CAG CONSULTANTS

Devon County Council

European Commission

Devon Community Energy:

Socio Economic Impact Assessment

Final Report

INFORMING POSITIVE CHANGE

Devon County Council

Socio Economic Impact Assessment of Community Energy

Final Report

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Executive Summary

Introduction

Devon County Council (DCC) commissioned CAG Consultants to undertake a review of the socio-economic benefits of Community Energy. This report was funded by the European Investment Bank as part of their European Local Energy Assistance (ELENA) programme. The purpose is to assess whether investing in local, community-owned renewable energy generation projects can deliver better value for money for a local economy than purchasing similar energy from a traditional commercial provider. Whilst this study has specifically addressed the issue in a Devon context, the findings may have wider applicability for other local authority areas.

Socio-Economic Benefits of Community Energy

There are a range of different types of wider benefits that can derive from investment in Community Energy (in the form of a local, community-owned renewable energy generation project). These include:

- **Direct benefits** from investment in local, community-owned renewable energy generation (e.g. jobs/GVA, local multiplier effects from this investment, returns to local shareholders, direct carbon savings and – for some types of projects – reductions in energy prices for local consumers and improvements in local resilience, in addition to local environmental impacts)

- **Indirect benefits** from local investment of the surplus generated by local, community-owned renewable generation, together with any leveraged funds. Investment of this surplus can bring wider benefits, depending on how it is targeted and spent. The benefits can range from further carbon savings (if surplus is invested in further renewable generation) to local social and environmental initiatives. The evidence suggests that well-targeted energy efficiency and fuel poverty work can generate multiple types of benefits encompassing energy bill savings, income maximisation, health and welfare benefits (including health service savings), in addition to carbon benefits.

Some of these benefits (e.g. local employment and economic activity impacts) would be similar for a local community-owned renewable energy scheme and any comparable local renewables project delivered by a private commercial developer. But others, such as returns to local community shareholders and local investment of surplus, are specific to a local community-owned scheme.

Valuing Benefits for the Devon Economy

The study aim was to understand what, if any, difference in cost there might be from purchasing energy, or in the case of Devon 'carbon certificates', from a Community Energy provider compared with a mainstream commercial provider. We then sought to assess whether the additional socio-economic benefits associated with Community Energy were greater than this cost differential.

To do this we constructed an illustrative financial model for a large-scale solar energy farm under three scenarios:

- 30 MW solar farm developed as a local community energy project
- 30 MW solar farm developed through a mainstream private sector provider locally in Devon
- 30 MW solar farm developed through a mainstream private sector provider elsewhere in the UK

The purpose of the local and non-local variant is to understand whether, and if so the extent to which, it is the Community Energy or local elements of the project that are driving any additional costs.

We have conservatively assumed that a local Community Energy scheme would cost more than a commercial scheme, although the cost difference may be lower than we have assumed for a Community Energy scheme that is developed and operated in a professional and quasi-commercial manner. On the basis of the figures used for our models, the local Community Energy scheme could cost Devon County Council an additional £2.2m in net present value terms over a twenty-year term over the local commercial scheme and an additional £4m over the non-local commercial scheme. The non-local scheme was assumed to be cheaper due to lower grid connection costs.

But the review of evidence had shown there were a number of additional socio-economic benefits associated with Community Energy schemes that could be monetised:

- **Local Economic Impact** – the construction and operation of the solar farm bring economic benefits to Devon in terms of jobs and GVA. These are large enough to outweigh the additional cost of the higher grid connection charges in Devon. They are also slightly higher for a Community Energy development than a conventional commercial one.
- **Community Benefit Fund** – this is in essence what the additional money is paying for: a fund to invest in social and community projects.
- **Leveraged Funds –** the initial fund is able to leverage in further funding to invest in such projects, generating additional value.
- **Fund Impact –** evidence shows that investing in such social and community projects generates more in benefits than the cost of the investment.
- **Local Income Multiplier** – the investment return to local shareholders means greater income will be retained in the local economy rather than leaking out to external investors. As this money is spent in the local economy it will generate further rounds of economic activity, supporting additional jobs.

Using cautious and well evidenced assumptions we estimate that these additional benefits would, on this model, generate an additional £15.9m in economic value to the Devon economy. This would more than outweigh the additional cost to Devon County Council of purchasing either a local, or non-local, commercial equivalent product. This is only a notional scheme and clearly there are a wide range of potential outcomes. The report sets out a series of sensitivity test around our central assumptions to help illustrate this.

Clearly the larger the gap between the money paid to a Community Energy provider and the market price, the more difficult it may become to justify value for money, though closing the gap in terms of monetised benefits is not the whole answer. In addition to the monetised benefits set out above there are non-monetised benefits that should also be included. These are beneficial impacts created through:

- Community engagement and education about the energy transition
- Community empowerment/ agency, within or beyond local CE groups

In considering value for money, weight should also be given to these factors.

Getting Best Value

The way in which any surplus generated through a Community Energy project is used will have a material effect on the level of social impact delivered.

If the priority for Devon County Council is solely to generate carbon reductions, then consideration needs to be given as to how best to secure such reductions. Surplus could be used by the community energy sector in Devon to pursue 'narrow and deep' approaches, for example by directly investing surplus in new generation capacity – perhaps leveraging in additional external funds in the process. Alternatively, 'broader and shallower' approaches could be used, e.g. a focus on raising awareness and generating behavioural change (leading to small but widespread carbon reductions). Alternatively, a combination approach could be used, e.g. retrofitting community buildings in tandem with a community-based social marketing approach.

If the objective is to maximise the co-benefits of community energy activity in Devon, our research suggests that funding energy efficiency measures for individuals on low incomes, in poor housing conditions and with related health problems, offers multiple co-benefits in the form of income maximisation, health and welfare improvements and health service savings, as well as energy bill savings and carbon reductions.

1 Introduction

1.1 Purpose of Report

Devon County Council (DCC) commissioned CAG Consultants to undertake a review of the socio-economic benefits of Community Energy. This report was funded by the European Investment Bank as part of their European Local Energy Assistance (ELENA) programme. The report is part of the South West Energy Unit which is a partnership between Bristol City Council, Devon County Council and Plymouth City Council. The South West Energy Unit is part-funded by the European Local Energy Assistance and Horizon 2020 programme.

Although this report will explicitly be making reference to DCC the report may have relevance for all local authorities.

As part of its process to reduce its carbon output, DCC is considering investing in renewable energy through a large-scale Synthetic Purchasing Power Agreement (SPPA) for around 25 MW. The purpose of this report is to provide evidence as to whether, or under what conditions, investing in a local Community Energy scheme might provide additional economic value within Devon that would justify the additional cost of the SPPA relative to purchasing conventional renewable energy.

The SPPA would not involve procurement of energy per se but would give DCC access to carbon certificates for electricity generated by the local Community Energy (CE) scheme. The SPPA would be a 20-year contract that would operate in a similar way to 'Contracts for Difference'. If DCC entered into a SPPA, the council would agree a fixed, index-linked strike price with a local Community Energy scheme. If the actual electricity price realised by electricity sales from this scheme on the open market was above this level, DCC would receive the difference, but if the actual electricity price realised was below this level, then DCC would make up the balance. In summary, the local CE scheme would be guaranteed to receive the strike price for the renewable energy that it generated. DCC would purchase the electricity that it needed separately on the open market, from the UK electricity grid, using usual procurement procedures. The SPPA would provide DCC with a hedge against future carbon prices and future electricity prices – the SPPA would give DCC access to locally-generated carbon certificates for the agreed volume of production and the cost of the SPPA would go up if electricity costs came down and vice versa.

1.2 Structure of Report

Chapter 2 describes the Community Energy model and indicates the scale of existing community energy activity in Devon.

Chapter 3 then presents an overview of the socio-economic benefits that can derive from Community Energy projects. It draws on an extensive literature review and consultations with stakeholders who are actively engaged in Community Energy projects.

Chapter 4 details the method and assumptions used to calculate the benefits of Community Energy.

Chapter 5 sets out a financial appraisal of different options for purchasing renewable energy through a SPPA. These consist of:

- A Community Energy project
- A local renewable energy project developed by a mainstream provider
- A renewable energy project developed by a mainstream provider elsewhere in the UK

In Chapter 6 notional schemes for each of the three options are compared using a social cost benefit analysis. A series of sensitivity tests are applied to the costs and benefits associated with each scheme.

Chapter 7 provides a good practice review of how to optimise the benefits a Community Energy project might potentially bring.

Finally, Chapter 8 provides a summary of the findings and overall conclusions.

1.3 Acknowledgements

We are grateful for the help of the many consultees who assisted us with this research, as listed in Appendix 1, together with individuals in Community Energy England's Loomio community.

A list of the evidence sources identified during the research is presented in Appendix 2.

2 Community Energy

2.1 What is community energy?

In the UK Energy Research Centre report 'Evolution of Community Energy in the UK' (2015), community energy is defined very broadly as any energy project that *is owned or controlled by a community or third sector body*, and/or that involves a significant degree of *direct citizen participation and control*.

We understand from the ITT that DCC's interest lies in a sub-set of the community energy sector that, as well as being community-owned or controlled, is also:

- Local (e.g. within a given local authority area).
- Involved in generating renewable energy (e.g. electricity from solar PV).

Given DCC's interest in purchasing electricity at scale for local authority/public sector operations, of the order of 25 MW in total, we understand that DCC wish to focus on the socio-economic costs and benefits of local, community-owned renewable energy schemes that can offer generation at scale. Solar PV, primarily in the form of solar farms, is the most cost-effective and publicly acceptable form of community-owned renewable energy and therefore the focus of this study. Scale may be achieved directly through solar farms (typically 12 MW or more to achieve viability without Feed-in-Tariff subsidy). In theory, community-owned renewable energy could also be generated through aggregation of multiple smaller roof-top solar sites but we do not anticipate that domestic roof-top solar would be feasible at the scale that DCC requires.

2.2 Current challenges and opportunities for community energy

The UK energy system is currently in the throes of a major transformation. This is creating a range of new business opportunities for distributed energy resources including renewable generation, energy storage, demand-side response, peer to peer trading and micro-grids. In theory community energy businesses are well placed to take advantage of these opportunities, given their ability to engage local communities and their close relationship with local domestic energy customers. However, a decline in Government support (in the form of development grants and generation subsidies) has led to a significant slow-down in the growth of the community energy sector. Community Energy England's most recent State of the Sector survey reported that 2019 was a tough year for the community energy sector, with 89 potential projects being stalled, mostly due to reduced subsidies and lack of access to finance. [1]

With the demise of grants and subsidies, community energy schemes need to pursue different approaches to ensure their ongoing sustainability. In the absence of Feed-in-Tariff (FiTs) income, investment in new renewable energy generation by community energy groups increasingly depends on scaling up the size of renewable energy generation projects and on setting up PPAs with major consumers such as local authorities, public bodies, utilities and commercial organisations. The price achieved in these PPAs, and the extent to which this can be supplemented by other sources of income such as flexibility services or electric vehicle charging

1 Community Energy, 2020, State of the Sector report

revenue, now determines whether such investments can provide a viable level of return to community investors. The level of PPA price achieved also determines whether these projects can also generate significant surpluses for investment in other community energy activities (e.g. fuel poverty work) or for distribution via community benefit funds (as was previously achieved by many FiTs-funded investments).

2.3 Comparative Cost of Community Energy

Community Energy projects face certain challenges specific to the sector that may impact on project costs. A literature review of such challenges identified the following factors that may affect the cost of Community Energy projects:

- *"**Internal process costs** – Due to their 'bottom-up' organisational structure, community projects are generally responsive to the diverse perspectives of their constituents. This can result in slower decision making, meaning community projects are less responsive to windows of opportunity and exposed to greater development times and costs.*

- ***Transaction costs** - Communities commonly lack in-house skills and knowledge and therefore have to engage with the private sector for project development services. This exposes community projects to (higher?) market costs, which can be exacerbated by a lack of bargaining power and market knowledge.*

- ***Legitimacy costs** – As new entrants to markets in which commercial counterparts are already established, community projects can face greater challenges in accessing finance and investment.*

- ***Internal diseconomies of scale** – Community organisations are typically significantly smaller than commercial renewable energy organisations. They therefore do not benefit from the same economies of scale in terms of bargaining power, finance and the ability to manage risks (also O+M)."*[2]

Our consultees have also noted that there are also costs associated with the fact that community energy groups are limited by geography. They cannot cherry pick the best and most profitable sites, so are often left with the sites that commercial parties are less interested in. Further community energy groups do not have the development resource to bank lots of sites so again are left with the sites with high grid costs or larger planning challenges, which in turn increase transaction costs.

We are aware that the scale of development proposed by the Devon Energy Collective is atypical of Community Energy projects and that the proposed project would be developed with professional support and in a quasi-commercial manner. It is possible that the cost differential between Community Energy and commercial developments for this type of project would be much reduced, so the assumption of higher costs might be reviewed in future studies of this type, as more evidence becomes available.

[2] The Comparative Costs of Community and Commercial Renewable Energy Projects in Scotland

2.4 The Community Energy Sector in Devon

Devon has an active and well-established community energy sector. A profile of the sector prepared by Regen[3] in 2018 found that there were 23 community energy organisations in Devon, including the unitary areas of Plymouth and Torbay, more than in any other county in the UK at the time. Seventeen of these were locally-controlled community energy organisations while six were pre-existing community organisations (e.g. parish councils or charities) that were developing energy projects or installing generation. The common feature of these organisations was that they aimed to give local communities greater control over how energy is generated and used, and that they aimed to increase the community engagement and social benefit from energy projects. Many of the groups were motivated by concerns about climate change and aimed to promote low-carbon energy.

At the time of Regen's research, the 23 groups in Devon were undertaking a range of activities, from installing hydro power and roof-top solar PV to installing or buying existing solar farms (e.g. Plymouth Energy Community and Yealm Community Energy) to undertaking energy efficiency and fuel poverty initiatives (e.g. 361 Energy, Exeter Community Energy).

Table 2.1 Key statistics about the community energy sector in Devon

• Installed 12.3 MW of capacity through 62 community owned renewable electricity generation projects (Figure 1)
• Generated 17,431 MWh of renewable energy to date, including 10,610 MWh in 2017
• Saved 6,080 tonnes of CO_2e emissions, including 3,701 tonnes saved in 2017
• Raised £14.1 million of investment, including £5.5 million raised through community shares
• Created 33 FTE jobs
• Supported 2,717 households with energy efficiency services or physical installations
• Run 250 events to share knowledge on energy efficiency, attended by more than 2000 people
• 3,457 members, 1,530 shareholders, 297 volunteers and over 8,079 people on their mailing lists.

Source: Regen (2018), Devon Community Energy Impact Report

Devon has approximately 905 MW of renewable electricity installed (as of March 2017).[3] This means 1.3 per cent of total installed renewable electricity in Devon was community owned in 2017.

Regen reported that community energy organisations in Devon had raised £14.1 million, mostly through loans (£8.0 million), which would be repaid from scheme profit or through future share offers to refinance the project, and community shares (£5.5 million). The balance was provided by grants (£0.5 million). These figures are likely to underestimate the total funding as some organisations did not give funding details in response to the Regen survey, and further funding will have been raised since the Regen research.

[3] Regen (2018), for DCC, Devon Community Energy Impact Report

The community energy organisations in Devon with renewable energy assets installed have varied financial models and approaches to profit distribution. Typically, they use the income from the sale of electricity and the FiTs to pay running costs, repay loans and pay community shareholders a dividend. Shareholders are largely local people who invest in community energy (shares start from as little as £20) and receive a return (historically around 4-8% but more recently around 3-4% due to the phasing out of FiTs); this helps retain the economic benefit in the community.

