2015 **Energy Research Partnership**

Community energy and the low-carbon transition

The Energy Research Partnership

The Energy Research Partnership is a high-level forum bringing together key stakeholders and funders of energy research, development, demonstration and deployment in Government, industry and academia, plus other interested bodies, to identify and work together towards shared goals.

The Partnership has been designed to give strategic direction to UK energy innovation, seeking to influence the development of new technologies and enabling timely, focussed investments to be made. It does this by (i) influencing members in their respective individual roles and capacities and (ii) communicating views more widely to other stakeholders and decision makers as appropriate. ERP's remit covers the whole energy system, including supply (nuclear, fossil fuels, renewables), infrastructure, and the demand side (built environment, energy efficiency, transport).

The ERP is co-chaired by Professor John Loughhead, Chief Scientific Advisor at the Department of Energy and Climate Change and Dr Keith MacLean (formerly Director of Policy & Research at Scottish and Southern Energy). A small in-house team provides independent and rigorous analysis to underpin the ERP's work. The ERP is supported through members' contributions.

ERP Membership

Co-Chairs		
Prof John Loughhead FREng	Chief Scientific Advisor	DECC
Dr Keith MacLean	Independent industry co-chair	
Members		
Dr Julian Allwood	Reader in Engineering	University of Cambridge
Carl Arntzen	Managing Director	Bosch Thermotechnology Ltd
Dr Peter Bance	Entrepreneur in Residence	Origami Energy Ltd
Dr Masao Chaki	Chief Researcher	Hitachi Europe Ltd
Dr David Clarke FREng	Chief Executive	Energy Technologies Institute
Tom Delay	Chief Executive	Carbon Trust
Miles Elsden	Acting Chief Scientific Advisor	DfT
Peter Emery	Production Director	Drax Power Limited
Angus Gillespie	Vice President CO_2	Shell Int'l Petroleum Co. Ltd
Dr Martin Grant FREng	Chief Executive Officer - Energy	WS Atkins PLC
Derek Grieve	Exec Leader – Systems & Projects Eng	GE Energy Power Conversion
Dame Sue Ion FREng		Royal Academy of Engineering
Prof Neville Jackson FREng	Chief Technology & Innovation Officer	Ricardo UK Ltd
Dr Ron Loveland	Energy Advisor to Welsh Government	Welsh Government
Margaret McGinlay	Director, Energy & Clean Technology	Scottish Enterprise
Duncan McLaren	Advisor	Friends of the Earth, UK
Prof John Miles FREng	Director & Professor of Energy Strategy	Arup / Cambridge University
Professor Philip Nelson	Chief Executive	EPSRC
Rob Saunders	Head of Energy	InnovateUK
Phillip Sellwood	Chief Executive Officer	Energy Saving Trust
Robert Sorrell	Group Head of Technology	BP
Marta Smart	Head of Partnership Funding	SSE
Stephen Trotter	Managing Director, Power Systems	ABB Limited
Dr Jim Watson	Executive Director	UK Energy Research Centre
Nick Winser FREng	Executive Director, Transmission	National Grid
Andrew Wright	Finance Director	Ofgem
Jonathan Yewdall	Assistant Director, Green Growth Team	BIS

Table of contents

The Energy Research Partnership Reports

ERP Reports provide an overarching insight into the development challenges for key low-carbon technologies. Using the expertise of the ERP membership and wider stakeholder engagement, each report identifies the challenges for a particular cross-cutting issue, the state-of-the-art in addressing these challenges and the organisational landscape (including funding and RD&D) active in the area. The work seeks to identify critical gaps in activities that will prevent key low-carbon technologies from reaching their full potential and makes recommendations for investors and Government to address these gaps.

This project was guided by a steering group made up of experts from ERP members and other key organisations, as listed below. The views in this report are not the official point of view of any organisation or individual and do not constitute government policy.

Lead Analyst
Simon Cran-McGreehin Energy Research Partnership

Steering Group

Naomi Luhde-Thompson	Friends of the Earth
Anna Wieckowska	Hitachi
Laura Morris	The Energy Technologies Institute (ETI)
Christian Inglis	Innovate UK
Chris Noyce	Economic and Social Research Council (ESRC)
Fiona Booth	Department of Energy and Climate Change (DECC)
Ron Loveland	Welsh Government

We would like to thank all those who helped inform this work, including the wide range of experts that were interviewed (see Annex).

If you have any queries please contact Simon Cran-McGreehin (simon.cran-mcgreehinp@erpuk.org).

Summary

The UK's energy sector is undergoing significant changes due to the need to replace aging infrastructure, the impacts of new technologies entering the sector, and the need to decarbonise, whilst seeking to maintain security of supply and limit long-term costs. This transition offers an opportunity to decide between replacing existing centralised systems and perpetuating the current regimes, and moving to a more decentralised system. Such a decision would have to be based on an assessment of the costs and benefits of both approaches, and combinations thereof.

A greater role for decentralised energy can be attempted by various routes: through incumbent energy companies, by focussing on individual customers, and at a community level. Community energy projects can seek to deliver a range of benefits, both in terms of energy and wider factors. Community energy projects are already a core part of the energy sectors in Denmark and Germany, and offer alternative approaches in other markets and emerging energy sectors.

This report considers the role of community energy in the transition to low carbon energy. The key question for the project is whether the advantages of community energy justify reframing markets, regulations and policy to address challenges and incentivise community energy projects. This report is based on a review of the literature, and interviews with organisations with interests in community energy. The work was guided by a steering group drawn from member organisations of the Energy Research Partnership (ERP), and has links with other ERP projects, including on Cities, Smart Energy, and Public Engagement.

Community energy in the UK

Community energy can be defined as energy projects in which local residents have a shared stake and from which they receive benefits. Community energy is of a decentralised scale by nature, owing to its capacity and ownership. These projects can produce energy, reduce energy use, manage energy demand and purchase energy. Some projects attempt a combination (e.g. using income for energy production to fund energy efficiency projects), and some make use of energy storage. Community energy projects are larger than individual homes or businesses, and can range up to municipal systems. They can be owned and run by groups of residents, local organisations (e.g. schools), local councils, community energy support groups, co-operatives, or businesses working in partnership with communities. Whatever the business model, the key distinguishing features are the shared community stake and benefits.

Community energy is being promoted by the UK and Devolved Governments. The UK Government published its Community Energy Strategy in 2014,[1] and an update on this strategy in early 2015.[2] The Scottish Government has consulted on its Community Energy Policy Statement (CEPS).[3] Community energy features in Welsh Government's energy strategy,[4] and the Northern Irish administration intends to develop an action plan for community energy.

Over 5,000 community energy groups are active in the UK. Renewable electricity projects provide at least 60MW of generation capacity (0.3% of the UK's installed renewable capacity of 18GW), of

[1] Community Energy Strategy (DECC, 2014)
[2] Community Energy Strategy Update (DECC, 2014)
[3] Community Energy Policy Statement – Draft for public consultation (2014)
[4] A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement (2010)

which c.43MW is in Scotland (c.70%).[5] The Scottish Government has an ambition for 500MW by 2020.[6] Independent modelling suggests that the UK has the potential for between 0.5GW and 3GW of community renewable electricity capacity by 2020.[7] A study concluded that community energy (including joint ownership) could account for 5.27GW of generation capacity by 2020 (almost 20% of the UK's forecast renewable energy capacity).[8] Another study concluded that c.1.5GW of solar PV capacity could be installed on schools.[9] Germany is the best example of this approach: over 40GW of renewable electricity generation capacity[10] is directly owned by an estimated 1 million small energy suppliers including households, farmers, and community co-operatives.

The role of community energy

Community energy has the potential to engage local communities to bring two main broad benefits: acceptance of change; and engagement with energy production and consumption. It can set up a "virtuous circle" involving: increased "energy literacy"; greater acceptance of the case for change; greater acceptance of new technologies, infrastructure and behaviours; and greater engagement with energy. This can bring benefits to the local communities in terms of greater security of supply and lower energy costs (e.g. through energy efficiency, or local energy production). It can also provide income from incentive schemes that can be reinvested to bring further energy benefits, or other community benefits (e.g. employment, community cohesion, funding for local services, etc.). Community energy can also provide benefits to wider society, by reducing pressure on the energy system, by providing low-carbon energy, and by making communities more self-reliant.

Acceptance of, and interactions with, energy can be affected by "governance arrangements", i.e. which entities have a role in a project's initiation, ownership, deployment, operation and regulation. Acceptance of the changes that are necessary for the energy sector's low-carbon transition has a very local and personal context. Individual consumers use energy in accordance with basic needs (e.g. heating) and social norms (e.g. entertainment). Expectations about energy's costs, other impacts, and convenience are shaped by personal experience and wider views in society about environmental impacts, energy companies' motives, and fairness (including the types of benefits, who receives those benefits). Energy customers can be more willing to accept changes and support the low-carbon transition if they understand the issues, are involved in the decisions, and are supported in the implementation. These steps might be facilitated more easily if there is community involvement (as well as, or instead of, corporate or individual efforts).

Members of society have a range of views about the deployment of infrastructure, based on views about technologies or deployment in particular locations. With more involvement from local residents, projects can be tailored to bring local benefits and to reduce unwanted impacts. With more support from local residents, infrastructure can be more likely to receive planning permission, and with fewer delays and lower costs. Local support is more likely to apply to local energy projects where communities can more easily identify with the projects' benefits; it is less applicable to wider infrastructure projects that have negative local impacts but less tangible local benefits.

[5] This c.43MW is part of Scotland's total of 285MW of "community or locally owned" renewable electricity projects (c.4% of Scotland's total installed capacity of 6.6GW).
[6] Renewable Energy for Communities (Scottish Government, last updated 2013)
[7] Community Renewable Electricity Generation: Potential Sector Growth to 2020 (Peter Capener, 2014)
[8] The Community Renewables Economy – Starting up, scaling up and spinning out (Respublica, 2013)
[9] Run on Sun (Friends of the Earth, 2014)
[10] This is about half of Germany's renewable electricity generation capacity, which is in turn about half of its total electricity generation capacity.

Community involvement can assist in following through on consumer-focused approaches, to deliver intended benefits. Energy-related benefits can come through combinations of changes in outlook and access to funds. If local residents undertake a project, this can change their outlook by increasing their awareness of issues ("energy literacy"), and their motivation to act to try to address these issues.

If greater engagement with energy through community projects causes residents to appreciate the challenges of meeting wider energy needs, then they might be more willing to accept other energy infrastructure. Alternatively, an experience of a particular technology could make a community less supportive of wider infrastructure and more interested in local energy. When trying to determine attitudes (and changes in attitudes), surveys must be designed carefully and used consistently, because responses can vary considerably according to the questions asked and options presented.

Community energy projects can also deliver benefits that are not related to energy usage, e.g. local services and employment (albeit some employment can also be provided by other energy projects). Indeed, many community energy projects are motivated by financial, social and environmental objectives, and energy is simply a convenient vector.

Challenges and solutions

Community energy in the UK faces challenges: some are intrinsic to community energy (e.g. skills needed), and some are extrinsic (e.g. regulations). Some challenges apply more widely to decentralised energy projects (e.g. obtaining planning permission). Where a challenge exists, there are two interlinked questions. Firstly, do the benefits of the project justify addressing the challenge? Secondly, what would be an appropriate means of addressing the challenge?

Predicting benefits

It is important to forecast the net effects of any energy project, including community energy projects. This should be as accurate as it practicable (but without providing spurious accuracy). A forecast should include the full range of inputs and outputs, including non-financial factors. It would be beneficial if community energy projects gathered certain key information about: costs or requirements; available resources; energy benefits; and non-energy benefits. There would also be benefits in decision-making organisations making a more holistic assessment of the overall costs and benefits of energy projects. A key issue is the choice of a suitable counterfactual: simply measuring against the current centralised system (and its markets and regulations) could fail to identify a more efficient overall solution for a different future energy system.

