September 2015 Energy Research Partnership

Community energy and the low-carbon transition

ERP Energy Research Partnership

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	Formerly of SSE

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
Prof Phil Blyth	Chief Scientific Advisor	DfT
Dr Masao Chaki	Chief Researcher	Hitachi Europe Ltd
Dr David Clarke FREng	Chief Executive	Energy Technologies Institute
Tom Delay	Chief Executive	Carbon Trust
Paul Drabwell	Business & Energy Policy Advisor	BIS
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
Kathryn Magnay	Head of Energy Programme	EPSRC
Prof John Miles FREng	Director & Professor of Energy Strategy	Arup / Cambridge University
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	Director	UK Energy Research Centre
David Wright	Director, Electricity Transmission Asset Management	National Grid

Observers

David Joffe	Head of Modelling	Committee on Climate Change
Ali Naini	Managing Director	Turquoise International
Mary McAllan	Director of Energy and Climate Change	Scottish Government
Andrew Wright	Finance Director	Ofgem

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.

Analyst

Simon Cran-McGreehin	Energy Research Partnership

Steering Group

Naomi Luhde-Thompson (*chair*)	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 1).

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

Executive Summary

This discussion paper considers the potential role of community energy in the UK's transition to low carbon energy. It presents examples of community energy in the UK, to consider the motivations, benefits, costs and risks, and to identify challenges that it faces in the UK. Those challenges are grouped into: assessing outcomes, deploying projects, and delivering benefits.

The paper proposes measures to improve the assessment of projects, and research to improve the understanding of community energy in the UK in order to determine whether its costs and benefits (and their distribution in society) justify addressing the challenges that it faces. The paper also highlights opportunities in the short-term to increase the uptake of projects and improve the delivery of expected benefits.

Overview and theory of change

Community energy has the potential to engage local communities in energy matters, with the aim of bringing two main benefits: firstly, acceptance of change, including new technology and behaviours, and deployment of infrastructure in the local area; and, secondly, engagement with energy, including demand reduction and energy balancing. Acceptance of change and engagement with energy can occur sequentially or concurrently, or in a cycle to build up a "virtuous circle".

Community energy can be broadly defined as energy projects in which local residents and businesses have a shared stake and are the main intended beneficiaries. Motivations for community energy include political objectives, local priorities, and some consumers' desire for more control of their energy affairs. Projects include energy production (heat and/or power), energy efficiency, demand reduction, demand balancing (with available supply), and contracting for energy supply. Community energy projects are larger than individual homes or businesses, and can range up to municipal systems. They can be run by groups of residents and businesses, local organisations, local councils, community energy support groups, or businesses in partnership with communities. A project's focus will depend upon local opportunities and resources (e.g. wind power in rural areas, and solar power on urban rooftops), and upon the needs and interests (e.g. deprived urban areas focussing on fuel poverty, and affluent areas focussing on environmental or engineering opportunities).

Current status

Over 5,000 community energy groups are active in the UK, covering: heat, power, energy efficiency, demand reduction, transport, balancing, energy education, and energy purchasing. Schemes have a range of ownership structures, including joint ownership within a community, leadership by local authorities, community share options in commercial projects, and joint ventures. Some projects use expertise from a range of organisations, e.g. local authorities co-ordinate the work, residents provide knowledge of local needs, local businesses provide land for energy production, technology providers test equipment, and energy supply companies provide tariffs. Indeed, many community energy projects aim to achieve a range of objectives, and can therefore justify resources (including funds) from a variety of organisations, helping to make them viable.

The UK Government published its Community Energy Strategy in 2014, and an update on this strategy in early 2015: a key driver is the potential for greater competition with traditional energy suppliers. The Scottish Government has a Community Energy Policy Statement (CEPS): key drivers include renewable energy production, and income streams to fund land reform, employment and local services. Community energy features in the Welsh Government's energy strategy: drivers include supporting communities' aspirations to produce energy and address fuel poverty. The Northern Irish administration intends to develop an action plan for community energy: some community groups already incorporate energy as part of their local projects.

Community energy projects are active in several countries around the world. Local circumstances and government policies help to shape motivations that include: aiding development; offering alternatives in established energy markets; and contributing to national energy strategies.

Assessing outcomes

The current approach to assessment poses a challenge to community energy projects in the UK, by not necessarily accounting for all of the relevant issues in a consistent manner. This makes it difficult to assess the impacts of existing projects, and to forecast the outcomes of proposed projects. It also impedes the ability to understand the role of community energy in the UK. This is partly an intrinsic challenge because community energy projects seek to address multiple issues which are not always easily defined (including 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, and not necessarily with an appropriate counterfactual.

The most appropriate solution to this challenge would be two-fold. Firstly, there could be improvements in the evaluation processes used by evaluators and decision-makers (i.e. funders, planning authorities, network companies, etc.), such that they considered all of the factors in a co-ordinated manner, allowing for a more holistic and consistent treatment of existing projects and proposals. Secondly, there could be an increase in resources for community groups, in the form of information (e.g. a database of case studies about similar projects) and guidance (e.g. template documents) to help them to produce business cases that consider all of the important factors and to report effectively on existing projects. Through a wider assessment (see the scoping note in Annex 2), there is an opportunity to better understand the role of community energy in UK, in order to inform decisions about whether community energy's net impacts (and their distribution in society) justify taking action to address challenges that it faces in the UK.

Deploying projects

There are many reasons why more community energy projects are not attempted in the UK, and why many of those that are attempted do not reach deployment. These challenges include intrinsic issues (primarily lack of certain skills and expertise in many community groups), and also extrinsic issues (primarily funding, risks, planning permission, and regulations).

The DECC work programme on funding and planning is outlined in its Community Energy Strategy. For regulations, the appropriate solutions could involve amending the requirements that projects must satisfy under current arrangements. This could take the form of derogations, but these could introduce further complexity to the sector. Alternatively, the appropriate solutions could involve amending the assessment processes, to include wider costs and benefits. There is an opportunity to investigate this option further by conducting trials (as per above) of alternative arrangements for electricity, and new arrangements for the emerging heat sector. Once further research has provided more information about the role of community energy projects in the UK, it could be justified to consider substantive changes to address deployment challenges that they face.

In the meantime, there are some less substantive changes that could be made: given the present small scale of the community energy sector, certain changes could be desirable (there is merit in assisting the deployment of projects, including for studies of technology and services) and acceptable (there is little risk of distorting the wider energy sector). The most beneficial actions that could be taken at present would be those that provide community energy groups with more resources (especially guidance and expertise) to help them to meet the existing requirements. Available routes for providing guidance and expertise include: tailored guidance and advice from community energy support groups: partnering with corporate energy developers through schemes such as the voluntary shared ownership arrangements; and partnering with providers of new products and services that wish to conduct trials for localised energy. In addition, the ability to delegate administrative functions to a central team (e.g. in a local authority that could work on behalf of various groups in an area) would make it easier for groups to undertake projects and would reduce the costs to each individual project, whilst not diminishing the delivery of benefits within the communities.

Delivering benefits

Delivering a full range of intended benefits and avoiding unintended consequences can be a challenge for projects. It 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 about demand reduction). Support groups in Wales and Scotland have developed guidance and toolkits for community energy projects. 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. There are issues for which community energy groups need tailored advice (e.g. how to balance multiple objectives). Support groups in Wales and Scotland offer more tailored advice services, whereas the Community Energy Hub currently lacks funds to offer that service.

Conclusions and recommendations

Community energy could be an effective means of delivering benefits, both for the low carbon transition, and in other aspects of society. Examples from the UK and from other countries illustrate the motivations, benefits, costs and risks of community energy. Motivations for community energy include political objectives, local priorities, and some consumers' desire for more control of their energy affairs. Energy-related benefits that have been delivered include: low-carbon 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; and greater community cohesion. Community energy faces challenges in the UK, in how projects are assessed, in the deployment of projects, and in the delivery of expected benefits.

There are opportunities to address the challenges posed by the assessment of community energy projects, by taking into account the full range of costs and benefits in a co-ordinated manner. Furthermore, through a wider assessment, there is an opportunity to better understand the role of community energy in UK: evidence from existing projects could be reviewed; data from proposed projects could be monitored more consistently; and trials could be conducted to test specific local arrangements for community energy. This research would inform decisions about whether community energy's net impacts (and their distribution in society) justify taking action to address challenges that it faces in the UK.

We recommend steps to improve assessments of community energy projects, and to improve the understanding of the role of community energy in the UK:

- **DECC and the Devolved Administrations should develop recommended approaches for monitoring and evaluating community energy projects (including key data that should be collected), and for producing business cases for proposed projects.**
- **DECC and the Devolved Administrations should develop guidance for decision-makers (funding, planning permission, energy regulation, wider social benefits, etc.) for assessing community energy in a holistic and co-ordinated manner.**
- **DECC and the Devolved Administrations should review and monitor community energy projects, and, with Ofgem, should trial alternative arrangements for local energy.**
- **Support groups should develop a database of community groups that are interested in participating in studies of technology and services, to allow product developers and service providers to more easily find suitable partners.**

In time, more information will become available to inform decisions on changes that could increase the deployment of community energy in the UK. In the meantime, there are certain opportunities to reduce the challenges for projects without increasing costs or risks for other consumers. In addition, there are opportunities to increase the delivery of expected benefits of projects, and to reduce unintended consequences. This can be done in part by providing community groups with more guidance and advice for developing their own abilities, and in part 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 (including for conducting studies) and the delivery of benefits:

- **DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice for their projects.**
- **DECC and the Devolved Administrations should identify routes by which community energy groups could delegate administrative tasks.**

1. Introduction

The UK's heat, power and transport sectors are undergoing significant changes due to the need to decarbonise, whilst seeking to maintain security of supply and limit long-term costs. Additional challenges (but also opportunities) are presented by the need to replace infrastructure all along the supply chains (energy production, distribution, and consumption), by new technologies entering the sector, and by changing interactions between sectors. There is broad agreement that this transition will be more easily achieved if the UK's energy systems become more developed at local levels, including greater involvement by users of energy.

Localised energy systems and greater involvement by energy users could be attempted in different ways, including by large energy companies (producers, networks, or suppliers), or via individual consumers (residents or businesses), or through community groups representing multiple consumers (residents or businesses). Community energy projects take a range of forms, and the focus will depend upon local opportunities and resources (e.g. wind power in rural areas, and solar power on urban rooftops), and upon the needs and interests (e.g. deprived urban areas focussing on fuel poverty, and affluent areas focussing on environmental or engineering opportunities). But they all have the common characteristics that locals (residents and/or businesses) have a shared stake and are the main intended beneficiaries (often for more than just energy provision). In order to decide how to introduce more localised energy systems with more involvement by energy users, there would have to be an assessment of the costs, benefits and risks, including opportunities for addressing multiple issues. There are many current (and planned) localised energy projects from which lessons can be learned for electricity and heat (and also some for transport).

This discussion paper considers the potential role of community energy in facilitating localised energy and greater involvement by energy users to aid in the UK's transition to low carbon energy. It presents examples of community energy in the UK and other countries, to consider the motivations, benefits, costs and risks of community energy, and to identify challenges that it faces in the UK.