After running costs, loans and shareholders have been accounted for, some organisations generate a small surplus which they use, or intend to use, for good works in the community. For example, some set up 'community benefit funds' which are grant funding pots awarded to local community projects, whilst others pay directly for renewable energy, energy efficiency, education and fuel poverty work or other community energy related activities. The Regen research found that community benefit funds from four organisations with community-owned renewables were expected to provide a total of £1,125,000 to tackle issues such as fuel poverty until 2030.

Most of the community energy groups within Devon have originated in a particular locality but wider partnerships have been established across the county. Support networks for the Devon groups have been facilitated by Regen, by Devon County Council and by the South West Devon Community Energy Partnership (SWDCEP). In January 2020, a Devon-wide community energy company was founded (the Devon Energy Collective Community Interest Company (CIC)) which aims to develop, finance and own renewable energy projects in Devon for the benefit of the local community. Devon Energy Collective CIC is owned by a network of local-level community energy enterprises in Devon. With the help of partners, the organisation aims to develop a portfolio of 100 MW of community renewable energy projects. The Devon Energy Collective CIC provides a structure through which public sector organisations, such as Devon County Council, could purchase community-owned energy at scale, generating social benefits through the network of CE organisations that own the CIC.

3 Socio-economic benefits from Community Energy

3.1 Introduction

In this chapter we set out a review of the types of benefits that have been associated with Community Energy. This draws on an extensive literature review and also on interviews with stakeholders engaged in the community energy sector[4]. We first categorise the types of benefits identified and then assess the evidence to substantiate or quantify the claimed benefits.

3.2 Types of socio-economic benefits

There are a wide range of socio-economic benefits that have been put forward to advance the wider social value that Community Energy as a model brings.

A wide number of studies and reports have developed different categorisations of the wide range of economic, social and environmental benefits potentially arising from Community Energy. Two examples of these categorisations are given below, one from the WPI Economics report on 'The future of community energy'[5] and one from Community Energy England's State of the Sector (2020)[6]: There are slight variations in the benefits cited and the categorisation used, but overall similar benefits are cited.

[4] Sources used for the literature review are set out in Appendix 1. Appendix 2 sets out a list of consultees.
[5] WPI Economics (January 2020), The future of community energy
[6] Community Energy England (2020), State of the Sector report

Table 3.1 Types of socio-economic benefits cited in other studies

Category	WPI – The future of community energy	CEE State of the sector report (2020)
Environmental	• Carbon reduction • Education and awareness raising	• **Preventing carbon emissions** through low carbon energy generation and demand reduction • **Local environmental programmes** including pollution reduction through energy efficiency, heating system improvements, low carbon transport initiatives and recycling waste reduction initiatives • **Conservation and habitat improvements** for solar and wind farms • **Indirect carbon savings** via education and awareness raising, leading to behaviour change on environmental issues (e.g. carbon, waste, habitats)
Economic	• Supporting community initiatives through generating funds • Reduction in energy bills through provision of low-cost energy and energy efficiency measures • Job creation in local areas • Skills development through training initiatives • Local fuel poverty reduction through energy efficiency • Reduced transport costs through electric vehicle charging infrastructure (not for generation)	• **Community benefit fund** grants and spending (e.g. energy advice services, sports clubs, environmental conservation charities) • **Cost savings** to local people and businesses (e.g. low-cost generation for local homeowners, community buildings and schools; cost savings via energy efficiency upgrades in the local community) • **Job creation** in the local area (within CE groups and partner organisations) • **Dividend and interest payments** to community investors
Social Benefits	• Community cohesion • Provision of community assets (e.g. electric vehicles) • Improved health and wellbeing	• Improvements to community facilities • Education initiatives • Supporting community services • Fuel poverty reduction • Low carbon training and workshops • Resilience and capacity building
Resilience	• Economic resilience • Energy system resilience	• Included under social benefits
Innovation	• Piloting new approaches to energy generation • Increased R&D spending	• Not explicitly included

A report by Pure Leapfrog[7] on monitoring and evaluating community energy commented that community energy provides environmental, social and financial benefits to communities.

[7] Leapfrog (2017), Monitoring and evaluating community energy - reviewing existing tools and outlining a pilot standardised tool - O'Leary and Speciale with support from Community Energy England and Big Society Capital.

However, this report found that there was currently no tool that enabled groups to accurately and comprehensively monitor and evaluate these benefits. Based on interviews with nine Community Energy groups, the Leapfrog report proposed the following monitoring and evaluation metrics:

- Avoidance of CO_2 Emissions
- Protecting and Increasing Biodiversity
- Financial Benefits for the Local Community
- Return of Value to the Local Economy
- Creation of a Community Fund
- Increase in Skills, Knowledge, and Confidence
- Community Cohesion
- Supporting the Formation and Growth of New Community Energy Groups
- Awareness Raising and Behaviour Change
- Control and Empowerment

Whilst a number of reports identify benefits, the "Community Energy in the UK" report (DECC, 2014) noted that many community groups do not monitor the impact of their wider activity. It stated that, *"One of the key added value benefits of community-led renewables projects is that the income generated from the project is generally recycled in the community. However, the existing evidence base provides limited insight into precisely how the income is used and, therefore, the lifetime benefits of the project."*[8]

3.3 Types of benefit from local community-owned renewable generation

The socio-economic benefits arising from local, community-owned renewable energy generation projects, as identified through our evidence review, can broadly be classified into one of nine types as set out in Table 3.2. These include direct economic activity from construction and operation of the project, together with economic activity generated through local multiplier effects[9]. But they also include more catalytic impacts where the community energy project has been the spur for associated social and community activity, including reinvestment of surplus in community projects. These nine types of benefits cut across the broad outcome categories introduced in section 3.1: for example, surplus may be used to fund community initiatives that address economic, social or environmental objectives.

[8] DECC (2014), Community Energy in the UK: Part 2 – Databuild Research & Solutions Ltd, supported by the Energy Saving Trust.

[9] Subsequent rounds of economic activity from purchases of goods and services from suppliers and expenditure of wages of employees in the local economy.

Table 3.2 Typology of benefits identified as flowing from Community Energy projects

Type of Benefit	Direct benefits from local community-owned renewable generations scheme	Indirect benefits from investment of surplus funds (and leveraged funds) from scheme	Outcome category
Direct Benefits			
Jobs/local economy	Construction and operational phases of the development and associated supply chain and multiplier effects	Surplus/leveraged funds could be used to increase employment by CE groups; there may be modest multiplier effects from this employment and from local investment of surplus	Economic
Local investment	Retention of dividend income in the local economy that would otherwise leak out through investor profit		Economic
CO_2 savings	Similar to CO_2 savings from mainstream renewable generation, but local scheme means that locally generated CO_2 savings are locked in for 20 years	Surplus/leveraged funds could be invested to generate further carbon savings through energy efficiency, fuel poverty and low-carbon transport schemes, nature and tree planting and through community engagement and education around low-carbon behaviours	Environmental
Local environmental impact	Renewable generation scheme may have some negative impacts, but local community-owners are likely to be more motivated than mainstream providers to minimise these impacts and manage the asset in such a way as to encourage biodiversity	Where the investment of surplus/leveraged funds is targeted at environmental projects, these could bring other positive environmental impacts (e.g. increased biodiversity from improved habitat management)	Environmental
Energy bills	Where lower energy prices from local generation can be passed on to local businesses, organisations or consumers	Surplus/leveraged funds could be invested in energy efficiency or fuel poverty schemes which reduce consumer energy bills	Economic
Resilience	Where diversification and local delivery provide greater energy security	Surplus/leveraged funds could be invested in innovative schemes that would increase electricity demand flexibility and energy security	Resilience
Generation of surplus for community benefit	Surplus income that is reinvested to benefit the local community (either directly by a community energy organisation or via a community benefit fund)		All

Indirect Benefits			
Leverage		Additional match funding secured from other sources to match the surplus or community benefit funds, which is itself invested in maintaining or increasing activities to benefit the local community	All
Community engagement and education		Surplus/leveraged funds could be invested in further community engagement, education and behaviour change	Social/environmental (links to CO_2 savings)
Community empowerment/ agency, within or beyond local CE groups	Improving skills and confidence of community energy members can empower people and act as a catalyst to go on and do other things	Surplus/leveraged funds could provide greater financial stability for CE groups and other community groups, leading to greater agency and empowerment for CE groups and other community groups	Social
Health and well-being		Surplus/leveraged funds could be targeted at fuel poverty and other health & well-being projects, which could bring significant health impacts and health service savings	Social/economic

The remainder of this chapter describes the mechanisms through which each of these benefits might be realised and any evidence that has been reported to substantiate the existence of these benefits or to quantify their size or scale. The first sub-section focuses on the direct benefits of local community-owned renewable energy generation while the second sub-section focuses on the indirect benefits of investing the surplus from this generation.

3.4 Sources of evidence on direct benefits

Jobs/Local Economy

Job creation

A local community-owned renewable energy project represents investment in the local economy. There will be jobs created during the construction phase of the project and jobs in the ongoing operation and maintenance of the utility over its lifespan. In broad terms, construction jobs are temporary and will be proportionate to the capital cost of the development. Operational and maintenance jobs will be permanent and primarily relate to maintenance activity.

Several studies have made estimates of job creation with respect to both community-owned renewables projects and renewable energy projects more generally.

WPI Economics calculated that there were 1.1 full time equivalent (fte) jobs per MW of installed capacity in Community Energy projects. Their report also cited research from the Institute of Welsh Affairs that estimated 0.7 jobs for MW and £0.5m Gross Value Added (GVA) per MW for solar renewables. The WPI Economics report uses the range 0.7-1.1 jobs per MW of installed capacity to estimate the jobs created in local areas.[10]

A similar figure of 0.64 fte jobs per MW for a community-owned wind farm was cited in a presentation by Regen[11]. This presentation noted that local jobs per MWh were higher for Community Energy projects than for private, though this was based on comparison of two farms.

A report by the Centre for Regeneration Excellence Wales[12] estimated that for hydro schemes there were 5.5 fte jobs per MW, generating £0.37m per MW in economic output and £0.15m per MW in GVA in the development and operation of these projects. It noted this was higher than for solar PV where it cited a figure for annual employment per MW in development and operation of 1.4 fte.

A 2014 UKERC[13] report which review jobs estimates across a range of renewables technologies estimated for solar PV a figure for short-term construction jobs of 21.6 job years per installed MW. A standard convention for converting job year to full time equivalent permanent jobs is to divide by ten, giving a figure of 2.2 fte jobs per MW.

A review of international renewables project IRENA estimated 0.3 jobs per MW in operational and maintenance as an average across OECD countries[14].

Our assumptions for modelling the Devon scheme are discussed further in chapter 4.

Local multiplier effects

In addition to direct economic activity and employment there will be further economic impacts generated through multiplier effects. There are two main types of multipliers from expenditure on the project itself:

- Supply chain multipliers through spending on goods and services to support the development and operation of the energy project.
- Induced or consumption multipliers generated through expenditure on goods and services by those employed in the construction and operation of the project.

The size of the multiplier is a function of the geographical area that is defined as the ‘impact area’. It is higher at a national level than a local level as a greater proportion of expenditure is captured at a national level, including some expenditure that leaks out of the local area but does not leak out of the country. For example, in the HCA Additionality Guide, the recommended ready reckoner for medium projects with average linkages is a composite multiplier of 1.1 at Neighbourhood level and 1.5 at the Regional level[15].

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[10] WPI Economics (2020), The future of community energy
[11] Regen (2019), Assessing the impact of community energy, Presentation to SELCE, London
[12] Centre for Regeneration Excellence Wales (undated), The Economic and Social Impact of Small and Community Hydro in Wales
[13] UKERC (2014), Low carbon jobs: The evidence for net job creation from policy support for energy efficiency and renewable energy
[14] IRENA (2014), The Socio-economic Benefits of Solar and Wind Energy
[15] HCA (2014) Additionality Guide (4th Edition)

A report by the James Hutton Institute[16] looking at community-owned windfarms estimated a local multiplier of 1.33 for the construction phase of a project; 1.28 for the operational and maintenance phase; and 1.41 for income for community activities.

IRENA estimated an indirect multiplier of 1.68 for renewables employment in the UK, but that is a national level multiplier which we would expect to be higher.

Some Community Energy organisations state they make a particular effort to use local supply chains, which may boost the local multiplier. BWCE estimate that 35%-40% of income is retained locally.[17]

Tourism impacts are sometimes claimed for Community Energy or renewables projects but we do not think these are likely to be significant for a solar farm in Devon.

Based on this evidence, our central assumption of a sub-regional multiplier, treating Devon as the impact area, is 1.2. Further discussion of multipliers for indirect impacts are set out in the next sub-section. Our assumptions for modelling the Devon scheme are discussed further in chapter 4.

Local Investment

According to some of our consultees, the benefits of local investment are the principal rationale for developing Community Energy projects. By encouraging local investment, money is retained in the local economy through the dividend return being paid to local investors and hence recirculated in the local economy rather than leaking out to external investors. The same principle applies to the ultimate redemption of local investors' shares or loans.

There may be no net economic benefits at the UK level from retention of investment income locally, although distributional effects would need to be taken into account. The net effect at the UK level effect will be determined by the extent to which return on investment is payable to overseas investors.

The source of finance is important. The more that is raised via local share offers the greater the income retained in the local area, both through interest payments and ultimate debt/share redemption. Local economic impact is created by the extent to which this investment is then spent on goods and services in the local economy. Essentially, there is then an income multiplier effect.

Some Devon groups, such as Yealm Community Energy, are highly localised: a survey in 2020 found that 90% of Yealm CE's supporters came from the five parishes that benefit from the group's Community Benefit Fund. However, YCE has yet to undertake a share offer and this profile may change when it does so.[18] There is evidence that some schemes have a significant

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[16] Hutton (2014), Measuring the Local Economic Impact of Community-Owned Energy Projects - The James Hutton Institute

[17] Source: BWCE

[18] Power to Change (2021), Yealm Community Energy – Member survey results 2020 – prepared by CAG Consultants.

proportion of non-local investors in community shares, for a variety of reasons. A detailed example of this is set out in a case study of the Edinburgh Solar Community Co-operative[19]. The need to raise money quickly meant going to a UK-wide list of investors in similar schemes and hence only 70% of capital was raised locally. Similarly, Brighton Energy Co-op estimate, from member records and surveys, that their membership – after a number of share offers - is about 60% local to the Brighton and Hove area. The profile of their membership was previously 70% local but became more geographically widespread after a widely advertised share offer.[20]

Some community energy groups are looking at introducing bonds for non-local investors and offering community shares first option/lower thresholds to local investors.

The counterfactual depends on what local investors would have done with their money if they did not invest in community energy. Given that UK interest rates on savings are very low at present, community energy could prove an attractive alternative to mainstream investments. As a relatively safe form of investment in a utility with a mature market, community energy schemes may encourage local people to switch out of low interest savings accounts into more productive investment. This would unlock people's savings whilst also increasing their wealth.

There is also a local distributional question to consider. If, for example, the local investment is all from wealthier or high-income people in the upper decile of the income distribution range, then the impact is likely to increase local inequality. For a more equitable distribution of income, the scheme needs to be as accessible as possible, probably through low threshold investment levels. Securing investment from lower income households would also produce a higher local multiplier as the marginal propensity to consume is higher for lower income households.