Deploying projects

There are two questions about the deployment of community energy. Firstly, why are comparatively few community energy projects attempted? Secondly, if they are attempted, why do some projects not reach deployment? The answers to both questions are similar. However a project is initiated (by residents, or an external party such as a public agency, a support organisation, or a commercial partner), it relies upon interest from residents. Many residents are interested in community energy projects in principle,[11] and some communities are very enthusiastic about their own (proposed)

[11] See, for example, a recent survey that found that 42% of people would be interested in taking part in community energy (if they could save money on their energy bills). (Research for DECC, 2014)

projects. Where interest is lacking from residents, this can be due to disengagement from energy (reinforced by political and media messages), or a general lack of involvement in community activities. Some communities views are split, e.g. between local benefits and visual impacts.

Few communities have all of the necessary skills to develop and deploy a project, and can find it hard to match up with organisations that can help. Funding is a challenge, with many projects having to seek start-up funds from various different sources, and using incentive income that could fall in future. Planning permission introduces challenges, partly through different interpretations of guidance. Energy regulations pose challenges: market rules can be complex; retail market simplification could reduce the scope to offer community level tariffs; and some network costs are placed upon new entrants (and not shared with incumbents). Some commentators argue that the UK's energy sector has reached a point where it faces a key decision: either to continue in the centralised model with some incremental changes; or to actively move to a more decentralised system. Various alternative market and regulatory arrangements have been proposed, involving local communities, local authorities, and other groups. Not-for-profit arrangements could warrant lesser regulatory requirements, which could match better with community project's capabilities. Ofgem is considering non-traditional business models, and there would be merit in conducting trials to determine the benefits that each can deliver, the interactions with other parts of the energy sector, and the level of regulation that would be appropriate.

Delivering benefits

In order to deliver energy benefits, other local benefits, and benefits to wider society, projects need different skills and local networks, compared to those needed for initiation and deployment. Bringing about the full benefits of a project requires involvement from as much of the community as possible, especially to engage in demand reduction and social action. Success in this depends upon the closeness of the links between the leadership group and key local "opinion formers" and trusted networks. There can be advantages to involving organisations (e.g. local authorities) that have an understanding of the issues across the different residents of the community, so long as residents still have a sufficient role in the project.

Some examples of community energy have strong feedback loops that can help to initiate and sustain residents' engagement with a project. Some communities have strong technical feedback loops: isolation from the main energy networks makes customers focus on demand reduction and balancing (especially if they use variable renewable sources). Other examples have strong financial feedback loops: local supply over private wire systems can provide lower energy prices. These types of examples are rare, and other means would have to be found of engaging most customers in the short term.

Having multiple objectives can offer advantages, but can pose risks. Non-energy benefits can help to justify spending on community energy, and the objectives are usually aligned, but it can be difficult to agree on a suitable balance (e.g. between maximising energy savings, and maximising benefits for vulnerable customers). Finally, projects should be aware of the risks of unintended consequences, including cheaper energy increasing unnecessary consumption, or a sense of community self-reliance reducing support for other infrastructure.

Conclusions and recommendations

Community energy can be an effective means of delivering important benefits, both in the energy sector and beyond. There are examples from around the UK and from other countries in which community energy has delivered benefits, including: new energy sources with less local opposition; area-wide improvements to buildings' energy efficiency; community level balancing of supply and demand; and greater interest in debates about energy. Projects have also delivered other benefits to communities and society more broadly, including: income streams to fund local services; training and employment; improved health of residents; and greater community cohesion and population retention. To realise the benefits of community energy in the UK, it would be necessary to address challenges that they face, but to so in a way that is justified by the benefits that they can bring.

There are opportunities to improve the way that impacts are predicted and assessed, to take into account the full range of costs and benefits: the community energy sector could provide more evidence of the costs and benefits of projects; and decision makers could consider the whole range of costs and benefits in a co-ordinated and consistent manner.

- ***We recommend steps to improve forecasts and assessments of community energy projects:***
    - ***DECC and the Devolved Administrations should develop recommended approaches for monitoring and evaluating community energy projects, and for use in business cases for proposed projects.***
    - ***DECC and the Devolved Administrations should develop guidance for decision-makers (funding, planning permission, energy regulation) for assessing community energy in a holistic and co-ordinated manner.***

There are opportunities to increase deployment of projects, initially through trials of new technologies, services and regulatory arrangements, all of which could then be useful for the larger-scale uptake of projects. Intrinsic challenges (particularly the need for skills and expertise) can be addressed in some cases by partnering with organisations that have mutual interests, including trialling new technologies and services. External challenges (including energy regulations) could be addressed by alternative local arrangements for energy.

- ***We recommend steps to encourage uptake of community energy projects, through trials of new technologies, services and regulatory arrangements, that will also provide useful results for future uptake:***
    - ***Support groups should develop a database of community groups that are interested in participating in trials of technology and services, to allow product developers and service providers to more easily find suitable partners.***
    - ***DECC and Ofgem should agree a plan to trial alternative arrangements for local energy (including the role of storage) throughout the UK, with appropriate funding and commensurate regulatory requirements.***

There are opportunities to increase the delivery of expected benefits. This can be done in part by providing community energy groups with more guidance and advice for developing their own abilities. It can also be done by allowing community energy groups to delegate certain tasks (e.g. administrative or legal) to other organisations.

- ***We recommend steps to improve the deployment of community energy projects, and the delivery of their expected benefits:***
    - ***DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice and delegate tasks.***

1 Introduction

The UK's energy sector is undergoing significant changes due to the need to replace aging infrastructure, the impacts of new technologies entering the sector, and the need to decarbonise, whilst seeking to maintain security of supply and limit long-term costs The UK has had a centralised system; this infrastructure is being replaced, but changing technologies and objectives mean that replacements will not all be like-for-like. There are options for the future energy systems, and an opportunity to choose which type of the systems the UK wants. Technology, markets and policy all shape (and are shaped by) each other, and it is appropriate to consider all of options and how they could be (or not be) compatible.[12]

There is an increasing role for decentralised energy production: much renewable power generation is naturally dispersed, and heat has to be produced near to customers. There is also an increasing role for a more customer-focused sector, thinking less in terms of consumers and more in terms of participants who can aid the transition by supporting changes and engaging with energy. There is an increasing role for smarter networks to help to manage the interfaces between supply and demand. The transition poses challenges, but also offers opportunities locally and more widely. For example, innovations in heating controls can link with communications systems to offer greater convenience, and to allow researchers to study health indicators for vulnerable residents. Similarly, innovative financing and ownership models for electric vehicles could make travel more widely affordable.

Decentralisation and greater involvement by customers could be brought about at different scales. At a large scale, incumbent energy companies can change their practices to involve customers more in infrastructure decisions, and in demand reduction and balancing. At a small scale, individuals can engage in the retail market, and can produce heat or power. At a mid-scale, communities can undertake energy projects that have community involvement and that seek to provide local benefits.

This report considers community energy as part of the low-carbon transition, in which engagement is a key part of both winning support for change and for delivering that change. The report considers the question of whether the advantages of community energy and its potential in the UK justify reframing markets, regulations and policy to address challenges and incentivise community energy projects. Section 2 discusses the theory of change for how community energy can deliver decarbonisation and wider benefits, and introduces different approaches that can be used to overcome challenges faced by projects. Section 0 presents an overview of community energy in the UK, including estimates of its technical potential, and examples from around the UK and from other countries. Sections 4, 0 and 6 identify challenges faced by community energy, in predicting benefits, deploying projects and delivery benefits. Section 7 summarises the report's conclusions and recommendations.

This report is based on a review of the literature, and interviews with organisations with interests in community energy (see **Error! Reference source not found.**). The project was guided by a steering group drawn from member organisations of the Energy Research Partnership (ERP) (as listed above). Some of the issues raised in this report have links with other ERP projects, including:

- *Public Engagement* highlights publics' roles in developing an approach to the transition;
- *Cities* considers the energy systems in urban areas, including the role of local authorities; and
- *Heating buildings* considers approaches to improving customer engagement with energy.

[12] See, for example: Distributing Power: A transition to a civic energy future (Realising Transition Pathways, 2015); and City Energy: A new powerhouse for Britain (IPPR, 2014).

2. The role of community energy

This section presents an overview of how community energy can deliver changes in the energy sector and more widely.

Overview

Community energy can be broadly defined as energy projects in which local residents have a shared stake and are the intended (but not sole) beneficiaries. Projects include energy generation, demand reduction (energy efficiency), demand balancing, and switching suppliers.[13] Community energy projects are larger than individual homes or businesses, and can range up to municipal systems.[14] They can be run by groups of residents, local organisations (e.g. schools, faith groups, etc.), local councils, community energy support groups, or businesses working in partnership with communities. The key distinguishing features are that the community has a stake and receives benefits.

Community energy has the potential to engage local communities in energy matters, to bring two main benefits: acceptance of change, including new technologies and behaviours, and local infrastructure; and engagement with energy, including demand reduction and balancing. Acceptance of change and engagement with energy do not necessarily occur in a set order. Indeed, they can occur concurrently, or in a cycle with feedback loops to build up a "virtuous circle", as illustrated in Figure 1. Community energy can feed into this cycle at multiple points.

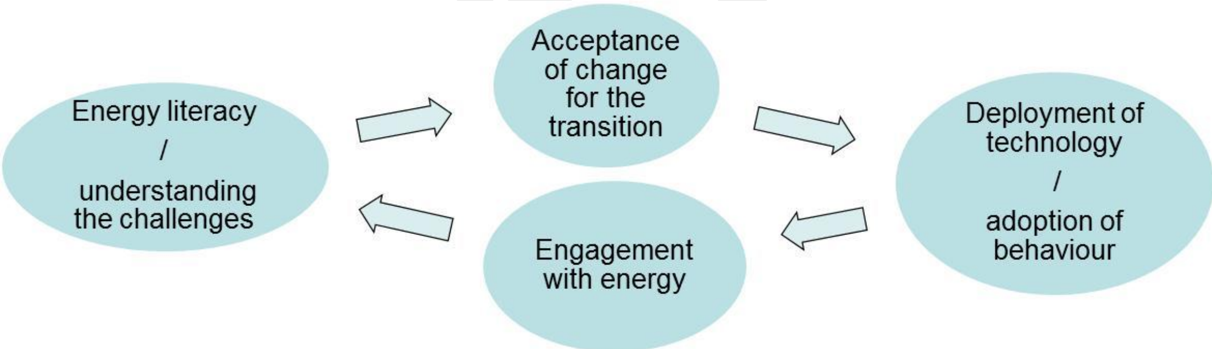

Figure 1: Illustration of the "virtuous circle" that can be established by greater public acceptance of change and engagement with energy.

Acceptance of change

Public acceptance of change for the low-carbon transition is affected by various factors. Of the various viable options, some will succeed if they become less expensive and if they have sufficient public support or interest. Acceptance of, and interactions with, energy can be affected by "governance arrangements", i.e. which entities have a role in a project's initiation, ownership, deployment, operation and regulation. The current governance arrangements are based around the centralised energy systems with large incumbent energy companies and many individual customers. Energy companies own most of the energy infrastructure (much of it previously national assets, paid

[13] See, for example: DECC's "Power to Switch" campaign
[14] Community energy might lose some economies of scale in energy production, compared to large traditional energy projects; but it gains economies of scale for projects that are usually conducted by individual customers (e.g. microgeneration, retrofitting buildings, switching suppliers, etc.)

for by public funds), and individual energy customers have deployed most of the demand-side technologies (e.g. by purchasing appliances). Recently, these roles have been altering and becoming more mixed (although these changes have been undertaken within the context of the existing arrangements that are based around the incumbent energy companies). Energy supply companies had an increasing role in demand-side deployment (e.g. retrofit of buildings through Government schemes), and customers have an increasing role in the deployment of small-scale energy production. There are examples where local authorities (or housing associations) take on a role, providing energy services for their estate and tenants. This can range from co-ordinating between organisations to facilitate a project (e.g. for micro-generation, building refurbishments, etc.), through to funding and owning projects (e.g. heat networks).

