energy schemes work symbiotically to support the aim of decarbonising the energy system, rather than replacing the existing energy systems. Geels and Schot (2007) describe four transition pathways to explain the process of transition or change; transformation, de-alignment and re-alignment, substitution and reconfiguration. In the *transformation pathway*, incumbent or regime actors may re-orient the direction of development paths in response to disruptive change but niche-innovations are not sufficiently developed to put pressure on the incumbent regime. In the *de- alignment and re-alignment* pathway, change is large and sudden, resulting in a loss of faith from the incumbent actors, opening up opportunities for many niche innovations. In the technological *substitution pathway*, specific shocks or disruptive changes coincide with a moment when niche innovations are well developed and competitive. They are able to break through and replace the regime. The *reconfiguration pathway* sees symbiotic niche innovations adopted to solve problems in the regime, such as in this case, with the need for new sources of electricity flexibility (Geels and Schot, 2007).

For niche innovations such as community energy projects to be commercialised, new business models may need to be developed. Defined as '…a set of interdependent organisational activities' (Zott and Amit, 2010, p. 217), business models 'can consist of adding new activities, linking activities in novel ways or changing which party performs an activity (Amit and Zott, 2012, p. 41)', such as a community rather than just big energy companies producing energy. Business models can act as 'translation devices between niches and regime' that allow for the commercialisation of niche innovations (Bolton and Hannon, 2016, p. 1739).

Findings are presented from an Innovate UK-funded study to look at what it takes to get communities involved in local energy projects. The study took place in a new town that is undergoing extensive new development; involving a partnership between two universities, a smart energy SME, a local council, a community support group, software developer, and a satellite data provider. An interactive platform was developed to support communities and local authorities in developing community energy projects. The vision was to connect communities and suppliers via the online platform, to enable citizens and local authorities to access the necessary information and resources to create and implement an energy project. Suppliers would also be able to benefit from using the platform as a shop window for their products and services. A distinctive feature of the platform was that it would put Big Data tools in the hands of local communities. These tools worked by bringing together satellite images of local buildings, with energy performance data, energy usage data and sociodemographic information.

Drawing on the gathered data, this paper reveals how existing community energy schemes are developing and then explores three possible pathways to mainstream community energy: top-down, in which community energy schemes are set up and run by big energy companies or local authorities; bottom-up, involving schemes developed and run by communities; and a hybrid of these two. For each pathway, factors that could lead to the mainstreaming of community energy and a new decentralised, democratised and decarbonised energy paradigm are explored. Their relevance to policy makers, regulators, new and existing businesses in the energy sector, local authorities and communities are considered. The paper begins by outlining the methods used to collect and analyse the

data, followed by a review of findings and discussion of the possible future community energy pathways.

2   Methods

Reflecting the emergent and dynamic nature of the field, an exploratory approach using in-depth interviews and workshops was used (Kumar et al., 1993).The aims were to explore the motivations for community involvement in energy projects, the process by which these projects unfold, the barriers faced and the resources needed to implement them. This data gathering approach generated a rich understanding of community energy projects through the perspectives of different stakeholders and communities. A purposive sampling approach was used to identify individuals with relevant knowledge and experience of community energy and, who as a group, offered a wide range of perspectives. In-depth interviews were undertaken with local authorities, NGOs, landlords, suppliers, academics and community energy groups, primarily from the town where the platform was being developed, but also with experts from across the country. Data were also gathered from two workshops in the city, to which a wider group of citizens with interests in community energy was invited.

The majority of interviews were conducted by two or three researchers, to ensure detailed insights were gained from being directly involved in the data collection. In most cases, interviews were audio recorded and later transcribed, with contemporaneous field notes taken. Overall, 25 interviews and two workshops were conducted over an 18-month period between December 2015 and June 2017. The interviews lasted between 30 and

180 minutes, resulting in over 30 hours of recordings. Data were gathered from the workshops in the form of field notes, rich pictures[1] and photos.

After transcription, all interviews were anonymised prior to analysis. The data analysis followed an iterative approach (Corbin and Strauss, 2008), which began with members of the research team reflecting on each interview. Two data analysis workshops involving four members of the research team took place. A deductive approach was used to generate the main data codes. One researcher then used NVivo to analyse the data in detail, beginning with the open codes agreed at the workshops and then assigning axial codes to further break down and delineate the data. To support the triangulation of results, a second member of the research team independently reviewed the open and axial codes (Denzin, 1989). Appropriate reliability was ensured by two researchers working together to re-check the emergent themes against the data. Themes concerning key developments in community energy and possible pathways for mainstreaming arising from those developments emerged from the findings and are considered next.

3   Findings: Current Developments

This section draws together the main ways in which community energy is currently developing and the importance of these developments as stepping stones to mainstream community energy. This early stage of mainstreaming is illustrated through three themes: the innovative new business models being developed; the process of empowerment and

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[1] Rich pictures were developed by Peter Checkland as a soft system methodology to gather and depict complex situations in a cartoon like pictures. These pictures represent different ideas, connections, influences and so on.

democratisation community energy projects can involve; and how community energy projects can be test beds as a vehicle for change to inform and mainstream policy and practice. Each of these themes is considered in turn.