Our central assumption is that 50% of community shares would be taken up by shareholders who are local to Devon, given that access to UK-wide community investors may be needed for the large-scale community energy investment that is envisaged here.

CO_2 savings

Direct CO_2 savings

A reduction in CO_2 emissions is a major driving motivation behind most Community Energy schemes. The Community Energy State of the Sector report[21] estimated that 222.3 GWh of electricity was generated by community-owned generation in England and Wales during 2019, saving an estimated 60,000 tonnes of CO_2 emissions at current carbon-intensity rates for the national electricity grid. However, these savings would be the same for any comparable renewable energy generation project, and hence this is primarily an argument to invest in renewables rather than in Community Energy per se.

[19] UKERC (2015), Financing Community Energy Case Studies: Edinburgh Community Solar Cooperative – University of Strathclyde and others.
[20] Personal communication from Damian Tow, Brighton Energy Coop.
[21] CEE (2020), Community Energy – State of the Sector 2020

Our analysis is premised on the assumption that all the schemes considered are new developments, whether community-owned or commercial, so that the CO_2 savings are additional and can be attributed to Devon County Council's Synthetic Power Purchasing Agreement.

While the value of carbon savings is the same for all the schemes considered here, and is therefore not relevant to our assessment of Community Energy compared to commercial alternatives, we present the standard Treasury Green Book factors for estimating CO_2 savings from renewable electricity generation in Appendix 3.

Leveraging of planning

It was suggested by consultees for this study that a renewable energy development might be more likely to receive planning permission if it was offering benefits to the local community. In this case, community ownership would effectively increase the likelihood of a low carbon development going ahead. If necessity requires that community energy groups develop more marginal projects that commercial interests do not see as profitable enough, this may also add to the stock of low carbon energy.

Indirect carbon benefits, arising from activities funded by the surplus from generation, are outlined in the next sub-section.

Local environmental impacts

A major renewable energy scheme will involve significant construction work and may have some lasting impacts on the local environment, depending on the technology involved: a solar farm is likely to have less visual impact than a wind farm and no noise impact. The direct impact on biodiversity would depend on the previous land use at the site and on how the land was managed during construction and operation of the solar farm. Planning requirements would require a minimum level of mitigation of local environmental impacts for community-owned and commercial schemes alike. But it is probable that local, community-based owners of a renewable energy scheme will be more likely than mainstream providers to minimise any negative impacts and manage the asset in such a way as to encourage biodiversity.

Indirect impacts on biodiversity and the local environment through investment of the surplus from a generation scheme are considered further below.

Energy Prices

Theoretically, as a provider of electricity, a community-owned renewable generation project has some say on the price that is charged for its power. For a roof-top solar scheme on commercial or council building, the electricity price for local consumption would be negotiated with the host organisation. Similarly, for schemes involving a private wire network, local generation could be used to deliver lower prices to local residents or provide targeted reductions for those in fuel poverty. The sale prices could be intermediate between the wholesale electricity prices obtainable by renewable energy generators and the retail prices paid by commercial or domestic consumers.

In practice, it is anticipated that the electricity price obtained by the proposed community-owned renewable energy scheme in Devon will be set by the Synthetic Purchasing Power Agreement

(SPPA). As explained in section 1, the SPPA provides a mechanism for Devon County Council (DCC) to guarantee the price realised by the scheme, while the electricity generated by the scheme is actually sold on the wholesale electricity market (and DCC actually buys its supplies on the wholesale market). Our understanding is that the SPPA would not involve a local authority procurement process because it is essentially a financial instrument.

An alternative mechanism to the SPPA would be a 'sleeved' PPA, in which the electricity generated by the renewable energy scheme would be sold to an intermediary utility company which would then sell the electricity to DCC at a price agreed between the parties. However, this would involve direct purchase of energy which would be subject to local government procurement rules. While local authority procurement can take 'social value' into account, under the Social Value Act (2012), DCC understand that it would currently not be possible to focus procurement solely on electricity supplied by new local community-owned energy developments (or new local commercially-owned energy developments) as opposed to electricity generated elsewhere.

Resilience

In theory, local supply could increase the resilience of electricity consumers to potential power outages. In practice this is unlikely to be the case in Devon because of grid constraints within the local distribution and transmission networks for electricity in South West England. At times, there are constraints on distribution of electricity within parts of Devon, and on export of electricity from the South West via the transmission network. Investment in a solar farm in Devon is unlikely to increase the resilience of local consumers to power outages unless these were to arise from outages in import capacity via the transmission network.

The cost of grid reinforcement to enable connection of a sizeable renewable energy scheme within Devon has been factored into the cost estimates set out chapters 4 and 5. This cost is assumed to be higher than grid connection cost in most other parts of the UK, although the exact cost would depend on the location of the scheme in relation to specific constraints within the local distribution network.

For future reference, there might be some modest energy security benefit if a generation scheme involved roof-top solar on a public or commercial building with a significant electrical load, if some of the electricity generated was consumed 'behind the meter' without being exported to the distribution grid. It would be possible to estimate savings from reductions in power outages, or savings in use of other back-up power sources (e.g. back-up generators).

For community energy schemes involving private wire or micro-grids, it might be possible to estimate the value of increased energy security for customers served by the scheme by measuring the change in frequency of power outages and applying estimates of 'Value of Lost Load' (VOLL). VOLL is an estimate of the value that domestic and small commercial customers place on security of supply and is used by Ofgem as part of price-setting calculations for Distribution Network Operators (DNOs). Figures for VOLL are based on choice-based survey work to estimate customer's 'willingness to accept' a power outage (i.e. the level of compensation at which they would accept a power outage). Major industrial and commercial consumers are excluded from the VOLL estimates because they increasingly have various options to deal with loss of load (e.g. demand-side response contracts, back-up power or onsite supply). VOLL estimates are therefore based on a weighted average of willingness to accept power cuts by domestic customers and small/medium-sized enterprises (SMEs).

In the current regulatory period (RIIO-ED1), Ofgem has used an average figure of £16,000 per MWh for VOLL. This regulatory period runs from April 2015 to March 2023. Ofgem are currently consulting on VOLL value or values that will be used in the next regulatory period (RIIO-ED2). They anticipate at least updating the RIIO-ED1 figure for inflation and are consulting on other changes which might raise the figure higher in some circumstances. At 2019 prices, Ofgem state that the updated RIIO-ED1 figure would be £21,000/MWh.

Further indirect contributions to resilience through the investment of surplus are considered further in the next sub-section.

Investment of surplus for community benefit

Community-owned renewable generation projects receiving FiTS or Renewable Obligation Certificate (ROCs) subsidies generally aim to generate a surplus to reinvest in some form of local community or social support programmes. The surplus may be used to fund community activities run by the community energy organisation itself or may be used to fund grants for other community activities via a Community Benefit Fund. The scale of this investment will depend on the scale of surplus created by the renewable energy generation scheme. Some modest Community Benefit Funds are also awarded by commercial renewable energy developers, either to fulfil planning conditions or to encourage good relationships with the local community (see more detail below).

Community Energy England's State of the Sector report noted that in 2019, community energy organisations were found to have spent £720,000 through community benefit funds, in addition to distributing grants worth £872,000 and loans worth £1.1 million[22]. It reported that community benefit funds were sometimes used to develop further community energy projects or offered grant programmes to support wider low carbon development (e.g. grants for energy efficiency upgrades).

There is strong evidence that the scale of predicted surplus from new renewable energy investments has been reducing over time, partly because of the withdrawal of FiTs subsidies and partly because of changing economic conditions (including reductions in wholesale electricity prices). For example, a report on 'Community Renewable Electricity Generation: Potential Sector Growth to 2020', prepared in 2014, refers to the industry standard for wind schemes being award of a community fund of £5,000/MW per year. We understand from community energy stakeholders that no equivalent industry standard applied to solar farm developments. More recent evidence from Community Energy England suggests that community awards from developers are now significantly lower, with some offers being as low as £200/MW per year.[23]

[22] Community Energy England (2020), Community Energy -State of the Sector 2020
[23] Community Energy England – personal communication.

3.5 Sources of evidence on indirect benefits via local investment of surplus

Leverage

Income invested by the community organisation in community activities or assets can leverage significant additional funds from a wide variety of sources. For example, if a community energy organisation has existing capacity to apply for project or grant funding, the receipt of a given sum would enable the organisation to apply for match funding from other sources. Alternatively, if a community energy organisation has very limited capacity (e.g. being entirely run by volunteers), the receipt of a grant might enable it to bring in some paid inputs to develop the organisation's capacity, extend its activities and raise funds from other sources. The stability offered by a steady source of income, over several years, would give organisations the confidence to develop their activities and, where necessary, take on part-time or full-time staff.

We found evidence of leverage of this type. For example, one of the consultees for this study said they leveraged extra benefits from grants awarded by their Community Benefit Fund by offering community organisations a set amount of funding, in return for them raising the rest.

Similarly, a study of community-owned windfarms in Scotland reported that, "*This funding, in-turn, leverages in significant additional match-funding from a wide range of public and private sources, typically 1.5 – 3.0 times the value of the operational income alone"*[24]. It further noted that, "*the additional funds represent, on average, 60-75% of total project costs although the percentage varies by project type."*

The sub-sections below provide evidence about the types of community benefits that could be generated through investment of surplus funds – and additional leveraged funds - into community energy activities or Community Benefit Funds in Devon. Where possible, we present evidence about the 'benefit/cost' ratio of different types of activities, to enable us to estimate the overall benefit of investing surplus/leveraged funds. The types of indirect benefits considered below include:

- Community engagement/education about the energy transition
- Increased community empowerment/agency
- Jobs/local economy
- CO_2 savings
- Local environmental impacts
- Energy bill savings
- Improved health and well-being
- Improved resilience

In practice, surplus may be invested in activities that generate multiple benefits. For example, fuel poverty advice services, if targeted at those with respiratory problems living in poor housing, and if combined with income maximisation advice, may generate energy bill savings, income improvements, improved health and financial savings for the health service. Depending on the fuel poor person's previous level of suppressed demand for heat, such initiatives may also

[24] Measuring the Local Economic Impact of Community-Owned Energy Projects

generate CO_2 savings. Similarly, support for nature conservation activities involving vulnerable people may bring mental health as well as biodiversity benefits. We provide an overview of benefits for some key activities in the concluding section of this chapter.

Community engagement/education about the energy transition

Climate change is a key motivator for 95% of community energy groups (CEE, 2019[25]). This is supported by a recent member survey[26] for Yealm Community Energy (YCE) in Devon: 92% of respondents said that the motivation “I want to take action to tackle climate change” was important or very important to them, while 89% said that the motivation “I want to contribute to something that benefits the local area” was also important or very important.

A report on ‘Mainstreaming low carbon lifestyles’ by Climate Outreach and the CASPI unit at Cardiff University[27], involving research in seven countries, found that people’s values and identities are crucial to how they engage with climate change and that social networks are one of the most powerful influences to change energy-related behaviours.

> *“There are few influences more powerful than someone’s social network and the social norms they are surrounded by. Where there is no social or cultural norm around a particular low-carbon behaviour, it sends a signal: this type of behaviour is not typical or widespread.” (quote from Climate Outreach/CASPI report)*

Findings from surveys with community energy group members suggests that involvement in a community energy group can help to motivate people to adopt more sustainable behaviours. For example:

- In the recent YCE member survey[28], nearly half (48%) of respondents said that being involved with Yealm CE had influenced them to take action to reduce their personal carbon footprint.
- Similarly, in a stakeholder survey by Low Carbon Hub in Oxfordshire, including members, partners and supporters, 76% of respondents reported that Low Carbon Hub had contributed to their taking some or substantial action on energy or environmental issues.[29]

CEE estimates that, in 2020, there were 93,000 members of community energy groups across England and Wales, while Regen estimate that the total number of people on community energy mailing lists in Devon since 2011 was 8,079. Community energy groups and the projects they run can play an important role in educating local people, including children, about renewable energy and the low carbon transition. For example:

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[25] Community Energy England (2019), State of the Sector 2019
[26] Power to Change (2020), Yealm Community Energy - Member survey results 2020, prepared by CAG Consultants.
[27] Climate Outreach/Cardiff University (2019), Mainstreaming low-carbon lifestyles.
[28] Power to Change (2020), Yealm Community Energy - Member survey results 2020, prepared by CAG Consultants.
[29] Low Carbon Hub (2020), Social Impact Report 2020. Based on 217 responses to “How are we doing?” Low Carbon Hub stakeholder survey, April 2020.

- Orchard Community Energy report that commercial operation and maintenance providers for solar farms do not always want (initially) to make provision for community site visits (e.g. because this can raise complex health and safety issues). The OCE board had to put in significant time and effort to organise site visits by local stakeholders and schools.[30]
- Education and awareness-raising activities organised by community energy groups may have far-reaching impacts on the individuals in their communities.

> *"It's a little step that may contribute to something that's not exactly what you were initially aiming for, but something that is important. I like to think that the involvement of schools will trigger a few children to go further, to go into geoengineering or whatever that's going to help" (quote from member of Edinburgh Solar)*[31]

While it is not easy to quantify these benefits, community energy groups can play an important role in helping to educate people and raise awareness of the energy transition and helping to establish sustainable energy behaviours as the norm within their communities. Community energy groups can make an important contribution to pathways to net zero, helping DCC to achieve its wider objectives: behaviour change and community engagement is one of the principal cross-cutting themes in Devon's Interim Carbon Plan[32].

Community empowerment, agency and increased capacity of local CE groups

Community energy (CE) groups are part of a wider 'community development' process. The UN defines community development as 'a process where community members come together to take collective action and generate solutions to common problems[33]'.

One significant outcome from the proposed Synthetic Purchasing Power Agreement scheme would be increased financial stability for local CE groups. Increased certainty about future income would enable them to plan for increased activities, providing stability for staff, and empowering them to expand activities in the community further by bringing in more funding from other sources.

The process of community development is about empowerment. As well as providing funding, success in establishing a local community-owned renewable energy scheme will improve skills and confidence amongst the people involved, generating learning and acting as a catalyst for them to take further action. This contributes to a greater sense of self-determination within the community.

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[30] Orchard Community Energy (2020), Presentation by Penny Shepherd to public consultation meeting for Kent Community Energy

[31] Lancaster University (2019), The power of renewable energy co-operatives: how can they contribute to wider social-ecological innovation in the UK? – report by Hoare in collaboration with Energy4All, with support from ERDF.

[32] Devon Climate Emergency (2020), Summary found at https://www.devonclimateemergency.org.uk/the-interim-devon-carbon-plan-summary/

[33] UNTERM (2014), Community Development

The CLG Report, 'Valuing the Benefits of Regeneration'[34] describes the community development logic chain as follows:

> *"A common feature of this set of activities is the 'theory of change' that greater civic participation, community development and generally resident involvement in neighbourhood activities can bring outcomes such as greater trust, better quality of life and can feed through into economic benefits such as employment and the desirability of a neighbourhood. Conceptually, community development activities are seen at the heart of many regeneration programmes."*

The CLG report estimated that volunteering in community development activities in general had a benefit/cost ratio of 1.1 to 1. We do not have quantified evidence of the benefits from the community empowerment effect of establishing local community-owned renewable energy schemes, but there is considerable qualitative evidence of this:

- Trust is critical in delivering change within disadvantaged communities, so well-trusted local community organisation is well-placed to deliver change on energy and wider issues.

> *'Trust – generally people in disadvantaged communities don't like change… And changing that requires a lot of trust. And on top of that, energy is an incredibly emotive thing to talk about – it's heat, and warmth, and TV, and it's really important. And getting people to think differently about that, to think that it could be done a different way, even though it's not really risky for them at all, is really, really hard… And having a community organisation like 'Comas' already there is critical' (quote from Comas)* [35]

- Involving local people, including young people, in delivering change can be critical to building confidence and capacity within a disadvantaged community.