Acceptance of the changes that are necessary for the energy sector's low-carbon transition has a very local and personal context. Individual customers use energy in accordance with basic needs (e.g. heating) and social norms (e.g. entertainment). View about the cost and other impacts of energy are shaped by personal experience wider views in society about environmental impacts, energy companies' motives, and fairness (including the types of benefits, and who receives those benefits). Customers can also have concerns based on lack of experience, where they have little evidence of how certain technologies could enhance their lives. They can struggle to assimilate climate change into their thinking, given its enormity, the inherent difficulty of predicting exact impacts, and the fact that it will have more of an impact upon future generations.

Acceptance of technology can be affected by customers' views of that technology. For example, solar PV can be popular as a "status symbol", whereas external insulation for buildings can be unpopular in part because of the appearance, and smart metering can be resisted due to concerns about privacy. Acceptance of behaviour changes is also affected by consumers' views of their own scope and limits for changing their energy use and habits. Consumers can be more willing to accept changes and support the low-carbon transition if they understand the issues,[15] are involved in the decisions,[16] and are supported in the implementation. Education, involvement and support can be more effective if provided at a community level, whereby residents can discuss issues with each other, seek trusted advice, and find strength in numbers. Local residents can be more likely to accept change as part of a wider community project, e.g. refurbishing multiple buildings together helps with arranging the work, providing trusted advice, offering cost savings through economies of scale, and providing momentum to extend the scope.

Residents also have views about the deployment of infrastructure. There can be general support or opposition to particular technologies, or specific support or opposition based on local issues. Residents can be more accepting of infrastructure in their local area if they initiate (or have a stake in) the project. Acceptance of infrastructure can be affected by views on the technology, e.g. opposition on environmental grounds to nuclear and shale gas. It can also be affected by views about deployment in particular locations, e.g. opposition on the grounds of visual impact to electricity transmission lines or wind turbines.[17] With involvement from local residents, a project can be tailored to bring local benefits and to reduce unwanted impacts. With support from residents, infrastructure can be more likely to receive planning permission, with fewer delays and lower costs. This support is more likely to apply to localised energy projects where communities can more easily identify with the projects' benefits; it is less applicable to wider infrastructure projects that have with local impacts but fewer tangible local benefits (albeit they can provide employment).

[15] See, for example: Big Ideas (The National Energy Foundation, 2014).
[16] See, for example: What's the missing ingredient in UK energy policy governance? (CSE, 2014)
[17] See, for example: Beyond Nimbyism: A Multidisciplinary Investigation of Public Engagement with Renewable Energy Technologies (The IGov Project, University of Exeter, 2007)

Engagement with energy

Once initiated, consumer-focused approaches have to be followed through in order to deliver the intended benefits; community involvement can assist with this. Energy-related benefits can come through combinations of changes in outlook and access to funds. If local residents undertake a project, this can change their outlook by increasing their awareness of issues ("energy literacy"), and their motivation to act to try to address these issues. For example, involvement in a renewable energy project can give residents an appreciation of the challenges of meeting demand and of balancing generation and demand. Some residents can afford to act upon the knowledge (e.g. by retrofitting buildings); others can only afford to act if given financial assistance, which can come from the income from the local energy production; and others might respond purely to the financial arguments and use the available funds. These benefits can be more effectively delivered at community level, where mutual support from residents can encourage engagement, and the impacts of many residents can be aggregated to provide a larger overall impact. The benefits of these changes are not just local: demand side measures can reduce the pressure on networks and energy sources, hence reducing some challenges for the system operators and costs for other customers.

Feedback loops can help to initiate and sustain this engagement with energy. Strong technical feedback loops exist in communities that are isolated from the main energy networks, making customers focus on demand reduction and balancing (especially if they use variable renewable sources). However, this type of technical feedback is not possible or desirable in most cases: there are distinct benefits to the vast majority of communities and customers being linked by the main energy networks. Strong financial feedback loops exist where customers have a local supply over private wire that offers lower energy prices (as opposed to normal retail energy prices for individual residents and separate incentive payments to the community). However, most community energy projects would need to receive funds in that way to perpetuate their work.

There is a question of whether community energy projects can increase acceptance of energy technologies more widely, beyond the technology for the community project itself. If greater engagement with energy through community projects causes residents to appreciate the challenges of meeting wider energy needs, then they might be more willing to accept other energy infrastructure. There is also another possibility, whereby community energy does not affect views on other infrastructure, but rather the other way around; e.g. opposition to fracking at Balcombe was a reason why some residents supported the REPOWERBalcombe community energy project.

When trying to determine attitudes (and changes in attitudes), surveys must be designed carefully and used consistently, because responses can vary considerably according to the questions asked and options presented. For example, acceptance of a particular technology might differ depending on whether the question seeks a "for or against" view on that technology in isolation or a ranking alongside other technologies.

Wider community benefits

Community energy can also deliver benefits that are not specifically related to energy usage. This is not exclusive to community energy: all energy projects provide employment during deployment. However, community projects can be specifically targeted to meet needs identified by local residents and groups (e.g. charities, clubs, faith groups, etc.), including employment offered directly by the project and services funded by project income. Indeed, many community energy projects are motivated by financial and social objectives, and energy is simply a convenient vector.

Challenges and solutions

From examples discussed in the following sections, it is possible to identify factors that contribute to the success of community energy projects. When considering success, it is important to focus not just on deployment of projects (inputs), but also on delivery of the expected benefits (outputs). The examples also illustrate some challenges that community energy projects can face, i.e. when its resources are insufficient to meet a requirement. This section briefly introduces different approaches to addressing challenges, for reference later in this report.

Some challenges are intrinsic to community energy (e.g. skills needed). Some challenges are extrinsic (e.g. regulations), and might be purely a result of a particular "point of view" (e.g. the way that cost-effectiveness is measured in the context of the current energy sector). Some challenges apply more widely to energy projects (e.g. obtaining planning permission). Where a challenge exists, there are two interlinked questions. Do the benefits of the project justify addressing the challenge? And, what would be an appropriate means of addressing the challenge (including when the costs of the approach are included)?

The main options for addressing challenges are illustrated in Figure 2: change the project's scope to avoid some of the requirements; increase the resources (e.g. incentive payments); change the requirements (e.g. regulatory derogations); or change the evaluation process. This last option (changing the evaluation process) is the most radical; but, if it was justified by evidence, it could perhaps be the simplest in the longer-term by avoiding complex incentive payments or derogations to existing regulations.[18] Changing the evaluation process can have two elements: if wider benefits are taken into account, then more resources could be attracted to a project; and if incremental impacts are attributed more widely (i.e. not just to new entrants, but also to other participants who are using the existing infrastructure) then the requirements will be lesser for new projects. These different approaches are considered in Sections 4, 0 and - for key challenges that are identified.

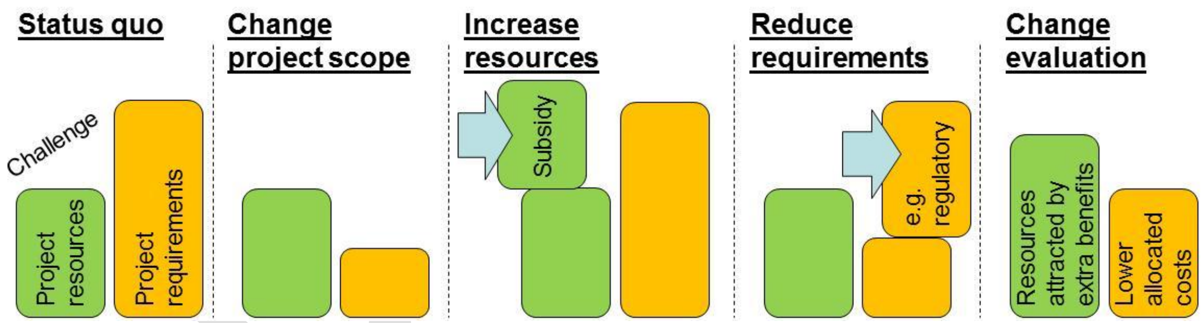

Figure 2: Illustration of different approaches to addressing challenges faced by energy projects.

[18] See, for example, a discussion of how Germany has changed the nature of its energy market: Allies in Energiewende (Alan Simpson, 2014)

3. Examples of community energy

This section provides a brief overview of community energy in the UK, and then presents examples from around the UK and in other countries, to illustrate the benefits that motivate different projects.

Overview in UK

Community energy is being promoted by the UK and Devolved Governments. The UK Government published its Community Energy Strategy in 2014,[19] and an update on this strategy in early 2015.[20] The Scottish Government has consulted on its Community Energy Policy Statement (CEPS).[21] Community energy features in Welsh Government's energy strategy,[22] and the Northern Irish administration intends to develop an action plan for community energy.

Over 5,000 community energy groups are active in the UK.[23] Community energy schemes in the UK have a range of ownership structures, including joint ownership within a community, local authorities acting on behalf of local residents, community share options in commercial projects, and joint ventures. Some projects draw on expertise from a number of organisations, e.g. local authorities co-ordinate the work, residents provide knowledge of local needs, technology providers trial technology, and energy supply companies provide tariffs.

Renewable electricity projects have the highest profile: they account for at least 60MW of generation capacity (0.3% of the installed renewable capacity of 18GW, and 0.07% of the total 89GW of installed generation capacity of 89GW).[24] Scotland accounts for 43MW (c.70%) of the UK's renewable electricity community energy capacity, part of a total of 285MW of "community or locally owned" renewable electricity projects (c.4% of Scotland's total installed capacity of 6.6GW).[25]

Independent modelling suggests that there is a potential of between 0.5GW and 3GW of community renewable electricity by 2020 in the UK;[26] the Scottish Government has an ambition for 500MW by 2020.[27] A report from 2013 concluded that community energy (including joint ownership) projects could account for 5.27GW of generation capacity by 2020 (almost 20% of the UK's forecast renewable energy capacity).[28] A study has concluded that c.1.5GW of solar PV capacity could be installed on schools, and noted that the potential would be even larger if extended to other community buildings.[29] With regards to community energy, heat it is a less developed area, although heat projects make up a third of those to receive funding under the Rural Community Energy Fund (RCEF). DECC's Community Energy Sector Survey in 2016 will gather more information about projects that use heat, energy efficiency and demand-side response.