3.1   Business models

A recent BEIS and Ofgem (2017) report on energy flexibility, recognised the need for flexible local markets that could support decentralised generation. Industrial and commercial customers are already benefiting from these local markets, but the potential amongst domestic customers and in the community is largely untapped. The research findings indicate that while the potential is recognised, it remains unclear how householders will respond. Respondents suggested a need to develop this market, to help promote the concept of individuals providing a flexibility service to the grid. The following quote highlights the mistrust individuals feel towards big businesses, which can be both a barrier to actively engaging in energy but also a motivator for democratisation.

> "If I was to say you should put a battery in your house because it's going to help stabilise the grid, people would say, well actually that's a reason not to do it because I hate the people... You know, I hate the fat cat that's going to be making all the money, you know? So as much as people in the solar industry, you know, thousands of people realising that actually the grid needs help. The individual homeowner isn't going to want to do it because all they see is they pay so much out each month and the... If I'm paying that out each month, well they can pay to

stabilise the grid. They don't realise that actually billions of pounds are needed,

are going to push their prices up even higher" (Manager, Solar PV installer).

One of the major barriers for community energy and decentralisation is the continued

investment in large-scale energy production driven by the structure of the electricity and

gas markets (Watson and Devine-Wright, 2011). For example, micro generators, such as

community energy projects cannot sell the electricity they produce to the wholesale

markets (Watson and Devine-Wright, 2011) and it is hard for them to access time-

specific revenues. There are also barriers to the use of demand side measures, with the

taxation measures in place less favourable than from existing revenue streams. Without

what Watson and Devine-Wright (2011, p. 290) describe as a 'levelling of playing fields',

greater investment in decentralised local energy projects is likely to be limited.

Even with these barriers, the energy system is changing. Demand side changes are

forcing the system to adapt. These include the roll out of smart meters; the drive for

electric vehicles to be the norm by 2050 (Joint Air Quality Unit, 2017); and increased use

of electric heat systems, such as heat pumps. On the supply side, despite the barriers,

almost one million homes have solar panels on their roofs (HM Government and Ofgem,

2017), some of which are associated with community energy schemes. These existing

households and community energy schemes are locked into the existing FiT, but new

schemes will be seeking innovative ways beyond the dwindling FiT, to generate revenue

from their energy. This combination of demand and supply side developments is driving

innovative new business models, as the following example illustrates.

"In homes, definitely in homes, an east/west system in the current climate is better than south system. When you were being paid a lot of money per kilowatt hour, south is a better financial return and will generate more energy. But not that much more energy. If you go east/west, in a home particularly, you're generating when you get up in the morning and when they're home in the evening, you know, you still generate through lunchtime as well, but your main generation, your curve is a lot lower, a lot less steep, and a lot more of that will get used" (Manager, Solar PV Installer).

This comment suggests that as the FiT dropped, a shift in the business model has developed to take advantage of the ability to *use*, rather than to '*sell'* the energy; in this case by changing the orientation of the PV panels to east and west facing roofs. The effect was to generate electricity at either ends of the day when the usage by households is higher. However, the viability of this east/west orientation model will depend on how regulation and technologies develop. With improving battery storage technologies and increasing use of EVs in vehicle-to-grid demand side response (DSR), installing a south facing orientation could still be a good option, especially if Ofgem's review of storage licenses (HM Government and Ofgem, 2017) is favourable for microgeneration projects.

As 'smart grids' develop, enabled by technology that reacts to local changes in usage, decentralised or distributed generation could become an integral part of the wider energy network. Distributed generation is connected to the electricity grid enabling bilateral

trading (Alanne and Saari, 2006). Such schemes have the potential to feed the grid's needs to deliver new forms of flexibility that manage supply and demand in line with current government policy (see HM Government and Ofgem, 2017). These schemes have differing implications for community energy projects in how they are set up and run, with business models being developed to allow communities to sell their energy locally. A community energy group explains how they could develop a business model and become a very local energy supplier, whilst again highlighting antipathy towards the big energy companies:

> "Okay, we have a number of sources of revenue. So we are getting an income. Those sources are people paying their bills, yes? So we've got solar... So we chuck solar panels on a roof, the people underneath...So there's no capital outlay for that business. But they pay for their energy. They pay a better rate than they'd pay to any of the big six, but they're still paying. So we invoice them monthly for their energy. We are EON, but we're lovely. We're nothing like EON" (Director, Community Energy Group).

The peer-to-peer energy market is another possible business model, allowing people to buy energy directly from the producers. An existing scheme run by Piclo in partnership with Good Energy, matches customers with local renewable energy suppliers. While only currently available to businesses, Ofgem plans to extend this scheme to domestic customers with smart meters (HM Government and Ofgem, 2017). Extending this

approach to community energy groups, would offer them an interesting way to earn revenue from their schemes.

