Net Zero Community (NZCom)

Work Package 5

M5.2 Community business cases - Options

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Acronyms

BESS	Battery Energy Storage System
BUS	Boiler Upgrade Scheme
CEC	Climate Emergency Centre
CEP	Community Energy Plus
CIC	Community Interest Company
CIL	Community Infrastructure Levy
COP	Coefficient of Performance
CNA	Community Network Area
DHN	District Heating Network
ECO	Energy Company Obligation
EIA	Environmental Impact Assessment
EPC	Energy Performance Certificate
EV	Electric Vehicle
HUGS	Home Upgrade Grant Scheme
HV	High Voltage
ICE	Internal Combustion Engine
kW	Kilowatt
kWh	Kilowatt Hour
LV	Low Voltage
MEES	Minimum Energy Efficiency Standard
NGED	National Grid Electricity Distribution
NZCom	Net Zero Community
P2P	Peer to Peer
PMG	Pseudo Microgrid
PPA	Power Purchase Agreement
PV	Photovoltaic
SEG	Smart Export Guarantee
WREN	Wadebridge Renewable Energy Network
WPD	Western Power Distribution
WPCNA	Wadebridge & Padstow Community Network Area
VCS	Voluntary and Community Sector

1 Introduction

1.1 Project Background

Project VENICE (Vulnerability and Energy Networks, Identification and Consumption Evaluation) is a Western Power Distribution (WPD[1]) programme funded under the 2020 Network Innovation Allowance (NIA) call: 'Energy Transition: Leaving no one behind'. This comprises three related projects, one of which is the Net Zero Communities (NZCom) project.

The NZCom project is using the Wadebridge & Padstow Community Network Area (WPCNA) in Cornwall as the focus of its activities and research. The Network Area is defined as the cluster of 13 Lower Super Output Areas in and surrounding Wadebridge and Padstow, and the three Cornwall Council electoral divisions that cover this area.

NZCom is looking to gain understanding about how the needs of WPD's vulnerable customers (domestic and non-domestic) will change in the future, creating new pathways to support a whole community through the transition to net zero. As part of exploring the nature of this transition, the positive role that community energy groups can play will be considered.

The purpose of Work Package 5 of NZCom is to translate the findings of Work Packages 2-4 (that respectively establish future scenarios, carbon accounting, and solutions, impacts, and mitigation) into business propositions that are community led, and community owned initiatives that can be taken forward. It will consider the range of technical options developed within Work Package 4 and identify approaches that will allow appropriate business plans and investment strategies to be adopted.

1.2 Purpose of this document

As noted above, at this stage of the project, we will consider the range of options developed within Work Package 4 and identify approaches that will allow appropriate business plans and investment strategies to be adopted.

This will be focused on delivery options that can be considered by community groups of all types and structures, but with a focus on the group being able to connect with and include everyone in their community, to ensure that no-one is left behind in the transition to a low carbon/net zero community.

The lead partner for the NZCom project is Wadebridge Renewable Energy Network (WREN), a well-established and active community energy group that has delivered a range of projects over many years. Given the experience of WREN, this Options paper has been written with an understanding of their aspirations and capacity to deliver projects across the Network Area. We hope this will act as an inspiration and discussion prompt for other community energy and climate action groups.

Community Energy Plus is Cornwall's energy advice agency, and over the past 24 years has actively promoted the delivery of community led renewable energy projects and the development of groups

[1] During the course of project delivery Western Power Distribution (WPD), was bought and rebranded as **National Grid Electricity Distribution** (NGED).

addressing the multiple challenges rooted in the climate, ecological and resource depletion emergencies.

1.3 Constraints

- No assumptions will be made about the appropriate legal structures that community groups considering action have either already used or will need to use to operationalise any proposals.

- We understand that most groups are run by volunteers and are not necessarily able to employ people to deliver projects. As many of these proposals require long-term commitments for delivery, volunteer turnover and burn out must be a factor in any planning.

    - We have experience of projects where the initial volunteers who got a project established decided to retire after several years of hard work to realise their ambitions, handing over to others who weren't involved in original decisions. Unless this process and the natural evolution of groups is recognised, it may create tensions where new members wish to take a project in a different direction, or don't understand the rationale of the initial decisions and the constraints of the start-up period.

- Major increases in energy costs in the UK have led to well-publicised concerns about the growing numbers of households unable to afford the costs of energy for domestic consumption. This creates a dilemma for this project, underlining the urgency to create initiatives that enable low-income households to take action to reduce their costs, whilst also understanding that where a capital investment of new technology is required, those same households are least able to act. It is recognised that a consequence of fuel poverty is that households limiting their energy consumption, as a result, will be already restricting their carbon emissions and it is often more affluent households that generate greater emissions. We also recognise that energy efficiency and low carbon technologies are not synonymous, although hopefully complementary. This paper will reflect on where proposals can work to ensure the greatest take-up across the whole community.

- Urban vs rural communities. The Wadebridge & Padstow community network area has a mix of denser housing in its two major towns, around which several villages and a lot of dispersed rural housing is situated. The two towns host the major shopping centres, public sector buildings and business areas. This variety creates both challenges and opportunities for delivering community energy projects.

It should also be noted that the area of Cornwall that this project has focussed upon is heavily impacted by the tourism sector and energy demands fluctuate through the year.

1.4 The role of community-led initiatives

Community energy groups, local Transition groups and climate action groups come in all shapes and sizes. They will reflect the interests and passions of their active members, usually all volunteers. From the experience of Community Energy Plus there are a range of activities that groups can focus on depending on the capacity and availability of group members; it is also our experience that across many community energy groups there is considerable technical expertise, and they are often well connected to academic and commercial experts.

We strongly recommend groups associate with umbrella organisations such as Community Energy England, and the growing network of Climate Action groups, as a great way to access resources, advice, and encouragement to ensure that there is coordination and that common goals are actively being achieved[1].

The three principal areas of activity that groups may wish to pursue can be described as -

Education, Facilitation and Action

1 To inform and educate about opportunities

For those of us who have worked in the environmental and renewables sectors for many years, it is important to remind ourselves that the wider public are often unfamiliar with much of the language around Zero Carbon and low carbon technologies. Therefore, there is a huge task of engagement and education still needed to help people understand what they can do, individually and together. Community groups who can gain a reputation as a trusted source of impartial, accurate information are well placed to work alongside their local authorities and others to educate their friends and neighbours. This often can be done at a low cost in terms of the materials needed.