[19] Community Energy Strategy (DECC, 2014)
[20] Community Energy Strategy Update (DECC, 2014)
[21] Community Energy Policy Statement – Draft for public consultation (Scottish Government, 2014)
[22] A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement (2010)
[23] Community Energy Strategy (DECC, 2014)
[24] Community Energy Strategy (DECC, 2014)
[25] Community Energy Policy Statement – Draft for public consultation (Scottish Government, 2014)
[26] Community Renewable Electricity Generation: Potential Sector Growth to 2020 (Peter Capener, 2014)
[27] Renewable Energy for Communities (Scottish Government, last updated 2013)
[28] The Community Renewables Economy – Starting up, scaling up and spinning out (Respublica, 2013)
[29] Run on Sun (Friends of the Earth, 2014)

Scotland

Most of Scotland's c.240MW of "locally owned" capacity is owned by local land owners as opposed to jointly by members of a community; these projects are not necessarily designed to bring the same benefits as community energy projects. The minority (43MW) is under community ownership. This comparatively high uptake of community energy in Scotland has been driven partly by technical and political factors. Renewable generation offers an alternative to diesel-powered generators for island communities that are not connected to the mainland networks (e.g. the Isle of Eigg[30]), and to remote communities that are often cut-off from the networks during bad weather (e.g. the Isle of Gigha[31]). The political factors include land reform (with rural communities having greater rights to buy the land that they have rented), and the preservation of remote communities (which require income streams for employment and services). Both of these policies involve improving the financial situation of the communities through some combination of reducing energy costs (e.g. by offering an alternative to diesel generation), and providing income (e.g. from incentive payments for renewable electricity generation). Any vector would have sufficed (e.g. perhaps tourism or water) if it had had an economic case, but renewable energy was the most obvious because of its abundance, because of its financial incentives, and because it aligned with other policy objectives (particularly around climate change). It has allowed different government departments and agencies (both devolved and regional) to work together to provide grants, loans and guidance (often through a single delivery agency, the Community and Renewable Energy Scheme (CARES)).

Other projects in Scotland have developed without these strong technical and political drivers. The village of Fintry[32] is on the main grid, and its projects were motivated by improving the energy efficiency of buildings in the village, including to address fuel poverty. To finance these projects, the scheme borrowed money from a wind farm developer to enter a joint venture for one wind turbine on the developer's wind farm. Planning applications, grid connections, etc. were undertaken jointly with the commercial developer. The feed-in tariff income from the turbine is used to repay the loan (over a period of 15years) and to fund the village's energy efficiency activities. The project was instigated by locals, backed by the community council, and efforts were made to involve the local community in a range of energy-related initiatives. It is seen by many as an excellent example of community energy, and members of the project are invited to advise other communities.

Wales

The motivations for community energy in Wales come partly from local initiatives. For example, the Awel Amen Tawe[33] project uses funds from solar energy to fund other local energy projects; two wind turbines are also planned, but have taken over ten years to move through the various stages of plans and permissions. Initially, the main local motivation was climate change mitigation, but increasingly it is energy efficiency to alleviate fuel poverty, particularly in areas with solid wall homes and no mains gas (e.g. the Talybont on Usk[34] scheme has refurbished a small hydroelectric power station and uses the income to fund energy-related community projects). Motivations are also partly due to Government policies to tackle poverty, create employment and reduce greenhouse gas emissions. The support scheme, Ynni'r Fro,[35] seeks to assist communities to develop schemes.

[30] See: http://www.isleofeigg.net/eigg_electric.html
[31] See: http://www.gigha.org.uk/windmills/TheStoryoftheWindmills.php
[32] See: http://www.fintrydt.org.uk/about/
[33] See: http://www.awelamantawe.org.uk/
[34] See: http://talybontenergy.co.uk/
[35] See: http://www.energysavingtrust.org.uk/organisations/content/ynnir-fro-community-programme

Northern Ireland

Northern Ireland has active community energy schemes. For example, The Fermanagh Trust[36] is a community development organisation that uses community energy to fund activities. It is led by local groups, and members provide advice to other communities that are considering potential projects. There is public sector support for distributed energy and renewable energy more generally, and there is an intention to develop an action plan for community energy that would consider approaches proposed in DECC's Community Energy Strategy.

England

DECC launched the UK government's Community Energy Strategy in 2014 (and published an update in 2015). One of the key drivers for Government ambition for community energy is the potential for greater competition for traditional energy suppliers. Government support totalling £25 million is available through the Rural Community Energy Fund (RCEF)[37] and the Urban Community Energy Fund (UREF).[38] In 2014, the community energy sector established Community Energy England (CEE)[39] to support the range of projects that are being undertaken.

There are many existing projects. For example, Sustainable Charlbury[40] provides education, advice and assistance to local residents relating to environmental impacts, including of energy, and it plans to build a solar farm on rural farmland to fund further activities.[41] In Nottingham, the Meadows Ozone Energy Services (MOZES) project[42] operates as an energy services company (ESCO) for local residents; it has obtained funding that has paid for solar panels and energy efficiency improvements. The Wadebridge Renewable Energy Network (WREN)[43] offers advice to local residents and seeks funding for projects; it recently established its own electricity generating company. Woking Borough Council installed in the 1990s a combined heat and power (CHP) unit, and exports power and heat to neighbouring buildings. It set up Thameswey Ltd, an Energy and Environmental Services Company (EESCO), and is further developing local heat networks.

International examples

Community energy has potential in remote areas of developing countries with limited infrastructure. Mobile phones have provided telecoms to some areas, illustrating that networks are no longer essential, but also bringing demand for electricity. This is one driver for deployment of small-scale renewable generation, and associated local networks, that improve quality of life at much lower cost than extending networks.[44] Such markets are seen by some product developers as currently being more promising than those in developed countries. Similarly, in South Africa, community energy is driven partly by social policy aims to provide energy in poorer communities and remote areas.[45]

[36] See: http://www.fermanaghtrust.org/special-initiatives/community-energy-and-community-benefits
[37] See: http://www.wrap.org.uk/content/rural-community-energy-fund
[38] See: https://www.gov.uk/urban-community-energy-fund
[39] See: http://communityenergyengland.org/
[40] See: http://www.charlbury.info/community/21?category=1
[41] Planning permission was rejected due to visual impacts in an Area of Outstanding Natural Beauty (AONB).
[42] See: http://www.mozes.co.uk/
[43] See: http://www.wren.uk.com/
[44] See, for example: Mera Gao in Uttar Pradesh, India: http://meragaopower.com/
[45] See, for example: CHOICES: http://www.iied.org/choices-community-energy-project-south-africa

Australia has examples of community energy in a liberalised energy market. In Australia, there are many community energy projects,[46] often making use of abundant solar energy (as well as wind) and helping to meet demand in dispersed communities. Projects can be aided by Australia's planning system that uses "Citizen Juries" to decide on local projects, as opposed to local councillors.[47] Recent falls in the cost of solar panels mean that some communities can produce electricity more cheaply than the utilities' conventional power plants, leading to attempts to move to localised energy models. For example, Northern Rivers Energy[48] in Australia aims to become a community energy company encompassing generation, network asset management and retail, as well as education for energy literacy.

In the USA's liberalised energy market, community energy projects have gained prominence as a potential alternative to energy utility companies (some of which are vertically-integrated). For example, Clean Energy Action[49] in Boulder in the USA has won support in city ballots for its proposal that the city's energy contract should be run as a community energy project instead of by a utility.

Japan has examples of community energy in a less liberalised energy market. Interest in renewable energy stemmed partly from opposition to nuclear energy, and led to the creation of groups such as Hokkaido Green Fund (HGF).[50] The energy sector has local monopoly providers, so customers could not opt to be supplied by a company that used specific generation technologies. Instead, customers were able to demonstrate a preference for renewables by making voluntary donations to the HGF of 5% of their energy bills. Additional funds for HGF were provided by over 200 small, private investments and a bank loan. HGF used the funds to pay for a wind turbine, which was built for them as part of a commercial wind farm. Other examples have developed in Japan, and interest in renewables (and community energy) might have increased since the Fukashima nuclear accident.[51]

In Europe, Denmark has examples in both electricity and heat. For electricity, Denmark made far-sighted decisions in the 1970s (in response to the oil price shocks) to be a first-mover in the development of wind turbine technology. It decided to deploy wind turbines using community share options, such that all wind farms must offer 20% of the project to local groups. The result is that Denmark now produces almost one third of its electricity using wind turbines,[52] and it is a centre of the global wind farm industry. Whilst many of these are centralised energy projects and do not seek to produce the "virtuous circle" as community energy can, the scale of the deployment illustrates some of the benefits of greater community support. For heat, Denmark introduced a ban in the 1980s on the centralised generation of electricity using fossil fuels unless the waste heat was used. This led to the plant owners seeking markets for the waste heat, and hence the establishment of district heating networks. These heat networks are perhaps a clearer example of community energy, offering elements of the "virtuous circle": local residents have roles in their deployment and management; and they have been an accepted part of Danish society for several decades.

Germany is the world's biggest example of localised energy, including community energy. More than half of its c.80GW of renewable electricity generation capacity (evenly split between wind and solar) is directly owned by an estimated 1 million small energy suppliers (community co-operatives, households and farmers). This situation is the result of a combination of public aspiration, political

[46] See, for example: Coalition for Community Energy: http://c4ce.net.au/
[47] See: The Community Renewables Economy: Starting up, scaling up and spinning out (ResPublica, 2013)
[48] See: http://nre.org.au/
[49] See: http://cleanenergyaction.org/
[50] See: http://www.renewablesinternational.net/the-pioneer-of-community-wind-in-japan/150/435/84058/
[51] See: http://www.brightonenergy.org.uk/2011/09/fukashima-researchers-visit-brighton-energy-co-op/
[52] See: http://www.windpower.org/en/

policy and fortuitous situations. The growth in localised energy has required (and has stemmed from) support from the public (as energy customers, tax payers, and property owners). There appears to be a general willingness to accept the costs of addressing the impacts of energy;[53] however that willingness might be reducing due to higher costs,[54] and there is an acknowledgement that the feed-in tariffs could have been more socially-equitable.

Public aspiration has encouraged the German government's ambition for localised energy. In turn, public support has been encouraged by the government's long-term political and financial commitment to localised energy, presented with consistent messages in a "strategic narrative" (as recommended for the UK by the ERP).[55] The "Energiewende" plan has evolved from 1970s energy efficiency policies (in response to energy price shocks) to now include the deployment of renewable energy production. This is linked to strategies for industry and employment: since 2006, job creation has totalled around 400,000 in renewable energy, and nearly 900,000 in retrofitting buildings.[56] The work is partly funded by the German public investment bank (KfW) that sees the energy transition as its third big project, after post-war reconstruction and reunification.

The growth in localised energy in Germany has been aided by the regional nature of government, financial institutions, and the energy sector.[57] The energy sector's regional nature is largely due to historical decisions, but it does provide levers for supporting localised energy. Regional energy companies provide energy sources, networks and supply (linked by national transmission networks), with roles for local authorities. The regulations and processes are set up accordingly, and small-scale producers and suppliers can more easily fit into that framework. Similarly, regional financial institutions are more receptive to loaning to community groups. Also, the objectives of community and municipal energy align conveniently with other local objectives: a study found that the key overlap was in the desire to minimise exposure to international energy prices, and that decision-makers should focus on drivers and possibilities present in local communities.[58] Examples include the city of Freiburg, where (motivated in part by anti-nuclear views) residents and city officials developed a municipal energy company[59] that aims to be self-sufficient using renewable energy. In another example, combined heat and power (CHP) units are installed in Hamburg in most blocks of offices and flats; these are paid by the local utility to provide local grid balancing services.

The changes in Germany have also been facilitated by a greater tendency for citizens to engage in community projects. This is due in part to social factors, but also regulations and incentives; perhaps the most well-known example is feed-in tariffs to incentivise renewable energy production. Another major contributing regulation is that landlords have responsibility for heating in their buildings, so there is a strong likelihood that the c.50% of homes that are rented will make use of local heat networks. The prevalence of heat networks, and well-established arrangements for connection and supply, make them appealing also to private owners. Retrofit of buildings is paid for by loans that are large enough to cover the costs of deep refurbishment, and that have low interest rates, helping to sway decisions in favour of undertaking these major building works.