3.2 Empowerment of communities and citizens

The ability to sell energy by becoming energy suppliers supports the democratisation of energy. Democratisation can be considered a consequence of the decentralisation of decision making (Alanne and Saari, 2006). Greater participation and voice in the political and economic institutions within the energy system are promoted (Tomain, 2015), with ownership spread beyond the big companies into the hands of individuals, community groups and local authorities (Watson and Devine-Wright, 2011). The community groups interviewed were strongly in favour of such empowerment, seeing it as important for the democratisation of energy, as well as for the inclusion and democratisation of the community in the economy and policy making.

> "There is something about community ownership, but I think it is really important, community empowerment in a sense, that certainly their taking some control and responsibility for production of energy. For me, there is a practical and a political element to that really which is that so many of today's technologies don't empower local communities, they disempowered them, they can't be involved, it's too big etc. So I think that move has been really important in enabling communities to generate; and political with a small P is the bit for me. I think it's really important that, beyond the practical, people feel more in control of their communities and that, they're not marginalised by that, by processes and the economy, and the

politics actually" (Super Homes owner and Co-Director of a faith based organisation).

3.3 Energy as a vehicle for change

Increasing empowerment through the control of production and consumption for communities, can help support wider changes and learning. There is the opportunity for small-scale projects to become a place for government to test out regulatory frameworks, in what Tomain (2015) describes as "policy laboratories". Under such arrangements, local projects could be involved in the development of best practice and education, at a scale appropriate to their needs (Tomain, 2015). Such grassroots projects could also inform more sustainable ways of living. White and Stirling (2013) suggest that these bottom-up grassroots projects could highlight the unsustainability of current systems, help solve local problems; and support experimentation in methods that could inform or be integrated into the mainstream, with shorter time-scales and lower capital investment requirements than large-scale projects. This opportunity to be involved in such bottom-up projects can be the impetus for communities to unite behind a common goal, heightening citizen participation, engaging them in energy, but also more generally in the community.

"Energy is often, or energy and climate change certainly, are often a useful kind of vehicle by which they can do other things, if you like….They often were, more than anything, were looking to improve their local community in some way, shape or form, and energy became a useful vehicle for at a certain point in time to allow them to do that, you see what I mean" (Academic).

These examples of business models, empowerment, and energy as vehicles for change, illustrate the first steps towards mainstreaming community energy. In the next section the pathways that could support this process of mainstreaming community energy are discussed.

4 Pathways to mainstreaming community energy

Community energy has not yet become mainstream, even though the need to decentralise energy production to ensure security of supply and decarbonise the energy sector is recognised. Local community energy systems are beginning to challenge the existing paradigm of centralised production and control, moving towards a more decentralised and democratised approach. A paradigm that supports the shift to a flexible system, is better suited to manage the intermittency of low carbon energy sources. The desire to create a flexible energy system is unlikely to be a primary motivator for community energy groups. These groups are more likely to be motivated by the wider benefits of community cohesion, empowerment and the potential to improve their local community. However, with shortfalls in the necessary funding and expertise in local communities, on their own these bottom-up schemes will struggle to scale up to the levels necessary to decarbonise the energy system. Other ways to scale up and mainstream community energy will also be needed.

Several pathways to mainstreaming community energy emerged from the data analysis, each with strengths and weaknesses. These top-down, bottom and hybrid schemes, and the extent to which they are likely to be democratised or decentralised, are illustrated in

Table 1. Bottom-up grassroots community energy schemes tend to be small, local, rural or urban community schemes, created and run by the community that will reap the benefits. SNM conceptualises such niche developments as bottom-up processes (Amit and Christoff Zott, 2012, p. 41). These schemes offer both decentralisation and democratisation of energy. In contrast, top-down projects could be led by businesses or local authorities. Loorback (2010) describes niche developments and policies developed by government as top-down. These projects might include new housing developments or involve the local authority becoming a not-for-profit Energy Service Company (ESCo). Under this pathway, the development and benefits of the project are focussed on businesses and local authorities; although wider societal benefits are also likely. Local top-down projects deliver decentralised energy production and some democratisation by shifting power from a national, to a regional setting. However, the power remains with larger organisations, rather than in the hands of individuals or local communities. Smith et al (2016) describe a third 'hybrid' option, involving energy partnerships with businesses, local government or the third sector. The hybrid system concept could be important in bringing together local authorities, businesses and communities, as it develops a role for all of these stakeholders in the energy system. A hybrid approach also offers shared benefits between the community and larger organisations, going some way towards supporting the democratisation of the energy system.

These future pathways – bottom-up, top-down and hybrid are important in developing policy and strategies for key stakeholders to support the mainstreaming of community

energy. The pathways are developed in the following discussion, to consider their

potential to enable community energy to become a mainstream part of the energy system.