This discussion paper is structured as follows:

- Section 2 discusses the theory of change for how community energy can deliver decarbonisation and wider benefits, and discusses different approaches that can be used to overcome challenges faced by projects.
- Section 3 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, 5 and 6 identify challenges faced by community energy, in categories of: assessing benefits, deploying projects, and delivery benefits.
- Section 7 summarises the discussion paper's conclusions and recommendations.

This discussion paper is based on a review of the literature, and interviews with organisations involved in community energy (see Annex 1). The work was guided by a steering group drawn from member organisations of the Energy Research Partnership (ERP). The work has links with other ERP projects, including on Cities, Heating Buildings, and Public Engagement.

2. Theory of change

This section presents an overview of the theory of change for community energy: i.e. how projects could deliver changes in the energy sector and in other areas of society.

Localised energy and consumer involvement

In the transition to low-carbon energy, localised energy systems could, by their nature, meet some of the needs of the UK energy sector: heat has to be produced near to consumers; much renewable electricity generation (e.g. wind) is naturally dispersed (although some can be harnessed near to consumers, e.g. rooftop solar PV); and transportation fuels are distributed locally. Similarly, there is also an increasing role for more involvement by energy users in the energy sector, thinking less in terms of consumers and more in terms of participants who can aid the transition by supporting changes (e.g. new infrastructure or new energy contracts) and engaging with energy (e.g. demand-side response). There is also an increasing role for smarter networks to manage interfaces between supply and demand, particularly if heating and transportation become increasingly electrified.

Energy systems that are more localised and have more consumer involvement could be attempted through different organisations: traditional companies operating in the sectors; or individual consumers (residents and businesses), or groups acting for communities.[1] Companies in the sectors are naturally best-placed for the technical aspects of delivering energy systems (e.g. infrastructure including energy sources, networks, smart metering, responsive appliances). However, companies in the sectors can face challenges in terms of public support for those energy systems, and in terms of encouraging energy users to engage with the systems. Energy companies can look to adapt their practices, including energy producers and transporters involving consumers more in decisions about the location and appearance of infrastructure, and energy supply companies incentivising consumers to undertake demand reduction and demand-side response. Alternatively, individual consumers, with suitable incentives and opportunities, can produce energy, modify their own energy behaviour, and engage in the energy market. But their scope is limited to just their own energy use, and some economies of scale are lost. Finally, community groups can potentially be an effective option (as discussed below), by helping local residents and businesses to achieve benefits.

Overview of community energy

Community energy can be broadly defined as energy projects in which local residents and businesses have a shared stake and are the main intended beneficiaries. Projects types include energy production (heat and/or power), energy efficiency, demand reduction, demand balancing (with available supply), and contracting for energy supply.[2] Community energy projects are larger than individual homes or businesses, and can range up to municipal systems. Community energy projects gain economies of scale compared to activities by individual consumers (e.g. microgeneration, heating buildings, insulating buildings, switching suppliers, etc.). Community energy projects might lose some economies of scale compared to the asset costs of larger energy producers, although they can be more efficient in terms of energy (e.g. CHP plants waste less heat). They can be run by groups of residents and businesses, local organisations (e.g. schools, faith groups, etc.), local councils, community energy support groups, or businesses working in partnership with communities.

Community energy has the potential to engage local communities in energy matters, with the aim of bringing two main benefits: firstly, acceptance of change, including new technology and behaviours, and deployment of infrastructure in the local area; and, secondly, engagement with energy, including demand reduction and energy balancing. Acceptance of change and engagement with energy can occur sequentially or concurrently, or in a cycle to build up a "virtuous circle", as illustrated in Figure 1. Community energy can feed into this cycle at different points.

[1] 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] See, for example: DECC's "Power to Switch" campaign

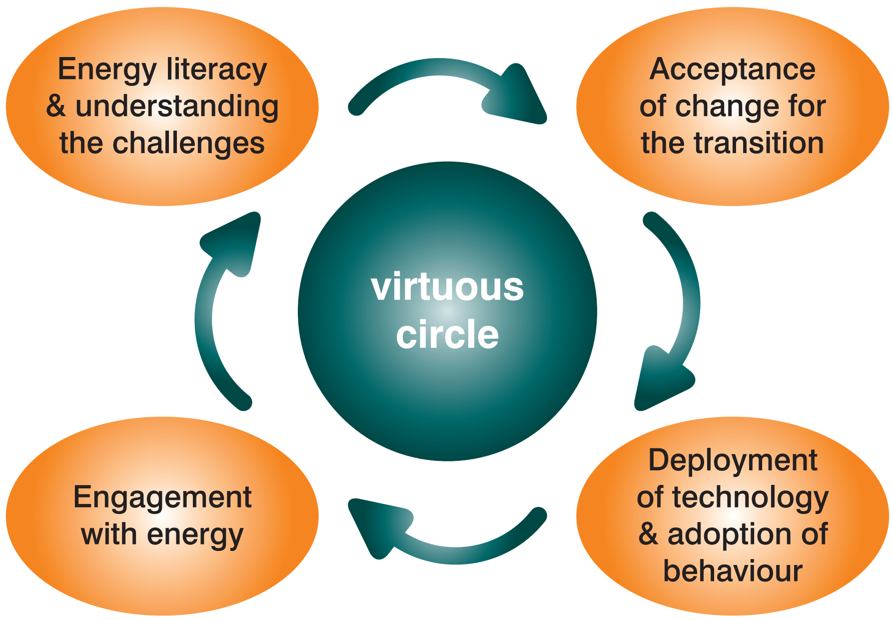

Figure 1: *Illustration of the "virtuous circle" that can be established by greater public acceptance of change and engagement with energy.*

Acceptance of change

Public acceptance of change for (and participation in) the low-carbon transition is affected by many factors including "governance arrangements", i.e. which entities have a role in a project's initiation, ownership, deployment, operation and regulation. Resistance to change and lack of engagement could be linked to unsatisfactory experiences under the current governance arrangements; different arrangements could lead to greater acceptance of change and greater engagement. That is, the general public has low levels of trust in energy supply companies[3] and, by extension, of the energy sector more widely,[4] leading some to desire more control of their energy affairs. This is partly an emotive issue, and cannot be assessed purely by cost-benefit analysis.

The current governance arrangements for production, transportation and sale of gas and electricity are based around the centralised systems: a comparatively small number of companies own most of the infrastructure for energy production and transportation (much of it previously national assets, paid for by public funds). By contrast, the arrangements for use of gas and electricity are decentralised: millions of individual energy consumers have deployed most of the demand-side technologies, by purchasing electrical appliances and heating systems that use the electricity and gas that are provided from centralised systems.

Recently, these roles have been altering and becoming more mixed (although these changes have been undertaken within the context of the existing arrangements). Electricity supply companies had a significant role in demand-side deployment through Government schemes (e.g. insulating buildings and deploying heat pumps), and consumers have an increasing role in the deployment of small-scale energy production (e.g. solar PV). 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 consumers use energy in accordance with basic needs (e.g. heating) and social norms (e.g. entertainment); some needs and norms are shared throughout a community. Communities vary markedly in the UK: some deprived urban communities focus on fuel poverty, some rural areas focus on employment opportunities, and some more affluent areas focus on the environmental or engineering opportunities. Views about the cost and other impacts of energy are shaped by personal experience and wider views in society about environmental impacts, energy companies' motives, and fairness (including the types of benefits, and who receives those benefits). Consumers can also have concerns based on lack of experience, where they have little evidence of how certain technologies could affect their lives. Also, consumers can struggle to assimilate climate change into their thinking, given its enormity, the inherent difficulty of predicting exact impacts, and the fact that its greater impacts will occur in the future.

[3] See, for example, Edelman's Trust Barometer (2014)

[4] Under the UK retail energy market's "supplier hub" model, energy consumers interact only with their energy suppliers, and so consumers can easily conflate issues from across the energy sector. For example, mistrust in energy supply companies due to mis-selling and consumer service issues can affect the public's views of the sector more widely. But energy supplies can also receive unfair criticism for issues outside of their control.

Acceptance of a technology can be affected by consumers' views of that technology. For example, solar PV can be popular as a "status symbol", whereas some people can resist smart metering due to concerns about data privacy or external insulation for buildings because of its appearance (or even its association with social housing). Acceptance of behaviour changes can be affected by consumers' views of their own scope and limits for changing their energy use and habits. Consumers can be more willing to accept change and support the low-carbon transition if they understand the issues,[5] are involved in the decisions,[6] and are supported in the implementation. Education, involvement and support can be more effective if provided at a community level, whereby residents and businesses can discuss issues with each other, seek trusted advice, pool resources, 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 at one time reduces the overall effort of running the projects, allows owners to support one another with trusted advice, offers cost savings through economies of scale, and provides momentum to extend the scope to more buildings.

Residents can also have views about the deployment of infrastructure. There can be general support or opposition relating 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 about the technology, e.g. opposition on environmental grounds to nuclear and shale gas. Acceptance of infrastructure can be affected by views about deployment in particular locations, e.g. opposition on the grounds of visual amenity to electricity transmission lines or wind turbines.[7] With involvement from local residents and businesses, a project can be tailored to bring local benefits and to reduce unwanted impacts. With support from local residents and businesses, infrastructure can be more likely to receive planning permission, with fewer delays and lower costs (although many still face these challenges). This possible local support is more likely to apply to small-scale, localised energy projects where communities can more easily identify with the projects' benefits. Local support can be less likely for larger infrastructure projects (e.g. large wind farms) that have local impacts (e.g. upon visual amenity). Whilst these larger projects can bring local employment (during construction, and sometimes in the longer term), local residents can find it harder to identify with the projects because their purpose is not primarily to serve the local community.

Engagement with energy

Approaches that focus on energy users require triggers that can initiate (and sustain) consumers' interest. Some consumers' local situations trigger their interest. For example, in areas that are isolated from the main energy networks, technical limitations of local energy sources can cause consumers to focus on demand reduction and balancing. Similarly, some local energy projects provide consumers with strong financial links between their energy bills and the project itself (especially if the energy prices are lower), giving the consumers cause for greater interest in the projects. These "feedback loops" that can trigger interest can be a key part of some community energy projects; they are discussed further in Section 6 about delivering benefits. However, this technical feedback is not a realistic (or desirable) option for many consumers: there are distinct benefits to the security of supply that comes from being connected to the main energy networks. Similarly, most consumers do not have these financial feedback loops: under standard arrangements with energy suppliers they pay retail prices for energy imported from the main networks.[8]

In most cases, other triggers are needed for initiating (and sustaining) consumers' interest in energy. The trigger for some consumers can be their desire for more control of their energy affairs. This can be facilitated by community involvement, which can further develop the interest in energy and awareness of issues ("energy literacy"). Community energy can also provide access to resources to address issues (e.g. income to alleviate fuel poverty is a major driver for some groups and local authorities). These benefits can be more effectively delivered at community level, where mutual support can encourage engagement, and the impacts can be aggregated to provide a larger impact. There can also be non-local impacts: demand reduction and balancing can reduce the pressure on networks and energy sources, potentially reducing costs for other consumers. However, as discussed in Section 5 about deploying projects, community energy projects also face risks (e.g. income from energy production can fall in response to reductions in wholesale prices or low-carbon incentives), and can cause unintended consequences (e.g. local demand reduction can cause fixed costs to be split between fewer consumers, some of whom can struggle to afford the costs).