> *'On this estate, nothing ever seemed to get done, the council let the residents down, so there was a sense that 'oh this isn't going to happen', so getting them to believe that this was going to happen was difficult.. a lot of things that helped people to see the project as something positive was seeing all the young people, week in week out, knocking on people's doors, being involved…for a lot of people, just seeing that was really important.. that the young people engage with something positive… for the young people to see their opinion being valued, see things being followed through, it gave them a voice. It's so, so important in a place where they feel they're on the outside…them being accountable for their own area….Now people are proud to say, 'this happened on our estate, we've got this to show for ourselves' (quote from Banister House Solar* [36]

[34] Valuing the Benefits of Regeneration - Cambridge Economic Associates with eftec, CRESR, University of Warwick and Cambridge Econometrics Department for Communities and Local Government (December 2010)
[35] CSE (2019), Bringing local energy benefits to deprived communities – report by Samson, funded by Barrow Cadbury Trust.
[36] Ibid.

Jobs/local economy

Many Community Energy groups aim to build local skills and provide opportunities for local employment and volunteering. Investment of surplus/leveraged funds may have various indirect impacts on the local economy:

- Grants or payments may create jobs within community energy groups and other community groups. This is likely to be on a modest scale. CEE[37] estimates that there were 263 full time equivalent (fte) positions in the CE sector across England and Wales in 2019, and that CE activity supported a further 51 fte further positions in other organisations. Regen's survey of the community energy sector in Devon found that there were 33 fte positions within the county in 2018, in addition to 297 volunteers. The number of additional jobs that could be created through investment of surplus of (say) £50,000 per year would be unlikely to exceed 1-2 fte per year, but this could be further increased by leverage on other community sector activities.

- Surplus funds could be specifically targeted at education, training, confidence-building or support for young people or those out of work. Standards have been developed for Community Energy apprenticeships[38] and groups such as Repowering offer Youth Training programmes as part of their work.[39] There is also evidence of some Community Benefit Funds using funds for education and training purposes. For example the Sheriffhales and Community Renewable Energy Committee (SACReC) has used funds generated by the local solar farm to provide support for the local primary school, including support for the ongoing education for children of key workers during the COVID-19 pandemic[40].

- Second-order multiplier effects may arise from expenditure of surplus on activities that generate community benefit. For example, fuel poverty or energy efficiency activities involving expenditure on energy efficiency measures and services will create multiplier effects if these are provided by local suppliers.

- Fuel poverty work may have indirect economic effects through income maximisation work. The case studies for Kirklees Warm Homes, Exeter Community Energy and 361 Energy (see below) indicate that income maximisation (through reduced energy bills, tariff switching and social security benefits advice) forms an important part of fuel poverty work. Increasing disposable income for those on low incomes will allow them to increase expenditure on other items.

I did a home visit where we were able to secure unclaimed disability benefit of £1,826. The lady immediately said she would be "going to shops and treating herself to something nice and buying Christmas presents for the grandchildren." (quote from South Staffordshire CE)[41]

[37] CEE (2020), Community Energy State of the Sector 2020
[38] https://www.instituteforapprenticeships.org/apprenticeship-standards/community-energy-specialist/
[39] Communication from Community Energy England, 2021.
[40] Details available on SaCREC website: https://sacrec.org.uk/?page_id=881
[41] Consultation with Anthony Walters, South Staffordshire Community Energy.

While the evidence presented here suggests that investment of surplus (and leveraged funds) will generate economic benefits, there is insufficient evidence to assess the typical ratio of benefits to costs. For assessment of economic benefits from expenditure of surplus, we recommend using the conservative overall benefit/cost rate of 1.8, as estimated for community-based regeneration activities by CLG (2010).

CO_2 savings

Use of surplus and leveraged funds can generate further carbon savings if these funds are invested in further renewable energy generation schemes, or in energy efficiency and fuel poverty schemes (as discussed below), as well as community engagement and education activities relating to the low carbon transition (as discussed above). Tree planting and re-wilding initiatives may also contribute to CO_2 savings (see local environmental impacts below). CEE estimate that 5,200 tonnes of CO_2 emissions were saved in England and Wales through these types of activities in 2019, in addition to 60,000 tonnes of direct savings from renewable generation.

The residential sector currently accounts for around 18% of the UK's annual CO_2 emissions[42]. There has been considerable research on the scope for energy and carbon savings through domestic energy efficiency measures. The Energy Efficiency Strategy Statistical Summary, published by the Government in 2012, provides estimates of the levels of savings achievable through different measures, with reference to the Domestic Energy Behaviours Framework and National Energy Efficiency Data framework[43]. The latest research for the Climate Change Committee, by Element Energy[44], estimates that decarbonisation of UK existing housing stock can be achieved with average net investment of less than £10,000 per home, including insulation measures and low-carbon heating (e.g. heat pumps).

Energy efficiency programmes can potentially generate multiple benefits, not just energy and carbon savings. Examples of carbon and wider benefits from domestic energy efficiency programmes are presented below, and in the sub-sections that follow on energy bill savings and health benefits. The role of Community Energy groups in initiatives of this type is often to act as a trusted intermediary, helping to identify people who need help with energy efficiency and signposting them to energy efficiency grants and support, offered in partnership with local authorities and other organisations.

[42] BEIS (2020), 2018 UK Greenhouse Gas Emissions, final figures.
[43] DECC (2012), Energy Efficiency Statistical Summary
[44] Element Energy (2020), Development of trajectories for residential heat decarbonisation to inform the Sixth Carbon Budget

Case study 1: Kirklees Warm Zone

An evaluation of the Kirklees Warm Zone scheme, a home energy-efficiency programme in a deprived area of the UK, found that an initial investment of £20.9 million would generate social benefits of nearly £250 million. This included a reduction in CO_2 emissions of 23,350 tonnes per year, lifetime CO_2 savings (over 40 years) of 934,000 tonnes (valued at £30.6 million), lifetime fuel bill savings of 4,237 GWh (valued at £156.0 million at current fuel prices), savings to the NHS of £4.9 million, jobs and indirect income impacts valued at £29.1 million, house value increases valued at £38.4 million and benefits claims valued at £0.7 million. This suggests a lifetime benefit/cost ratio of 1.5 for CO_2 savings alone, with an overall benefit/cost ratio above 10, largely driven by fuel bill savings. The methodology for estimating energy savings and carbon emissions assumed that only 50% of predicted carbon and energy savings would be realised because of uneven installation of insulation and/or 'comfort taking'.[45] The cost per tonne of CO_2 savings was estimated to be just over £22 per tonne CO_2 and the cost of energy savings was £4.92 per megawatt hour saved.

Source: Carbon Descent (2011), Kirklees Warm Zone Economic Impact Assessment – final report – Prepared by Butterworth et al for Kirklees Council.

Energy efficiency work by community energy groups may also extend beyond the domestic sector, to community facilities and local businesses. The case study below also highlight work by a community energy group on energy efficiency for small and medium-sized businesses, undertaken in partnership with other organisations.

Case study 2: Oxfutures

OxFutures is a partnership between Low Carbon Hub, Oxford City Council, Oxford Brookes, Bioregional and other partners that offers energy audits and part-funding for energy efficiency/innovation grants to small and medium-sized businesses. In the first three year of the project, they supported 648 small businesses with practical support, energy-saving and innovation grants, undertook 136 energy audits, made 907 energy saving recommendations (one third of which were implemented). 86% of small and medium sized enterprises (SMEs) reported having reduced CO_2 emissions and improved business performance because of the grant. Examples of actions taken by SMEs include conversion of Oxford River Cruise boats to electric power and incorporation of occupancy detection technology into Ecosync's energy management system for buildings. Oxfutures calculate that potential energy savings in the project's first three years were 3.4 GWh for grants totalling of £71,116 (providing part-funding for projects with total cost of £294,294). Carbon savings in the first three years were more than 1,000 tonnes of CO_2, but the savings from enduring measures will increase over time.

Source: Low Carbon Hub (2020), Social impact report 2020.

[45] The assumption that 50% of predicted savings would be realised in practice is reported to be an Ofgem assumption that applied to carbon calculations for the national Carbon Emissions Reduction Target (CERT) programme.

Community energy groups are active in a wide range of low carbon initiatives, beyond renewable energy generation and domestic energy efficiency. For example, Community Energy England's State of the Sector Report (2020) highlights a number of low carbon heat and low carbon transport initiatives, which also have potential to save carbon. Given the innovative and small-scale nature of these initiatives at present, it is too early to quantify the carbon savings from these emerging business models for community energy, but they have potential to become significant in the future.

Energy bill savings and wider benefits from energy efficiency and fuel poverty work

Community Energy England (CEE, 2020)[46] reports that energy efficiency formed a core element for more than 100 Community Energy organisation's activities in England and Wales. Activities include:

- community engagement about energy efficiency (e.g. energy cafes, events, workshops),
- energy efficiency services (e.g. home energy visits, advice)
- direct implementation of home improvements
- grants or loans for energy efficiency works.

CEE estimates that, in 2019, 76 Community Energy organisations in England and Wales engaged with 22,000 householders and 415 businesses on energy efficiency issues. These organisations delivered energy efficiency services (e.g. advice and visits) to more than 9,000 homeowners, community organisations, charities and businesses. Out of the total 263 community energy organisations reported in CEE's State of the Sector survey, 57 were directly involved in arranging or installing energy efficiency measures (e.g. insulation, draft proofing, energy efficient lighting or energy controls) across 3,649 buildings, including homes and businesses. This involved £1.5 million of investment, some of it in partnership with local authorities and NHS trusts (see health benefits below).

Regen's Devon Community Energy Impact Report (2018) found a similar picture within Devon. Eleven out of the 23 Community Energy groups in Devon deliver energy efficiency projects, with all 11 undertaking awareness-raising work and sharing information/advice about energy efficiency. One group in North Devon, 361 Energy, specifically targets people in fuel poverty while other groups support both 'able to pay' and vulnerable households, as outlined in the case study below. Seven of the 23 groups in Devon install 'small' physical energy efficiency measures.[47] Four of the Community Energy groups in Devon also work in partnership with health services and housing associations to refer vulnerable households in their areas to the Local Energy Advice Programme (LEAP) which operates in partnership with the local-authority fuel poverty partnership Cosy Devon. These community energy groups receive a referral fee for each home visit delivered. Referrals from community energy groups represented more than 50% of referrals to the Cosy Devon scheme in the six months to January 2018.[48]

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[46] Community Energy England (2020), Community Energy State of the Sector 2020.

[47] Small energy efficiency measures include draught excluders, LED lighting, radiator panels, chimney balloons, standby pugs, shower aerators, pipe lagging and energy monitors.

[48] Regen (2018), Devon Community Energy Impact Report

Case studies on the impacts of energy efficiency and fuel poverty work within and beyond Devon are given below. The impacts of this work extend beyond energy efficiency, into income maximisation, health benefits and health service savings. Further evidence about health service savings is presented under 'health and well-being' below.

Case study 3: Energy bill savings from energy efficiency and income maximisation work by Plymouth Energy Community, Devon

In 2019, Plymouth Energy Community provided energy efficiency services to over 2,800 local households, including support for tariff switching, reducing fuel debts and supporting vulnerable customers to access benefit entitlements. This included over 1,300 home visits. PEC uses standard estimates of energy bill savings from energy efficiency measures and behaviour change measures. Examples of annual average savings for major energy efficiency works which would generate savings over a long timescale include:

- £155 saving from cavity wall insulation (assuming gas-heated 3-bed semi)
- £260 saving from solid wall insulation (assuming gas-heated 3-bed semi)
- £140 saving from loft insulation (no previous insulation)
- £15 saving from topping up loft insulation from 100mm to 270mm
- £75 saving for secondary glazing
- £40 saving for a new energy efficient appliance (e.g. fridge, freezer, dishwasher)
- £10 saving per LED bulb

Examples of annual average savings for minor energy efficiency measures, income maximisation measures and behaviour change measures include:

- £200 saving from tariff switch (actual figure varies by customer)
- £140 saving on energy bills from Warm Homes Discount (income maximisation)
- £120 saving from correct use of night storage heating controls
- £50 saving from energy monitor
- £30 saving for draught proofing windows
- £10 saving for reflective radiator panels
- £13 from switching off lights in unoccupied rooms
- £10 from fully loading the washing machine

While these are assumed savings, and may not be realised in every case (since energy advice may not be followed in practice), they are evidence-based and provide an indication of the scale of savings that can be achieved.

Source: Profile of PEC in State of the Sector report 2020; plus monitoring data from PEC.

Case study 4: Fuel poverty work by 361 Energy, Devon

361 Energy, based in North Devon, works with the One Northern Devon Partnership. This partnership, which includes representation from the NHS, local authorities, North Devon Homes, GPs and the voluntary sector, has been working to develop a fuel poverty and COVID-19 strategy. This is in line with strategic guidance from the National Institute for Health and Care Excellence (NICE) on the health impacts of cold homes.[49]

The role of 361 Energy in the One Northern Devon Partnership is to undertake home visits (or, under COVID-19 constraints, telephone consultations) to vulnerable people living in cold homes. They provide advice on energy efficiency, on tariff switching and on other health and welfare issues (e.g. ensuring that vulnerable people are listed on the Priority Services Register for their utilities).

The cost of this service is typically £130-£150 per visit, which pays for administrative support plus the services of a self-employed energy adviser, provision of post-visit information and small energy saving measures (typically £30/household). Energy advisers are qualified to NVQ Level 3, while some are qualified as Domestic Energy Advisors. Average energy bill savings as a result of these visits are estimated by 361 Energy to be about £500 per year. These typically comprise an estimated saving of £200 from tariff switching, together with other savings as a result of small energy efficiency measures. This suggests that the ratio of benefits to costs for energy bill savings within the first year is around £500: £150 (i.e. 3.3 to 1). This should be a conservative estimate as some energy bill savings are likely to persist beyond one year.

The home energy advisers also provide referrals to wider income maximisation services through the Local Energy Advice Partnership (LEAP), and can provide extra help accessing debt relief grants on energy and water bills (typically costing an further £40-60 for additional home energy advisor time). This is not included in the benefit/cost ratio above.

This benefit/cost ratio does not take account of wider benefits from Energy 361's home visit service. Because Energy 361 has good knowledge of their local community and are well-networked with other service providers, the energy advisers can signpost vulnerable people to other services provided by local charities and by 'social prescribers' within the health service. The range of services that can be accessed from charities and 'social prescribers' range from befriending to home-based hair cutting services for disabled people.

361 Energy also provides more in-depth support for vulnerable people with more complex cases. For example, if a home visit or consultation identifies someone who has no heating they will help this person to access an ECHO emergency grant for a new boiler. If the grant did not cover the full cost, they would use their local knowledge to identify potential sources of top-up funding.

While 361 Energy work in partnership with health service providers, via the One Northern Devon Partnership, the home visits are not funded by the health service but by the Local Energy Advice Partnership, working closely with DCC's Cosy Devon scheme. Western Power Distribution and Fullabrook CIC also provide some funding for their services.

Source: 361 Energy website and consultation interview.

[49] NICE (2015), Excess winter deaths and illness and health risks associated with cold homes.