Example: There is a growing interest in the emerging network of Climate Emergency Centres (CECs) across the UK[2]. Using a model of pop-up shops, their ambition is to use "empty buildings as inspirational community hubs for the benefit of people and planet." Their website has a comprehensive handbook to help the development process. https://climateemergencycentre.co.uk/

Example: For several years WREN ran an 'Energy Shop' on similar principles to the CECs. Acting as a public point of reference such as an outlet can act as an important signposting service, pointing the way to pre-vetted local installers and steering enquiries to the right actions. WREN have reflected that the model does make considerable demands on volunteer time so it is not for every group, and a regular presence with a stall at a local farmers' market, or similar community event can be effective; even a regular presence at a car-boot sale can be a profitable outreach mechanism.
https://www.wren.uk.com/

There are costs in running a shop as an outreach venue: ground rent and rates, insurances, etc., but a range of funders can help with these costs if a clear plan has been developed. One source of help is your local Community Foundation[3].

Example: Chacewater Energy Group have hosted a popular annual Renewable Energy and Electric Vehicle Show and several other showcase events, pulling together local suppliers and attracting significant general interest across Cornwall.
https://www.facebook.com/chacewaterenergygroup/

Example: At the time of writing NZCom partners Planet A have hosted two successful Decarbonisation Roadshows, with a range of businesses and electric car and bike suppliers showcasing their offer to businesses and consumers.
https://planetaenergy.org/

Both examples, along with a growing number of energy groups hosting annual or more regular events are enabled by people who are keen to connect suppliers, influencers and consumers to encourage conversations. From the business perspective it is an effective way to meet potential new clients, but perhaps more importantly, by using the event to raise the profile of what is happening locally, it shows people the scale of what is available to them.

2 To facilitate action by making connections

Several of the proposals outlined below could be progressed with a partnership with local installers and other stakeholders in the Public, Commercial, Voluntary and Community sectors. A community energy group may serve a vital connecting role at various points which differ in their level of involvement.

Coordinating relationships with local installers has the potential to unlock the power of collective buying to be utilized for solar buying clubs, for example, to ensure the cost savings from “bulk-buying” are passed onto the consumer.

These relationships with local installers also ensure that certain trusted suppliers can be vetted and recommended to local individuals. This may also have a cumulative effect with recommendations reaching across friends, families and acquaintances in order to extend the benefit across the community, not just those that are actively engaged with energy groups.

Connections established with a network of community climate action groups ensures that local communities are benefiting from the shared knowledge of multiple groups working in slightly different capacities and in different locations.

3 To deliver action

Developing projects takes time and commitment and is potentially where a community energy group can evolve into a group that employs its own staff to perform an array of services and actions.

WREN has developed a number of community energy projects with differing degrees of involvement and commitment from their Management Board, volunteers and on occasion, employees.

- Installation & ownership of community solar
- Sunshine Tariff trial
- Energy Equality peer-to-peer trading
- Encouragement for members of the community to take advantage of the FIT
- Renewable heat Installations
- Distribution of Renewables Community Funds
- Promotion of household insulation

These projects grew out of the relationships WREN had established with a number of key actors in the energy market, and they were able to apply for funding when calls were made, based on discussions they had already had as a group and with partners. More information on their current and past projects is available via the WREN website: https://www.wren.uk.com/

Like other groups in similar situations, access to funding means that the group must evolve over time and adjust its ambitions and capacity to deliver accordingly. (See section 12 for more information around funding for community groups.) WREN have employed project staff but recognise that this is a major commitment for a group of volunteers. Some of the potential projects and activities described below require the option of partnerships to be considered, possibly with local charities and CICs that share similar aspirations but already employ staff.

2 Outcomes based on outputs from Work Package 4

Before considering the options described in this paper, it is important to read and understand the proposals contained in the following documents produced in Work Package 4:

- M4.1 Review of technical and system options
- M 4.2 Characterisation of confining factors
  and
- D8 NZC Wadebridge by 2050 report

This project is funded by the Network Innovation Allowance, so a number of the proposals in the above reports are innovative and require significant regulatory change and new approaches by the DNO and regulator. As a result, some proposals, for example the pseudo microgrid, will require development of sandbox trials and cannot immediately be turned into business proposals and it is not yet possible to assess the full operational costs.

Therefore, this Options paper will consider proposals that community groups can start to develop immediately that potentially will support progression towards more advanced ideas and technological innovations such as the pseudo-microgrid.

2.1 Key outcomes from work package 4

From the research undertaken, several conclusions were drawn about how the community will move to a Net Zero scenario. These include:

- Greater penetration of rooftop solar PV, both domestic and commercial
- Additional ground-mount solar PV and wind generation
- Greater adoption of heat pump technologies for domestic heating
- Greater use of EV with associated domestic and community-based charging infrastructure
- Options for community scale battery storage

Microgrid considerations

- The creation of a Pseudo Microgrid (PMG) has been proposed as an efficient way in which locally generated energy can be used within a defined community. The PMG could operate from a HV or LV substation circuit and may be offered with a tiered pricing structure which would ensure that lower usage participants pay less per unit of electricity than higher usage individuals. As the concept has been discussed amongst the NZCom project team, the use of community scale battery storage has been included which would also operate on the PMG at the substation level. This facility would ensure greater stability on the microgrid supply side and also ensure that the use of energy generated by renewable sources can be maximised when it is needed locally (See chapter 10).

3 Solar PV

3.1 Domestic rooftop solar PV

Despite the end of the feed-in tariff, the market for solar PV remains very buoyant although it has shifted to developing opportunities for where daytime generation can be used on site, to maximize the benefits of off-setting grid supplied electricity. This trend is putting more focus on commercial and public sector buildings rather than domestic properties. The Smart Export Guarantee payment replacing the Feed-in Tariff is changing the incentives to install domestic solar PV, with potentially more focus now on the carbon reduction benefits of systems rather than simply on a pay-back period and financial profit from a system. The recent increase in electricity costs has prompted some to reconsider solar PV as an option to reduce their energy costs, although at the domestic level there is often a confusion between the benefits from the generation of electricity from solar PV, with peak output in the summer months, against reductions in heating costs which are greater at times of the year when solar radiation levels are reduced.