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. This is discussed in Section 6 about delivering benefits. There are anecdotal examples of local residents' attitudes: some see the wider energy challenges and become more supportive of other infrastructure; but some feel that they are self-sufficient and resist other infrastructure. Sometimes it is views about infrastructure that trigger interest in community energy, e.g. opposition to fracking at Balcombe was a reason why some residents supported the REPOWERBalcombe community energy project.

[5] See, for example: Big Ideas (The National Energy Foundation, 2014)

[6] See, for example: What's the missing ingredient in UK energy policy governance? (CSE, 2014)

[7] See, for example: Beyond Nimbyism: A Multidisciplinary Investigation of Public Engagement with Renewable Energy Technologies (The IGov Project, University of Exeter, 2007)

[8] An exception is consumers that produce energy on-site. They receive an incentive payment for producing energy, they buy less (or no) energy from a supplier, and can receive a payment for exporting any surplus.

Wider community impacts

Community energy can also deliver benefits that are not related to energy use. This is not exclusive to community energy: all energy projects can provide local employment during delivery (e.g. building energy production plants and networks, and installing energy efficiency measures). But community projects can target needs identified by local residents and groups (e.g. 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. However, there can be undesirable wider impacts, such as unfair distributions of costs and benefits between different demographics, as discussed in Section 6 about delivering benefits.

Overview of challenges and solutions

There are factors that can contribute to success of community energy projects: success requires not only deployment of projects (inputs), but also delivery of benefits (outputs). However, as is often the case with alternative approaches, community energy in the UK can face challenges. These are discussed in detail in Sections 4, 5 and 6, grouped into: assessing outcomes, deploying projects, and delivering benefits.

A challenge can be thought of as a case in which resources are insufficient to meet a requirement. Some challenges are intrinsic to community energy: i.e. a requirement is fundamental to meeting a project's objectives (e.g. certain technical skills are needed in order to install equipment). Some challenges are extrinsic: i.e. a requirement is not fundamental to the objectives, but is due to external factors (e.g. administrative requirements), some of which are the 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 potential benefits of community energy in the UK justify addressing challenges that it faces?
- What would be an appropriate means of addressing these challenges, taking into account any costs incurred and their distribution across society?

Available options (illustrated in Figure 2) are as follows; these are applicable to energy projects in general, not just community projects.

- change the project's scope to avoid some requirements;
- increase the resources (e.g. incentive payments);
- change the requirements (e.g. regulatory derogations);
- change the evaluation process.

Changing the evaluation process would arguably be the most radical option, but it could be the simplest in the longer-term by avoiding issues that are inherent in other approaches (e.g. complex incentive payments or regulatory derogations). It could also be the most logical, by using a more holistic assessment that considers the overall costs and benefits across all of the relevant topics including planning issues, energy regulation, funding, and wider social benefits. It could have two elements: if wider benefits were considered, then more organisations might use a project to meet their objectives, hence increasing its resources; and if incremental impacts were attributed more widely (not just to new projects) then new projects could face lower requirements.

For each challenge identified in this paper, it considers which of these different approaches could be appropriate. Any changes (whether to resources, requirements or assessments processes) would have to be justified by evidence, although, as is discussed later, there are some gaps in the evidence about the impacts of community energy in the UK (partly because of the lack of a consistent assessment procedure, and limited resources to gather data).

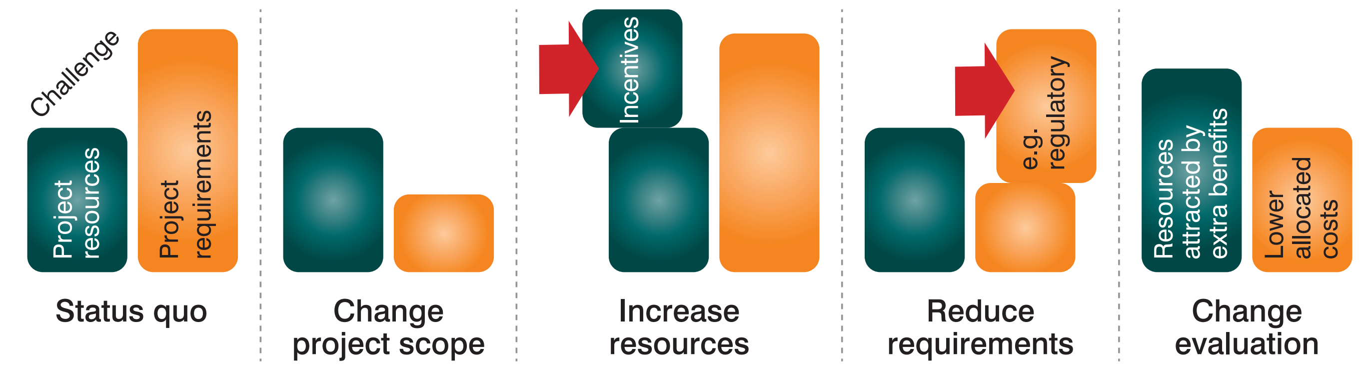

Figure 2: *Illustration of different approaches to addressing challenges faced by energy projects.*

3. Current status

This section provides an overview of community energy in the UK. It then presents examples of community energy projects from different areas of the UK and from other countries, to illustrate the range of motivations, benefits, costs and risks. Some of the examples are explored in more detail in Sections 4, 5 and 6 to identify challenges faced by community energy in the UK.

Overview of community energy in the UK

Over 5,000 community energy groups are active in the UK,[9] covering different aspects of energy: heat production, power production, energy efficiency, demand reduction, transport, energy balancing, energy purchasing, and energy education. Community renewable electricity projects in the UK account for at least 60MW of generation capacity[9] (of which 43MW is in Scotland),[10] excluding projects that are privately owned by local residents or businesses.[11] Community heat projects are a less developed area;[12] more generally, projects that do not generate electricity have been studied less, and DECC's Community Energy Sector Survey in 2016 will gather more information about these.

Independent modelling suggests that there is potential for between 0.5GW and 3GW of community renewable electricity in the UK by 2020.[13] 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).[14] The Scottish Government's ambition is for 500MW of community and locally owned renewable electricity generation capacity by 2020 (in 2014 there was 285MW).[15] In most of these forecasts, solar PV is a major driver. Another study has concluded that ~1.5GW of solar PV capacity could be installed on schools (and more if extended to other community buildings.[16] However, rather than focussing on only energy production, the important point is that community energy can provide other benefits besides energy production; although the evidence base needs to be improved, to develop a better understanding of projects' overall costs, benefits and risks (and distribution thereof to different members of society).

The focus of any project in the UK depends upon various factors, including: local opportunities and resources (e.g. wind power in rural areas, and solar power on urban rooftops); and the needs and interests (e.g. deprived urban areas focussing on fuel poverty, and affluent areas focussing on environmental or engineering opportunities). Similarly, ownership structures vary between projects, and include: joint ownership within a community, local authority leadership, share options in commercial projects, and joint ventures. Some projects use expertise from a range of organisations, e.g. local authorities co-ordinate, local residents present local needs, local businesses provide land, technology providers trial equipment, and energy supply companies provide tariffs. Indeed, many community energy projects have a range of objectives, and can therefore attract more resources (including funds) (see Section 5).

Community energy projects in the UK

Community energy is being promoted by the UK Government and Devolved Governments. The UK Government published its Community Energy Strategy in 2014,[9] and an update on this strategy in early 2015.[17] The Scottish Government has consulted on its Community Energy Policy Statement (CEPS).[18] Community energy features in Welsh Government's energy strategy,[19] and the Northern Irish Executive intends to develop an action plan for community energy.

[9] Community Energy Strategy (DECC, 2014)

[10] Community Energy Policy Statement – Draft for public consultation (Scottish Government, 2014)

[11] Privately-owned projects include those that are "locally-owned" by land owners as opposed to communities (e.g. ~240MW of renewable electricity generation capacity in Scotland). Similarly, most of the UK's ~8GW of solar PV panels are on individual buildings or private land.

[12] However, heat projects make up a third of those funded under the Rural Community Energy Fund (RCEF).

[13] Community Renewable Electricity Generation: Potential Sector Growth to 2020 (Peter Capener, 2014)

[14] The Community Renewables Economy – Starting up, scaling up and spinning out (Respublica, 2013)

[15] Renewable Energy for Communities (Scottish Government, last updated 2013)

[16] Run on Sun (Friends of the Earth, 2014)

[17] Community Energy Strategy Update (DECC, 2015)

[18] Community Energy Policy Statement – Draft for public consultation (Scottish Government, 2014)

[19] A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement (2010)

England

One of the key drivers for the UK Government's ambition for community energy is the potential for greater competition with traditional energy suppliers. Government support totalling £25 million is available for projects in England through the Renewable Community Energy Fund (RCEF)[20] and the Urban Community Energy Fund (UCEF).[21] In 2014, the community energy sector established Community Energy England (CEE)[22] to support the range of projects that are being undertaken.

There are many existing projects in England. For example, Sustainable Charlbury[23] 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 (but planning permission has been rejected).[24] In Nottingham, the Meadows Ozone Energy Services (MOZES) project[25] 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)[26] 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.[27]

Northern Ireland

Northern Ireland has active community energy schemes. The Fermanagh Trust[28] is a community development organisation that uses energy projects to fund activities. It is led by local groups, and members provide advice to other communities about potential projects. There is public sector support for distributed energy and renewable energy, and an intention to develop an action plan for community energy that would consider approaches proposed in DECC's Community Energy Strategy.

Scotland

The comparatively high uptake of community renewable electricity in Scotland (~70% of the UK's total) 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),[29] and to remote communities that are often cut-off from the networks during bad weather (e.g. the Isle of Gigha).[30] Political factors include land reform (with rural communities having greater rights to buy land from their landlords), and the preservation of remote communities (requiring income streams for employment and services). Both policies involve improving the financial situation of communities through some combination of reducing energy costs (e.g. by offering an alternative source), and providing income (e.g. from incentive payments for renewable electricity generation). Other vectors could have sufficed (e.g. perhaps tourism or water resources) if there had been an economic case, but renewable energy was the most obvious because of its abundance, because of the available 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 resources (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[31] is on the main electricity grid, and its projects were motivated by improving 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 15 years) 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 through 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.

[20] See announcement of RCEF funding: **www.wrap.org.uk/content/rural-community-energy-fund**

[21] See announcement of UCEF funding: **www.gov.uk/urban-community-energy-fund**

[22] For more information, see: **www.communityenergyengland.org**

[23] For more information, see: **www.charlbury.info/community/21?category=1**

[24] Planning permission was rejected due to visual impacts in an Area of Outstanding Natural Beauty (AONB).