Case study 5: Healthy Homes for Wellbeing project by Exeter Community Energy (ECOE)

Exeter Community Energy's Healthy Homes for Wellbeing (HHW) project provides home visits, drop-in advice clinics, awareness raising events and training for frontline workers. The HHW project works in partnership with the Royal Devon and Exeter NHS Trust and receives £45,000 in funding from the Big Energy Saving Network and Wester Power Distribution's South West Affordable Warmth Fund. The Annual Report for 2019-2020[50] estimates outcomes and benefits as follows. These benefits arose from a wide range of activities including 1289 enquiries or one to one sessions, 726 Local Energy Advice Partnership (LEAP) home visits, 627 Priority Services Register sign-ups, 97 Fire Safety checks, 62 health or local authority referrals.

ECOE report that the average annual saving (or income benefit) for households receiving a home visit was £1,102 per household and that the cost of their service in 2020 was £100 per household. So the simple benefit-cost ratio for each household (excluding the cost of energy efficiency measures) is around 11 to 1. However, these benefits arise from a mix of short-term, low-cost measures and longer-term energy efficiency measures involving significant installation costs. The figures below suggest that the benefit-cost ratio, taking into account the cost of these measures and conservative estimates of the likely lifespan of energy efficiency and income-maximisation measures, is estimated to be 3.3 to 1 (including the cost of energy efficiency measures funded by major energy suppliers) or as high as 14.3 to 1 (if these energy-supplier-funded measures are excluded). It is possible that some of this benefit may be taken as increased comfort, with implications for improved health and well-being rather than reduced bills, owing to the 'rebound effect' for fuel poor households. The benefits presented here do not include health and welfare benefits or health service savings arising from the Health Homes for Wellbeing project nor wider societal benefits such as preventing evictions and homelessness, and helping people to live in their homes for longer rather than moving into care homes.

Costs and savings of Healthy Homes for Wellbeing project run by Exeter Community Energy in 2019-2020.

Activities		**Number of households[51]**	**Total annual savings or income benefit[52]**	**Assumed lifespan (years)[53]**	**Total lifetime benefit (calculated)**	**Estimated total cost for this activity[54]**
Income maximisation referrals (e.g. benefits and debt advice)		286	£452,572	2	£905,144	Included in programme cost below
Behaviour changes and small energy efficiency measures (funded by LEAP)		845	£79,325	2	£158,650	Total cost of small measures estimated to be £84,500 (£100 per household) [55]

[50] Exeter Community Energy (ECOE) – Annual Report 2019-2020

[51] Exeter Community Energy (ECOE) – Annual Report 2019-2020.

[52] ibid.

[53] Conservative estimate by CAG Consultants, informed by advice from Exeter Community Energy, based on LEAP assumptions.

[54] ibid.

[55] The cost of small energy efficiency measures is borne by the LEAP partnership, not ECOE, but is shown here for completeness. We have assumed that measures are installed in each household, which may overstate the costs involved.

Switching tariff or supplier		200	£40,283	1	£40,283	Included in programme cost
Water Care Tariff/ Care team referrals		180	£19,800	2	£39,600	Included in programme cost
Warm Homes Discount (funded by energy suppliers)		114	£15,960	2	£31,920	Included in programme cost
ECO referrals (assuming 50% completion)[56] - measures funded by energy suppliers		143	£13,717	10	£137,170	Total cost of installation grants estimated to be £104,220 (from ECOE annual report)
ECHO referrals (broken boilers emergency scheme) - funded by energy suppliers		44	£8,800	10	£88,000	Total cost of boiler replacements estimated to be £79,200 (from ECOE annual report)
HEART referrals (energy saving appliances)		155	£6,200	5	£31,000	Total cost of appliances estimated to be £62,000 (£400 per appliance)
Total financial benefits over lifespan of measures					**£1,431,767**	
Total cost of installed energy efficiency measures						£329,920
Healthy Homes for Wellbeing programme delivery cost						£100,000[57]
Total costs associated with delivery of measures						**£429,920**
Estimated ratio of benefits to costs (including cost of energy efficiency measures)			**3.3 to 1**			
Estimated ratio of benefits to cost (programme costs only)			**14.3 to 1**			

Source: Exeter Community Energy (ECOE) – Annual Report 2019-2020; with supplementary information provided by Exeter Community Energy.

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[56] This includes referrals for first-time gas central heating installation, boiler replacement, loft and cavity wall insulation. Installation grants are assumed to be £4,000 for first-time gas central heating, £1,800 for boiler replacement, £400 for loft insulation and £750 for cavity wall insulation. Annual energy bill savings are assumed to be £338 for first-time gas central heating, £200 for boiler replacement, £150 for loft insulation and £150 for cavity wall insulation.

[57] This was the total cost to ECOE of running its programme in 2020, involving 5 advisers working on a self-employed basis. Referral income from LEAP (at £100 per referral) covered around half of this cost.

Health and well-being

A number of community energy organisations have used their community funds to support vulnerable members of the community during the COVID-19 crises. CEE's State of the Sector report (2020) reports that:

> *In the first week of the lockdown in March 2020, the Communities for Renewables (CfR) collective mobilised £100,000 of Corona Crisis Funds between them to support the most vulnerable in their communities. Six community-run solar farms in England and Wales supported by Community Owned Renewable Energy (CORE) Partners advanced a total of £195,000 in community benefit funds to support their local communities. Several community energy organisations such as Repowering, South London Community Energy (SELCE) and CREW Energy moved their fuel poverty advice services online or over the phone, working with other local community organisations to reach vulnerable members of their communities and help them access support and crisis funding. […] The challenges of COVID-19 have revealed the profound and much-needed contributions from the UK's community-led enterprises and initiatives, who responded rapidly to the needs of their communities and provided critical funding and social support.*[58]

More generally, there is considerable evidence that community energy work on energy efficiency and fuel poverty brings health benefits as well as energy bill savings and carbon benefits. There is a large body of literature about the negative effects of cold homes on health. BRE has estimated that investing in improvement of poor-quality homes would save the NHS around £1.4 billion in treatment costs for the first year alone, of which £0.8 billion would be due to addressing excess cold.[59]

A case study from South Staffordshire Community Energy below provides powerful evidence of health service savings that can be generated by targeted fuel poverty work. The health service savings cited here are in addition to the carbon and energy bill savings that this work can generate. The other case studies in this section show evidence of health benefits from energy efficiency work, drawn from outside the community energy sector.

[58] Community Energy England (2020), Community Energy – State of the Sector 2020.

[59] BRE (2015), The cost of poor housing to the NHS - briefing paper.

Case study 6: Saving Lives with Solar - South Staffordshire CE/UHNM NHS Trust[60]

South Staffordshire Community Energy (SSCE) have developed a close relationship with the University Hospitals of the North Midlands (UHNM) NHS Trust. In 2016, SSCE installed solar PV on seven buildings in the UHNM NHS Estate in Stoke on Trent and Stafford, financed by a community share offer over 20 years. The surplus from the SSCE panels on the Trust buildings is directed to help address fuel poverty. Consultants in the Accident and Emergency within the Trust identify people who are repeatedly admitted to A&E with health conditions related to cold, damp homes and request the patients' permission to refer them to a fuel poverty charity, Beat the Cold (BtC). BtC then "treat" the patients in their homes with a mix of solutions ranging from home improvement, energy debt write-off, getting them on priority risk register, securing relevant benefits and giving general advice. The cost of referrals to BtC is funded by the surplus from SSCE panels on Trust buildings.

SSCE has worked hard with BtC and UHNM to get the Saving Lives with Solar project off the ground and make it 'business as usual' for consultants at UHNM. This has involved high-level partnership working between UHNM Heads of Respiratory and Elderly Medicine, Director and Staff of UHNM Sustainability/ Energy Department, BtC, SSCE , Stoke City Council, EON and British Gas Vulnerable Customer Teams. Referrals to BtC have gradually increased and findings are as follows:

- There were 192 referrals to 'Beat the Cold' charity from 2016-2019, reaching 234 by January 2021.
- 98% of referrals were made by the Respiratory Medicine Team, primarily involving patients with history of repeat admissions for respiratory problems.
- The patients are from areas with indices of Fuel Poverty up to 40.2%.
- The cost of a visit from 'Beat the Cold', including an allocation of office and administration overhead and costs, was £136.

A 2017 study by the UNHM Data team compared readmission rates to another NHS Trust with similar demographics and case mix. They found that 13.4% of people referred to BtC were not readmitted. Overall, they estimated that the SSCE/UHNM/BtC initiative delivered:

- 22.8% reduction in admissions within 30 days of discharge
- 38% reduction in emergency readmissions within 30 days of discharge
- 14% reduction in use of health care system by this cohort has saved £0.2 million for the Clinical Commissioning Group (CCG) (approximately £1,000 per referral)

Referrals to 'Beat the Cold' are estimated to have generated health service savings of £1000 per referral. The cost of 'Beat the Cold' inputs was £136 per referral. So the ratio of benefits to cost, based on health savings alone, was around 7.4.

Additional energy-related and income-related benefits were generated by the energy efficiency improvements (e.g. boiler and house improvements) and by the additional financial benefits secured for patients via the visits (e.g. Warm Homes Discount, entitlements such as Pension Credit, Attendance Allowance, Meals on Wheels services etc). Beat the Cold have analysed income and energy benefits generated for a sample of 100 referral cases and estimate that the non-

[60] Southern Staffordshire Community Energy website (ssce.co.uk/the-community-fund) plus personal communication from Anthony Walters at SSCE.

health benefits in these cases were £127,500 (averaging £1,275 per referral). The benefits are reported to comprise:

- 54% were put on the Priority Service Register (Using the WPD Vulnerable Customer Benefit calculation, which is driven by energy advice and switching, this gives a total benefit of £16,435)
- 37% received Warm Homes Discount - £3,582
- 24% received energy advice and had billing issues that were resolved - £9,106
- 9% had their heating system set up correctly by BTC advisor - £352
- 7% were referred on for new benefits the majority of which were Disability Allowance/Attendance allowance - £52,582
- 5% were provided with fuel vouchers - £1,186
- 4% received new central heating systems - £35,000
- 3% had loft insulation installed- £2,100
- 1% had cavity wall insulation put in - £1,100
- 1% received City Council Funding for damp treatment - £6,050

If these energy and income related benefits are included, the total benefit rises to £2,275 per referral. This suggests a benefit-cost ratio of over 16 to 1 for 'Beat the Cold' referrals, when total benefits are compared to the direct cost of 'Beat the Cold' visits. However, fuller analysis would be required to include the indirect costs of delivering measures such as insulation, new boilers, damp treatment and so on, which will tend to reduce the benefit/cost ratio.[61]

Source: Southern Staffordshire Community Energy website (ssce.co.uk/the-community-fund) plus additional information provided by 'Beat the Cold' via personal communication from Anthony Walters at SSCE.

[61] The benefit/cost ratio would be different if viewed from a national perspective, since increased income from social security benefits would increase costs at a national level, as well as increasing benefits at a local level.

Case study 7: Warm Homes Oldham

The Warm Homes Oldham scheme offers advice, support and energy saving measures to residents at risk of fuel poverty. The scheme was set up by Oldham Council, NHS Oldham Clinical Commissioning Group (CCG) and Oldham Housing Investment Partnership (OHIP) in 2013. It offers physical energy efficiency improvements funded by the Energy Company Obligation (ECO) with top-up funding from the NHS (e.g. loft and cavity wall insulation, solid wall insulation, new boilers and heating controls); advice on energy use and efficiency; and support for income maximisation.

An evaluation of Warm Homes Oldham by Sheffield Hallam University in 2016 examined savings to the NHS as well as wider economic benefits, based on self-reported health outcomes. Key findings from survey work and in-depth interviews included:

- 60% of respondents with a physical health problem reported that the initiative had a positive impact on their health
- Four-fifths reported that the project had a positive impact on their general health and well-being
- Almost all (48 out of 50) of those who self-reported at being 'high risk' of mental illness at the start of the evaluation had moved to 'low risk' following the initiative
- 96% of respondents agreed that their home was easier to heat as a result of their involvement in the project
- 84% of respondents agreed that they spent less on their heating after the initiative

The most common health impacts experienced by those interviewed in-depth were reduced stress levels and improved emotional wellbeing, in some cases linked to improved physical well-being.

Investment of £250,000 per year by Oldham CCG resulted in a monetary benefit from an increase in 'Quality Adjusted Life Years' of between £399,000 and £793,000. Other economic benefits arose from improvements in those with Common Mental Disorders: benefits were estimated to include a £178,000 increase in GDP arising from higher employment rates, £37,700 increase in GDP arising from reductions in sickness absence and £137,300 reduction in benefits claims.

Source: Sheffield Hallam University, Warm Homes Oldham – Evaluation Final Report.

Case study 8: Gentoo – boilers on prescription[62]

The Gentoo housing group ran a 'Boilers on prescription' trial with Sunderland Care Commissioning Group (CCG) and Durham Darlington Easington and Sedgefield CCG, and a second study in partnership with the Centre for Health Economics and Medicines Evaluation at Bangor University, to calculate the improvements to health of people whose homes have been improved by energy efficiency measures.

Through Gentoo's wider retrofit work, including a 1,800 home Green Deal pilot scheme, they were able to demonstrate carbon reductions of around 25% per property, and energy bill savings of around £125 per annum for each household. However, they found that there were important qualitative improvements in addition to this: customers and families consistently reported feeling happier and their wellbeing increasing. The purpose of the 'boilers on prescription' trial was to translate anecdotal information about increased health and wellbeing into robust evidence.

A key success factor to engaging with local health trusts was framing the potential benefits in terms of the health system's own targets: not just speaking about improving health generally but focusing on reducing hospital admissions and re-admissions rates.

The 'boilers on prescription' project monitored six homes that received energy efficiency improvements, for patients with Chronic Obstructive Pulmonary Disease (COPD). The outcomes for these homes were compared to a control group of six patients who also suffered from COPD and lived in similar homes, but who did not receive home improvements.

While the sample size was small, partly because of difficulty in obtaining the relevant data permissions, the results after eighteen months of the trial showed:

- 60% reduction in GP appointments for those receiving energy efficiency improvements
- 30% reduction in A&E attendances
- 22% reduction in outpatient appointments (12)
- 25% reduction in emergency admissions to hospital (2)
- An average of 14% reduction in energy bills

Similar findings were observed in Warm Homes for Health, a research project undertaken by Bangor University in partnership with Gentoo. The study focused on self-reported health outcomes from 228 households and similarly found significantly reduced self-reported interactions with the NHS for those living in warmer conditions, and improvements in self-reported health status. They estimated that the home improvements for these households generated savings of £50,000 for the NHS, in the first year after improvements. The average cost of improving each house was £3,725, comprising a new combi boiler (£2,500) and double-glazing (£240 per window).[63]

Sources: (1) Gentoo (2016), Boiler on prescription trial – closing report. Prepared by Burns and Coxon for Gentoo.
(2) Bangor University (2016), Warm Homes for Health – end of study briefing. Prepared by the Centre for Health Economics and Medicines Evaluation, Bangor University in partnership with Gentoo and Nottingham City Homes.

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[62] Gentoo (2016), Boiler on prescription trial – closing report. Prepared by Burns and Coxon for Gentoo.
[63] Bangor University (2016), Warm Homes for Health – end of study briefing. Prepared by the Centre for Health Economics and Medicines Evaluation, Bangor University in partnership with Gentoo and Nottingham City Homes.

Case study 9: New Zealand research on the association between home insulation and hospital admission rates

The British Medical Journal has published peer-reviewed research on the relationship between home insulation and hospital admission rates in New Zealand. This research analysed data from the Heat Smart retrofit programme which ran from 2009 to 2014, involving over 990,000 residents in over 204,400 homes.