WREN have a strong record of promoting domestic solar PV in their community, taking advantage of Cornwall's high levels of solar insolation and the county has amongst the highest level of solar PV installations in the UK [4]. Previously, WREN have developed relationships with local installers, where they received a referral fee based on the scale of the installation.

Where community energy groups have developed a reputation as a trusted source of information and guidance in their locality, there are still great opportunities to promote the adoption of solar PV with residents. Moving the conversation away from solar PV as an income generator, to technology that can save money and carbon means this can be a worthwhile investment for consumers and for the wider community, when it comes to achieving net zero. This plays into a community energy group's role, both as an educator and in facilitating connections but there are however limits on the opportunities for income generation for the community energy group.

There is a challenge to identify clear social and environmental benefits in the current policy framework, where carbon emissions reduction is not quantified or adequately valued. While those of us convinced of the urgent need to reduce our carbon expenditure see the sense of promoting solar PV and other low carbon technologies for the future of the planet, the demise of the feed-in tariff has made making a business case for investment harder. Although painful for many consumers, rapidly rising energy costs helps to further make the case. For businesses with a high day time electricity load the business case still looks very good to invest in solar PV where on-site consumption is high, even without the FIT.

3.2 Solar buying Club

The fundamentals of a solar buying club are about getting a cheaper rate for the purchase and installation of solar panels, from the power of collective bulk purchasing. This provides a clear benefit to the householder, able to access a cheaper rate for PV panels compared to buying alone, but potentially it can also ensure that suppliers and installers are vetted by a trusted body, within the community coordinating the purchase.

Example: IChoosr [5] are a group-buying initiative that run Solar Together[6], a program that works with local authorities to promote the take up of solar PV and storage.

https://ichoosr.co.uk/solar/

Using the IChoosr model as an example, this may work in the follow steps of delivery:

1. A resident will register with the scheme organised by the community energy club. The resident provides information about their home, roof, and energy consumption. Surveyors may have to be deployed at this stage.
2. The club invites several installers to take part in the auction. If this is organised on a local basis, the group may decide to limit participation to locally based installers or apply other selection criteria.
3. A reverse auction takes place. The lowest bid meeting the agreed quality criteria wins the contract. All suppliers and installers are pre-vetted and must follow established criteria to guarantee the quality of the offer.
4. After the auction, a personal package is delivered to each resident, with details about their tailored offer. Participation in a group-buying scheme is without obligation. Each participant decides after the auction if they want to take advantage of the offer.

Challenges:

Currently iChoosr prefer to work directly with local authorities, so community energy groups will need to work alongside their relevant authority to develop a partnership. Clearly, the endorsement of a local authority for a scheme adds credibility. There may be scope for iChoosr to work directly with a collection of community energy groups, perhaps led by Community Energy England, in order to establish a solar buying club across a larger area to increase the penetration of cheaper PV for a greater number of individuals; at the time of writing this is still at an early stage of discussion.

One of the great advantages with collective bargaining is that the consumers benefit from the economies of scale. These discounts rely on bulk buying for specific goods and the saving is realised directly by the consumer. Due to the nature of purchasing in bulk, individual consumers would be unlikely to have a lot of say about the specifics of the model of the preferred solar PV panel which they are purchasing. This is unlikely to cause issue unless in specific circumstances where the consumer may have preference for a certain manufacturer or where they are seeking a higher specification panel.

Currently, the solar PV and renewable installers we have consulted are all reporting that they have full order books and are advising customers that the period between first enquiry through to install is typically several months. Therefore, at present, these trusted installers have little motivation to offer bulk purchasing discounts and so the space for “Buying Clubs” is limited; this also applies to the bulk purchase of heat pumps and EV charge points.

3.3 Rent-a-roof

At one time rent-a-roof projects were a great opportunity for community energy groups to generate income by investing in solar PV systems installed on residential properties and offering the householders free electricity at no cost to themselves, taking the Feed-in Tariff payments to cover the capital costs of the system and potentially earning additional income. The demise of the Feed-in

Tariff, together with uncertainty from mortgage and conveyancing professionals about these arrangements has largely ended this option.

Where a building has suitable daytime consumption demands, a community energy group could consider a situation where they pay for and install the system and then put in place a Power Purchase Agreement (PPA) offering on-site generation at a price lower than that of grid supplied electricity. Depending on the length of the agreement, the initial capital costs would be covered, plus on-going maintenance costs and potentially there will be additional income for the system owner. For some commercial properties, including public sector owned buildings with a steady daytime demand, this arrangement can be mutually beneficial both to the community group and the property owner, especially in the current environment of the uncertainty with electricity prices, where a fixed unit cost helps the business plan their expenditure over an extended period. It should be noted that the PPA as part of a lease on the property will involve discussions about the lending involved to enable the capital investment and so sound legal advice is essential.

Currently the only income generated from rooftop solar PV where power is sold onto the grid is from the Smart Export Guarantee (SEG). Octopus currently offers a competitive export tariff known as Octopus Outgoing; this can either be fixed at 15p per kWh or an “agile” tariff in which the outgoing tariff is matched to the wholesale rates[7].

Community energy groups may have the capacity to be instrumental in the development of this scheme through the linking of members within the community and energy suppliers or green investment firms. For a larger community energy group with access to capital, they may be able to put forward the investment for the install and maintenance of the panels themselves, and in turn collect the SEG and unit price agreed in a PPA as part of the pay-back. The capital investment required to fund such a scheme may also be generated in the form of community shares through a co-operative organisation.

The legal structure of the organization is important in this context; a CIC is an effective model as a “not for profit” company, however, if the group intends to raise investment through community shares, a Community Benefit Company (Co-op) is required.