Scheme	Who benefits?	Who develops?	Decentralised	Democratised
Bottom-up				
Community run energy production, possibly including storage.	Community.	Community.	Yes	Yes
Bulk buying of energy or insulation.	Community and suppliers.	Community and suppliers.	No	Yes
Peer to peer energy trading.	Small buyers and sellers.	Small buyers and sellers.	Yes	Yes, as prosumers.
Top-down				
Local authority energy service company.	Local authority and wider society through income to support local services.	Local authority.	Yes	No
New housing development.	Local authority and housing developer.	Local authority and	Yes	No

		housing developer.		
Housing refurbishment or regeneration.	Local authority, housing developer and residents.	Local authority and housing developer.	Yes	Partly, if citizens are involved in decision making process.
Energy company led community energy scheme.	Energy company, sometimes local community.	Energy company.	Yes	No
Hybrid				
Selling energy services e.g. flexibility or demand side response, through an intermediary.	Consumers and energy suppliers.	Energy suppliers and aggregators.	Yes	Partly, if consumers are actively engaged.
Community ownership of wind	Energy company and community.	Energy company.	Yes	Partly, if community

turbine in a larger wind farm.				involvement in decision making.
Co-developed community energy project with an intermediary (aggregator, local authority, 3rd sector) and community.	Intermediary and community.	Intermediary in partnership with community.	Yes	Partly, dependent on community involvement in decision making.
Community energy project identified by intermediaries, developed and run by community.	Intermediary and community.	Local community with support from other stakeholders.	Yes	Partly, dependent on community involvement in decision making

Table 1: Possible future energy pathways

4.1 Bottom-up Grassroots

As Table 1 shows, bottom-up projects can include the production and storage of energy, where the community becomes a prosumer; bulk buying energy or insulation; or peer to peer energy trading. A community energy project that produces and stores energy is the most complex option, requiring high levels of expertise and funding. Options requiring no infrastructure or less expertise are likely to be easier to deliver but may have less potential for decarbonising the energy system.

A major advantage of these bottom-up schemes is that the motivations for initiating the scheme will be pertinent to the community. The scheme they adopt will be determined by these motivations, which may not always be energy. Smith et al (2016) describe a pathway from community health, fresh food, and food waste to community biogas schemes. As this quote illustrates, the desire to be part of a community group, can be a strong motivator.

> "And, yes, so again, what we were consistently finding in terms of motivations is that, you know, is that you know it's very hard to put your finger on it. Sometimes there are very explicit `we want to cut carbon', but almost always when you look in more depth, there are loads and loads of different motivations going on here, from simply 'I want to be part of a community group because I'm now retired' to `I really want to combat climate change' or whatever it might be, or `reduce my energy bills'" (Academic).

Ensuring that the motivations go beyond an interest in community energy and to include some kind of community vision, appear to be key to the long-term sustainability of these projects.

> "But everyone's lost interest because the idea has come around a project, not around an idea and a vision. So there's that whole long-term approach that actually the idea of a community vision gives you, which means that actually it's not about solar panels, it's not about biomass, it's not about any of those things.

It's actually the community want X, let's deliver X. And as a part of that there

will be solar panels, there will be energy efficiencies, there will be trying to

alleviate fuel poverty, or all of those things, whatever the community wants at that

point" (Co-Director, Community Energy Group).

Smith (2016) also points out that just as energy may not be the starting point,

sustainability may not be the main motivation. A frustration with the existing centralised

energy regime could, for example, be a significant motivation.

Energy production is psychologically and physically remote from consumers,

contributing to a passive engagement with energy. Unconscious and potentially wasteful

consumption practices are often associated with this passivity (Rogers et al., 2012). A

further attraction of bottom-up community energy is its potential to change local energy

use behaviours. The social learning that is an intrinsic element of these projects, can help

to increase levels of engagement, bringing energy closer to citizens and changing their

energy consumption practices (Rogers et al., 2012). Indeed, Delind (2006, p. 143) argues

that it is 'acts of physical engagement' that can bring more sustainable lifestyles (Shaw et

al., 2018). We found evidence of these outcomes, with those who had installed PV panels

also changing their behaviour as they became engaged with energy production and

realised savings could be made.

"I mean, we do want to see behaviour change as part of the outcomes of what

we're doing. Particularly if you do put solar on your roof ... It makes sense to then

run your dishwashers or washing machines, your... You know, anything that has

an almost discretionary time of use, when you are generating renewable energy.

Particularly with the energy spike in the middle of the day with solar which is

really giving the grid a lot of havoc. We're trying to say to people, you know, if

you can set timers on your appliances so that things are running when the grid

needs that power to be used in the home and not overloading the grid" (Manager,

Solar PV installer).

This engagement contrasts with the 'information-deficit' view of consumers perceived by

policy makers and industry, under which a lack of knowledge and interest from the public

is considered the norm (Watson and Devine-Wright, 2011, p. 291). According to these

authors, there is no guarantee that decentralised energy production will lead to lower

carbon energy, greater levels of engagement or increased energy security. As Hobson et

al (2016, p. 1396) identify, instead of supporting community cohesion, there is the risk

that community energy projects could lead to 'fractures and disputes'. Such disputes

include concerns about who benefits from the project, or whether changes in attitudes and

behaviours reach beyond those of the immediate group members. Ultimately, these

benefits are key to the scheme's success.