The rationale for the study was that excess winter mortality and morbidity are often greatest in countries with relatively mild climates, including New Zealand, because of poorer thermal housing standards compared with well-insulated houses in colder climates. The paper refers to several previous studies which have shown that improving thermal efficiency can lead to improvement in symptoms of cold-associated disease (either measured or self-reported). The aim of this study was to provide evidence about impacts on hospital admissions.

The research uses quasi-experimental methods to analyse hospital admission rates for the 'intervention group' compared to a 'control group'. The method controlled for differences in demographics, deprivation, insulation type and climate in different parts of New Zealand by matching pairs in the 'intervention' and 'control' groups. Out of the potential study population, the matched pairs of 'intervention' and 'control' groups involved 49,457 houses and 157,338 people. The study used a 'difference in difference' approach to compare the change in hospital admissions compared to baseline for the intervention group to the change in hospital admissions compared to pre-scheme baseline for the control group.

The study found that retrofitting home insulation was associated with a statistically significant reduction in the frequency of hospital admissions. The magnitude of the reduction was more pronounced for those with respiratory disease.

Source: BMJ (2020), Association between home insulation and hospital admission rates: retrospective cohort study using linked data from a national intervention programme - paper by Fyfe et al.

Realisation of these benefits depends on energy efficiency measures being implemented well, in parallel with measures to ensure adequate ventilation of homes. While the case studies above show significant benefits for health, a recent research paper[64] did not find a reduction in hospital admissions for patients with asthma, COPD and cardio-vascular disease living in homes that had received energy efficiency measures (compared to those living in homes that had not) and found some marginal disbenefit for asthma admissions at Devon hospitals. While this finding may reflect underlying health differences between the groups compared in this study, or may mean that the energy efficiency measures were not sufficient to address fuel poverty for these patients, the authors caution that a whole house approach is needed if using energy efficiency to tackle health issues.

The case studies above, and the body of wider literature on links between cold homes and health, suggest that well-implemented energy efficiency and fuel poverty work that is closely targeted at those with health conditions can generate significant savings for the health sector, as well as energy bill savings and carbon benefits. The benefit/cost ratio for the South Staffordshire

[64] Sharpe et al (2019), Household energy efficiency and health: Area-level analysis of hospital admissions in England. Environment International 133, pp 105-164.

Community Energy and University Hospitals of the North Midlands (UHNM) NHS Trust project 'Saving lives with Solar' was over 7, excluding energy bill savings and carbon emission savings.

Resilience

Depending on how surplus funds are invested, there may be an indirect contribution to community resilience. For example, as outlined above, the surplus income from community-owned renewable generation schemes could be used to increase the energy efficiency of local houses and community buildings, protecting consumers against the impact of fluctuating fuel prices. However, the benefits realisable through this may be less than those could be gained by targeting energy efficiency improvements at people with specific health problems living in poor housing.

Surplus funds could alternatively be invested in schemes that encourage local consumers to adopt more flexible demand behaviours, possibly alongside energy storage, with the aim of improving the resilience of the electricity grid and generating revenue from flexibility services. Increased demand flexibility is an important element of the low carbon transition: there is a growing need for flexible demand to help accommodate the increasing proportion of electricity generated by non-flexible renewable sources. Over time, as the smart meter roll-out continues, and changes to regulations mean half-hourly tariffs are possible, energy suppliers are likely to offer more complex and flexible 'time of use' electricity tariffs which may be attractive for some customers but challenging for others who cannot vary their demand. Community energy groups can potentially work in partnership with Distribution Network Operators and energy suppliers, acting as trusted intermediaries with members of the community. Just as community energy groups have helped to identify people willing to take up (or in need of) energy efficiency measures, they may be able to help identify people willing to take up demand-response behaviours (and support vulnerable customers with choices about new, flexible tariffs).

An example of a community energy group playing this role is the Sunshine Tariff Trial. This was led by the Wadebridge Renewable Energy Network (WREN) in partnership with Tempus Energy, Western Power Distribution and Regen. This project started in 2016 and offered participants in Wadebridge lower electricity tariffs during the day, to encourage them to shift some of their demand to times when local solar panels were generating. This helped to make best use of capacity on the local distribution network. The summary report on the trial explained WREN's role as follows[65].

> *The marketing and promotion was carried out by the local community energy group, Wadebridge Renewable Energy Network (WREN), which had good local contacts and an existing network of members. [...] It enabled WREN to use a wider range of marketing techniques and its reputation as a local trusted brand. [...] Almost three quarters of the households that signed up for the trial were WREN members, suggesting that those already bought into the organisation trusted their advice.*

[65] Regen/WPD (2017), Sunshine Tariff Summary report

The Bath and West Community Energy (B&WCE) group is currently trialling a demand-side response project, aggregating flexibility provided by individual households who have installed smart, controllable heat pumps, solar PV, hot water heaters and EV charge-points. B&WCE aim to offer flexibility services to their local distribution network operator (DNO), sharing benefits with participating households. This project is part of the Next Generation innovation programme supported by Power to Change. Carbon Coop and CREW Energy are also receiving support from Next Generation to test for innovative approaches to flexibility.[66]

Community energy activities around demand-side flexibility may be able to leverage support from DNOs and energy suppliers, because of the importance of demand-side flexibility in reducing upgrading costs for the electricity grid. It is too early to assess the benefit/cost ratio of activities focused on grid resilience, but this is an area which may generate significant benefits over time.

Local environmental impacts

Depending how the surplus from renewable energy is invested, there is scope for indirect environmental benefits through nature conservation, re-wilding and tree planting projects. For example, Yealm Community Energy in Devon have used their Community Fund to support a number of local initiatives to improve biodiversity and raise local awareness of nature conservation issues.[67] In 2019, the Community Fund allocated £2,500 to Wembury Parish Council for environmental and biodiversity improvements for the local recreation ground, £1,500 to Wembury Allotments to improve the biodiversity of the allotments, £509 to Newton & Noss to create a wildflower meadow in the orchard and £500 to Friends of Yealmpton School to extend wildflower areas in the school ground to extend the 'bee line'.

There are many other examples (e.g. Orchard Community Energy in Kent, Gower Power in Shropshire) where community funds have been used to fund activities with joint nature conservation and social or health objectives (e.g. community gardening activities for people with mental health issues; food growing initiatives involving local schools)[68].

Innovative low carbon initiatives by community energy groups, such as electric vehicle projects, also have scope to contribute to improved air quality in the local environment.

While it is not feasible to create a benefit/cost ratio for these indirect impacts, we note that investment of surplus may also generate these types of benefits.

[66] next-generation.org.uk/innovation

[67] Yealm Community Energy website- Community Fund. 2019 Community Fund grants. https://www.yealmenergy.co.uk/wp-content/uploads/2019/12/YCE-CF-2019-awards.pdf

[68] Orchard Community Energy website: http://orchard.coop/about/community-fund/; Gower Power website: https://www.gowerpower.coop/community-projects/

3.6 Conclusions

There are a range of different types of wider benefits that have been put forward as deriving from investment in Community Energy. These include:

- **Direct benefits** from investment in local, community-owned renewable energy generation (e.g. jobs/GVA, local multiplier effects from this investment, returns to local shareholders, direct carbon savings and – for some types of projects – reductions in energy prices for local consumers and improvements in local resilience, in addition to local environmental impacts)
- **Indirect benefits** from local investment of the surplus generated by local, community-owned renewable generation, together with any leveraged funds. Investment of this surplus can bring wider benefits, depending on how it is targeted and spent. The benefits can range from further carbon savings (if surplus is invested in further renewable generation) to local social and environmental initiatives.

Some of these benefits (e.g. local employment and economic activity impacts) would be similar for a local community-owned renewable energy scheme and any comparable local renewables project delivered by a private commercial developer. But others, such as returns to local community shareholders and local investment of surplus, are specific to a local community-owned scheme.

In terms of indirect benefits, the evidence presented in this chapter suggests that well-targeted energy efficiency and fuel poverty work can generate multiple types of benefits encompassing energy bill savings, income maximisation, health and welfare benefits (including health service savings), and (depending on levels of comfort taking) potentially some carbon benefits. Table 3.3 below summarises the types of costs and benefits, and benefit-cost ratios, that this type of activity can generate – drawing on the case studies above. This does not include the value of any carbon savings.

Table 3.3 Summary of Cost and Benefits from Case Study Projects

Case study	Direct cost per fuel poverty visit	Health service benefits generated (per referral)	Energy bill and income maximisation savings	Benefit cost ratio – direct costs only	Estimated benefit cost ratio – including cost of energy measures
Case study 4 – 361 energy	£130-150[69]	Not known	£500 (energy bill savings only)	n/a	3.3 to 1
Case study 5 – Exeter Community Energy	£100	Not known	£1,102	11 to 1	3.3 to 1
Case study 6 - South Staffordshire case study	£136	£1,000	£1,275	16 to 1	Not known

[69] Includes cost of small energy measures, where required

Chapter 4 below sets out the assumptions we have made, based on the evidence presented in this chapter, taking into account whether benefits are specific to local and community-owned developments. Some of these benefits are clear and measurable and form part of our cost benefit analysis, while others are described rather than quantified in the analysis below. Chapter 7 sets out approaches to using surplus to generating potential benefits in line with the objectives of DCC and the community energy sector in Devon.

4 Benefit Assumptions

4.1 Introduction

In this chapter we draw on the findings from the preceding chapter to set out the conclusions and assumptions we apply to the subsequent cost benefit analysis. Some impacts we are able to monetise. For some others there is clear evidence that a benefit occurs but insufficient evidence to attempt to apply a monetary value. In line with Green Book Guidance, we include these unmonetiseable benefits where there is evidence of their impact[70]. For most impacts there is a range of evidence and some impacts will only occur under certain conditions. Hence, we set out a range of sensitivity tests around a central assumption. In Chapter 7 we set out some best practice advice on how to get the most out of these potential benefits.

4.2 Assumptions

Local Economic Impacts

We do not think there is likely to be any significant difference between the local economic impact generated by a Community Energy project and a comparable commercial local development project. For a non-local project, the same impacts will occur but they will not directly benefit the Devon economy.

Using the figure of 0.7 jobs and £0.5m GVA per MW for solar renewables cited in Chapter 3, a 30MW solar farm would generate 21 jobs and £15m in GVA. Taking £15m as a lifetime value and averaging it over the scheme period would generate in net present value terms £10.7m[71].

An alternative estimate based on the capital value of the construction and on-going maintenance produces an estimate of 15 FTE jobs and £11.7m GVA using the capital costs for a Community Energy Solar Farm set out in Chapter 5. In net present value terms this would generate a figure of £11.1m. We use this approach in our estimates.

There is likely to be some level of displacement of activity associated with this project, but we would expect this to be low. In line with the HCA Guidance we apply a factor of 25% for displacement[72].

As a sensitivity test, we apply a factor of plus or minus 20% around our central assumption.

Community Benefit Fund

The Community Benefit Fund (CBF) for a local community-owned 30MW solar farm is assumed to have a value of £50,000 a year plus any additional surplus generated after Year 20 when debt is paid off (see next chapter). This is based on an estimate provided by Devon Energy Collective CIC.

To the extent that the project makes a greater surplus than this would automatically be re-invested into the Community Benefit Fund and hence this figure could be higher. Equally it is

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[70] The Green Book Central Government Guidance on Appraisal and Evaluation – HM Treasury 2020
[71] In reality the GVA would be more frontloaded from the construction phase and hence the NPV would be higher.
[72] Additionality Guide 4th Edition – Homes and Communities Agency (2014)

possible that the project may not generate a surplus and then there would be no funds available to invest.

As a sensitivity test, we have assumed that the average CBF payment over the period is a 'Low' of £25,000 plus half of projected additional surplus after Year 20. For the 'High' sensitivity we assume CBF is 50% higher than in the central assumption.

It could be argued that any surplus is enabled by paying a high price for energy and that the equivalent sum could be directly invested by DCC in local social impact or community projects. But as set out in the preceding chapter the Community Benefit Fund is arguably harnessing and leveraging greater community engagement and impact than would be achieved through a mainstream programme. In addition, whilst notionally budgets are interchangeable, in reality local authority budgets do not work this way. An annual grant from DCC for community energy activities is likely to be more subject to change and review than the proposed SPPA, which would be long term and not subject to annual budget reviews.

Leverage

We have assumed as a central assumption that the initial CBF leverages an additional 50% of investment from other stakeholders, programmes and funds.

As a sensitivity test, we assume a 'High' of 75% and a 'Low' of 25%, noting that the 'High' case is lower than some of the evidence cited in the previous chapter.

Community Benefit Fund Impact

The CLG Report, 'Valuing the Benefits of Regeneration'[73] derived an estimated benefit/cost ratio (BCR) of 1.8 for the category of 'Investment in Community Organisations'. As a sensitivity test, they also derived a lower estimate of 1.3 based on a shorter persistence period for the benefit. We apply this for our 'Low' sensitivity test. The 'High' sensitivity test assumes a BCR of 2.5. These figures are well-supported by the evidence presented in Chapter 3. As noted from the evidence in Chapter 3 and developed further in Chapter 7, the impact will depend to a large extent on the nature of activities the money is spent on.

The Benefit Cost Ratio can improve significantly where benefits show persistence.

Local Investment Income Multiplier

The local investment multiplier is a function of the value of Community Energy shares, the proportion of these shares held locally, the rate of return on those shares and the local multiplier generated through retained spending.

We have assumed the following:

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[73] Valuing the Benefits of Regeneration - Cambridge Economic Associates with eftec, CRESR, University of Warwick and Cambridge Econometrics Department for Communities and Local Government (December 2010)

- 35% of the capital cost is funded through Community Energy shareholding which is paid back in Years 21-25.
- An interest rate of 4% p.a. is paid on this community investment.
- 50% of the shares are held locally. Evidence from other projects suggest a high proportion of investment is secured from individuals who want to invest in community energy projects, but who are not based in the local project area.
- That a sub-regional multiplier of 1.2 is applied. In the HCA Additionality Guidance the recommended ready reckoner for medium projects with average linkages is a composite multiplier of 1.1 at Neighbourhood level and 1.5 at the Regional level. Devon lies between these two spatial areas, so the multiplier would lie within this range. And as we are here only considering the income multiplier rather than the composite multiplier we would expect it to be at the lower end of that range.

As an upper sensitivity test, we assume that 100% of community investment is held locally as this would be the objective for a local Community Energy project.

Summary

The table below summarises the monetised impacts included in the cost benefit analysis.

Table 4.1 Summary of Monetised Benefit Assumptions

Socio Economic Impact	Central Assumption	Low Sensitivity	High Sensitivity
Local Economic Impact		-20%	+20%
Displacement	25%		
Construction Jobs	6.5 per £m		
Operational Jobs	8.3 per £m		
Community Benefit Fund	£50,000 p.a. +surplus after Yr20	£25,000 p.a. +50% of surplus after Yr20	Central +50%
Leveraged Funds	50%	20%	65%
CBF Impact (BCR)	1.8	1.3	2.5
Local Income Multiplier	1.2	1.1	1.3
Proportion of shares held locally	50%	50%	75%

4.3 Non-Monetised Benefits

The evidence review in Chapter 3 suggests there are real beneficial impacts created through:

- Community engagement and education about the energy transition
- Community empowerment/ agency, within or beyond local CE groups

These positive beneficial impacts cannot readily be monetised, though they can be measured by understanding the extent and effectiveness of the activity. They are benefits to include in an appraisal of options.