Challenges

Rent-a-roof schemes often require the property owner to sign up to a commercial lease for the installer to have access to install, repair or remove the panels. This arrangement, in law, is seen as a business lease and is in effect, a grant of rights to a third party. This leads to problems notably with mortgages and insurers, due to the lease granting first charge rights to a third party which affects contracts between lenders and the property owner. As noted, homeowners may be impacted when they come to sell their property as it often takes effort to persuade the purchaser’s legal advisers that this arrangement is valid and that benefits and commitments agreed by a previous owner are transferable to the new owner.

3.4 Domestic Rooftop solar with local peer-to-peer (P2P)

The benefits to behind-the-meter-generation (BTM) are as follows: A reduced draw on the national grid and a mitigation in the costs of transmission and distribution charges.

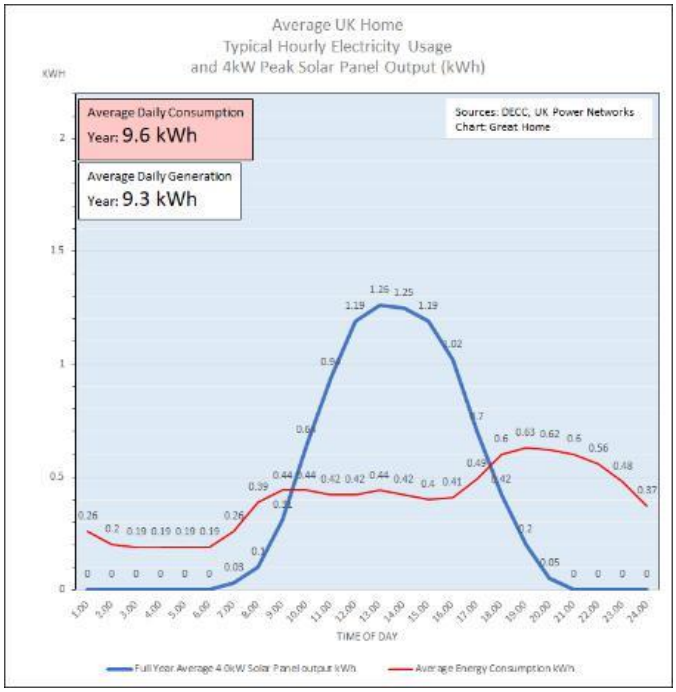

Fig. 1 Graph showing the average generation of a 4kW PV system over a year compared to the annual usage.[8]

The nature of solar generation, without energy storage technology, means that the usage curve does not often meet the generation curve. As seen in figure 1, an average home's electricity usage with a 4kW peak solar array generating around 4,000 kWh per year would only use around 40% of the solar energy produced by the panels, without the use of any battery storage. The remainder would be exported to the grid[8].

With the high cost of small-scale individual battery storage technology, both financially and environmentally, it would be more advantageous for grid-scale energy storage technologies to be implemented (see section 9). This would allow for better demand response, load shifting, back-up power and much more efficient integration with the intermittent generation of renewable energy technologies.

With the use of a microgrid "sharing" electricity locally within the community, BTM generation will be evenly distributed throughout the local community, providing the area with a lower cost per kWh than grid-supplied electricity when it is using locally generated electricity.

Working alongside an established energy supplier would be a most practical solution, due to their capacity to collect meter data and to perform the billing which is required for each consumer. Energy Local uses a similar strategy for local generation schemes, using a larger energy supplier to monitor the usage of each meter point and raise bills reflecting the balance of consumption between the times when there is local, linked renewable energy exported to the grid and when renewable resources are not operating[9]. This same scheme could be used with community domestic rooftop solar, potentially sharing electricity when it is not being used by one PV system with another domestic consumer with immediate demand.

Whilst some local energy groups may have the capacity to take on the role of the energy supplier in this scenario, it would be more common for these groups to instead act as the intermediary

between the consumer and the scheme manger itself, realizing their role as an educator and connector.

3.5 Solar PV on commercial buildings

Installing solar PV on commercial buildings can generate several distinct advantages. Whilst generally these types of buildings have a greater daytime energy requirement than domestic properties, they also often have a larger area than domestic properties[10].

A community energy group looking at the opportunity to propose and develop solar PV installations on community buildings may be able to offer community share offers to raise capital for such projects. This has the added benefit of ensuring there is a wider engagement within the community for shared spaces and for the drive towards net zero.

Community energy groups may have the capacity to broker these agreements with other commercial buildings within the local area for example within industrial/trading estates. This enables commercial buildings to rent their roofs but ensures that they pay a pre-set rate for electricity, enabling them to benefit both from a cheaper rate of electricity from renewables without having to expend the capital for the installation and maintenance and be assured of the cost of the power they need[11].

Challenge:

There are difficulties when it comes to PV on commercial buildings due to the issue of occupancy. The building itself may be owned or managed by a separate organization to the occupier and energy bill payer, therefore, this may complicate proceedings and create legal difficulties for the installation of PV. For example, although seen as a popular option, there are a number of challenges in working with schools or academies due to the buildings being leased from the local authority. The responsibility for the upkeep of the roof may contractually fall to a company who may not be specialized in the maintenance of solar PV panels, and access for installation and maintenance out of term time can add to logistical challenges. It should also be noted that peak solar generation in the summer months tends to overlap with periods when these buildings are unoccupied for school holidays, so planning investments based on predicted on-site consumption can be a complex challenge.

4 Community Owned Wind

The installation of community owned onshore wind turbines which would be connected to the microgrid to share energy generation benefits within the local community would be greatly beneficial for the journey to net zero. There is a clear benefit in terms of additional power generation to the grid, particularly during the winter months when solar PV generation is not as productive and energy needs are higher. That said, these projects historically have faced significant difficulties in terms of not only gathering local support but also through current government regulations. Currently the successful implementation of a plan to install more onshore wind turbines within a community may be very limited.

The capacity of the electricity grid in the southwest of England is severely constrained for new wind and ground-mount solar installations to be added to the network. For several years, the DNO has responded to connection enquiries with connection quotes which include the costs of reinforcing the relevant parts of the local grid to ensure that installations do not cause additional stresses on the grid. The level of connection charges proposed has largely prohibited business cases being developed further, despite good local wind resources and insolation levels making sites favourable.