[53] c.70% of Germans supported the Energiewende in 2013: http://energytransition.de/2012/10/key-findings/
[54] See, for example: Germany's green power surge has come at a massive cost (Gert Brunekreeft)
[55] See: http://erpuk.org/project/public-engagement/
[56] Exact figures vary between sources, but are large. See, for example: Cutting Carbon Costs: Learning from Germany's Energy Saving Program (LSE Housing & Communities, London School of Economics, 2011). See also: http://energytransition.de/2012/10/key-findings/
[57] See, for example: Creating Local Energy Economies: Lessons from Germany (Respublica, 2014)
[58] See: Local power: exploring the motivations of mayors and key success factors for local municipalities to go 100% renewable energy (Henner Busch and Kes McCormick, 2014)
[59] See: http://www.energieagentur-regio-freiburg.de/ (in German)

4. Predicting outcomes

This section draws on examples from the previous section to consider how to predict the outcomes of community energy projects. Where challenges are identified for making these predictions, this section considers which of the available approaches (as illustrated in Figure 2) could be appropriate for addressing each challenge.

Information about projects

It is important to have a forecast of the net effects of a proposed community energy project; this should be as accurate as it practicable (but without providing spurious accuracy). A forecast should include the full range of inputs and outputs, including both financial and non-financial factors, to allow assessment of the benefits that a project can achieve (effectiveness), and the cost of doing so (cost-effectiveness). The most easily accessible data is about cost (e.g. per unit of energy output, or per unit of energy demand reduction). These costs are determined in part by the current energy system, markets and regulations, and less by technology or ownership. Some costs are met by non-financial resources, e.g. volunteers' time which can be a substantial, unpaid resource.

Community energy projects can have other benefits, but these may be hard to measure financially, e.g. community cohesion, security of supply, energy literacy, and the societal benefits of investing in infrastructure.[60] Although these factors are harder to measure, they can be assessed, but there has not been much attempt to do so, thus far. If they are assessed, it can be hard to accurately translate all factors into financial terms, but the benefits are nonetheless tangible and relevant. There are trade-offs, for example between community projects potentially having greater support during the planning process, but diminished economies of scale compared to larger projects (although having improved economies of scale compared to projects on individual homes and businesses).

In order to conduct such an assessment, there would need to be access to the relevant data; this is often lacking, partly because the sector is still fairly new in the UK. There have been actions to gather and analyse data from across a number of projects,[61] and DECC holds a database about projects that it will update through its 2016 Community Energy Sector Survey. Studies find that some projects have not collected data, because it is not a priority for the limited resources. When data is collected the comparability can be limited, and it is often not easily accessible, either because it simply has not been publicised, or because it has commercial value. The difficulty in predicting proposed schemes net benefits diminishes their business cases and contributes to the uptake challenges (discussed below).

There are also data issues when trying to assess projects by large energy companies. Confidentiality prevents a clear view of costs within individual energy companies, and the complexity of value chains and reporting can make it difficult to determine the costs and benefits for each party, including consumers and tax payers.

[60] For example, the large programmes of work by nationalised industries (in energy, transport, telecoms, etc.) were not justified only (or indeed fully) by a narrow set of financial criteria, but were to meet certain key needs for "the common good". That infrastructure has facilitated many aspects of society over generations, and underpins more recent developments (e.g. modern communications) that were not envisaged at the time of construction. Community projects can contribute such benefits for communities now and in the future

[61] See, for example: Measuring the Local Economic Impact of Community – Owned Energy Projects (Scotland) (Entwistle, G., Roberts, D., and Xu, Y., Gilmorton Rural Development and the James Hutton Institute, for Community Energy Scotland, 2014)

Data about the following criteria for existing projects would be useful for forecasting the impacts of proposed projects. Some criteria would be applicable only for electricity or heat generation projects; but, most criteria would be relevant for all types of project, e.g. the establishment of a "virtuous circle" would be expected to reduce demand regardless of the original type of project. Provision of such information would rely upon community energy groups continuing in their willingness to share information that some could view as being commercially-sensitive. This would be in line with the general ethos of the sector, which seems to be keen to help other projects.

- Costs or requirements:
  - Management / operating costs (staff; repairs and replacement; insurance; rent)
  - Initial feasibility study; planning applications, etc. (including time taken)
  - Capital costs (cost of equipment; installation; land (if purchased))
  - Other capital costs (interest payments on loans; payments to local investors)
  - Network connection and network reinforcements
  - Network use-of-system charges (ongoing)
  - Balancing and other network services
- Resources:
  - Funding (capital, from various sources)
  - Funding (revenues: incentive payments (e.g. FITs); sales of excess energy to grid; sales of energy to local customers)
  - Voluntary resources (time and level of expertise)
- Energy benefits:
  - Renewable energy produced per year (and type of technology)
  - Contribution from project to annual local demand
  - Contribution from project to peak local demand
  - Local demand reduction in years following deployment
  - Local demand shift from peak (and costs of avoided network reinforcements)
  - Savings on energy costs for customers (individuals and organisations)
- Energy engagement and attitudes
  - Surveys of engagement (energy literacy; participation in demand reduction & response; support for further local energy investments)
  - Surveys of attitudes (before & after deployment) towards the project and other infrastructure projects (using metrics to describe communities' attitudes)
- Non-energy benefits:
  - Investment of project income in local community and economy
  - Employment and training opportunities
  - Educational opportunities about energy
  - Measures of community cohesion, population change, etc.
  - Health benefits (e.g. improved air quality)
  - Environmental benefits (e.g. new use of land, changes in biodiversity)

It would also be necessary to define the boundaries of the analysis, including:
- timescale (lifetime of technology until replacement, to capture benefits that might take longer to become apparent)
- energy system scope (distribution and transmission networks)
- geographic spread of community benefits (mainly limited to the local area, but cultural attitudes could spread further)

Assessment of information

A challenge for business cases is the way that cost benefit analysis chooses and uses data about projects that aim to deliver a range of benefits. On a macro-economic level, there are debates about the ability of some models to properly assess environmental policies.[62] There are concerns that some Government policies do not fully recognise the benefits of community energy, focusing only on the amounts of energy produced, and not on their scope to reduce energy demand, tackle fuel poverty and help communities more generally.[63] On a project-by-project level, decision-makers that can facilitate projects by giving permission (or support) for one aspect (e.g. planning permission) might limit their interest to only the costs and benefits of that one aspect, giving a fragmented assessment. This might work in principle, if all parts of the business case are judged appropriately; but there can be inconsistencies (e.g. due to using different criteria), and some factors are not included in any of the assessments.

Therefore, there is merit in a more holistic assessment of the overall costs and benefits, using expertise that covers the various topics including: planning permission, energy regulation, funding and wider social benefits. (These issues are considered in more detail in the section about deploying projects.) This is seen to a greater extent in Scotland, where different public bodies are broadly aligned in their objectives around community energy. Lessons from this approach in Scotland could be applied more widely in the UK. This could be facilitated initially by DECC working in conjunction with other organisations across key policy areas to develop guidance for assessing community energy projects. This could build on work by DECC to establish an internal working group to aid in the delivery of related policies (e.g. buildings energy improvements, smart meters, and community energy), and with other organisations (e.g. DCLG and Ofgem) on key issues such as planning and energy regulations. The administrations in Wales, Scotland and Northern Ireland would need to develop or enhance existing planning guidance, and guidance on energy regulations.

The current counterfactual used in analysis is another challenge: impacts are measured against the current energy sector, in which incumbents have certain rights (explicit or implicit) and new entrants bear more costs of changes. A better counterfactual would be future situations, e.g.: traditional energy companies achieving the same level of decarbonisation with less contribution from communities of customers; or traditional energy companies being unable to fully renew the energy sector, with subsequent environmental damage due to climate change, and the social and economic impacts of insufficient energy infrastructure.

Summary

Predicting outcomes is partly an intrinsic challenge because community energy seeks to address multiple issues which are not always easily defined in financial terms. However, it is primarily an extrinsic issue, due to how community energy is assessed, by multiple organisations using different selections of data and sometimes different criteria. So, there is an opportunity to gain a better understanding of the role of community energy as a means of delivering multiple benefits.

Figure 2 illustrated different approaches to addressing challenges. In the case of predicting outcomes, the most appropriate solution would be two-fold. Firstly, an increase in resources, including information (e.g. a database or case studies about similar projects) and guidance (e.g.

[62] See, for example: (Mis)understanding Climate Policy – The role of economic modelling (Synapse, for Friends of the Earth and WWF-UK, 2014)
[63] See: A grassroots sustainable energy niche? Reflections on community energy in the UK (UEA, 2014)

template documents) would allow community groups to produce business cases that considered all of the important factors.[64] Secondly, improvements in the evaluation process such that decision-makers (i.e. funders, planning authorities, network companies, etc.) considered all of the factors in a co-ordinated manner would allow for more holistic and consistent treatment of proposals.

- ***We recommend steps to improve forecasts and assessments of community energy projects:***
    - ***DECC and the Devolved Administrations should develop recommended approaches for monitoring and evaluating community energy projects, and for use in business cases for proposed projects.***
    - ***DECC and the Devolved Administrations should develop guidance for decision-makers (funding, planning permission, energy regulation) for assessing community energy in a holistic and co-ordinated manner.***

[64] The ESRC's innovation research institutes could be a valuable source of research into business models.

5. Deploying projects

This section draws together lessons learned about how to projects are deployed. Where challenges are identified, this section considers which of the available approaches (as illustrated in Figure 2) could be appropriate for addressing each challenge. There are two key questions about the deployment of community energy. Why are comparatively few community energy projects attempted? And, if they are attempted, why do some projects not reach deployment?

Skills, expertise and involvement

An over-arching theme in this section is the need for specialist skills and expertise. Getting a community energy project to the stage where deployment begins (e.g. construction of energy sources, installation of insulation, provision of information) requires certain skills and expertise (e.g. project management, administration, accounting, law, engineering, marketing, etc.). Some projects are proposed and run by a small leadership group of local enthusiasts, of whom one or two have some (but rarely all) of the necessary expertise. Peer-mentoring schemes allow groups to draw on the experience and expertise of other community energy groups; this is encouraged by the sector support groups around the UK, and is a requirement for recipients of Government support. Schemes sponsored by the Welsh and Scottish Governments employ experts to encourage communities to consider using local renewable energy sources and to provide support.[65] However, mentoring and support are not always sufficient: not every group has people with the ability and time to train in skills such as accounting, administration and law. Another model is for professionals to run projects (which is common in Denmark and Germany), but in such a way that local involvement is facilitated in order to achieve the various benefits thereof.[66]

Each of these approaches has merits, and there would be benefits to greater use of each in the UK. However, an important alternative that is currently not readily available in the UK is to allow community groups to opt for another organisation to undertake functions on their behalf. For example, schools have to individually go through the feed-in-tariff processes, whereas it would be much more efficient to delegate this to a central team (e.g. in a local authority) that could work on behalf of all groups in an area.

Some energy companies are offering tariffs and services for communities.[67] These may, or may not, satisfy all of the objectives of low-carbon community energy, but this model could provide community energy groups with support and expertise. In the case of electricity generation, an alternative means of finding expert support is through working with a professional project developer. Developers of infrastructure (e.g. solar farms, wind farms, etc.) can benefit from working with local communities in order to win support for their work (as discussed in the section about financial factors). There are examples of these relationships developing further, allowing community groups to use the developer's expertise in order to advance their community project (e.g. Fintry wind farm, as discussed earlier).