"We had our first [community energy group] AGM a few days ago, and this is

solar panels on what were previously farm buildings, which now house a variety

of businesses, and then there's one with a freestanding solar array which is a

poultry farm, in fact, but this is a community, what do they call it, a community

benefit company, and there's going to be… the money that's invested will be paid

back over 20 years plus interest, but there'll also be money put into a community

fund to help pay for it, and the members of this co-operative, well, it's a co-

operative, really, will decide how the money's going to be spent, but mainly it'll

be on ways to help people become more energy efficient and things like that in

the community" (Community energy scheme member).

Ensuring investors and those that owned the buildings saw a return from the community

energy scheme was important, as was the ability to reinvest in the community.

"You know, if we're working with particular roof at the moment, they want to

know how their community will benefit from this, because that's what makes us

different. So we have to be able to say, in year one it will generate £10,000 that

you can invest in your community and £5,000 that you can invest in your

building. Because that's what makes us different" (Director, Community Energy

Group).

These bottom-up schemes offer many advantages, including unlocking the energy system

to communities and individuals, empowering them and giving them a democratic voice in

the energy system. Such benefits can lead to changes in energy consumption behaviours

that then become stepping stones to other sustainable practices. However, these schemes

face significant challenges and disadvantages. They tend to be very reliant on the

enthusiasm of one or several key individuals in the community. Having access to other

stakeholders who can offer the necessary expertise, is also important. If these individuals

are not available, or if they lack the respect of the community, the scheme is likely to fail. Inconsistent and dwindling funding streams make these small schemes particularly vulnerable, although sometimes a financial shortfall can stimulate innovative new business models. However, the biggest barrier to these bottom-up projects significantly impacting the decarbonisation of the energy sector, is the small size of the communities in which they are situated. The 202 GWh (Community Energy England, 2018) of electricity they produce is tiny in comparison to the UK's total annual production of 339 TWh (Department for Business, Energy & Industrial Strategy, 2018). The degree of impact on climate change and the integration of renewables into the energy system of these bottom-up schemes alone, is therefore questionable.

4.2   Top-down

As Table 1 shows, top-down schemes tend to be run by big organisations such as energy companies or local authorities. These schemes are less likely to offer democratisation for the communities, as the decisions are made for them. So while the schemes are situated in the community, they are done *to* rather than done *by* the community. The benefits of community buy in and the opportunity to align with what motivates local people, will be less obvious. This situation is especially the case in new housing developments, where the local authority decides on the property build standards and whether low carbon technologies will be included. Such top-down schemes run by local authorities also have an important role in delivering equity within the community. UK community energy projects tend to be led by committed and well-educated people and reaching out to a wider demographic poses a challenge (Smith et al., 2016).

"I mean, one of the things that I will say is that we've had... A lot of the people that get interested are middle class lovely people. Not all. But you know, generally white, you know, all of that. And that's just the way... You know, it just is what happens. And you know, we've got 20% Asian population in [town] and we haven't necessarily engaged with them as much as we would like. And that's quite disappointing. It's difficult to... You know, but because we haven't necessarily got the same level of engagement. And we'd love to be able to do more within that context. You can't force anyone to be involved in these things" (Co-Director, Community Energy Group).

These kinds of engagement challenges are also found in lower income communities, but these communities are unlikely to see low carbon technologies as a priority, or to have the money to invest in them. There was an expectation that local authorities would support those in fuel poverty.

"You know, the point is that the numbers don't work when you talk about people and fuel poverty. Saving them £50 a month isn't going to do them any good. you've got to make a difference. You've got to make a structural difference. And unless the council has the money to do it, no one's going to do it." (Co-Director, Community Energy Project).

In instances where schemes were run by the local authority for those in fuel poverty, behaviour changes and greater empowerment for those involved could result.

> "… PV and fuel poverty, and the council has rolled out the kind of project where they put on a few houses PV panels, so... and that has shown that it's quite empowered the people in fuel poverty, because they're very knowledgeable about energy. …but a lot of them could integrate the solar panels really well, because they had sort of that knowledge already. It took a bit of time to know how, when it would produce any energy, and when it wouldn't, but most of them said it really empowered them, because it gave them the possibility of using energy in a different way" (Academic 2).

The need for a wider demographic to benefit from these projects is evident. As more communities create community energy projects and become empowered as they go 'off grid', those who were unable to participate risk becoming even more disempowered. The cost of running the grid will then disproportionally be focussed on a smaller number of customers, particularly those least able to pay, resulting in a two-tiered energy system.

Three factors combine to influence fuel poverty: household income; household energy requirements; and fuel prices. Those in fuel poverty are more likely to live in poorly insulated homes, often with solid walls and located off the gas grid, with the consequence that their energy requirements are likely to be higher. Measures are already in place to improve the energy efficiency of homes, such as the Energy Company Obligation (ECO)

funded by the big energy companies, which offers support to make homes energy efficient and create affordable warmth. Local authorities have a role in facilitating access to such schemes to improve insulation levels and make cheaper fuel available. Community energy groups were interested in working with local authorities to promote collective buying, but felt it was important to focus on renewable energy buying schemes rather than on a top-down scheme with limited interest in the sources of energy.