A community energy group may have the capacity to act as an educator and persuader for members of the community who are unsure of this technology. Community engagement is vital to ensure that members of the community are convinced on the carbon and financial savings which may be realised through the installation of a wind turbine project. Raising funds for these projects may be done through a number of different approaches. With the establishment of a co-op, offering community shares is an efficient way of gathering support and financing wind projects with the benefits realised by the members, either in the form of dividends or in the form of a reduced rate of electricity when utilising energy from the microgrid (see 10). Borrowing from investors or crowdfunding are also mechanisms by which a community energy group could invest in a wind turbine project and contribute to reducing, not only the carbon used locally but also the energy bills of members within the community.

Example: The Delabole wind farm was the first commercial onshore wind farm built in the United Kingdom, in November 1991. Good Energy bought the wind farm in 2002 and has owned and operated it ever since. In early 2013, in response to local concerns about rising energy bills, Good Energy launched the pioneering Delabole Local Tariff as an additional community benefit associated with the wind farm. Around 170 local households now benefit from 100% renewable electricity at a special rate, set at 20% less than the standard Good Energy electricity tariff.

Example: Gorran Highlanes, in Cornwall saw the installation of 2 community-owned 80kW wind turbines. This project was facilitated by local energy group Community Power Cornwall which helped to fundraise within the local community and employ local installers. A community benefit fund was set up which distributed the revenues to local community environmental projects, overseeing insulation for the village hall and LED lighting for the local church.

Example: Each year WREN manage and distribute community benefit funds generated from the revenue from the St Breock Downs wind farm to the west of Wadebridge. Established as part of the planning agreement that permitted the repowering of the site, these funds are part of the Section 106 agreement, previously commonly used in a variety of planning permissions; the Community Infrastructure Levy (CIL) is now used in a similar way to S106 monies. The purpose of the agreement is to ensure that the communities closest to the development, and those affected by its presence, see a benefit from the commercial activity.

This model is an excellent opportunity for a community energy group to ensure that there is direct community benefit for those residents living close to a development. When a planning proposal is lodged, and community consultations are held, the local group should quickly engage with the developer. (Note at times this can create a tension in the community that needs a careful approach, if the proposals are resisted – we have experienced local groups strongly opposing development proposals and then missing the opportunity for creating benefit funds, as in the midst of the fight against a proposal it was seen as accepting the case for the development.)

https://www.wren.uk.com/community-funds

5. Fabric First, Energy Efficiency and thermal improvement of properties

One of the most effective ways to achieve a reduction in carbon within a community is to reduce the energy used within homes themselves. This can be done with the reduction in demand for electricity, encouraging households to reduce their energy consumption. This may involve education on changing energy habits as well as installing energy efficient fittings and white goods. Energy awareness education can be targeted at specific groups within the community who are the most vulnerable and the most likely to benefit from savings as a result of reduced energy bills. Local energy awareness raising opportunities, can be delivered by local energy groups to ensure that no one is left behind in the transition to a low carbon society.

Energy efficiency measures such as draught proofing, leak fixing, or smart metering can be rolled out across the community. This can ensure that multiple households are benefiting from these energy efficiency measures and that the effect within the community is notable, in terms of a reduction in carbon emissions, as well as being a cost-effective measure.

This poses difficulties as some properties may not be able to reduce their energy consumption any further than they already have achieved, and this strategy must be used in combination with others measures to truly achieve net zero.

The funding for these retrofit improvements may come from several different sources and it may be beneficial for a local energy group to help to coordinate some of the allocation of these funds. Community share offers, crowdfunding and applying for grants may be different mechanisms by which community groups can raise funds for fabric efficiency improvements. 'Green Finance', that is funding mechanisms to enable energy efficiency retrofits, is an area where demand greatly exceeds supply, but this is changing; a number of Government backed initiatives are trying to currently unlock investment at the scale needed to meet the retrofit challenge and is again an area for groups to watch and inform their community on new opportunities[12]. (For more information on different mechanisms by which a community energy group can raise funds, see chapter 12.)

5.1 Retrofit opportunities

With the electrification of heat, the energy usage of homes may increase, therefore it is important to ensure that the energy which is actively being used is not wasted[13]. It is therefore highly recommended that properties within the target area look to encourage and facilitate domestic thermal improvement programs to ensure that that energy which goes into the property is being used efficiently.

Within the Wadebridge and Padstow Community Network Area approximately 3,400 properties are known to have an Energy Performance Certificate (EPC) rating of D or below (it should be noted that, as in most of Cornwall, about 50% of properties do not have an EPC rating so it can be safely assumed that at least 7,000 homes in the area need some form of energy efficiency retrofit). There is serious scope for improvement to the energy efficiency of these properties. Measures to improve the fabric efficiency of properties are already numerous and commercially available, offered by national suppliers with a number of local installers. Identifying areas in a property where improvements could be made may involve installing roof insulation, insulating internal or external

walls, or installing double or triple glazing and ensuring there are no cold bridges with external surfaces.

A community energy group would be able to coordinate installers and energy advice providers to identify suitable properties and to direct the residents of the appropriate steps and measures they may be able to take. Energy advice providers such as Community Energy Plus are also able to direct individuals towards opportunities for funding and to ensure that those in vulnerable positions can ensure that their properties are also insulated to an adequate level (EPC C or above).

Example: Local authorities across the country are delivering Green Homes Grant Local Authority Delivery Scheme (LADS) and Home Upgrade Grant (HUGs) programmes. The HUGs programme is targeted at improving off-gas privately owned properties (a particular issue in Cornwall and some of the Network Area) and for eligible households, dependent on the current EPC rating unlocks funding to make significant improvements. It is likely that similar schemes will continue to be available and there is a key role for community energy groups to work with scheme managers, both to identify properties and to help householders understand the benefits of participating.

Nationally: Home Upgrade Grant: https://homeupgradehub.org.uk/

Example: The Energy Company Obligation (ECO and ECO Flex) is the main mechanism that the Government and energy suppliers have for improving the thermal efficiency of fuel poor homes. The main objective of the fourth iteration of the ECO grant scheme is to improve the least energy efficient housing often occupied by low income and vulnerable households. Eligibility criteria for this grant funding is linked to households in receipt of certain benefits.