Finally, communities can find expert support by partnering in trials with product manufacturers. This is currently rarely used, but could have potential. Whereas energy companies could view community energy groups as competitors, product manufacturers have different objectives that could align with those of community energy groups. Product innovation is driven by the need to

[65] See, for example: Ynni'r Fro in Wales, and CARES in Scotland.
[66] See, for example, Energy4All, an expert support organisation for community groups that co-own it.
[67] See, for example, Ovo Communities.

address certain key challenges, especially for remote communities, including: limited grid access; high technology costs; and dependence on expensive fossil fuels. Some product manufacturers see the potential for localised energy to be their main market in the coming decades, and are keen to develop their portfolios. They conduct their own research, but also try to work with public research programmes, e.g. on projects for localised energy systems,[68] local energy economies,[69] and for the wider energy networks.[70] A successful match between communities, product developers, and funders can lead to successful projects that deliver valuable findings for research and marketing, as well as benefits to the communities that can continue to use the technology after the trials. Examples include: on-site battery storage on Gigha;[71] hydro-electric power and smart electric heating at Applecross;[72] and integration with hydrogen and a transport fuel on Orkney.[73] However, product developers comment that the arrangements for some research programmes are not conducive to setting up effective trials: the funding rules can prevent the use of other funding sources;[74] and it is the responsibility of project teams to find suitable communities. If these challenges were addressed, then more projects could be undertaken that provide manufacturers with valuable experience and data, and community energy groups with the necessary expertise.

Public attitudes

All community energy projects require engagement from local residents; this is true whether a project is initiated by local residents or by an external organisation (see the section about skills and expertise). Some communities are enthusiastic about community energy projects; but their enthusiasm can wane when faced with challenges that they feel ill-equipped to address. Where residents lack the initial interest, this could be due to disengagement from the underlying issues affecting the energy sector. Energy is promoted as a service that will be provided without interruption or inconvenience; and it is provided by a system that is largely centralised in which customers can be largely passive. Attitudes to environmental issues can be affected by economic, political or personal concerns. Public opinions are not necessarily reflected in political views and policies,[75] and media messages can contribute to erroneous public perceptions.[76] Ongoing debates about energy costs and incentives have not addressed the main issues, i.e. the opportunities for demand reduction (via efficiency) and unit cost reduction (which can involve localised energy).

Lack of inclination or ability to engage could also be due to limited engagement in community activities in general by some residents. UK residents can lack a sense of connection to their local community, sometimes due to short occupancy (we move home on average every c.5-10years), a desire for privacy, or a difference of opinion over the nature and needs of a community (e.g. preservation and development). However, there are factors that can act to encourage involvement. Within the UK home rental sector, local authority and housing associations are often quite ambitious

[68] See, for example: £11M joint InnovateUK and EPSRC "Localised Energy Systems Competition"
[69] See, for example: £20M Scottish "Local Energy Challenge Fund"
[70] See, for example: Low Carbon Network Fund (LCNF); and the Electricity Demand Reduction (EDR) Pilot.
[71] See: the Isle of Gigha Flow Battery Project
[72] See: Hydro2Heat:
[73] See: Wind2Wheels
[74] For example, LCNF trials must be led by network companies, and are incompatible with some other funds.
[75] See, for example, comments that the public was "fed up" with onshore windfarms (quoted in The Guardian, 2014). Survey data that shows 68% of the public supports onshore wind (Public attitudes tracking survey – Wave 12, DECC, 2015). Another poll showed public support for onshore wind farms in their own areas was 62% in general, and 55% in rural areas, but far lower amongst some MPs (ComRes, for REG Windpower, 2014).
[76] A poll showed that most people think that wind power receives fourteen times the public funding that it does, and has about half the level of public support that it does (OnePoll, for RenewableUK, 2015).

in meeting tenants' energy needs; they can raise the profile of local energy, and could offer services to the wider community. The private rental sector faces future regulatory requirements to improve energy performance, and tenants now have the right to request improvements, which could be a popular option amongst the growing numbers of young professionals who face being long-term tenants. Home owners face few regulatory pressures for energy performance improvements, and are often deterred by the costs and disruption. However, home ownership reflects, in part, a desire for independence that could see an appeal in local energy projects (e.g. mass retrofits and heat networks) that offer greater independence from energy imports, energy companies, fluctuating prices, or even neighbouring UK regions.

Social factors within a local area can be complicated and even contradictory; different demographics can have contrasting views about local needs. Some rural projects have support from residents with local family links: they welcome a source of employment, and can see renewable energy as a continuation of a heritage of energy or industry. Projects can be opposed on the grounds of visual impacts, sometimes by some residents who have fewer links to the local economy, e.g. newer residents who have moved to the area for a country lifestyle including a particular view.[77]

Planning permission

Planning permission can be a challenging area for energy projects in general, including for community groups, often involving lengthy and complex procedures that can be difficult for community groups to navigate. There are challenges at local levels: e.g. some local councillors can be (due either to their personal assessments or their perceptions from the press) swayed more by view on visual impacts than by social, economic and other environmental factors.[78] There are also challenges with national-level systems. The definition of "major development" is very broad, meaning that local energy projects are assessed in the same way as industrial developments,[79] and the guidance on how to treat projects that contribute to sustainable development is arguably too open to interpretation.[80] There is also concern at the proportion of planning applications for onshore wind farms in England that DCLG has adjudicated on (superseding local processes),[81] the time taken to make decisions,[82] the proportion of those that it has rejected,[83] and apparent inconsistencies between its decisions.[84] Similarly, solar PV developments have also encountered planning rejections, although some have been reversed.[85] Rejections prevent the particular projects from proceeding, but also introduce risk and uncertainty that deter other groups from spending time, money and effort in preparing proposals. These issues were identified by the DLCG-led Planning and Permitting Working Group[86], and DECC is seeking to make improvements in the three key areas of: skills, knowledge and resources of practitioners and communities in energy planning; the local planning process; and the national policy framework for community-led renewables.

77 Source: Interviews conducted for this project.
78 Source: Interviews conducted for this project.
79 See: The Town and Country Planning (General Development Procedure) (Amendment) (England) Order 2006
80 National Planning Policy Framework (DCLG, 2012)
81 DCLG has adjudicated in over 50 wind farm planning applications since 2010.
82 See, for example: Enquiry into the Operation of the National Planning Policy Framework (House of Commons, Communities and Local Government Committee, 2014)
83 DCLG has rejected planning permission for 80% of wind farms on which it has adjudicated.
84 Source: Interviews conducted for this project.
85 See, for example: http://www.planningportal.gov.uk/general/news/stories/2015/Mar15/190315/190315_3
86 Report by Planning and Permitting Working Group (2014)

Funding

Financial issues can pose challenges to community energy, sometimes intrinsically because cost requirements exceed the available financial resources. Sometimes challenges are extrinsic, e.g. funding or legal arrangements that are difficult for community groups to navigate (including business plan preparation, as discussed in the section about predicting benefits).

Ongoing incentives for renewable energy production (e.g. Feed-In Tariffs, the Renewables Obligation, and the Renewable Heat Incentive) have encouraged deployment of technologies that could not compete under the current arrangements. There have been concerns that these incentives lacked the long-term certainty that is necessary for robust business cases, for example during process of reducing the FITs payments in 2011 and 2012.[87] These were partly in response to cost reductions for solar PV panels, but there have also been unsubstantiated concerns about the impacts of solar farms[88]. Now the Levy Control Framework provides more certainty about the overall funds that will be available for incentivising low-carbon generation, and includes a "degression mechanism" that will reduce tariffs (whilst overall volumes and total incentive payments increase).[89] There is a related, debate about improving the social equity of incentives, so that they benefit poorer residents (who contribute to the payments) as well as wealthier residents (who can afford to invest in the technologies).

Many of the projects discussed in the previous section have received financial support in the form of up-front grants or loans, or as on-going incentive payments. This is similar to other nascent sectors where funders recognise the value of investment as a means of realising benefits and advancing the sector to the point where is can support itself independently. Up-front support for projects is limited, and often has to be amalgamated from a variety of sources, each with different objectives. For example, the support organisations across the UK (RCEF, UCEF, Ynni'r Fro and CARES) provide grants for initial feasibility investigations, and loans to support planning applications and develop a robust business case to attract further investment from other sources.

As discussed previously, wind farm developers have incentives to gain local support for their projects. This can be achieved through providing funds for community projects.[90] There is now a voluntary framework whereby wind farm developers can offer shares to local residents, of between 5% (for larger developments) and 25% (for smaller developments).[91] These can be provided one of three ways (split ownership, joint ownership, or shared revenue), and are seen as a key way forward in delivering renewable generation capacity, alongside some of the benefits of community energy. In some cases (e.g. the Fintry wind farm), the funds are part of a wider community energy project. However, without such plans, there are questions about whether this arrangement could have insufficient financial feedback loops to have all of the desired benefits in communities.

Buildings' refurbishment has been funded through a succession of energy supplier obligations, but progress has slowed in recent years due to changes to the Energy Company Obligation and the slow start of the Green Deal.[92] However, the UK has a strong culture of home improvements, with people being willing to spend large sums of money on projects such as double glazing and kitchens in order to achieve non-quantifiable aspirations such as comfort or luxury. If owners came to associate

[87] FITs consultation (2011)
[88] See, for example: FOI release: Common Agricultural Policy (CAP) subsidy on solar arrays, Defra, 2015
[89] See: Levy Control Framework, including degression mechanism for tariffs
[90] See, for example: Community benefit registers: http://www.communitybenefitsregister.org/
[91] See: Shared Ownership Taskforce: Report to DECC (Shared Ownership Taskforce, 2014)
[92] See: Left out in the cold (The Association for the Conservation of Energy, 2015)

energy performance with such aspirations, they might be more willing to spend money on improvements, and to work in local collaborations to reduce costs.

Private investments in community energy have been modest, but are growing, with £35million raised since 2012.[93] However, the UK has a strong culture of owning shares, including in the privatised services and utilities. Local energy projects could offer an opportunity for owning shares in a new niche of a familiar sector. This could apply to local investors who are offered shares in specific projects, or investors in portfolios of projects; and it could apply to investors with an interest in utilities, small businesses, or environmental projects. Community energy could be well-suited to "crowd-funding" (e.g. for the Balcombe project) whereby large numbers of people each provide a small sum of money (e.g. £1), sometimes with as more a gift than with the expectation of a return.

Financial regulations

Community energy groups currently face particular investment risks in comparison to commercial energy generators; for this reason, they have been eligible for tax relief, to encourage their development. Many community energy groups in the UK have incorporated themselves as mutual societies (also known as co-operatives, which have worked well in countries such as Germany) in order to qualify for tax relief through schemes including the Enterprise Investment Scheme (EIS), the Seed Enterprise Investment Scheme (SEIS), and the Venture Capital Trust Scheme (VCTS).

In June 2014, the Financial Conduct Authority (FCA) published a consultation clarifying rules on the registration of co-operatives and community benefit societies. The consultation considered questions about the suitability of the co-operative model, including concerning social benefits and the gains that are captured only by members. Many community groups have since suggested that this prevents the registration of community energy co-operatives, and that they would have to change their legal structures in order to qualify for favourable tax treatment, introducing more costs and administrative effort. DECC is working with the FCA to ensure that the concerns of community energy stakeholders are acknowledged, in order to allow continued growth in the sector whilst protecting investors. However, the FCA is an independent body, and Government has strictly limited powers in relation to the operation of the FCA in order to prevent interference in the FCA's work and to maintain the FCA's credibility and impartial role in the market.