[25] For more information, see: **www.mozes.co.uk**

[26] For more information, see: **www.wren.uk.com**

[27] For more information, see: **www.thameswaygroup.co.uk**

[28] For more information, see: **www.fermanaghtrust.org/special-initiatives/community-energy-and-community-benefits**

[29] For more information, see: **www.isleofeigg.net/eigg_electric.html**

[30] For more information, see: **www.gigha.org.uk/windmills/TheStoryoftheWindmills.php**

[31] For more information, see: **www.fintrydt.org.uk/about**

Wales

The motivations for community energy in Wales come partly from local initiatives. For example, the Awel Amen Tawe[32] project uses income 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 (illustrating that community projects still face planning difficulties, despite greater local support, as discussed under "Motivations" in Section 5). 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 supply. For example, the Talybont on Usk[33] scheme has refurbished a small hydroelectric power station and uses the income to fund energy-related community projects.

Motivations for community energy in Wales are also partly due to Government policies to tackle poverty, create employment and reduce greenhouse gas emissions. The support scheme, Ynni'r Fro,[34] seeks to assist communities to develop schemes.

Community energy projects around the world

Community energy projects are active in several countries around the world. The following examples illustrate some of the motivations, benefits, costs and risks, which can be shaped by local circumstances and government policies.

Aiding development

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 for delivering services), bringing demand for electricity. This is one driver for deployment of small-scale renewable generation that can improve quality of life at much lower cost than extending networks.[35] Similarly, in South Africa, community energy is driven partly by social policy aims to provide energy in poorer communities and remote areas.[36] Such markets are seen by some product developers as currently being more promising than those in developed countries.

Offering alternatives in established energy markets

Australia has examples of community energy in a liberalised energy market.[37] Many projects make use of abundant solar energy (as well as wind), and help 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.[38] 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. Northern Rivers Energy[39] aims to become a community energy company encompassing generation, networks and retail, and energy education.

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[40] in Boulder (Colorado) 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).[41] The energy sector has local monopoly providers, but consumers 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 small, private investments and a bank loan, used by HGF to pay for a wind turbine, which was built as part of a commercial wind farm.

[32] For more information, see: **www.awelamantawe.org.uk**

[33] For more information, see: **www.talybontenergy.co.uk**

[34] For more information, see: **www.energysavingtrust.org.uk/organisations/content/ynnir-fro-community-programme**

[35] See, for example: Mera Gao in Uttar Pradesh, India: **www.meragaopower.com**

[36] See, for example: CHOICES: **www.iied.org/choices-community-energy-project-south-africa**

[37] See, for example: Coalition for Community Energy: **www.c4ce.net.au**

[38] The Community Renewables Economy: Starting up, scaling up and spinning out (ResPublica, 2013)

[39] For more information, see: **www.nre.org.au**

[40] For more information, see: **www.cleanenergyaction.org**

[41] For more information, see: **www.renewablesinternational.net/the-pioneer-of-community-wind-in-japan/150/435/84058**

Contributing to national energy strategies

Denmark has examples of both electricity and heat community projects. Denmark made far-sighted decisions in the 1970s (in response to oil price shocks) to be a first-mover in developing wind turbine technology. It required that wind farms must offer 20% of the project ownership to local groups. Denmark now produces almost one third of its electricity using wind turbines,[42] and it is the centre of the global wind farm industry. Whilst these centralised energy projects do not seek to produce the "virtuous circle" as community energy can, the large deployment illustrates a potential benefit 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 creation of district heating networks, and they have been an accepted part of Danish society for several decades. These heat networks are perhaps a clearer example of community energy, offering elements of the "virtuous circle", with local residents having roles in their deployment and management.

Germany is the world's biggest example of localised energy, including community energy. More than half of its ~80GW of renewable electricity generation capacity (evenly split between wind and solar) is owned by an estimated 1 million small energy suppliers (community co-operatives, farmers and households). This is the result of a combination of public aspiration, political policy and fortuitous situations. The growth in localised energy has required (and has stemmed from) support from the public (as energy consumers, tax payers, and property owners). There appears to be a willingness to pay costs of the low-carbon transition,[43] partly because energy efficiency helps to offset higher unit costs. Attitudes might be changing due to cost increases,[44] other impacts,[45] and an acknowledgement that 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).[46] 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.[47] 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 refurbishing buildings.[48] The work is partly funded by the German public investment bank (KfW) that sees the energy transition as its third major project, after post-war reconstruction and 1990 reunification.

The growth in localised energy in Germany has been aided by the regional nature of government, financial institutions, and the energy sector.[49] Regional companies (linked by national transmission networks), established in the mid-1900s, are responsible for energy sources, networks and supply, with roles for local authorities. The regulations and processes more easily accommodate small-scale producers and suppliers. Similarly, regional financial institutions are more receptive to loaning to community groups. The key overlap between energy objectives and other local objectives is the desire to minimise exposure to international energy prices.[50] In Freiburg, residents (motivated in part by anti-nuclear views) and city officials developed a municipal energy company[51] that aims to be self-sufficient using renewable energy. In Hamburg, combined heat and power units are installed in most blocks of flats or offices, and are paid to provide 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. Feed-in tariffs incentivise renewable energy production. Landlords have responsibility for heating in their buildings, and so the ~50% of homes that are rented are likely to make use of local heat networks; these are prevalent, and have well-established arrangements for connection and supply, and are hence appealing also to private owners. Refurbishment of buildings is paid for by loans that are large enough to cover the costs of deep refurbishment, and that have low interest rates that help to sway decisions in favour of undertaking these major building works.

---

[42] For more information, see: **www.windpower.org/en**

[43] Surveys suggest ~70% support for Energiewende in 2013: **www.energytransition.de/2012/10/key-findings**

[44] See, for example, a short article at: **www.theconversation.com/germanys-green-power-surge-has-come-at-a-massive-cost-33202**

[45] Neighbouring countries accommodate some power flows of German renewable power; and Germany has been using lignite coal to provide firm capacity, although is seeking to reduce its use. See: Managing Flexibility Whilst Decarbonising the GB Electricity System (ERP, 2015)

[46] For more information, see: Engaging the public in the transformation of the energy system (ERP, 2014)

[47] See, for example, a discussion about changes in Germany's energy market: Allies in Energiewende (Alan Simpson, 2014)

[48] See, for example: Cutting Carbon Costs: Learning from Germany's Energy Saving Program (LSE Housing & Communities, London School of Economics, 2011). See also: **www.energytransition.de/2012/10/key-findings**

[49] See, for example: Creating Local Energy Economies: Lessons from Germany (Respublica, 2014)

[50] 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)

[51] For more information, see (in German): **www.energieagentur-regio-freiburg.de**

4. Assessing outcomes

This section draws together lessons learned about how community energy projects are assessed, including both reviews of existing projects and forecasts for proposed projects. It considers three aspects of the assessments: methodologies for assessments; information used in assessments; and approaches for gathering that information.

Furthermore, this section considers how assessments affect the ability to understand the role of community energy in the UK. Where challenges are identified, this section considers which of the available approaches (as illustrated in Figure 2) could be appropriate for addressing each challenge.

Methods of assessing information

A suitable assessment methodology should assess the benefits that a project can achieve (effectiveness), and the cost of doing so (cost-effectiveness). It should be as accurate as it practicable, but should recognise uncertainties and avoid providing spurious accuracy.

An assessment (whether a review of existing projects, or a forecast for proposed projects) should incorporate the range of topics that the project aims to address. A challenge for community energy is the way that current cost benefit analysis chooses and uses data about projects. On a macro-economic level, there are debates about the ability of some models to properly assess environmental policies.[52] 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 including other outcomes (e.g. to reduce energy demand, tackle fuel poverty and help communities more generally).[53] 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, and some factors are not included in any of the assessments.[54]

There is merit in a more holistic assessment of the overall costs and benefits, using expertise that covers: planning permission, energy regulation, funding, and wider benefits (considered in more detail in Section 5 about deploying projects). 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 existing work that has established an internal DECC working group to aid in the delivery of related policies (e.g. buildings energy efficiency improvements, smart meters, and community energy), and on work with DCLG and Ofgem on planning and energy regulations. The Devolved Administrations could develop or enhance their guidance (although, as noted earlier, in Scotland, different public bodies are broadly aligned in their objectives and assessments).

Assessment of any proejcts requires a valid counterfactual: i.e. a realistic view of the outcome that would be expected in the absence of the project. The counterfactual used in analysis at present is the current energy sector, in which incumbents have certain rights (explicit or implicit) and new entrants bear more costs caused by changes. This does not necessarily consider new entrants' role over the longer-term system. A counterfactual could consider possible future situations, e.g. the UK energy sector in 2030 or 2050 in which existing energy companies have simply replaced centralised systems like-for-like. Against this could be compared consumer-focussed and decentralised approaches for renewing the systems. This analysis would have to include risk factors for each approach (e.g. public opposition, or not triggering sufficient engagement with energy), and the consequences thereof (e.g. environmental damage due to climate change, and the social and economic impacts of insufficient energy infrastructure).

[52] (Mis)understanding Climate Policy – The role of economic modelling (Synapse, for FOE and WWF-UK, 2014)

[53] A grassroots sustainable energy niche? Reflections on community energy in the UK (UEA, 2014)

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

Types of information

An assessment (review or forecast) of community energy projects should consider the full range of inputs and outputs, including risks. Some data can easily be measured (e.g. energy production or energy demand reduction; some data can be measured, but might not be recorded fully (e.g. volunteers' time). Some benefits can be hard to translate into numerical, terms, but are nonetheless tangible and relevant. These topics include: community cohesion, security of supply, energy literacy, the societal benefits of investing in infrastructure,[55] and the value placed by some consumers on having more control over their energy. Data types that would be useful for making assessments are listed in Annex 2. Some data would be applicable only for heat or electricity generation projects; but most data would be relevant for all types of project (e.g. the establishment of a "virtuous circle" could reduce demand regardless of the original type of project).

A range of data has to be gathered to allow consideration of trade-offs. For example, compared to larger projects, community projects could have more support for planning permission, but lower economies of scale (although some are more energy efficient, e.g. CHP). Or, compared to projects on individual properties, community projects need wider agreement, but gain economies of scale.

The data types include attitudes to: community projects, wider infrastructure, and energy in general. When attempting to determine attitudes (and changes in attitudes), surveys must be designed carefully and used consistently. Responses can vary considerably according to the questions asked and options presented, e.g. views about a particular technology might differ depending on whether the question seeks a "for or against" view or a ranking alongside other technologies.

Methods of gathering information

An assessment requires an effective approach to gathering information. A current challenge is inconsistent gathering of data and hence limited data availability. For some community energy projects, data gathering has not been a priority for their limited resources. When data has been collected, some is not easily accessible, because it has not been publicised; although community energy groups are usually very willing to share information, in line with the sector's ethos to help other projects. Some data is not easily accessible, because it has commercial value (e.g. for consultants advising on projects). Finally, some data is not easily comparable owing to differences in collection methods.

However, there are, similarly, data issues when trying to assess large energy companies' projects: confidentiality prevents a clear view of costs within individual companies, and the complexity of value chains can make it difficult to determine the costs and benefits for each party, including energy consumers and tax payers.