The ECO Flex mechanism allows local authorities to apply local knowledge and enable the grant to be accessed by households that fall below the main ECO4 criteria thresholds. For a local group to promote the take-up of this programme requires a partnership with a supplier who holds brokerage deals with the obligated energy suppliers, or with a local authority (or their agents) delivering ECO Flex arrangements.

While there is potential for community energy groups to partner with installers or local authorities to identify suitable households, there are a number of constraints to the ECO programme.

- The uplift in fabric improvement is limited in its capacity and will not include properties which are at an EPC rating of C or above.
- To calculate the suitability of a property for an ECO4 grant, it must have an EPC to calculate the potential uplift of measures. At this stage there is currently no set funding to enable a household without an EPC to get one in place. This is an issue emerging with the roll-out of ECO4 and solutions to this question are still being developed.
- The “whole-house” approach to improving fabric efficiency must uplift the EPC rating by a minimum amount; for properties on the lower rungs of the EPC rating this may not go far enough to raise a household out of the risk of fuel poverty.
- As of late summer 2022, ECO4 is still in the initial stages of delivery so it is not yet clear what the preferred technologies are. Installers are still working through the best mix of measures to make it cost effective.

- As with previous iterations of the scheme, it should be noted that ECO funding is by definition, directed at low-income households, often being assisted by benefit payments.

  Frequently Community Energy Plus's experience has been that ECO funding available is not sufficient to cover the full install costs and a client contribution is required. This becomes problematic where the household has already been identified as low income and cannot make a contribution and so the upgrade proposal stalls.

Example: Private Rentals and the Minimum Energy Efficiency Standard (MEES)

Properties that are privately rented must meet the MEES and should not be rented without achieving an EPC E rating. Although this standard has been in place for several years, it is still the case that many private tenants are living in properties that are not compliant with MEES, and struggle to afford to keep warm as a result. Many smaller landlords, only renting one or two properties are unaware of the regulations and, again, this is an area where a community energy group can play a role educating landlords.

CEP and Cornwall Council have produced guidance for landlords about MEES and also for the owners of historic buildings where there is confusion about what retrofit upgrades are possible.

www.cep.org.uk/our-services/warmer-tenants-advice-service-for-landlords/

5.2 Thermal Imaging

A popular starting point for conversations about the right actions to take to improve the thermal efficiency of a property is to use a thermal imaging camera to identify the thermal leakage in a property. This is a quick and efficient way to work out the fabric efficiency of multiple properties within a community and can be used for both the external walls and roofs of eligible properties.

For a community energy group to invest in a thermal imaging camera, it would be a quick and efficient way of displaying to community members the fabric efficiency of properties within the area. The images generated by a thermal survey can be a powerful tool to engage sceptical householders about the benefits of taking action, as the images graphical show where heat is wasted. Key to this type of project is having volunteers trained in the use of these cameras able to interpret the images and signpost on appropriate actions from a survey report.

Example: CHEESE Project, Bristol[14] - The Cold Homes Energy Efficiency Survey Experts (CHEESE) Project is a Bristol-based not-for-profit CIC that aims to reduce domestic energy losses. Surveys start at £135 although are offered for free to people in poor housing conditions and fuel poverty. These can quickly identify properties which are thermally inefficient and also to identify the areas where cold bridges are leaking heat and energy.

https://cheeseproject.co.uk/

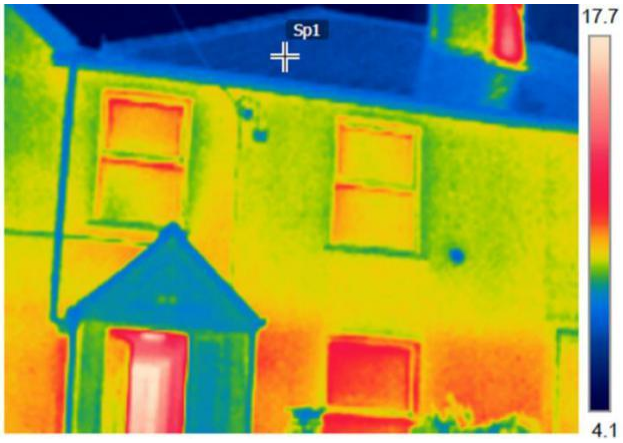

Fig. 3 – Image displaying the output from a thermal imaging camera.

6 Electrification of heat

The transition to low carbon heating options is focused on a move away from hydrocarbons and towards heating sources which use electricity to provide the heat energy. This in combination with renewable energy sources will be the most effective way to deliver a transition to a low carbon community.

6.1 Heat pumps

One of the most commercially viable forms of the electrification of heat is the installation of a heat pump. These range in size from 3kW to 15kW for domestic air source heat pumps and extract heat from the outside air and transfer this heat to a refrigerant; ground source heat pumps extracting heat from the ground operate in the same way. The refrigerant is then compressed which increases the output temperature. Heat pumps can either be used to directly heat air and mechanically ventilate a property (Air to Air), or to heat a water source which can be used in a more conventional “wet” system to heat a property (Air to Water).

Heat pumps are highly efficient, operating at 3-4 times the efficiency of conventional gas boilers. They not only reduce carbon emissions but also potentially lower energy bills, and this will be accentuated in the future with a greater mix of renewables on the grid producing low carbon intensity in the electricity supply compared to natural gas.

There are challenges to address when planning to install heat pumps. One of the significant difficulties is that due to the output temperature being lower than a conventional gas boiler system, a property has less heat energy used for warmth, therefore insulation of the property is paramount, and commonly systems require larger radiators or underfloor heating. It is for this reason that the fabric first approach should be considered in conjunction with other proposed business ideas (see section 5).

Whilst there is an increase in interest for heat pumps within the general population, there are a number of misconceptions which may hinder progress for the electrification of heat. Leading educational groups and classes would be an effective way for a community energy group to target the myths and concerns and to ensure that the whole community is prepared for the transition to low carbon heating.