Community energy groups will be able to benefit from tax-advantaged investment under Social Investment Tax Relief (SITR).[94] The UK Government believes that the community purpose underpinning community energy schemes makes accessing risk finance under SITR more appropriate for community energy than using the other tax-advantaged venture capital schemes. SITR is specifically designed for social enterprises, and offers the same tax incentives as EIS. SITR differs from the venture capital schemes by offering tax relief on unsecured debt as well as equity investments giving community groups more opportunity to attract investment. The Government is currently seeking EU State aid approval to expand the maximum amount of tax-advantaged investment available for individual organisations under SITR to £5 million per year and £15 million in total. To provide a smooth transition from the venture capital schemes to SITR, the Government announced at the Budget 2015 that all community energy organisations will continue to qualify for investment under the venture capital schemes for six months following the confirmation of EU State aid approval of the enlarged SITR scheme. It is hoped that this will provide a period for adjustment and more certainty to affected groups, as well as demonstrating the long-term stability of SITR.

[93] Community Shares Unit
[94] SITR for renewbales

Environmental regulations

Community energy projects can face challenges in satisfying environmental regulations. Environmental permitting can be complex, placing requirements that increase project costs, and can ultimately block a project altogether. For example, applications to build small hydro-electric generation schemes have to satisfy regulations on water abstraction, ecological impacts, etc. These regulations are set by organisations in devolved administrations. In Wales, Natural Resources Wales was created in 2013, with the remit including forestry, fishing, water resources and flooding. It has taken steps to improve the process of permitting for hydro-electric schemes, including by providing guidance for applicants.[95]

Another area of potential complexity is the sourcing of biomass for local heating projects. There are ongoing controversies over the suitability of some sources, with concerns over impacts upon habitats in the source areas, and emissions due to transporting the material. Guidance is available about biomass for various uses, including for communities.[96]

Energy regulations

Energy regulation is cited as the most frequent and most significant regulatory challenge for community electricity projects. Regulations of some form are essential for smooth operation of the system and the market, but the actual regulations could take many different forms, depending upon the specific objectives.

Regulations are less of an issue for heat projects. Most buildings are heated by gas, which is provided through the national transmission networks and local distribution networks. There is no realistic opportunity for community groups to engage in that system, except through energy efficiency to reduce demand. However, local heat networks do offer an opportunity for community projects to generate, distribute and use heat. There are regulations for the provision of accurate metering on heat networks,[97] but there is less regulation of networks and markets than for gas and electricity systems. Many organisations believe that is helpful at present for facilitating innovation, trials, and deployment, although additional regulations might be necessary as the sector expands in order to ensure high performance and fair terms for consumers.

For electricity, there is a misalignment of governance arrangements between suppliers and individuals or communities: incumbent energy companies have innate advantages because the sector’s regulation and operation is set up to suit their scale and approach. Electricity grid connection is a complex administrative process,[98] and can have high costs (especially in congested areas of the networks). Annual network charges can be high in some cases, and can fluctuate from year to year, including due to factors beyond the control of individual customers. For example, if a customer applies for a new (or expanded) connection to the network in an area with limited grid capacity, then charges can increase for all customers in that area to provide a price signal to deter use of the increasingly limited grid capacity. The licencing process is complex, particularly for energy suppliers. Some options have simpler regulatory requirements, e.g. private wire networks. As an alternative for suppliers operating on the main energy systems, Ofgem introduced “Licence Lite”;[99]

[95] National Resources Wales hydro guidance
[96] Community Biomass Guide (Forestry Commission, DECC and DEFRA)
[97] Heat Network (Metering and Billing) Regulations 2014 (National Measurement Office, 2014)
[98] See, for example: Ofgem-led work for DECC’s Connections work stream of the Community Energy Strategy.
[99] Ofgem’s proposed updates to the “Licence Lite” arrangements;

but thus far there has been only one Licence Lite application, and this was by the Greater London Authority (GLA) for a commercial project. There are some concerns that the retail market simplification[100] (that is intended to protect customers) will remove options to offer innovative tariffs including for communities.

There is debate over whether there could be different arrangements that would allow customers and communities to a greater role in their local energy systems. Some communities already do own the local energy networks and other energy assets (on some islands that are not connected to the mainland, and on mainland private wire networks). To apply this more widely would be complex, and would require communities to have access to specific expertise. For most cases, there would be benefits from some entity playing a co-ordinating role on behalf of individuals and communities. Some local authorities are seeking to play that role: installing sources of electricity and heat, supplying energy to residents, and co-ordinating energy efficiency schemes.[101] Some local authorities could be interested in going further and seeking to purchase the local electricity distribution network, and operating them as not-for-profit community services. Others would simply like the network companies to provide them with more information about the local networks, so that they can play a more informed role. For example, local authorities could use such data to identify areas where high demand could be reduced, and constraints on the networks that could be alleviated. Issues affecting local authorities are discussed further in the ERP's project on Cities that considers the possibilities for a return to municipal energy.[102]

The net impact upon customers of such changes in not clear. If profit-making was removed from part (or all) of the value chain, then those savings could be passed to customers. If some economies of scale were lost, this could add costs for customers. Certain regulatory requirements would have to remain in place, particularly around safety and reliability, as would rules about competition and third party access. However, some requirements could be scaled back in proportion to reductions in risk, including those designed to protect consumers from potentially negative impacts of a profit-motivated sector, as was recommended by DECC's Local Energy Supply Working Group. All of these topics could be investigated through trials of alternative local arrangements, as recommended below. Local Energy Scotland is offering £20million of funding for innovative ways of linking local energy production with local energy consumption.[103] Finally, Ofgem is discussing alternative arrangements through its project on non-traditional business models (NTBMs)[104]. These range from energy supply companies offering new tariffs or services, through to municipal energy companies and community groups.

Some electricity regulatory issues stem from technical matters. The rules for network operation were developed in an era of large non-renewable power stations, and have been modified incrementally as more renewables have been added. Most wind generation capacity is known by network operators, so they know what contribution it is likely to make, and can instruct changes in output if necessary. By contrast, the increasing quantity of solar generation is not known by network operators. It is very small scale (on homes, etc.), but amounts to c.5GW throughout the UK, mainly in the South West of England. It sits at the lowest distribution network levels, and manifests itself as lower demand during sunny periods. This new situation is causing some issues for network operators, sometimes in terms of balancing, but more often in terms of voltage levels. Germany is experiencing challenges with managing many times more solar capacity. These issues are can have

[100] Retail market simplification
[101] See, for example: City Energy: A new powerhouse for Britain (IPPR, 2014)
[102] ERP Cities project webpage
[103] See: http://www.localenergyscotland.org/challenge
[104] Non-traditional business models (Ofgem, 2015)

technical solutions, but will incur costs. One commonly-cited option is to increase the level of localised energy storage. This is being investigated by some LCNF trials,[105] as a tool for balancing the system with more localised generation and supply. However, the approach to balancing and storage could be different under alternative local energy arrangements (e.g. local supply), so there is merit in investigating storage as part of trials of alternative arrangements.

Some supporters of community energy ask the fundamental question of whether the current regulatory regime is the correct basis on which assessments should be made. The existing rules seek to find the most efficient overall solution, given the existing centralised system; but this does not ask whether there could be a more efficient solution under a different system. The UK's electricity generation capacity is changing dramatically. The UK's nuclear power plants are due to close soon (and some have been unavailable for long periods in recent years due to reliability or safety issues); and the UK's large coal plants will close soon under the LCPD (and some might close earlier for reasons such as network charges). The UK could have an opportunity to decide between replacing these with similar large power plants and perpetuating the current regimes, or deliberately moving a more decentralised system. Such a decision would have to be based on an assessment of the costs and benefits of both approaches and combinations thereof, including the wide range of factors (as discussed in the section about forecasting impacts). A similar choice exists for heating. Most heating is currently provided by natural gas that is transported throughout the UK from major import terminals. Significant minorities of heat demand are provided by other fuels, and an increasing amount of heat is being provided at local levels (e.g. biomass, heat pumps, waste heat, etc.), either for individual buildings or heat networks. The gas networks will cope with this continuing change (e.g. balancing the gas system is generally easier than for the electricity networks). However, as the UK's North Sea gas reserves continue to fall, and the future of fossil fuel use faces constraints due to climate change mitigation, the UK could have an opportunity to more ambitiously increase the use of localised heat.

Summary

This section has illustrated that there are many answers to the questions of why more community energy projects are not attempted, and why of those that are attempted do not reach deployment. In order to increase the development of community energy projects, it would be necessary to address certain intrinsic issues, primarily limited skills and expertise. The appropriate solution could involve providing extra resources in the form of guidance and advice, or allowing delegation of some tasks (see section about delivering benefits).

Alternatively, community groups can partner with renewable energy developers (e.g. for solar PV farms, roof-top solar PV, wind farms, renewable heat networks) through schemes such as the voluntary shared ownership arrangements (which might need to be made mandatory). This would bring mutual benefits, including expertise for the community groups, and increased local support for the project developers.

There is also a niche for community energy groups to partner with product manufacturers that wish to trial conduct more trials of products and services. This might perhaps be small compared the overall ambition for community energy, but it does offer an important opportunity to increase the number of projects at this time. But its greatest benefit could be the opportunity to develop the types of products and services that will be necessary for an energy sector that is more decentralised and customer-focussed. This could be facilitated by community energy support groups creating a

[105] LCNF trials using energy storage technologies

database of communities that are interested in participating in trials. Product manufacturers and service providers could access this database and approach suitable communities. These discussions would be independent of funding bodies and Government departments, and so would be acceptable under rules for procurement and state aid.

It would also be necessary to address other issues that are extrinsic to community energy projects, primarily funding, planning and regulation. The DECC work programme on funding and planning is outlined in the CES.[106] For regulations, the appropriate solutions could involve amending the requirements that projects must satisfy under current arrangements. This could take the form of derogations or incentive payments, but these could introduce further complexity to the sector. Alternatively, the appropriate solution could involve amending the assessment process, to include wider costs and benefits (as discussed in the section about forecasting impacts). There is an opportunity to investigate this option further by conducting trials of alternative market and regulatory arrangements. Trials could be funded from DECC, devolved administrations, or an innovation scheme run by Ofgem.[107] Trials could be undertaken in a regulatory "safe space" created by Ofgem, allowing it to test some of the proposals raised in its discussions about non-traditional business models.

- ***We recommend steps to encourage uptake of community energy projects, through trials of new technologies, services and regulatory arrangements, that will also provide useful results for future uptake:***
    - ***Support groups should develop a database of community groups that are interested in participating in trials of technology and services, to allow product developers and service providers to more easily find suitable partners.***
    - ***DECC and Ofgem should agree a plan to trial alternative arrangements for local energy (including the role of storage) throughout the UK, with appropriate funding and commensurate regulatory requirements.***

[106] See: Community Energy Strategy Update (DECC, 2015)
[107] See, for example, the recommendation to create a "Local supply innovation fund" in the report "Local Electricity Supply: Opportunities, archetypes and outcomes" (University of Leeds, Realising Transition Pathways, 2015)

6. Delivering benefits

This section draws together lessons learned about how the forecast benefits of projects can be delivered. Where challenges are identified, this section considers which of the available approaches (as illustrated in Figure 2) could be appropriate for addressing each challenge.

Emphasis of project

Having multiple objectives can offer advantages, but can pose risks. Community energy projects can, if so designed, help to deliver large and near-term positive impacts for employment, health, and community renewal. This helps to justify spending on community energy, and with gathering support for projects. These non-energy aims are often aligned with the energy objectives (e.g. insulating homes provides employment, improves occupants' health, and increases disposable income that can be spent in the community). Whilst there can be an appeal (and efficiency) to addressing multiple objectives through one project, there can be the risk of achieving each one less effectively. For example, the biggest energy savings might not result in the biggest cost savings for low income households, so there can have to be trade-offs. Some residents can be motivated more by the non-energy objectives of a project (e.g. using an income stream to fund community services) to the detriment of energy aims (e.g. using the income stream to fund insulation). To deliver the energy benefits, residents have to be engaged in the energy aspects, especially demand reduction.