There have been actions to gather and analyse data from across a number of projects;[56] the Energy Saving Trust is seeking to build up an evidence base;[57] and DECC holds a database about projects and will update this through its 2016 Community Energy Sector Survey. There would be merit in further studies of community energy, to improve the understanding of its impacts, and to improve forecasts for proposed projects. Annex 2 presents a scoping note of how such studies could be conducted, including: reviewing existing projects; monitoring proposed projects from the start; and trialling alternative arrangements for local energy.

Reviews of existing community energy projects (including their resources, costs, benefits and risks) can be undertaken on an appropriate sample. Monitoring of proposed projects could, in some cases, use projects for which monitoring is already planned for some other purpose, provided that this did not compromise the data gathering for either purpose. Regarding trials of alternative arrangements, Ofgem has been discussing with stakeholders about alternative arrangements through its project on non-traditional business models (NTBMs).[58] These business models range from new tariffs or services from existing energy supply companies, through to energy services provided by local authorities and community groups. Following on from those discussions, there is merit in conducting trials of alternative arrangements for local energy, to study their costs and benefits in detail. Some trials of alternative market arrangements would pose certain risks, or shift costs between market participants, so there would need to be a regulatory "safe space", in which affected parties gave their consent and were offered appropriate protections and recompense. Some such trials could be conducted under Ofgem's Low Carbon Network Fund (LCNF), but these projects have to be proposed and led by DNOs, and it is not clear whether they would be motivated or best-suited for trials of community energy.

[55] Large programmes of work by nationalised industries (energy, transport, telecoms, etc.) were not justified only 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 recent developments (e.g. modern communications) that were not envisaged at the time of construction.

[56] See, for example: Measuring the Local Economic Impact of Community-Owned Energy Projects (Scotland) (Gilmorton Rural Development and the James Hutton Institute, for Community Energy Scotland, 2014)

[57] Community energy partnerships (Energy Saving Trust, ongoing)

[58] Non-traditional business models: Supporting transformative change in the energy market (Ofgem, 2015)

Monitoring and trials could also be conducted in partnership between communities and companies developing products and services for localised energy (e.g. communication and financial services to facilitate the market). There would be some aligned incentives between these partners and community groups. Some 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,[59] local energy economies,[60] and the wider energy networks.[61] Similarly, the innovations in services (including tariffs, communications, and financial instruments to facilitate the market) are motivated by the potential markets of communities that lack the expertise and resources of conventional energy companies. A successful match between communities, research funders, and providers of products and services, 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, services and finance. Examples of existing projects include: on-site battery storage on Gigha (by "Gigha Green Power"); hydro-electric power and smart electric heating in Applecross ("Hydro2Heat"); and integration with hydrogen as a transport fuel on Orkney ("Wind2Wheels"). Some product developers comment that the funding rules can prevent the mixing of funding sources, hence limiting project options.[62] They can also find it difficult to identify suitable communities; this could be addressed by community energy support groups creating a database of communities that are interested in joining studies, which could then be approached by developers, independently of funding bodies and Government departments (which would be acceptable under rules regarding procurement and state aid).

Summary and recommendations

The current approach to assessment poses a challenge to community energy projects in the UK, by not necessarily accounting for all of the relevant issues in a consistent manner. This makes it difficult to assess the impacts of existing projects, and to forecast the outcomes of proposed projects. It also impedes the ability to understand the role of community energy in the UK. This is partly an intrinsic challenge because community energy projects seek to address multiple issues which are not always easily defined (including 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, and not necessarily with an appropriate counterfactual.

Figure 2 illustrated different approaches to addressing challenges. The most appropriate solution to this challenge would be two-fold. Firstly, there could be improvements in the evaluation processes used by evaluators and decision-makers (i.e. funders, planning authorities, network companies, etc.), such that they consider all of the factors in a co-ordinated manner, allowing for a more holistic and consistent treatment of existing projects and proposed projects. Secondly, there could be an increase in resources for community groups, in the form of information (e.g. a database of case studies about similar projects) and guidance (e.g. template documents) to help them to include important factors (as noted in Annex 2) when producing business cases for proposed projects and when reporting on existing projects. Furthermore, through a wider assessment (see the scoping note in Annex 2), there is an opportunity to better understand the role of community energy in UK, in order to inform decisions about whether community energy's net impacts (and their distribution in society) justify taking action to address challenges that it faces in the UK.

We recommend steps to improve assessments of community energy projects, and to improve the understanding of the role of community energy in the UK:

- **DECC and the Devolved Administrations should develop recommended approaches for monitoring and evaluating community energy projects (including key data that should be collected), and for producing business cases for proposed projects.**
- **DECC and the Devolved Administrations should develop guidance for decision-makers (funding, planning permission, energy regulation, wider social benefits, etc.) for assessing community energy in a holistic and co-ordinated manner.**
- **DECC and the Devolved Administrations should review and monitor community energy projects; and, with Ofgem, they should trial alternative local energy arrangements.**
- **Support groups should develop a database of community groups that are interested in participating in studies of technology and services, to allow product developers and service providers to more easily find suitable partners.**

[59] See, for example: £11M joint Innovate UK and EPSRC "Localised Energy Systems Competition"

[60] See, for example: £20M Scottish "Local Energy Challenge Fund"

[61] See, for example: Low Carbon Network Fund (LCNF); and the Electricity Demand Reduction (EDR) Pilot

[62] For example, LCNF trials must be led by network companies, and are incompatible with some other funds.

5. Deploying projects

This section draws together lessons about the deployment of community energy projects. Most of the examples are of renewable electricity generation, but many lessons apply more broadly to heat production, demand reduction, and other types of projects. 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 in the UK? 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. Developing 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, legal, engineering, marketing, etc.). Some projects are proposed and run by a small leadership group of locals that might have some (but rarely all) of the necessary expertise. Peer-mentoring schemes allow groups to draw on experience and expertise of other community energy groups. This is encouraged by the sector support groups around the UK, and required from recipients of DECC finance. Schemes sponsored by the Welsh and Scottish Governments employ experts to encourage communities to use local renewable energy sources, and to provide them with support.[63] However, mentoring and support are not always sufficient, because some groups do not have members with the ability and time to train in the necessary skills.

Another model is for professionals to run projects[64] (which is common in Denmark and Germany), in such a way that local involvement is facilitated in those aspects of projects that contribute to the "virtuous circle" of acceptance of change and engagement with energy. For example, in the UK, schools that install solar PV panels on their property have to undertake the administration for Feed-In Tariffs (FITs) themselves. This is an extrinsic requirement that does not contribute to the delivery of benefits relating to energy and the community more widely. The ability to delegate such tasks to a central team (e.g. in a local authority) would make it easier for groups to undertake projects and would reduce overall costs, whilst not diminishing the delivery of benefits within the community.

Some energy companies are offering tariffs and services for communities.[65] These may, or may not, satisfy all of the objectives of low-carbon community energy, but they could provide community groups with support and expertise. In the case of electricity generation, an alternative means of finding expert support is by working with a professional project developer (e.g. for solar farms and wind farms), which can also help to win support for the development (as discussed in the section about funding, below). These relationships can develop further, with community groups using developers' expertise to advance their community project (e.g. Fintry wind farm, discussed in Section 3). This approach might become more common under the voluntary shared ownership scheme for wind farm development.[66] Finally, communities can find expert support by partnering in studies with companies that are seeking to develop new products and services for local energy, including the necessary communications and financial services to facilitate the market, as discussed in Section 4 about assessing outcomes.

Motivations

Community energy projects can be driven by a range of motivations (see examples in Section 3), both from communities and from political policies. A survey suggested that a significant proportion (42%) of consumers would be interested in a community energy project if it would save them money;[67] it is not clear how many people are interested for other reasons. Some communities are enthusiastic about community energy projects, and motivations vary depending upon community characteristics, ranging from deprived urban areas where fuel poverty is a major problem, to some more affluent areas that focus on the environmental or engineering opportunities. However, views within a community can be contradictory, with different demographics having contrasting views about local needs. Some rural projects have support from residents with local family links, who might welcome a source of employment, and can see renewable energy as a continuation of a local heritage of energy or industry. But such 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.[68]

[63] See, for example: **www.energysavingtrust.org.uk/organisations/ynnir-fro-community-programme**

[64] See, for example: Energy4All, an expert support organisation for community groups that co-own it.

[65] See, for example: Ovo Communities: **www.ovoenergy.com/energy-plans/communities**

[66] Shared Ownership Taskforce: Report to DECC (Shared Ownership Taskforce, 2014)

[67] Research for DECC (DECC, 2014)

[68] Source: Interviews conducted for this project

Common motivations include energy bills, environmental views, and a desire for self-sufficiency or control of resources (whether through community ownership or democratic accountability through local authority ownership). These are likely to remain as motivations for community groups. Some policy objectives that have been important in encouraging uptake of community energy around the UK (see Section 3) are likely to remain in place (e.g. income streams for community services, and reducing fuel poverty), although others seem less certain (e.g. renewable energy production).

Lack of interest from some consumers can be due to disengagement from 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 consumers can be largely passive. Energy consumers' attitudes to environmental issues are affected by personal concerns and by perceptions of wider factors such as public opinion and economic impacts. However, messages that can shape perceptions do not necessarily reflect those wider factors,[69] and energy consumers' perceptions can become erroneous.[70] Furthermore, public debates about energy costs and incentives have focussed on the (comparatively small) costs of incentive schemes, and have ignored the longer-term savings that are provided by these investments in new energy sources and energy efficiency. In doing so, the debates have failed to present the benefits of demand reduction (via efficiency) as being the best way to reduce exposure to unit prices (and hence to reduce current bills and future risks).

There could also be an issue of limited engagement in community activities in general. Some UK residents (and businesses) lack a sense of connection to their local community, partly due to short occupancy times (we move home on average every 5-10years), a desire for privacy, or a difference of opinion over the nature and needs of a community (e.g. how to balance preservation and development). However, there are factors that can act to encourage involvement. Within the home rental sector, local authority and housing associations are often ambitious in meeting tenants' energy needs; they can raise the profile of local energy, and could choose to 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, some residents' desire for independence. This can sometimes extend to a desire for greater energy independence (e.g. from energy supply companies, energy imports, or even neighbouring UK regions). Some local energy projects can satisfy some of these ambitions (but not all, e.g. most heat networks rely upon fuel from outside of a local area).

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 for electricity generation projects: e.g. some local councillors can be (due either to their personal assessments or their perceptions from the press) swayed more by visual impacts than by social, economic and other environmental factors.[71]

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,[72] and the guidance on how to treat projects that contribute to sustainable development is arguably too open to interpretation.[73] There was concern at the proportion of planning applications for onshore wind farms in England that DCLG adjudicated on (superseding local processes),[74] the time taken to make decisions,[75] the proportion of those that it has rejected,[76] and apparent inconsistencies between its decisions.[77] Uncertainty has been introduced by the revised planning rules that allow local communities to decide on planning applications for wind farms; as noted above, a community can contain opposing views that can be hard to reconcile in decisions.

[69] See, for example, comments that the public was "fed up" with onshore windfarms (quoted in The Guardian, 2014). Survey data shows that 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).

[70] 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).