Community energy groups may also have the capacity to act as intermediaries between consumers and suppliers to ensure that the community is getting the best price for the heat pump. Their role as an educator in this regard can also be highly beneficial, targeting individuals who are unsure about the electrification of heat and providing information and guidance to consumers who are interested about the technology. Information about grants and schemes which can be used to install heat pumps is also a vital role and it is important for the energy group to keep up-to-date with what is available, for example, understanding the Boiler Upgrade Scheme and that air source heat pumps are available under the ECO4 grant scheme for properties with an EPC of D or below, potentially with the necessary fabric improvements also funded (see section 11).

6.2 District heat networks

A District Heating Network (DHN) scheme for the Wadebridge and Padstow Community Network Area would likely take a large amount of initial investment in order to successfully deliver low-carbon heat. Dependent on location there may be potential for a heating source from a borehole-

fed ground-source heat system in more built-up and urban areas, or water source for properties close to a suitable body of water. For a community such as Wadebridge sited on the Camel estuary, a river-based heat pump may be an option – however, the additional challenges of dealing with the Environment Agency on the impacts of heat extraction to the fluvial ecosystem and habitats may make this a difficult proposal to pursue without volunteers or partners committed to lengthy negotiations. The high cost of Environmental Impact Assessments (EIA) required as part of the feasibility studies for such schemes would likely prohibit a project progressing and achieving a cost-effective business case.

There are a number of benefits to using a DHN with ground-source heat arrays, in that as it is a large system providing power to a number of properties, there is an improved reliability as opposed to installing individual heat pumps which are not linked to a main heat supply. The coefficient of performance of a ground source heat pump is greater than that of an individual air-source heat pump meaning that they are more efficient and therefore require less energy to run. There is also less noise pollution from a ground-source heating system than from air-source heat pumps. The benefits of using a borehole system as opposed to ground arrays is that they are more condensed and therefore require less space, which suits more urban areas.

To install this type of network necessitates a significant disruption to the road network, careful planning of the location of the boreholes themselves and major upgrades to infrastructure used to deliver the heat to the properties. The implementation of ground-source heating as a DHN is an expensive engineering project which requires a significant amount of initial investment.

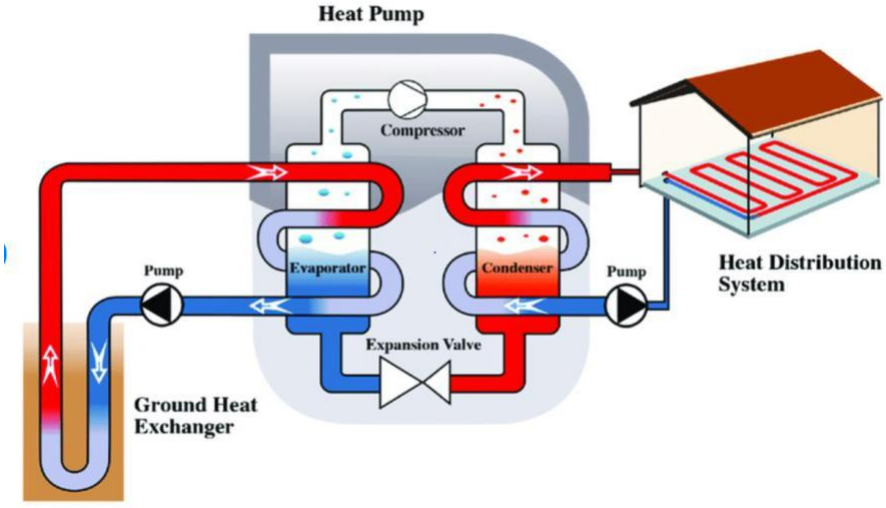

Fig. 3 – Diagram showing the schematics of a ground-source heat main to domestic property. [31]

Example: Heat the Streets is a district heat network currently under construction in Stithians, Cornwall by Kensa Heat pumps[15]; Stithians is a large village in the centre of Cornwall where the geology for borehole-fed ground sourced heat is right for this scheme. Several boreholes drilled approximately 100m deep into the existing road network and brownfield sites will collect heat from the ground and feed it into a circuit of pipes which will then deliver this heat to a manifold and then feed into individual properties. Each individual property will have to also have a Kensa 'shoebox' heat pump to "step-up" the heat for their own use.

Financial model - The plan for Heat the Streets is that infrastructure is owned by a separate subsidiary company, Kensa Utilities; this includes the boreholes themselves, the piping and the pumping mechanisms. Kensa Utilities then charge the residents a standing charge to connect to the network. This model is designed to ensure that the large initial investment costs will eventually cost neutral, and the upkeep and maintenance of the system is also paid out of this standing charge.

https://heatthestreets.co.uk/

Close to the Stithians project is the site of Cornwall's first geothermal power project at United Downs, St Day. Going much deeper than ground sourced heat pumps, the main output from the geothermal project is steam to power electricity turbines and the heat is technically a waste product. The ambition of GEL is again, if the economic case can be made, to retrofit a district heat network to deliver this heat to local communities.

https://geothermalengineering.co.uk/united-downs/

Community Energy Plus has conducted research on community-based models of providing decarbonized heat. Our report *Low Carbon Heat & Rural Fuel Poverty: Lessons from across Europe*[16], provides a comparative analysis across the UK and other countries of a variety of models and initiatives. Our research identifies a range of drivers and barriers affecting take-up of these models and hopefully provides inspiration for new proposals in the UK.

As illustrated in this report a community energy group acting as an Energy Service Company (ESCo) may take on financial management of the system, whilst the upkeep of the infrastructure could be sub-contracted out to different contractors as part of a multi-actor partnership. An ESCo is an organisation which may act within a wide array of energy solutions, including power generation, energy infrastructure management and energy supply.

As noted, the capital costs of many of the examples quoted in this section mean that these projects are largely outside the scope of most community focussed groups. However, there is potential for a group to be part of a larger consortium, bringing local knowledge and the established relationships in their community to the development process, adding value to larger partners.

7 Carbon Balancing

7.1 Offsetting carbon to finance energy measures

A community scheme in which individuals can offset their own high-carbon activities would be an innovative strategy for redistributing funds into carbon reducing technologies. A fund may be established, managed by a CIC which would encourage donations for "high" carbon polluting activities (such as international travel, commercial and industrial enterprises as well as agricultural practices [17].) Second-home owners may be reached through education outreach and local encouragement.