"One of the things we've been talking to [town] Council about as part of the community energy campaign with Citizens [town] is collective buying of energy. So collective buying schemes have been run by local authorities across the country, so basically, they... You know, the local authority promotes collective buying. So, they say, we're going to gather together thousands of people, collectively we have more buying power than Paul and I alone, and we're going to get a really good deal with an energy provider. And what we're trying to persuade [town] to do at the moment is part of that campaign, is to do that, but on a renewable basis. So to collect people together who want to go 100% renewable and find someone like Good Energy who are 100% renewable and sell thousands of people to Good Energy and get a great tariff. But not just a great tariff, a great renewable tariff as well" (Director, Community Energy Project).

As well as delivering equity, top-down local authority-run schemes can deliver revenue, help meet clean energy targets and support delivery of the authority's local development and engagement goals. For many local authorities, the uncertainty over central

government's support for community energy, means it is not considered a priority. A UKERC (2017) report on local authority engagement in energy, highlighted the unreliability of energy policy support for local initiatives. A specific focus was the failure of Green Deal and the rapid reductions in FiTs. However, the proposed changes to the energy system to deliver new forms of flexibility, bring new opportunities for local authorities to raise revenue beyond energy production. These could include energy storage, possibly through EVs or other purpose-built storage facilities; or forms of demand side response, using the authority's corporate estate or domestic housing stock. The vast roof spaces owned by local councils could also be utilised for energy production. One local council was planning to generate income from energy measures installed during redevelopment of their social housing stock. The redevelopment plans were designed to improve the quality and density of the housing stock, raise revenue for the council and contribute to carbon emission reductions. However, the initiative proved controversial with the community and was later abandoned, perhaps a reflection the scheme being *done to* rather than *done by* the residents.

> "Yes, the first plans for one of the major estate remodelling. This upwards of 1000-1200 dwelling, the original plans, I don't know what stage they are at the moment, but the first draft plans were to include PV on roofs, battery storage on a domestic scale. So that would be introducing battery storage almost as a white goods in your property that will not only help smooth out the electricity generation, but also provide additional income" (Environment officer, local council).

Research in Canada shows the role of local government in energy planning has typically focussed on energy efficiency and conservation, rather than on renewable energy schemes (van der Schoor and Scholtens, 2015). The UKERC 2017 review of UK local councils showed increasing interest in renewable energy projects, partly motivated by their revenue potential and partly by pledges to achieve 100% clean energy in their areas by 2050 (Webb et al., 2017). This trend suggests a change in ambition and motivations for energy projects among this stakeholder group. Under the new Ofgem proposals, local authorities could become suppliers of energy services and trade energy locally as an Energy Service Company (ESCo) (HM Government and Ofgem, 2017). In the UKERC (2017) review, one local authority is reported to already own a licensed gas and electricity company. Such approaches provide new ways for local authorities to balance their budgets by generating income rather than cutting budgets. However, local authority-led schemes could disempower households by tying them to community networks with no choice of energy supplier, or if they are unaware they are included in the scheme.

> "We have got community heating in the centre of the city, but again that is there because the environment was created politically, that we want combined heat and power in the city centre. And we were also able to apply for some funding from the EU and it met the government's objectives of the time, so it happened. A lot of people in the centre who benefit from it don't realise the system is there at all. A failing in our publicity I suppose" (Environment officer, local council).

Other top-down schemes could be in the form of new housing developments, where the local council works with developers to support the building of sustainable communities. Often these schemes are subject to planning requirements of planning gain through a Section 106. Planning regulations can force a development to include initiatives, even if there is little support for them.

> "Although we have had to do a lot of things, down to planning permission, we have had to do a lot of things, you know, like we have to have solar panels on the roof. I'm not sure whether the building project would have chosen to have them on it" (Community centre committee member).

However, this community group struggled to find funding to meet this obligation, partly due to their small size, but also because as a faith organisation they were ineligible for some sources of funding.

> "I'm just trying to set up crowdfunding thing at the moment, but I've got so far, but you have to use your own bank account which is a bit of a pain because it's not like a big organisation, so they have to check me out and my bank account out, and then all the money that I raise it goes into my bank account and then I have to pay it to the church. So is there another way that I can just give the churches, the Oaktree Centre's bank account details? No no no it has to be you" (Community centre committee member).

A lack of joined up thinking in the funding landscape is one of the biggest challenges communities face in top-down schemes, requiring many applications to be made to obtain finance. Local councils do have the option through planning and by using a Section 106, to raise carbon offset funds to support local environmental projects. However, a lack of transparency in the distribution of funds under this approach can harm the trust between communities and the local authority.