[71] Source: Interviews conducted for this project

[72] The Town and Country Planning (General Development Procedure) (Amendment) (England) Order 2006

[73] National Planning Policy Framework (DCLG, 2012)

[74] DCLG has adjudicated in over 50 wind farm planning applications since 2010.

[75] See, for example: Enquiry into the Operation of the National Planning Policy Framework (House of Commons, Communities and Local Government Committee, 2014)

[76] DCLG has rejected planning permission for 80% of wind farms on which it has adjudicated.

[77] Source: Interviews conducted for this project

Similarly, solar PV developments have also encountered planning rejections, although some have been reversed.[78] 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,[79] 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. Heat production projects might face fewer planning challenges than electricity projects in terms of visual impacts. However, local heat projects can be deterred by other aspects of the planning processes, and these challenges are greater if community groups lack expertise.

Funding

Funding issues can pose challenges to community energy. Projects need funding to cover their upfront costs (e.g. capital investments, regulatory compliance), and income to repay funding over time. Projects also need financial contingency to cover operational risks (e.g. credit, collateral); this is discussed in more detail below, under "energy regulations". Some funding challenges are intrinsic to projects: i.e. if a project's available financial resources are insufficient to pay for the core items (e.g. equipment and expertise). Some funding challenges are extrinsic: i.e. if a project has funds, but the administrative or legal arrangements are difficult for community groups to navigate (including business plan preparation, as discussed in section 4 about assessing benefits). There is also the issue of social equity: i.e. whether incentive payments benefit poorer residents (who contribute to the payments) as well as wealthier residents (who can afford to invest in the schemes).

Most (if not all) of the UK's community energy projects have received financial support in the form of up-front grants or loans, or as on-going incentive payments. Up-front support for community energy 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.

The ongoing income for community energy projects is affected by commodity prices and incentive payments. Renewable heat projects are exposed to increases in the price of biomass. All projects that export renewable electricity are exposed to reductions in electricity prices that would reduce their incomes. Incentives payments (e.g. FITs, RO, and RHI) have encouraged deployment of technologies that could not compete under the current arrangements. There were concerns that these incentives lacked the long-term certainty that is necessary for robust business cases, as borne out by unexpected changes to FITs payments in 2011-12.[80] (These were partly in response to cost reductions for solar PV panels, but there had also been unsubstantiated claims about the impacts of solar farms.)[81] The Levy Control Framework was supposed to provide 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).[82] However, in 2015, it was announced that incentive payments would be removed earlier than agreed for onshore wind turbines, and substantially reduced for other forms of low-carbon energy production. Given the provision of upfront financing and ongoing incentive payments, most community energy projects in the UK are not currently "financially self-sufficient". 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 it can support itself independently. However, it could be the case that community energy projects appear to be "financially unsustainable" only if they are viewed simply as energy production projects. Many community energy projects attempt to achieve more than just energy production, and instead go beyond and attempt to create a "virtuous circle" of energy benefits, as well as wider benefits. In those cases, they should not be judged as delivery mechanisms for a range of policy objectives, many of which require funding as an input. In that sense, grant funding can be justified, not as a subsidy but as a payment for providing a service. Furthermore, many large-scale corporate energy projects also use grants or energy sector support, including: incentive payments for renewable energy; and risk management through long-term certainty (via regulated returns, or wholesale price commitments).

Wind farm developers have a need to gain local support for their projects. This can be achieved through providing funds for community projects.[83] There is a voluntary framework whereby wind farm developers can offer shared ownership for local residents, of between 5% (for larger developments) and 25% (for smaller developments).[84] These can be provided in one of

[78] See, for example: **www.planningportal.gov.uk/general/news/stories/2015/Mar15/190315/190315_3**

[79] Report by Planning and Permitting Working Group (2014)

[80] Feed-in tariffs scheme: consultation on Comprehensive Review Phase 1 – tariffs for solar PV (DECC, 2011)

[81] See, for example: FOI release: Common Agricultural Policy (CAP) subsidy on solar arrays, Defra, 2015

[82] Control Framework for DECC Levy-Funded Spending (HMT, 2011)

[83] See, for example: Community benefit registers: **http://www.communitybenefitsregister.org**

[84] Shared Ownership Taskforce: Report to DECC (Shared Ownership Taskforce, 2014)

three ways (split ownership, joint ownership, or shared revenue), and are seen as a key way forward in delivering renewable generation capacity. In some cases (e.g. the Fintry wind farm), such funds are part of a wider plans for community energy. However, without such plans, there are concerns that this arrangement could have insufficient financial feedback loops to have all of the desired benefits in communities.

Buildings' refurbishment had been funded through a succession of energy supplier obligations, but progress slowed in recent years due to changes to the Energy Company Obligation and the limited impact of the Green Deal,[85] and there is no detail yet about their successors. 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, luxury and modernity. If owners associated energy performance with such aspirations, they might be more willing to undertake improvements (for which local collaborations might be attractive).

Private investments in community energy have been modest, but are growing, with £35million raised since 2012.[86] 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 more as 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 has worked 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).[87] 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.

[85] Left out in the cold (The Association for the Conservation of Energy, 2015)

[86] For more information, see: Community Shares Unit: **www.communityshares.org.uk**

[87] Income tax and Venture Capital Schemes for companies and community organisations benefiting from energy subsidies (HMRC, 2014)

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 a 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.[88]

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.[89]

Energy regulations

Energy regulation is frequently a significant challenge for community electricity projects.[90] Regulations of some form are essential for smooth operation of energy systems and markets. The current regime is designed to align the interests of consumers with those of the competitive market participants and incentive-driven network monopolies. But regulations could take many different forms, depending upon the situation and objectives. Community energy can seek to protect consumers' interests via ownership or democratic accountability (e.g. local authority ownership), potentially reducing the need for consumer protection regulations. Consumers could opt out of the consumer protection that can come from the right to switch energy suppliers in the competitive retail market, in favour of being served by local not-for-profit energy suppliers.

Energy regulations for heat projects are fewer (than for gas and electricity) which some groups believe to be helpful for facilitating innovation, studies, and deployment. Although as the sector expands, additional regulations might be necessary in order to ensure high performance and fair terms for consumers. However, even at present, energy regulations designed to protect consumers (e.g. data protection, third party access, and right to switch) have deterred some local heat projects.

The electricity sector's regulations are complex, in part due to technical necessities (e.g. to maintain balance between generation and demand), and in part due to the context in which the regulations developed (i.e. for a system run by large, expert companies). Introducing more localised energy affects the status quo in relation to the complexity of the sector's operation and relationships. System balancing can be harder now that there is more wind and solar electricity generation in the UK, owing to imperfect (albeit improving) weather forecasting, and lack of visibility of (and control of) solar generation at lower network levels. Some of these challenges are seen more in Germany.[91] The present financial incentives pass on the costs of balancing to the market participants that cause imbalance. Small electricity projects might be unable to cope with the financial risks: generators face potential costs relating to reliability (e.g. if they do not conduct repairs on time) and availability (e.g. if weather forecasts are inaccurate). There could be scope to reduce the balancing risks faced by smaller energy projects (generation or supply). Localised energy storage is often cited as an option to allow for more flexible use of variable electricity generation, to reduce the risks under the current regulations.[92] However, whilst storage could reduce operational financial risks, it would increase capital costs for projects that can already struggle to raise upfront finance. Alternative local arrangements (e.g. "local supply" model) could be used, in which consumers can consent to demand management to match with local generation.

Electricity grid connection is a complex administrative process,[93] 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 consumers. If a consumer applies for a new (or expanded) connection in a congested area, then charges can increase for all consumers in that area to provide a price signal to deter use of the limited grid capacity.

[88] See: **www.naturalresources.wales/apply-and-buy/water-abstraction-licences-and-impoundment-licences/water-abstraction-and-impoundment-licensing/hydropower/before-you-apply/?lang=en**

[89] Community Biomass Guide (Forestry Commission, DECC and DEFRA): **www.forestry.gov.uk/communitybiomass**

[90] Source: Interviews conducted for this project

[91] See, for example: Managing Flexibility on the Electricity System (ERP, 2015)

[92] Energy storage is being investigated by some LCNF trials, e.g. Orkney Energy Storage Park (SSE, ongoing)

[93] See, for example: Ofgem-led work for DECC's Connections work stream of the Community Energy Strategy

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";[94] but thus far there has been only one Licence Lite application, and this was by the Greater London Authority (GLA) for transport operations as opposed to a community energy project. There are some concerns that the retail market simplification[95] (that is intended to protect consumers) will remove options to offer innovative tariffs including for communities, although there can be flexibility within the regulatory rules.[96]

There is debate over whether there could be different arrangements that would allow consumers and communities to have a greater role in 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 some mainland private wire networks). To apply this more widely would be complex, and would require communities to have (or pay for) specific xpertise, so this arrangement would benefit from some entity playing a co-ordinating role on behalf of individuals and communities. Some local authorities are seeking to play that role, and there could be merit in expansion;[97] this is discussed further in the ERP's project on Cities that considers the possibilities for a return to municipal energy.[98] Perhaps the most common type of local authority involvement is in energy efficiency schemes, co-ordinating with other agencies to provide funding and to undertake mass refurbishments of homes and community buildings. In terms of energy production, heat projects are often the most straight-forward from a regulatory point of view, and so currently offer significant scope for local authority involvement. Electricity generation can also be an appealing option for local authorities. Some local authorities could be interested in going further in the electricity sector, and setting up not-for-profit community services: electricity supply companies for local residents and businesses; and perhaps even locally-owned electricity distribution networks. Others would simply like electricity network companies to provide more information about the local networks, so that they can play a more informed role in managing demand and siting new energy production.

The net impact upon consumers of such changes is not clear, and would require a wide cost-benefit assessment. For example, if profit-making was reduced (or removed) in part (or all) of the value chain, then those savings could be passed to consumers. But doing so could reducing investors' returns, which could reduce projects' access to finance, increase financing costs, and reduce pension schemes' returns (including for some local residents). If smaller networks reduced the economies of scale, this could add costs for consumers. Certain regulatory requirements would have to remain in place, particularly around safety, and EU rules for competition and third party access. Some requirements could be scaled back in proportion to reductions in risk, including those designed to protect consumers from potentially negative impacts of a competitive markets and incentives, 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 in Section 4), following on from Ofgem's discussion paper about Non-Traditional Business Models.[99]

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 due to reliability or safety issues), and proposed replacements are costly and many years from completion. The UK's coal plants will close soon under the Large Combustion Plant Directive (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 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, including the wide range of factors (as discussed in Section 4 about assessing outcomes).

A similar choice exists for heating buildings. Due to difficulties with transmitting heat, almost all heat for buildings is produced in the same location as it will be consumed. In that sense, heating is "localised": most heating systems are highly localised in individual buildings, whereas heat networks provide heat for buildings in a local area. Heat networks can use traditional heating fuels and technology (e.g. boilers fuelled by gas or oil). However, with the continued decline of North Sea reserves, and with the need for decarbonisation, heat networks can be fuelled using alternative energy sources (e.g. biofuels), or by existing fuels in newer systems (e.g. heat pumps powered by electricity), or without the use of any additional fuel (e.g. waste industrial heat). Given these options, the UK could have an opportunity to actively decide to increase the use of heat networks. This would have impacts upon the gas networks. Operational changes could probably be accommodated; balancing the gas system is generally easier than for the electricity networks. But financial impacts would be more challenging: the costs in building heat networks would be compounded by the fact that parts of the gas infrastructure would become "stranded assets" before they have been fully used; and gas investment that is needed for the shorter term could be deterred.