Skills and expertise

For projects that do attempt multiple objectives (e.g. energy production and poverty reduction), the same challenges can exist for delivery these benefits as for project initiation (as discussed in the section about project uptake). That is, local residents might not possess the full range of skills and experience that are needed in order to deliver all of the benefits. Some benefits emerge in a straight forward manner (e.g. producing renewable energy); but other benefits can be more complex to deliver (e.g. reinvesting income to reduce fuel poverty). For example, in some cases, renewable energy projects are initiated by wealthier, professional residents, who might not have an ambition to use the income to address fuel poverty. Or, if they do have such an ambition, some groups cannot target the project's income effectively to reduce fuel poverty because they lack an understanding of fuel poverty and lack the necessary local contacts.[108] Similarly, a founding project team might lack expertise for educational programmes to improve energy literacy, or to generate interest in residents who have not been so actively involved in the project.

Bringing about the full benefits of some projects requires involvement from as much of the community as possible, especially to engage in demand reduction and social action. Success in this depends upon the closeness of the links between the leadership group and key local "opinion formers" and trusted networks. There can be advantages to involving organisations (e.g. local authorities) that have an understanding of the issues across the different residents of the community. These advantages have to be traded off against the risk that less resident leadership could weaken "virtuous circle" of engagement, energy literacy, acceptance, and change.

[108] Source: Interviews for this project

Feedback loops

Some community energy projects have strong feedback loops that can help to initiate and sustain residents' engagement. For example, if an energy source (e.g. power for an isolated community) is sized to match a community's energy demand, then that provides a strong incentive for residents to avoid extra consumption and even to reduce demand. If the energy production cannot be controlled (e.g. wind or solar power) then that provides an incentive for residents to match their demand to that output insofar as possible. This balancing can be made easier with energy storage, although its expense means that it is usually only a partial solution and so demand response is still important. The technical link is weaker where communities have the resilience and back-up of the main energy networks, but could be effective with the use or smart meters and (dynamic) time-of-use tariffs.

Some community energy projects have strong financial feedback loops. For example, local supply over private wire systems can provide lower energy prices: residents have this ongoing reminder of the benefits of the project, which could trigger involvement in other aspects of the project and reinforce the "virtuous circle". The financial link is different for projects that are connected to the main networks. Where energy is produced on a community building (e.g. solar PV on a community centre) that building can use that energy free of charge. Where energy is produced elsewhere in (or near) a community (e.g. ground-mounted solar PV or a wind farm), it is exported onto the main network (the same is true of excess energy from individual buildings): local customers pay a regular retail price for imported energy, and the incentive income is received by the community energy group. In both cases (free energy for certain buildings, and separate accounting of energy costs and incentive income) individual residents lack clear financial links between their energy bills and the benefits of the community project. This might inhibit the "virtuous circle", but this is less significant than the benefits of the vast majority of customers being connected to the main energy networks.

It is not clear whether these strong technical and financial feedback loops could be mimicked in grid-connected communities. This is being attempted on a "virtual private wire" on Orkney.[109] The motivation there for this "local balancing" is to cope when constraints limit the export of renewable generation. But the approach used is to encourage residents to match their demand to available generation; it could, in theory be applied to other areas, if accepted by residents.

Private households with solar PV panels are an example of how customers can respond to feedback loops. They use some of this electricity at no charge, export the rest to receive income from the FITs incentives scheme, and pay a normal retail price for any electricity that they have to import. It appears that the free electricity encourages further engagement with energy: there are anecdotal examples of demand balancing, with residents making more use of electricity at sunnier times of day.[110] However, it is less clear whether the incentive payment encourages further engagement with energy: for example, the current low uptake of energy efficiency products for building's refurbishment suggests that most of these households are not reinvesting their FITs income on energy efficiency projects.

Unintended consequences

As well as the need for projects to deliver the intended benefits, there is the need to avoid causing detriment through unintended consequences. For example, some community energy schemes provide energy directly to residents, at lower costs than from normal energy suppliers. It is well

[109] Community Powerdown Orkney
[110] Source: Interviews for this project.

established that cheaper prices often result in higher consumption (the "rebound effect"). If the project has replaced fossil fuel sources with low carbon sources, then the net effect is still likely to be beneficial. Some increases in usage are simply wasteful and should be discouraged. But some are to be welcomed, e.g. if customers were previously struggling to heat their homes and are then were able to afford more comfortable and healthier temperatures.

Community energy projects could have unexpected impacts upon attitudes to infrastructure for the wider energy system (not that used for the community's project), including that located near a community. There is insufficient survey data to state this categorically, but there are some anecdotal examples. A sense of self-reliance due to their community project might make residents less likely to support infrastructure that they see as being for the benefit of customers in other areas. This view could be amplified if the residents feel that the infrastructure is only needed because other customers have not made similar efforts to them. Furthermore, if communities are impressed by their experience of localised energy, they might question more fundamentally the need for centralised energy and its infrastructure, or for certain technologies that they dislike.

Finally, there is the potential for differing views about community energy projects to exacerbate community divisions, which is contrary to one of the expected benefits, i.e. community cohesion. Reasonable efforts should be made to account for the views of residents and local groups, balancing the other intended benefits.

Summary

Delivering a full range of intended benefits and avoiding unintended consequences is largely an intrinsic matter; i.e. it is dependent upon the skills and expertise within the project. The appropriate means of addressing this issue would be to provide extra resources (guidance, advice or services).

There are some common issues for which generic guidance can suffice (e.g. how to communicate with residents about demand reduction). Support groups in Wales and Scotland have developed guidance and toolkits for community energy projects.[111] DECC is funding the initial development of the Community Energy Hub, which will provide a forum for discussion between groups, and signposts to sources of advice, including toolkits about renewables and energy efficiency.

There are other issues for which community energy groups need tailored advice (e.g. how to balance multiple energy and social objectives). Support groups in Wales and Scotland offer more tailored "hands on" advice services.[112] The Community Energy Hub currently lacks the funds to offer that service, and there would be merit in DECC considering how best to provide that support, whether through the Community Energy Hub or the UCEF and RCEF.

Some tasks can best be addressed by allowing delegation to other organisations to undertake administrative or legal work (e.g. local authorities working on behalf of schools and other groups).

- ***We recommend steps to improve the deployment of community energy projects, and the delivery of their expected benefits:***
    - ***DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice and delegate tasks.***

[111] Guidance and toolkits by Ynni'r Fro and CARES
[112] Advice services by Ynni'r Fro and CARES

7. Conclusions and recommendations

Community energy can be an effective means of delivering important benefits, both in the energy sector and beyond. There are examples from around the UK and from other countries in which community energy has delivered benefits, including: new energy sources with less local opposition; area-wide improvements to buildings' energy efficiency; community level balancing of supply and demand; and greater interest in debates about energy. Projects have also delivered other benefits to communities and society more broadly, including: income streams to fund local services; training and employment; improved health of residents; and greater community cohesion and population retention. To realise the benefits of community energy in the UK, it would be necessary to address challenges that they face, but to so in a way that is justified by the benefits that they can bring.

There are opportunities to improve the way that impacts are predicted and assessed, to take into account the full range of costs and benefits: the community energy sector could provide more evidence of the costs and benefits of projects; and decision makers could consider the whole range of costs and benefits in a co-ordinated and consistent manner.

- ***We recommend steps to improve forecasts and assessments of community energy projects:***
  - ***DECC and the Devolved Administrations should develop recommended approaches for monitoring and evaluating community energy projects, and for use in business cases for proposed projects.***
  - ***DECC and the Devolved Administrations should develop guidance for decision-makers (funding, planning permission, energy regulation) for assessing community energy in a holistic and co-ordinated manner.***

There are opportunities to increase deployment of projects, initially through trials of new technologies, services and regulatory arrangements, all of which could then be useful for the larger-scale uptake of projects. Intrinsic challenges (particularly the need for skills and expertise) can be addressed in some cases by partnering with organisations that have mutual interests, including trialling new technologies and services. External challenges (including energy regulations) could be addressed by alternative local arrangements for energy.

- ***We recommend steps to encourage uptake of community energy projects, through trials of new technologies, services and regulatory arrangements, that will also provide useful results for future uptake:***
  - ***Support groups should develop a database of community groups that are interested in participating in trials of technology and services, to allow product developers and service providers to more easily find suitable partners.***
  - ***DECC and Ofgem should agree a plan to trial alternative arrangements for local energy (including the role of storage) throughout the UK, with appropriate funding and commensurate regulatory requirements.***

There are opportunities to increase the delivery of expected benefits. This can be done in part by providing community energy groups with more guidance and advice for developing their own abilities. It can also be done by allowing community energy groups to delegate certain tasks (e.g. administrative or legal) to other organisations.

- ***We recommend steps to improve the deployment of community energy projects, and the delivery of their expected benefits:***
  - ***DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice and delegate tasks.***

Annex: List of interviewed organisations

Awel Amman Tawe
Bangor University
Camarthenshire Council
Cardiff University
Community Energy Scotland
Community Energy England
Energy Savings Trust
Energy Technologies Institute
Friends of the Earth
National Grid
Ofgem
SCENE's Connect
Sustainable Charlbury
UKERC
Welsh Government
Ynni'r Fro Programme

References

A grassroots sustainable energy niche? Reflections on community energy in the UK (UEA, 2014)
A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement (2010)
Allies in Energiewende (Alan Simpson, 2014)
Beyond Nimbyism: A Multidisciplinary Investigation of Public Engagement with Renewable Energy Technologies (The IGov Project, University of Exeter, 2007)
Big Ideas (The National Energy Foundation, 2014)
City Energy: A new powerhouse for Britain (IPPR, 2014).
Community Biomass Guide (Forestry Commission, DECC and DEFRA)
Community Energy Policy Statement – Draft for public consultation (2014)
Community Energy Strategy (DECC, 2014)
Community Energy Strategy Update (DECC, 2014)
Community Renewable Electricity Generation: Potential Sector Growth to 2020 (Peter Capener, 2014)
Connections work stream of the Community Energy Strategy (Ofgem, 2014)
Creating Local Energy Economies: Lessons from Germany (Respublica, 2014)
Cutting Carbon Costs: Learning from Germany's Energy Saving Program (LSE Housing & Communities, London School of Economics, 2011)
Distributing Power: A transition to a civic energy future (Realising Transition Pathways, 2015)
Heat Network (Metering and Billing) Regulations 2014 (National Measurement Office, 2014)
Left out in the cold (The Association for the Conservation of Energy, 2015)
Local Electricity Supply: Opportunities, archetypes and outcomes (University of Leeds, Realising Transition Pathways, 2015)
Measuring the Local Economic Impact of Community – Owned Energy Projects (Scotland) (Entwistle, G., Roberts, D., and Xu, Y., Gilmorton Rural Development and the James Hutton Institute, for Community Energy Scotland, 2014)
(Mis)understanding Climate Policy – The role of economic modelling (Synapse, for Friends of the Earth and WWF-UK, 2014)
Non-traditional business models (Ofgem, 2015)
Power to Switch campaign (DECC, 2015)
Proposed updates to the "Licence Lite" arrangements (Ofgem, 2014)
Renewable Energy for Communities (Scottish Government, last updated 2013)
Retail market simplification (Ofgem)
Run on Sun (Friends of the Earth, 2014)
Survey of public interest in community energy, cited n DECC's Community Energy Strategy (Research for DECC, 2014)
The Community Renewables Economy – Starting up, scaling up and spinning out (Respublica, 2013)
What's the missing ingredient in UK energy policy governance? (CSE, 2014)