5 Options Appraisal

5.1 Project Objectives

For the purpose of this assessment, we have a narrow and specific proposition we are trying to test, *"what are the socio-economic benefits of community energy and do these outweigh any additional costs associated with purchasing community energy"*. Therefore, in setting out our options appraisal we are testing a narrow range of options. We are not considering alternative ways of delivering carbon offsetting. Neither is this an assessment of the benefits of renewable energy.

Given our understanding of the current renewables energy market in Devon, the most cost effective form of renewable energy is a large-scale solar farm. Therefore, the three options being presented for appraisal are new renewable energy development projects of:

- 30 MW solar farm developed as a local community energy project
- 30 MW solar farm developed through a mainstream private sector provider locally in Devon
- 30 MW solar farm developed through a mainstream private sector provider elsewhere in the UK

The purpose of the local and non-local variant is to understand whether, and if so the extent to which, it is the Community Energy or local elements of the project that are driving additional costs.

The appraisal tests both the costs and the wider social and economic benefits associated with these two approaches. In doing so we are not attempting to replicate a precise financial model of a solar farm project, which would in any event be subject to sensitivities around the assumptions made and be subject to change over time. Rather our interest is in understanding what the difference in cost might be to DCC given certain conditions and whether the wider benefits might exceed any difference in costs.

5.2 Cost and Revenue Assumptions

Our cost and revenue assumptions are based on figures provided by one of our stakeholder consultees for a Community Energy project, subject to market assessment from Everoze, a multi-disciplinary team of due diligence professionals, with an integrated approach covering all renewable technologies.

We stress that these are illustrative examples designed to explain differences in the three types of model. Whilst using what we believe to be realistic assumptions they do not relate to actual projects and we recognise that there are a wide range of cost and revenue estimates that could be applied to specific projects.

Table 5.1 30 MW solar project assumptions

	Community Energy Local	Commercial Renewables Local	Commercial Renewables Non Local
Installed capacity (MWp)	30	30	30
EPC Price[74]	£14,025,000	£12,750,000	£12,750,000
Grid cost	£2,000,000	£2,000,000	£500,000
Development costs - pre consent	£200,000	£200,000	£200,000
Finance raising transaction costs	£950,000	£950,000	£950,000
Total capex	**£17,175,000**	**£15,900,000**	**£14,400,000**
Specific yield - P50 MWh/MWp	1050	1050	1000
Yield year 1 - P50 MWh/yr	£31,500	£31,500	£30,000
Plant capacity MWp	30	30	30
PPA £/MWh	£55	£50	£48
Revenue	**£1,765,500**	**£1,605,000**	**£1,440,000**
Cost of Sales	kWp	kWp	kWp
Import electricity	£30,000	£30,000	£30,000
MOP & comms	£1,000	£1,000	£1,000
O&M Scheduled	£165,000	£165,000	£165,000
O&M Unscheduled	£30,000	£30,000	£30,000
Rent	£90,000	£90,000	£90,000
Total	**£316,000**	**£316,000**	**£316,000**
Admin expenses	£90,000	£90,000	£90,000
Min community fund contribution	£50,000		
Maintenance Reserve Amount	£45,000	£45,000	£45,000
Other reserve amount			
Finance			
Bank / Council loan finance Share	65.0%	100.0%	100.0%
Bank / Council loan finance Rate	3.0%	3.0%	3.0%
Community / Junior investment Share	35.0%		
Community / Junior investment Rate	4.0%		
Community benefit	£50,000		
Inflation	2.0%	2.0%	2.0%
Discount rate	3.5%	3.5%	3.5%
Annual Depletion rate of Energy Performance	0.4%	0.4%	0.4%

[74] In this context, EPC stands for Engineering, Procurement and Construction

Community Energy Solar Farm - Local

Assumptions for the Community Energy model are derived primarily from assumptions from Communities for Renewables, reviewed by industry experts Everoze. One or two of these assumptions have been modified on the advice of Everoze.

We have assumed that a Community Energy scheme will have higher procurement cost than a commercial operator. For the purpose of this appraisal we have assumed a ten percent premium to the engineering, procurement and construction cost over a commercial operator, though recognise that some Community Energy projects may be able to procure at closer to the commercial costs.

The Community Energy Solar Farm is estimated to have a total capital cost of £15.9m and generate an annual revenue in Year 1 of £1.77m, based on a Purchasing Power Agreement (PPA) strike price of £55 per MWh. At the end of the PPA prices are expected to return to the market price. For the purposes of this assessment, we assume that to be the lowest of the three modelled prices here, i.e. £48 per MWh in constant prices.

Annual running costs are estimated at £450,000 in addition to which there is a £50,000 annual Community Benefit Fund contribution. Annual finance costs are estimated at £575,000.

We assume the bank loan is repaid in year 20 and the community shares redeemed between years 21-25. Any surplus after Year 20 is added into the Community Benefit fund.

Commercial Solar Farm – Local

We assume that a commercial provider is able to procure at lower cost. Operational costs are assumed to be the same as for the Community Energy project.

We assume no Community Benefit Fund. It is possible that some commercial developments will offer this. It would be likely to bring both the costs and benefits side of the equation closer and for the purpose of illustration we are maintaining a separation.

We modelled two different financing options for the commercial farm. In one it was capital funded, while in the other it was loan funded. In the loan funded option, the financing costs are slightly lower than the Community Energy model, at £453,000 a year.

The lower costs of the commercial model under these assumptions enable a lower PPA strike price of £50 per MWh and hence generate a lower annual revenue of £1.6m in Year 1. As with the Community Energy model this is assumed to fall back to £48 per MWh after Year 20.

Commercial Solar Farm – Non-Local

The difference with the Non-Local commercial model compared with the Local model is lower grid connection costs. We have been advised by a number of stakeholders that grid connection costs in Devon are much higher than elsewhere in the country. Hence we have assumed a much lower figure of £500,000 compared with £2m for the Local model.

This lowers the capital cost to £13.7m, which in turn enables a lower PPA Strike Price of £48 per MWh.

Depending on the location, the specific yield for solar PV may not be quite so high. A specific yield of 1,000 MWh/MWp would reduce the Year 1 yield to £30,000.

5.3 Summary Results

Table 5.2 below presents a summary financial appraisal of the three renewables energy models set out above. The results are presented in terms of the internal rate of return (IRR) for a 30-year project life. The figures are presented in real terms and we assume an inflation rate of 2.0% per annum. The fact that the IRR for each scheme comes out at broadly the same number gives confidence we are assessing comparable models.

The table also show the costs to DCC of the SPPA over twenty years, with the final column showing the additional cost to DCC of the indicative Community Energy option over the other variants. We stress again at this point that these are merely indicative models. The cost is presented in real net present value terms using an inflation rate of 2.0% and a discount rate of 3.5%

Table 5.2 Summary Financial Appraisal of Comparative Renewables Models

	IRR % (real terms)	Cost to DCC (millions)	Cost Differential over 20 yr PPA between CE Model and Mainstream (millions)
Community Energy - Local	5.5%	£23.82	
Mainstream - Local	6.1%	£21.65	£2.17
Mainstream - Non Local	5.9%	£19.80	£4.02

Source: Consultant's financial modelling

On the basis of these numbers, the local Community Energy scheme would cost DCC an additional £2.2m over the local commercial scheme and an additional £4m over the non-local commercial scheme.

Whilst Table 5.2 shows the Community Energy model to be more expensive, this will not inevitably always be the case. Evidence on Commercial versus Community procurement costs are mixed. For example, a report for Climate Exchange Scotland looking at whether community renewables projects incur higher costs than commercial projects found that whilst community-led projects are not on average more costly than similar scale commercial projects, they do experience greater cost variability – this is due to a mix of factors often including inexperience and lack of power in the markets. "*The main difference between community and commercial developer renewable energy costs are associated with the higher risk faced by community groups, particularly in the early stages of development*"[75]

[75] The Comparative Costs of Community and Commercial Renewable Energy Projects in Scotland – Harnmeijer et al for Climate Exchange Scotland

The same study found that partnership ownership models offered significant cost savings to community energy organisations (almost 50% less per MWp), when compared with 100% community ownership projects (Harnmeijer et al 2015: 18).

5.4 Sensitivity Tests

We have set out what we believe are a reasonable set of assumptions for these notional models of development. But there are a wider range of potential outcomes that may arise from an actual development as market prices change or dependent on locally specific factors.

Table 5.3 illustrates the cost to DCC of a range of different "Strike Price' agreements for a Synthetic Power Purchase Agreement (SPPA) over a twenty-year period. We assume an inflation rate of 2.0% per annum and a discount rate of 3.5% per annum.

It also illustrates the saving to DCC of buying at market price rather than, say, the £55/MWh strike price used for the Community Energy model set out above. For example, compared with commercial local renewables model set out above, which had a 'Strike Price' of £50/MWh, the additional cost to DCC of the Community Energy model would be £2.2m. Were the 'Strike Price' to be as low as £40/MWh, the difference in cost to DCC would be £6.5m.

This table is helpful in assessing the scale of additional benefits a local Community Energy scheme would need to generate in order to demonstrate value for money.

Table 5.3 Cost to DCC of SPPA at Different Strike Price levels[76]

Strike price	Nominal	Real	NPV
£40/MWh	£29.40m	£24.26m	£17.32m
£45/MWh	£33.08m	£27.30m	£19.49m
£48/MWh	£35.28m	£29.12m	£20.79m
£50/MWh	£36.75m	£30.33m	£21.65m
£55/MWh	£40.43m	£33.36m	£23.82m
Saving to DCC of buying at market price rather than £55/MWh strike price			
£40/MWh	£11.03m	£9.10m	£6.50m
£45/MWh	£7.35m	£6.07m	£4.33m
£48/MWh	£5.15m	£4.25m	£3.03m
£50/MWh	£3.68m	£3.03m	£2.17m

Source: Consultant's financial modelling

[76] Assumes same output delivered at each price point

6 Social Cost Benefit Analysis

6.1 Introduction

In this section we add in the wider economic and social benefits to the financial appraisal set out in the previous chapter. Chapter 5 set out the difference in costs that might emerge between a local Community Energy development and a conventional commercially funded one. It then established for a range of different 'Strike Prices' what the cost may potentially be to Devon County Council if it were to pursue the local Community Energy option. In this chapter we assess to what extent any potential cost gap would be met by the wider value brought about by the Community Energy social and economic benefits. All costs and benefits are set out in terms of cumulative net present value over the project lifespan.

The differential in cost between the Community Energy 'Strike Price' and that of the commercial alternatives is presented as a benefit in terms of savings to DCC.

We have not included in this assessment the monetised benefits of carbon as all the projects compared are renewables. But this would be an additional benefit to add to the assessment.

6.2 Monetised Cost Benefit Analysis

Community Energy Solar Farm

Table 6.1 summarises the wider socio-economic benefits from a local Community Energy Solar Farm development. In total these sum to £15.27m based on our Central assumption. These assumptions are cautious and can be robustly evidenced. The single largest economic benefit is the value brought in GVA to the local economy.

Applying the sensitivity test set out earlier gives a range from £9.04m under the low sensitivity tests to £25.38m under the high sensitivity tests.

Table 6.1 Socio-Economic Benefits of Community Energy Solar Farm (£m)

Socio Economic Impact	Central Assumption	Low Sensitivity	High Sensitivity
Local Economic Impact	8.78	7.02	10.54
Community Benefit Fund	2.28	1.19	3.42
Leveraged Funds	1.14	0.24	2.22
CBF Impact	2.74	0.43	8.46
Local Income Multiplier	0.33	0.16	0.74
Total	**15.27**	**9.04**	**25.38**

Source: Consultant's financial modelling

Commercial Solar Farm – Local

For the Local Commercial Solar Farm, the local economic impacts in terms of the construction and operational phase of the scheme will apply. We would anticipate that these benefits would be slightly lower than for the Community Energy model. There is some evidence on the fact the Community Energy schemes generate more jobs, though this is not strong evidence. But given that our financial appraisal included a higher capital cost for the Community Energy model, it is consistent that this would result in more jobs being created in the construction phase.

In addition to this local economic benefit there is, in our modelled examples, a financial saving of £2.17m. This gives a total local economic benefit of £10.42m.

The range in terms of our sensitivity tests is from a low of £8.77m to a high of £12.07m

Table 6.2 Socio-Economic Benefits of Local Commercial Solar Farm (£m)

Socio Economic Impact	Central Assumption	Low Sensitivity	High Sensitivity
Local Economic Impact	8.25	6.60	9.90
Total	**8.25**	**6.60**	**9.90**
DCC Savings	2.17	2.17	2.17
Total Benefit	**10.42**	**8.77**	**12.07**

Commercial Solar Farm – Non-Local

For the Non-Local Commercial Solar Farm there is a higher level of financial savings for DCC but no other local economic impacts. Whilst there will be comparable economic impacts at the UK level our impact area of concern here is Devon.

The total benefit for the Non-Local Commercial Solar Farm is 4.02m

Table 6.3 Socio-Economic Benefits of Non-Local Commercial Solar Farm (£m)

	Central Assumption	Low Sensitivity	High Sensitivity
DCC Savings	4.02	4.02	4.02
Total Benefit	**4.02**	**4.02**	**4.02**

Summary of Monetised Benefits

The monetised benefits from the three models are summarised in Table 6.4 below. On the Central assumption the Community Energy scheme generates the highest benefits with £15.86m against £10.42m for the Local Commercial scheme.

On the high sensitivity assumptions, the value of the Community Energy scheme is even greater with the gap rising to £14.67m. Even under the low sensitivity assumptions the Community Energy scheme delivers slightly better value.

Table 6.4 Comparison on Monetised Benefits (£m)

	Central Assumption	Low Sensitivity	High Sensitivity
Community Energy Local	15.27	9.04	25.38
Commercial Local	10.42	8.77	12.07
Commercial Non-Local	4.02	4.02	4.02

On the basis of robust and cautious assumptions about monetised wider socio-economic benefits, it can be demonstrated that paying a slightly higher price for energy to buy it through and Community Energy project can represent value for money.

We have modelled three alternative options and there will be a wide range of plausible outcomes. Clearly the larger the gap between the strike price paid to a Community Energy provider and the market price, the more difficult it may become to justify value for money, though closing the gap in terms of monetised benefits is not the whole answer.

6.3 Non-Monetised Benefits

In addition to the monetised benefits set out above we noted that there were non-monetised benefits that should also be included. These were beneficial impacts created through:

- Community engagement and education about the energy transition
- Community empowerment/ agency, within or beyond local CE groups

In considering value for money, weight should also be given to these factors.

7 Good Practice Note on Optimising the Benefits of Community Energy

As noted in chapter 3, a key source of benefit from community energy projects, and in particular large-scale assets such as solar farms and wind turbines, is derived from the use of the annual surplus that remains once operational and maintenance costs, and investor returns, have been paid.

The surplus can be used to establish a community benefit fund, indeed this is sometimes one of the primary drivers for a community energy project, or can be used to pay for staff and project activity directly undertaken by the community energy group. In both cases, groups may choose to reinvest some of the surplus in additional generation capacity.

Our understanding is that DCC would not be able to directly influence the use of any surplus generated by a renewable energy scheme investment made by the Devon Energy Collective. In any event, DCC and or the Devon Energy Collective (DEC) might consider any such attempts undesirable as it would reduce the sense of agency within the collective. However, as the ways in which the surplus is used has implications for the nature and extent of the benefits delivered, we think it appropriate to consider how the choices made about the use of the surplus might affect the impacts of the proposed Synthetic PPA.