[94] Proposed updates to the "Licence Lite" arrangements (Ofgem, 2014)

[95] The Retail Market Review – Implementation of Simpler Tariff Choices and Clearer Information (Ofgem, 2013)

[96] See, for example: Decision in relation to Ovo's Peterborough City Council Tariffs (Ofgem, 2012)

[97] See, for example: City Energy: A new powerhouse for Britain (IPPR, 2014)

[98] The Re-municipalisation of Energy (ERP, 2015)

[99] Non-traditional business models: Supporting transformative change in the energy market (Ofgem, 2015)

Summary and recommendations

This section has illustrated that there are many reasons why comparatively few community energy projects are attempted in the UK, and why many of those that are attempted do not reach deployment. These challenges include issues that are intrinsic to the projects (primarily lack of certain skills and expertise), and also issues that are extrinsic (primarily funding, planning permission, and regulations).

For regulations, the appropriate solution could involve amending the requirements that projects must satisfy under current arrangements. This could take the form of derogations, 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 Section 4 about assessing outcomes). There is an opportunity to investigate this option further by conducting trials of alternative market and regulatory arrangements for electricity, and new arrangements for the emerging heat sector (as recommended in Section 4). Once further research has provided more information about the role of community energy projects in the UK, it could be justified to consider substantive changes to address deployment challenges that they face.

In the meantime, there are some less substantive changes that could be made: given the present small scale of the community energy sector, certain changes could be desirable (there is merit in assisting the deployment of projects, including for studies of technology and services, as per Section 4) and acceptable (there is little risk of distorting the wider energy sector).

The most beneficial actions that could be taken at present would be those that provide community energy groups with more resources (especially guidance and expertise) to help them to meet the existing requirements. Available routes for providing guidance and expertise are discussed in this Section and also in Section 6, and include: tailored guidance and advice from community energy support groups; partnering with corporate developers through schemes such as the voluntary shared ownership arrangements; and partnering with providers that wish to conduct studies of new products and services for localised energy. Some of these opportunities have been discussed in Section 4 (about assessing projects). In addition, the ability to delegate administrative functions to a central team (e.g. in a local authority that could work on behalf of all groups in an area) would make it easier for groups to undertake projects and would reduce overall costs, whilst not diminishing the delivery of benefits within the community.

We recommend steps to improve the deployment of community energy projects (including for conducting studies) and the delivery of benefits:

- **DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice for their projects.**
- **DECC and the Devolved Administrations should identify routes by which community energy groups could delegate administrative tasks.**

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 helps to garner support for projects. These non-energy aims are often aligned with the energy objectives (e.g. insulating homes saves energy, 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 trade-offs might be needed. Some residents can be motivated more by the non-energy objectives of a project to the detriment of energy aims (e.g. using an income stream to fund community services rather than 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 fuel poverty reduction), the same challenges can exist for delivery of these benefits as for project initiation (as discussed in Section 5 about deployment). 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. Once a project has been deployed, some benefits emerge in a straight forward manner (e.g. producing low-carbon heat or electricity); but other benefits can be more complex to deliver (e.g. reinvesting income to reduce fuel poverty). In some cases, renewable electricity 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 might not target the project's income effectively to reduce fuel poverty because they lack an understanding of fuel poverty and lack the necessary local contacts.[100] Similarly, a founding project team might lack expertise for educational programmes to improve energy literacy, or to generate interest from 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 some issues across the community. These advantages have to be traded off against the risk that reducing the leadership from residents could weaken the "virtuous circle" of engagement, energy literacy, acceptance, and change.

[100] Source: Interviews for this project

Feedback loops

Some community energy projects have strong feedback loops that can help to initiate and sustain engagement from residents and businesses. For example, if a low-carbon local heat network is sized to meet peak demand, then residents have an incentive to avoid exceeding that heat demand. This technical link is weaker where residents have individual heating systems each with excess capacity. In a more stringent example, if an energy source is sized to match an isolated 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. 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. This technical link is weaker in communities that have the resilience and back-up of the main electricity networks; but it could be emulated to some extent using smart meters and (dynamic) time-of-use tariffs.

Some community energy projects have strong financial feedback loops. For example, local heat supply through a district heating network, or local electricity 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". Financial links are different for communities that are connected to the main gas or electricity networks, e.g. if a community wind farm exports its power onto the grid. These comments do not apply to the heat produced by community heat networks, because heat cannot easily be transported to other locations, and so there is no alternative to the financial arrangements discussed above.

There can be financial links for heating fuel (as opposed to heat produced from that fuel): if a local heat network uses biomethane (produced from anaerobic digestion) and if the community is connected to the main gas networks, then it can inject excess biomethane into the main gas network and receive an incentive payment. Similarly, where electricity is produced in (or near) a community (e.g. ground-mounted solar PV), but not on individual buildings, it is exported onto the main electricity networks. In these cases, local consumers pay a regular retail price for imported gas or electricity, and the incentive income is received separately by the community energy group. Individual residents lack clear financial links between their energy bills and the benefits of the community project, which might inhibit the "virtuous circle". However, there are distinct benefits to the vast majority of consumers being connected to the main energy networks with the resilience that this provides.

Alternatively for electricity, it can be produced on a community building (e.g. solar PV on a community centre). Users of that building can use that electricity free of charge, and export excess electricity onto the main network (as for non-building installations, discussed above). Again, individual residents lack clear financial links between their energy bills and the benefits of the community project, potentially inhibiting the "virtuous circle" of benefits.

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 (the Community Powerdown Orkney project). The motivation there for this "local balancing" is to cope when constraints limit the export of renewable electricity. 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 consumers.

Private households with solar PV panels are an example of how consumers 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 can encourage further engagement with energy: there are anecdotal examples of demand balancing, with residents making more use of electricity at sunnier times of day.[101] 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 buildings' refurbishment suggests that many of these households are not reinvesting their FITs income on energy efficiency projects.

[101] Source: Interviews for this project

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.[102] For example, some community energy schemes provide energy directly to residents, at lower costs than from normal energy suppliers. It is well established that cheaper prices often result in higher consumption (the "rebound effect"). Some increases in usage are simply wasteful and should be discouraged. But some are to be welcomed, e.g. if consumers were previously struggling to heat their homes and are then were able to afford more comfortable and healthier temperatures. Whatever the reason for any increase in energy demand, if the project has replaced fossil fuel sources with low carbon sources, then the net effect can still be environmentally beneficial.

Perhaps the biggest potential unintended consequence is for costs and benefits to accrue in undesirable ways (an issue for the energy sector in general, not only community energy). Within communities, benefits can accrue more to those residents that are aware of the project and able to engage with it, and not necessarily those that are in most need of help with energy costs (or have the greatest potential to make reductions). Some renewable electricity projects are led by wealthier residents whose communities then benefit from incentive payments, which include a redistribution of money from poorer electricity consumers throughout the UK.

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 different views, balancing the other intended benefits.

Community energy projects could have unexpected impacts upon attitudes to infrastructure for the wider energy system (not used for a community's project), including wider infrastructure located near to a local community. There is insufficient survey data on this issue, 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 consumers in other areas. This view could be amplified if residents feel that the infrastructure is only needed because other consumers have not made similar efforts to them in terms of energy efficiency and balancing. 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. It is possible that some communities might follow through on this line of reasoning and decide to disconnect from the networks, which would reduce the number of consumers from whom network costs are recovered, hence increasing costs for poorer consumers who in turn might disconnect to avoid costs (harming themselves, and reinforcing a vicious circle).

Summary and recommendations

Delivering a full range of intended benefits and avoiding unintended consequences can be a challenge for projects. It 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.[103] DECC is funding the initial development of the Community Energy Hub (having contracted the Energy Saving Trust) which will provide a forum for discussion between groups, and signposts to sources of advice, including toolkits about renewables and energy efficiency.[104]

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.[105] 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.

We recommend steps to improve the delivery of the expected benefits of community energy projects:

- **DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice for their projects.**

[102] Some of the examples in this section are anecdotal, taken from interviews for this project.

[103] See, for example: **www.localenergyscotland.org/funding-resources/resources-advice/cares-toolkit**

[104] See call for proposals for Community Energy Support and Advice Resource (DECC, 2014)

[105] See, for example: **www.localenergyscotland.org/funding-resources/resources-advice**

7. Conclusions and recommendations

Community energy could be an effective means of delivering benefits, both for the low carbon transition, and in other aspects of society. Examples from the UK and from other countries illustrate the motivations, benefits, costs and risks of community energy. Motivations for community energy include political objectives, local priorities, and some consumers' desire for more control of their energy affairs. Energy-related benefits that have been delivered include: low-carbon 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; and greater community cohesion. Community energy faces challenges in the UK, in how projects are assessed, in the deployment of projects, and in the delivery of expected benefits.

There are opportunities to address the challenges posed by the assessment of community energy projects, by taking into account the full range of costs and benefits in a co-ordinated manner. Furthermore, through a wider assessment, there is an opportunity to better understand the role of community energy in UK: evidence from existing projects could be reviewed; data from proposed projects could be monitored more consistently; and trials could be conducted to test specific local arrangements for community energy. This research would inform decisions about whether community energy's net impacts (and their distribution in society) justify taking action to address challenges that it faces in the UK.