> "So, what that does include however is money for sustainability. So within... Included in the 106 agreement will be an amount that goes into this fund that the council hold called the carbon offset fund. So rather than requiring every developer to put solar PV on their properties, because developers hate doing that, they say you don't have to do that, but you have to give us an amount of money and then we will use that to do good carbon neutral stuff in [town]. Except they don't. They sit on huge piles of money forever and ever and ever and never do anything good with it" (Director, Community Energy Project).

These top-down schemes offer promising ways to mainstream and scale up community energy, such as with the local authority as an ESCo, by supporting equity, or through new housing developments. Their ability to draw on centralised resources, including expertise, funding and the ability to deliver projects at scale, is advantageous. These features bring potential to increase the decentralisation of energy and benefit the local authority and society more widely. Such top-down schemes are, however, challenged by the shortage of resources within local authorities to support their development. For some communities

and citizens, top-down schemes that offer limited empowerment and democratisation may be counterproductive because they detract from the core values of the community (Seyfang et al., 2014). Without the deeper levels of engagement afforded by bottom-up schemes, buy-in to the schemes and behaviour change that supports sustainability could be limited. One participant raised concerns about whether such schemes would actually be good for the community.

"… just dumping a collective buying scenario for this, it would be lovely PR, but it actually wouldn't be a long-term thing. It would again be about saving money and making the council look good and all lovely things with the council. But they're not necessarily good things for the community" (Co-Director, Community Energy Project).

The concern with top-down schemes, therefore, resides in the fact that they are *done to* rather than *done by* the community. While these schemes offer scalability, they may not engender community support or lead to community cohesion, and problems of trust between the stakeholders can arise.

4.3 Hybrid

Smith et al's (2016) describe a hybrid route to developing community energy schemes, involving energy partnerships with business, local government or the third sector. Hybrid schemes go beyond the shared ownership models that Goedkoop and Devine-Wright (2016) describe, where communities benefit from a utility-led project through a

community fund, but have little control over the project. Hybrid schemes, which are energy partnerships that draw together community passion with the resources and expertise of business and local government, could be an important route to developing local community energy projects.

> "I think the only way forward is a hybrid model. If you are going top-down only, people at the bottom are not going to be interested or engaged and if you are coming bottom-up, they are going to find it very difficult to get engagement or support from the council" (Environment officer 2, local council).

A hybrid approach would mirror the changing definition of community energy, from one that focuses on isolated activities to a more networked approach. Under this approach, local authorities, businesses and third sector organisations can act as intermediaries that offer technical advice; give access to information, policy advocacy/support, business partnerships and professional services; provide access to buildings, loans, staff time or expertise, to help set up community energy businesses (Webb et al., 2017). As community energy changes, the findings suggest this intermediary role has opened up new business opportunities.

> "Or, even now, there's a growing number of much more sort of specialist groups that are trying to, you know, that actually offer specialist services, like Carbon Leapfrog, who do kind of explicitly offer accounting and legal assistance to

community energy groups and things like that. So, the field of intermediation has moved on quite a bit in the last couple of decades I guess" (Academic).

Such intermediary support is particularly useful in assisting the mainstreaming of community energy, as local groups need to create effective strategies that support environmental sustainability if they are to 'negotiate the dominant agenda and actors across regional, national and supranational scales to be effective' (Shaw et al., 2018, p. 266). A hybrid of intermediaries and community groups could be a valuable way of negotiating these challenges. However, the weak institutional links of community energy projects to the changes needed for the 'deep seated transformations' necessary to open up funding, are of particular concern (Smith et al., 2016, p. 428). One way to address this issue is through a hybrid model, in which the local authority, business or third sector's role is to create an environment where local community initiatives can thrive and top-down investment from intermediaries is encouraged. This approach has the additional benefit of meeting other local council targets for local engagement and creating opportunities for training and empowerment on dwindling budgets (Webb et al., 2017). One council officer saw this role as intermediary or facilitator as an important way to support community energy projects.

"So a hybrid where it's the council's role to create an environment where local community initiatives can thrive, to encourage top-down investment via the council" (Environment Officer, Local Council).

A hybrid approach, in which ownership and responsibility are shared between the community and the developer or local authority, could support more joined up ways of working. A jointly run ESCO was seen as a possible way to achieve a more hybrid approach.

"So I could imagine that we might have some kind of community interest company which would be like an ESCO, where the council could have like a holding majority, but it would be on a profitable basis. But with community, true community representation involved in the running of the company" (Environment Officer, Local Council).

Table 1 shows the different hybrid options, all providing a level of democratisation to community and citizens, involving partnerships between communities and organisations. This new way of working reflects how the energy sector is changing, with the emergence of new entrants, such as aggregators, to the system. These aggregators bring together energy from many different, often small and decentralised, sources to sell to the energy markets. Aggregators have a role in supporting small energy groups or individuals in selling their energy, which could encourage more widescale development of small community energy projects. One council participant suggested that aggregators may even take a role in leading the development of community-based energy schemes.