Issues associated with priority setting and the use of surplus

A key decision for Community Energy groups is whether to focus the use of surplus on a limited range of targeted benefits, for example carbon reduction or the alleviation of fuel poverty, or whether to allow a broader range of projects to be considered. The latter approach might better align with the varied priorities of their local community. For example, Gower Power operates a CBF which has provided match or in-kind funding, to groups that have difficulty accessing funding through other routes, to support cooking, mental health, sustainable schools, community supported agriculture and sustainable building skills schemes.

The Devon Energy Collective (DEC) is constituted as a Community Interest Company (CIC), a legal structure similar to that of limited liability company, but bound by an expectation that the organisation uses its assets, income and profits to deliver community benefit. The stated objectives of the DEC CIC, as recorded in their Articles of Association are as follows.

> *"The objects of the Company are to carry on activities which benefit the community and in particular (without limitation) to undertake the development, financing, operation, purchase and sale of low carbon infrastructure assets and services for the purpose of:*
>
> *a) generating and supplying heat and electricity from renewable and low carbon sources;*
>
> *b) generating income to provide funding for community organisations and projects in the local community;*

c) *supporting community services and activities in the local community which promote awareness of and help address energy, fuel poverty, climate change, biodiversity loss and the ecological emergency as well as other environmental issues;*

d) *supporting the development of low carbon transport infrastructure in the local community;*

e) *reducing energy spend and developing a local energy community in the local community;*

f) *reducing energy spend and developing a local energy economy in the local community;*

g) *supporting the development of community assets and services; and*

h) *enabling people and organisations in the local community and wider community to invest in and participate in the governance of the Company.*

The stated objects allow DEC to operate and support a wide range of activities. In our experience this is common for CICs and is done in order to allow flexibility now and in the future. However, given that the drivers for the establishment of the SPPA arrangement is to deliver direct carbon reductions, it is worth reflecting on the different ways by which these might be pursued.

The list of allowable activities open up multiple avenues for pursuing carbon reduction activity. In practice, when selecting the types of intervention that might be funded, consideration needs to be given to the level of certainty of impact, in terms of carbon reduction, whether there is a need to demonstrate impact (generally the more predictable an outcome the easier it is to monetise and account for, e.g. in a cost-benefit analysis) and the related issue of whether to pursue a broad and deep or a wide and shallow approach.

Direct or indirect approach to benefit delivery?

Community energy organisations might choose to use their surplus to pursue carbon reductions directly, for example by investing in new generation or energy efficiency retrofits. Or they could aim to achieve this indirectly by disbursing funding to other bodies (e.g. via a community benefit fund) to undertake agreed works.

Direct investment provides greater control and, in the case of investments in new renewable generation, provides an opportunity to set up a 'virtuous' cycle of growth in terms of the organisation's portfolio, direct carbon impacts and income (amongst other benefits). It is also possible that profitable business models will emerge for other low carbon activities undertaken by community energy groups (e.g. energy efficiency investments or flexibility investments) that would allow a similar 'virtuous cycle' of invested surplus generating further surplus. Meanwhile, allocating funding indirectly, via a CBF, provides an opportunity to enable action by a wider range of organisations, to reach a wider audience and may trigger greater agency and broaden interest in climate action amongst a wider audience.

Certainty of securing carbon reductions?
Certain types of measure offer greater certainty and control. For example, in principle, the installation of new renewable generation capacity, leads to the displacement of fossil fuel alternatives and delivers direct and readily measurable carbon benefits. Energy efficiency measures, which arguably should be a higher priority, offer less certainty (being more dependent upon user behaviour) and are generally much harder to measure.

At the other end of the certainty scale, social interventions, behavioural initiatives, advice schemes, training and awareness raising offer much less certainty of impact. In addition, such impacts as they may generate, are often much harder to measure and may lack the persistence of physical measures. On the plus side, they offer the opportunity to engage with a wider and larger audience and may generate additional, unplanned (and often un-measurable) second order impacts. For example, an individual who changes their behaviour may help to establish new social norms amongst their friends and family.

Conclusion
The way in which the surplus associated with the proposed SPPA is used will have a material affect on the level of social impact delivered. As a result DCC may wish to consider whether it is desirable to influence how the surplus is used, in partnership with DEC.

If, as has been assumed, the priority for DCC is solely to generate carbon reductions then consideration needs to be given as to how best to secure such reductions. Surplus could be used to pursue narrow and deep approaches, for example by directly investing surplus in new generation capacity – perhaps leveraging in additional external funds in the process. Alternatively, broader and shallower approaches could be used, e.g. a focus on raising awareness and generating behavioural change (leading to carbon reductions). Alternatively, a combination approach could be used, e.g. retrofitting community buildings in tandem with a community-based social marketing approach.

Whilst for the purpose of this section we have assumed the primacy of carbon reduction, our research suggests that the inclusion of co-benefits[77] would be likely to have a material impact on any assessment of benefits. For example, our research suggests that funding energy efficiency measures for individuals on low incomes, in poor housing conditions and with related health problems offers multiple co-benefits in the form of income maximisation, health and welfare improvements and health service savings, as well as energy bill savings and carbon reductions.

Finally, the approach to be taken should be dictated by organisational priorities and strategy but DCC and DEC should take into account the uncertainty and difficulty of assessing the impacts of broad and shallow approaches and approaches involving co-benefits. However, such issues can and should be mitigated by ensuring that interventions are well designed and implemented, and by ensuring that robust monitoring frameworks are set in place. The latter will better enable assessments of social impact to inform future initiatives.

[77] Ashden (2019), Climate Action Co-benefits Toolkit (https://ashden.org/climate-action-co-benefits-toolkit/)

8 Conclusions

8.1 Introduction

This report has reviewed the socio-economic benefits of Community Energy and specifically sought to assess whether investing in local, community-owned renewable energy generation projects can deliver better value for money for a local economy than purchasing similar energy from a traditional commercial provider. Whilst this study has specifically addressed the issue in a Devon context, the findings may have wider applicability for other local authority areas.

8.2 Socio-Economic Benefits of Community Energy

There are a range of different types of wider benefits that can derive from investment in Community Energy (in the form of a local, community-owned renewable energy generation project). These include:

- **Direct benefits** from investment in local, community-owned renewable energy generation (e.g. jobs/GVA, local multiplier effects from this investment, returns to local shareholders, direct carbon savings and – for some types of projects – reductions in energy prices for local consumers and improvements in local resilience, in addition to local environmental impacts)

- **Indirect benefits** from local investment of the surplus generated by local, community-owned renewable generation, together with any leveraged funds. Investment of this surplus can bring wider benefits, depending on how it is targeted and spent. The benefits can range from further carbon savings (if surplus is invested in further renewable generation) to local social and environmental initiatives. The evidence suggests that well-targeted energy efficiency and fuel poverty work can generate multiple types of benefits encompassing energy bill savings, income maximisation, health and welfare benefits (including health service savings), in addition to carbon benefits.

Some of these benefits (e.g. local employment and economic activity impacts) would be similar for a local community-owned renewable energy scheme and any comparable local renewables project delivered by a private commercial developer. But others, such as returns to local community shareholders and local investment of surplus, are specific to a local community-owned scheme.

8.3 Valuing Benefits for the Devon Economy

In essence we were trying to understand what, if any, difference in cost there might be from purchasing energy, or in the case of Devon 'carbon certificates', from a Community Energy provider compared with a mainstream commercial provider. We then sought to assess whether the additional socio-economic benefits associated with Community Energy were greater than this cost differential.

To do this we constructed an illustrative financial model for a large-scale solar energy farm under three scenarios:

- 30 MW solar farm developed as a local community energy project
- 30 MW solar farm developed through a mainstream private sector provider locally in Devon
- 30 MW solar farm developed through a mainstream private sector provider elsewhere in the UK

The purpose of the local and non-local variant is to understand whether, and if so the extent to which, it is the Community Energy or local elements of the project that are driving additional costs.

We have conservatively assumed that a local Community Energy scheme would cost more than a commercial scheme, although the cost difference may be lower than we have assumed for a Community Energy scheme that is developed and operated in a professional and quasi-commercial manner. On the basis of the figures used for our models, the local Community Energy scheme would cost Devon County Council an additional £2.2m in real net present value terms over a twenty-year term over the local commercial scheme and an additional £4m over the non-local commercial scheme. The non-local scheme was assumed to be cheaper due to lower grid connection costs.

But the review of evidence had shown there were a number of additional socio-economic benefits associated with Community Energy schemes that could be monetised:

- **Local Economic Impact** – the construction and operation of the solar farm bring economic benefits to Devon in terms of jobs and GVA. These are large enough to outweigh the additional cost of the higher grid connection charges in Devon. They are also slightly higher for a Community Energy development than a conventional commercial one.
- **Community Benefit Fund** – this is in essence what the additional money is paying for: a fund to invest in social and community projects.
- **Leveraged Funds –** and the initial fund is able to leverage in further funding to invest in such projects, generating additional value.
- **Fund Impact –** and evidence shows that investing in such social and community projects generates more in benefits than the cost of the investment.
- **Local Income Multiplier** – the investment return to local shareholders means greater income will be retained in the local economy rather than leaking out to external investors. As this money is spent in the local economy it will generate further rounds of economic activity, supporting additional jobs.

Using cautious and well evidenced assumptions we estimate that these additional benefits would, on this model, generate an additional £15.27m in economic value to the Devon economy. This would more than outweigh the additional cost to Devon County Council of purchasing a non-local commercial equivalent product £4.04m, or a local commercial equivalent product, which would generate savings and benefits of £10.42m.

This is only a notional scheme and clearly there are a wide range of potential outcomes. The report sets out a series of sensitivity tests around our central assumptions to help illustrate this.

Clearly the larger the gap between the money paid to a Community Energy provider and the market price, the more difficult it may become to justify value for money, though closing the gap in terms of monetised benefits is not the whole answer. In addition to the monetised benefits noted above there are non-monetised benefits that should also be included. There are beneficial impacts created through:

- Community engagement and education about the energy transition
- Community empowerment/ agency, within or beyond local CE groups

In considering value for money, weight should also be given to these factors.

8.4 Getting Best Value

The way in which any surplus generated through a Community Energy project is used will have a material effect on the level of social impact delivered.

If the priority for Devon County Council is solely to generate carbon reductions, then consideration needs to be given as to how best to secure such reductions. Surplus could be used by the community energy sector in Devon to pursue 'narrow and deep' approaches, for example by directly investing surplus in new generation capacity – perhaps leveraging in additional external funds in the process. Alternatively, 'broader and shallower' approaches could be used, e.g. a focus on raising awareness and generating behavioural change (leading to small but widespread carbon reductions). Alternatively, a combination approach could be used, e.g. retrofitting community buildings in tandem with a community-based social marketing approach.

If the objective is to maximise the co-benefits of community energy activity in Devon, our research suggests that funding energy efficiency measures for individuals on low incomes, in poor housing conditions and with related health problems, offers multiple co-benefits in the form of income maximisation, health and welfare improvements and health service savings, as well as energy bill savings and carbon reductions.

Appendix 1 Consultees

361 Energy

Bristol Energy Network

Community Energy England

Communities for Renewables/Devon Energy Collective

Exeter Community Energy

Energy4All

Gower Power

Power to Change (CORE/Next Generation programme)

Plymouth Energy Co-operative

Regen

South Staffordshire Community Energy

West of England Combined Authority

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Appendix 3 Value of future carbon savings

In calculating CO_2 savings from future electricity generation, it is important to recognise that the carbon intensity of the electricity grid in the UK is predicted to decrease as low-carbon generation comes onstream. Depending on the purpose of CO_2 savings assessment, it may be appropriate to use figures for the 'grid-average generation-based emissions factor or the 'long-run marginal electricity emissions factor' (which takes into account that the alternative to renewable energy would currently be generation from fossil-fuel sources). The relationship between the grid-average and marginal electricity emissions factors is predicted to change over time, as more low-carbon generation comes onstream, until eventually low-carbon energy technology becomes the sole option for electricity generation.

The Treasury Green Book provides projections of CO_2 emissions factors and projected carbon prices for use in project appraisals, as shown in the table below.[78] They currently predict that, while the grid-average carbon savings attributable to future electricity generation is expected to decline over time, emissions calculated using marginal emissions factors are predicted to be higher until around 2040, when low-carbon electricity generation is assumed to become the sole option for electricity generation.

The price of carbon is projected to increase over time as international and national carbon budgets become tighter. Overall, the economic value of the carbon savings per MWh of renewable generation is expected to increase from around £2-5/MWh in 2021 to £6-9/MWh in 2030 and then £5-6/MWh in 2040, at 2018 prices. The range in these values reflects the difference between grid-average and marginal CO_2 emissions factors.

These Treasury Green Book projections were published in 2018 and may be updated in future.

Table: Projected emissions factors and carbon prices (2018)

Year	Long-run marginal electricity emissions factor for generation (kg CO_2e/kWh)	Grid average generation-based emissions factor (kg CO2e/kWh; tonnes of CO_2e/MWh)	Projected traded carbon price (£/tCO_2e, 2018 prices)	Projected value of marginal CO_2 emissions saved per MWh (£/MWh, 2018 prices - calculated)	Projected value of grid average $C0_2$ emissions saved per MWh (£/MWh, 2018 prices - calculated)
2018	0.291	0.165	13	3.783	2.145
2019	0.281	0.133	13	3.653	1.729
2020	0.27	0.128	14	3.780	1.792
2021	0.258	0.105	21	5.418	2.205
2022	0.246	0.098	27	6.642	2.646
2023	0.233	0.102	34	7.922	3.468
2024	0.219	0.095	41	8.979	3.895
2025	0.205	0.096	47	9.635	4.512
2026	0.189	0.09	54	10.206	4.860

[78] Data tables supporting the Treasury Green Book Supplementary Appraisal Guidance on valuing energy use and GHG emissions (2018)

Year	Long-run marginal electricity emissions factor for generation (kg CO_2e/kWh)	Grid average generation-based emissions factor (kg CO2e/kWh; tonnes of CO_2e/MWh)	Projected traded carbon price (£/tCO_2e, 2018 prices)	Projected value of marginal CO_2 emissions saved per MWh (£/MWh, 2018 prices - calculated)	Projected value of grid average $C0_2$ emissions saved per MWh (£/MWh, 2018 prices - calculated)
2027	0.173	0.096	61	10.553	5.856
2028	0.156	0.091	67	10.452	6.097
2029	0.138	0.084	74	10.212	6.216
2030	0.118	0.076	81	9.558	6.156
2031	0.105	0.067	88	9.240	5.896
2032	0.094	0.056	96	9.024	5.376
2033	0.084	0.052	103	8.652	5.356
2034	0.075	0.045	111	8.325	4.995
2035	0.066	0.037	118	7.788	4.366
2036	0.059	0.037	126	7.434	4.662
2037	0.053	0.037	133	7.049	4.921
2038	0.047	0.037	141	6.627	5.217
2039	0.042	0.037	148	6.216	5.476
2040	0.037	0.037	156	5.772	5.772
2041	0.036	0.036	163	5.868	5.868
2042	0.035	0.035	171	5.985	5.985
2043	0.034	0.034	178	6.052	6.052
2044	0.032	0.032	186	5.952	5.952
2045	0.031	0.031	193	5.983	5.983
2046	0.03	0.03	201	6.030	6.030
2047	0.029	0.029	208	6.032	6.032
2048	0.028	0.028	216	6.048	6.048
2049	0.026	0.026	223	5.798	5.798
2050	0.025	0.025	231	5.775	5.775

Source: Data tables supporting the Treasury Green Book Supplementary Appraisal Guidance on valuing energy use and GHG emissions (2018)

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