We recommend steps to improve assessments of community energy projects, and to improve the understanding of the role of community energy in the UK:

- **DECC and the Devolved Administrations should develop recommended approaches for monitoring and evaluating community energy projects (including key data that should be collected), and for producing business cases for proposed projects.**
- **DECC and the Devolved Administrations should develop guidance for decision-makers (funding, planning permission, energy regulation, wider social benefits, etc.) for assessing community energy in a holistic and co-ordinated manner.**
- **DECC and the Devolved Administrations should review and monitor community energy projects, and, with Ofgem, should trial alternative arrangements for local energy.**
- **Support groups should develop a database of community groups that are interested in participating in studies of technology and services, to allow product developers and service providers to more easily find suitable partners.**

In time, more information will become available to inform decisions on changes that could increase the deployment of community energy in the UK. In the meantime, there are certain opportunities to reduce the challenges for projects without increasing costs or risks for other consumers. In addition, there are opportunities to increase the delivery of expected benefits of projects, and to reduce unintended consequences. This can be done in part by providing community groups with more guidance and advice for developing their own abilities, and in part 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 (including for conducting studies) and the delivery of benefits:

- **DECC and the Devolved Administrations should identify routes by which community energy groups could receive tailored advice for their projects.**
- **DECC and the Devolved Administrations should identify routes by which community energy groups could delegate administrative tasks.**

Selected 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)

Call for proposals for Community Energy Support and Advice Resource (DECC, 2014)

City Energy: A new powerhouse for Britain (IPPR, 2014)

Community energy partnerships (Energy Saving Trust, ongoing)

Community Energy Policy Statement - Draft for public consultation (Scottish Government, 2014)

Community Energy Strategy (DECC, 2014)

Community Energy Strategy Update (DECC, 2015)

Community Renewable Electricity Generation: Potential Sector Growth to 2020 (P. 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)

Decision to grant Ovo Energy Limited a temporary derogation from sub-paragraph 22B.2(b) of SLC 22B of their respective gas and electricity supply licences in respect of Peterborough City Council Tariffs (Ofgem, 2012)

Distributing Power: A transition to a civic energy future (Realising Transition Pathways, 2015)

Engaging the public in the transformation of the energy system (ERP, 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)

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)

Managing Flexibility on the Electricity System (ERP, 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: Supporting transformative change in the energy market (Ofgem, 2015)

Orkney Energy Storage Park (SSE, ongoing)

Power to Switch campaign (DECC, 2015)

Proposed updates to the "Licence Lite" arrangements (Ofgem, 2014)

Renewable Energy for Communities (Scottish Government, last updated 2013)

Run on Sun (Friends of the Earth, 2014)

Survey of public interest in community energy, cited in Community Energy Strategy (DECC, 2014)

The Community Renewables Economy – Starting up, scaling up and spinning out (Respublica, 2013)

The Retail Market Review – Implementation of Simpler Tariff Choices and Clearer Information (Ofgem, 2013)

What's the missing ingredient in UK energy policy governance? (CSE, 2014)

Annex 1: List of interviewed organisations

Awel Amman Tawe

Bangor University

Camarthenshire Council

Community Energy Scotland

Community Energy England

Energy Savings Trust

Energy Technologies Institute

Friends of the Earth

National Grid

Ofgem

Scene Consulting

Sustainable Charlbury

UKERC

Welsh Government

Ynni'r Fro Programme

Annex 2: Scoping note – proposed research into UK community energy

This scoping note sets out an initial outline of how a research project could be conducted to investigate resources, costs, benefits and risks of community energy (as discussed in this paper).

Topic: Investigation into the impacts of community energy projects in the UK

Purpose

The proposal for this work is to study community energy projects in the UK. The aim of this proposed work is to understand the impacts (costs, benefits and risks) of community energy projects in the UK, in order to facilitate a fuller discussion about the potential role of community energy in the UK's energy sector. A first step would be to develop an assessment protocol that accounts for the range of impacts of community energy. This (along with appropriate guidance for decision makers) would also be useful in allowing more effective decisions by project groups and decision makers when reviewing and forecasting impacts.

Background

Motivations for community energy include political objectives, local priorities, and some consumers' desire for more control of their energy affairs. Community energy is being pursued by groups across the UK, and is promoted by the UK Government and the Devolved Governments.

Community energy can bring benefits, both in the energy sector and more widely. It has the potential to engage local communities in energy matters, with the aim of bringing two main benefits: acceptance of change, including use of new technology, change in behaviour, and deployment of infrastructure in the local area; and engagement with energy, including demand reduction and energy balancing. Many community energy projects aim to achieve a range of other, non-energy objectives, e.g. funding for local services, community cohesion, etc. Indeed, for some projects, energy is simply a convenient source of income for other activities; but even in those cases, the energy-related benefits can be realised.

Community energy also incurs costs and faces risks, so projects need resources: finance to cover their upfront costs (e.g. capital investments, regulatory compliance); and income to cover their ongoing costs (including repaying finance). Projects also need financial contingency to cover operational risks (e.g. credit risks, commodity prices, and future levels of incentive payments).

Method

The proposed project should study the full range of resources and impacts (costs, benefits and risks) of a range of community energy projects. The project should use the following three approaches:

i) Review existing community energy projects (under current regulatory regime), using reviews of literature and project materials, and interviews;

ii) Monitor proposed community energy projects from the start (under current regime), using project materials, surveys, and some technical measurements;

iii) Trial alternative arrangements for community energy provision (in place of the existing regulatory regime, e.g. local energy markets and local balancing), using project materials, surveys, and larger numbers of technical measurements.

These three approaches (review, monitor, and trial) would require successively more effort, but would deliver commensurate levels of information. Reviews would have the lowest costs, but would yield least information due to lack of robust data (it might not have been collected) and limited meta-data (there is often uncertainty about how data was collected and hence how it can be interpreted). Monitoring and trials would have larger costs, but would allow for more effective gathering of data (and meta-data). Monitoring could be limited by the scope of the proposed community energy projects, whereas trials of alternative arrangements would be designed so as to allow study of any aspects of interest.

The three approaches could be arranged in “rings”: a core of a small number of detailed trials; a larger number of monitoring studies; and a large still number of reviews. Where projects in different rings shared similar characteristics, it could be possible to use those for which there is more detail to draw inferences about those for which there is less detail, potentially increasing the statistical power of the results.

Ideally, there would be sufficient trials to cover various combinations of communities and project characteristics (see below), at least one of each type (for validation). However, if the number of studies conducted is limited by the research resources, an alternative approach would be to treat the trials as a series of case studies: the aim should be to investigate key characteristics (see below) to determine which are significant in achieving key outputs, and to assess the costs, benefits and risks for each output.

It would be necessary to determine a suitable number of projects to study using each approach (review, monitor and trial). Taking into account the objectives, the risks (e.g. drop-out), and the number of community energy projects that are active (and planned) in the UK, an initial suggestion for the numbers of studies is: ~5 trials, 10-20 monitoring studies, and 50-100 reviews. It could be useful to draw on examples such as the Energy Demand Research Project (EDRP) and the Low Carbon Network Fund (LCNF).

It would be necessary to gather a large range of information (see below) about each project. Some quantitative data would be easily obtained (e.g. energy consumption would be available from consumers’ energy meters and network operators). Other quantitative data (e.g. costs and available resources) and most qualitative data could take more effort as it would have to be gathered specifically. In order to account for all impacts of community energy, the boundaries of the analysis (see below) should be wide enough; and they should be consistent between studies.

The duration of data to be studied should be at least two years, to allow annual weather impacts to be accounted for. Ideally, data should be collected periodically thereafter, particularly to determine the longevity of demand reduction and (changes in) attitudes to energy.

When considering what data to gather, it is necessary to set appropriate boundaries for the data gathering and analysis. The proposed boundaries for these studies are:

- **Timescale for analysis:** extrapolate data out to the lifetime of the installed technology (to capture impacts that take longer to accrue);

- **Energy system scope:** distribution and transmission networks, wholesale and retail markets (to capture local impacts on community, and wider impacts on other users);

- **Geographic scope:** community benefits in local area (to suit the definition of community energy);

- **Financial and risk scope:** all changes to any affected finances and risk burden (e.g. for local community, energy companies, other energy consumers, and investors in the energy sector).

Information to be gathered

The data to be gathered would have to be agreed in detail at the outset of the studies. As a starting point, the following lists present the relevant data types that have been identified thus far. An agreed data gathering protocol could also be useful outside of these proposed studies: some aspects could be used by community groups and decision makers, to provide more consistent treatment when reviewing and forecasting impacts.

Characteristics of communities and their projects:

- Community type: population, demographic breakdowns, level of deprivation/affluence, etc.;
- Involvement in project: residents, businesses, local authorities, etc;
- Leadership of project: community led, local authority led, commercial partnership, etc;
- Energy type: e.g. heat projects and electricity projects;
- Electricity source: e.g. solar and wind power;
- Location type: e.g. urban and rural;
- Location in UK (affecting climate, support mechanisms, etc.).

Resources for project:

- Upfront finance (grants, capital and debt);
- Ongoing income (incentive payments, energy sales locally, energy sales via grid, etc.);
- Voluntary resources (time given, and level of expertise).

Costs to project:

- Management / operating costs (staff, repairs and replacement, insurance, rent, etc.);
- Initial feasibility study, planning applications, etc. (including time taken);
- Capital costs (cost of equipment, installation, land (if purchased), etc.);
- Other capital costs (interest payments on loans, payments to local investors, etc.);
- Network connection and network reinforcements;
- Network use-of-system charges (ongoing);
- Balancing and other network costs.

Risks for project:

- Commodity prices (e.g. biomass);
- Energy prices (e.g. income from exporting renewable electricity);
- Energy balancing costs;
- Incentive payments (e.g. level of reliance upon this income source).

Benefits of project (intended outcomes):

- Energy benefits (not all data types are applicable to all projects):
  - Renewable energy (heat or electricity) produced per year (and technology type);
  - Contribution from project to annual local demand (heat or electricity);
  - Contribution from project to peak local demand (heat or electricity);
  - Local demand reduction (heat or electricity) following deployment;
  - Local peak demand reduction (heat or electricity) and any avoided network reinforcements;
  - Savings on energy costs for consumers (individuals and organisations).
- Energy engagement and attitudes:[106]
  - 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 (e.g. whether it fulfilled ambitions for local control of energy);
  - Surveys of attitudes towards other energy infrastructure projects (using metrics to quantify attitudes if possible).
- 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. related to warmth in homes, or energy sources with lower air pollution);
  - Environmental benefits (e.g. new use of land, changes in biodiversity).

Impacts (costs, benefits or risks) beyond project:

- Contribution (or use of) wider energy system services (e.g. balancing);
- (Un)certainty in system planning;
- Reallocation of costs to other energy consumers;
- Changes to returns on investment by energy companies.

[106] When attempting to determine attitudes (and changes in attitudes), surveys must be designed carefully and used consistently. Responses can vary considerably according to the questions asked and options presented, e.g. views about a particular technology might differ depending on whether the question seeks a "for or against" view or a ranking alongside other technologies.

Governance, funding and costs

It is envisaged that monitoring and trial projects would be run by consortia including community energy groups, and that a contractor would analyse the results from the monitoring and trials, as well as undertake the reviews. To undertake trials would require collaboration from a range of interested parties, including: consumers, community energy groups, developers of products and services for localised energy, network operators, energy suppliers, governments, and regulators. In particular, there would need to be agreement to modify regulatory requirements and to reallocate certain risks (e.g. balancing costs, supply interruptions, etc.). Local energy consumers would need to have a proper appreciation of the potential impacts before they could consent to trials.

The research could be commissioned by DECC, with close collaboration with Ofgem. A steering group should include: consumer representatives, community support groups, network companies, energy suppliers, academics, and providers of products and services for localised energy. The steering group would advise on: the selection of a contractor to undertake the analysis; the selection of projects for study; and the contractor's analysis of reviews, monitoring and trials.

Part of the funding should be provided from public funds. Reviews and monitoring could be funded by DECC. Trials could be funded by DECC or an Ofgem-administered scheme. The LCNF could be an option, but consideration would be required as to whether the requirement for DNO-leadership could preclude relevant studies. Public funding could be supplemented by funds from corporate partners involved in projects.

Detailed costings for this proposed research cannot be provided at this early stage. It is envisaged that a set of studies (reviews, monitoring, and trials) would have a budget less than (or comparable with) the EDRP or a single LCNF trial (typically a few £10million). The studies could, potentially, be broken down (e.g. to just do reviews) to reduce costs, although this would reduce the value of the exercise.

ENERGY RESEARCH PARTNERSHIP

11 PRINCES' GARDENS, LONDON SW7 1NA www.erpuk.org