"If you have greater uptake of rooftop PV, it is all very well…the FIT scheme is coming to an end, but that is not going to stop the installation of more PV panels

on householders or on our new builds, but there will be a role for energy aggregators. I don't know if you have come across these. I see no reason why they can't be community based to aggregate the production of… the very small-scale production on a community basis for the benefit of the users" (Environment Officer 2, Local Council).

Partnerships, in which community groups and citizens work with aggregators or third sector groups, can help overcome some of the trust issues associated with councils or big energy companies (Goedkoop and Devine-Wright, 2016).

As the energy system changes and new technologies become the norm, there is a greater potential for hybrid approach involving intermediaries, local authorities and community energy companies. However, as the environment officer points out, there may be opposition from the incumbent energy companies, requiring legislation to support such a shift in paradigm.

"Now with smart metering and smart appliances and the internet of things and it all gets very app based and do you want your electric car to go into export mode overnight or during peak periods. There is a whole new community energy market there or energy in the community market there. Who is going to take advantage of that or control it or exploit it is unsure at the moment? I do see the role for community energy companies, I do see a role for local authorities to support it.

Whether the large utility companies will tolerate it I don't know. It will come

down to government legislation I suppose" (Environment Officer, Local Council).

Hybrid schemes could offer real potential for the mainstreaming of community energy through the combination of business and community partnerships, but as this analysis has shown would require different roles for local authorities and aggregators. Under these schemes, local councils would act as facilitators and intermediaries to support rather than to lead. The role of aggregators would be as intermediaries to support the market development for community energy. Such approaches have the advantage that communities are actively involved in the decision process, whilst getting the support and expertise they need to implement a project effectively. The disadvantages of hybrid schemes involving local authorities include issues of trust between them and the community. To take on this new role, councils need to be consultative and work closely with the communities, ensuring their opinions are fully considered. While hybrid schemes are likely to offer a more supportive environment than bottom-up schemes, and be more collaborative than top-down ones, it is unclear whether they will offer the scale required for decarbonisation. These schemes do, however, shift the concept of *community energy* to one of *energy in the community*.

5   Conclusions and Policy Implications

These pathways show the advantages and disadvantages of the different routes to mainstream community energy. The decarbonisation of the energy system will not be achieved purely through a technical fix. To deliver the new forms of flexibility needed to accommodate renewable energy sources, small scale adaptations must accompany

consumer behaviour change. Engaging consumers and communities in energy is an important way to achieve this end. Through this process, there are key roles for stakeholders, ranging from central government to local communities, in the development of community energy projects.

Although the hybrid approach offers much promise, all three pathways will be needed, depending on the context for the community energy project. This conclusion has important implications for how and who could use these insights. For policy makers in government and the regulator (Ofgem), an awareness of all of these pathways is critical to ensure the right kind of policy and regulatory support to develop community energy.

Incumbent businesses in the energy sector, need to understand how community energy can be incorporated symbiotically into existing arrangements and to consider potential new business models. These businesses have had limited interaction with households and communities, instead regarding consumers as energy recipients at the ends of wires. Yet consumers and communities have a pivotal role in the energy system's future. By engaging with these pathways to identify how they might work with communities, changing who performs an activity (Amit and Zott, 2012), these businesses will be in a stronger position to meet the challenges of energy decarbonisation.

These insights are also useful to new entrants to the market. For example, aggregators could play an important role in these pathways - particularly under a hybrid approach - through developing a market for small-scale, decentralised energy production and energy

services. Developing and understanding these pathways, could result in the expansion of the aggregator market. A greater role for aggregators would help to support the democratisation and decentralisation of energy and promote competition in the sector and commercialisation of community energy (Bolton and Hannon, 2016). However, policymakers need to recognise this role, to enable the development of policy and regulation that supports growth in this area.

There are also implications for local authorities, as they navigate delivering low carbon targets, while balancing their budgets in an environment of decreasing funding. As a government body they also have a responsibility to ensure equity and to help fight fuel poverty. Further developing their role in either top-down or hybrid pathways could lead to progress in each of these areas. Finally, these insights are crucial to community leaders. By understanding their role in helping to meet the challenges the energy sector is facing, communities could benefit from earning income, having a voice in the energy sector, and enhancing the community through the wider benefits of community energy projects.

Community energy through a reconfiguration pathway (Geels and Schot, 2007), has the potential to support the decarbonisation of the energy network, whilst also leading to a decentralised and democratised system. Its role could be vital in aiding this paradigmatic shift from fossil fuelled to low carbon energy production, while also supporting more flexible ways to manage supply and demand, such as through energy storage and demand management.

As this paper has shown, community energy ranges from larger top-down schemes, such as wind farms that have been *done to* communities, to bottom-up schemes that they run and lead. Top-down schemes that are *done to* rather than *done by* communities, offer potential scalability that could support the decarbonisation of the energy network, but also risk alienating local people. Bottom-up schemes offer greater democratisation but have more limited opportunities to be scaled up. Hybrid schemes could offer the best of both worlds, delivering scalability, whilst giving power and control to the communities.

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