This scheme would rely on the generosity and honesty of individuals to offset their own high carbon lifestyles, with the emphasis being on community reallocation of funds to highlight positive changes within the local area and encouraging the entire community to work together to achieve net zero.

The difficulty here lies with the accounting of carbon used by individuals or businesses; there has been a great deal of research into efficient ways in which to reliably account for carbon expenditure [18]. *Achieving net zero: A review of the evidence behind potential carbon offsetting approaches* is an extensive and thought provoking report produced by the Environment Agency in April 2021[19].

(https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/achieving-net-zero-carbon-emissions-a-review-of-the-evidence-behind-carbon-offsetting)

Example: A fund could also be set up in partnership with a local community space which would be able to coordinate investment to help target low carbon changes within the community. The example of Zero Carbon Guildford[20] is a community space which not only promotes education and solutions for climate mitigation but also collects funds to actively invest in low carbon projects within the community.

https://www.zerocarbonguildford.org/

Example: MyClimate Foundation, https://www.myclimate.org/, is one of several organisations established to help individuals calculate their footprint from a range of activities including international flight and to direct offset donations to practical projects around the world. The algorithms use in their calculator tool are now very smart in addressing the true cost of flights and travel.

7.2 Target audiences

Given the need for the speed of action that we face with the climate emergency, a community energy group orchestrating and organising a carbon offsetting scheme would be beneficial in generating revenue to commit to fabric efficiency improvement measures (see Section 5).

With concerns around businesses using carbon offsetting schemes for "greenwashing", using a local community-based approach to this model would ensure that a tangible effect was felt within the community itself. The funds raised locally would be re-invested back into the community in ways

which would promote low carbon incentives. One of the ways in which to do this is to invest in providing fabric efficiency improvement measures for those in more vulnerable situations or fuel poverty. This would ensure that there is an efficient manner for the community to get to a low carbon lifestyle and that no one is left behind.

Mechanisms for ways in which funds could be generated for this scheme

- Volunteer donations
- Membership fees (a carbon balancing club for people to make regular donations)
- Community Fundraising

Example: Two of NZCom partners, Planet A and Community Energy Plus have started initiatives to link individuals wanting to make carbon compensation payments for long and short haul flights with fabric improvement projects in their locality.

Planet A's initiative is based on a partnership with Cornwall Hospice Care, to raise funding to help the managers of the hospice decarbonise their heating systems and improve insulation on their two sites.

https://www.justgiving.com/fundraising/planet-a-solutions

Community Energy Plus were offered a gift from an individual flying to Australia, and from the monies were able to install loft insulation in two properties in Falmouth; the recipients of the measures were not eligible for grant assistance but needed financial help and so the donation enabled fabric improvements that wouldn't have happened otherwise. From this initial test the charity is promoting this idea to link flyers with the local insulation programmes they support.

https://www.cep.org.uk/carbon-balancing/

Challenges

One of the challenges with carbon balancing and offsetting is in the accountability of the carbon savings which are proposed. The effect of the carbon savings can be hard to quantify and therefore this may make accountability difficult. Measuring an individual's air miles, or distance driven by car may prove difficult and may bring up issues in terms of the right to privacy. Therefore, this scheme may operate best on a voluntary basis, and it is unlikely to generate a large amount of interest with high carbon expending individuals due to apathy or passivity. A policy change from government would be the most effective way for schemes of this manner to be realised, but it is unlikely that in the event of a change to policy these funds are used within a specific community.

Equally important is to face the reality that collectively our carbon expenditure must reduce. If such a scheme is used to assuage the guilt of high carbon consumers without any checks on their carbon expenditure, then this approach is flawed. If it is used, while recognising that some carbon expenditure is necessary, and this activity can balance off that behaviour, then a positive outcome is achieved. Whilst some individuals argue for a complete ban on international air travel for example, others may use this as a scheme to recognise some flights are unavoidable and this mechanism as an effective route to address the carbon expended and potentially more beneficial than tree planting.

8 Electric Vehicles

8.1 Promotion and use of Electric Vehicles within the community

The total amount of the UK's emissions which come from transport is around 27% and of this the majority (around 91%) comes from road transport vehicles [19] and internal combustion engine (ICE) vehicles. To get to Net Zero by 2050 the decarbonisation of the transport network is of high importance.

There have been a considerable number of technological improvements in recent years within the electric vehicle market. Electric Vehicles (EVs) have reduced in price with a greater range of models within the market, along with an increase in the quantity of EV chargers along the road network.

With the advancement of battery technologies also ensuring that EVs have an increased range, these vehicles are no longer just viable for urban communities and may be a more practical option within more rural communities.

While the price point of new EVs is high compared to ICE vehicles and the second-hand market still yet to fully develop, the expensive nature of EVs seems to be a prohibitive factor in terms of rapid integration into the domestic transport network. From a carbon reduction perspective there is still a major challenge in simply replacing the existing domestic vehicle fleet with equivalent EVs, given the embedded carbon in a new car. Alternatives need to be explored and there is space for community groups to develop new models.

8.2 Car sharing

Community car-share schemes such as GoCar[21] and Co-Wheels[22] offer a subscription-based service which ensures that residents within a community can rent a car for the journey which they need. Economically this can benefit the consumer as they do not need to cover their own insurance or tax the vehicle, instead paying a subscription fee and only for the mileage that they cover.

The car share model has some potential to be deployed in villages and more urban locations due to the shorter distances which would likely need to be covered. Reducing the number of personal transport vehicles would be significant in the decarbonisation of the community. Using EVs within the fleet of these shared community cars would ensure that hydrocarbons are not being released into the atmosphere for every individual journey.

For a community car scheme to have a completely electrified fleet, this requires a significant infrastructure investment in community EV chargers. There are now over 42,000 EV charge points in the UK, with the county of Cornwall having around 115 charging stations[23].

A community scheme which invests in a community car share would be a good step towards the decarbonisation of the domestic fleet of vehicles. This would require significant investment and management costs for a community energy group; therefore, it would be better placed to incentivise an already established business to form partnerships to expand and invest their business within Cornwall.

Companies such as GoCar already have well established and successful business models, therefore investment from similar companies may prove to be successful in reducing the amount of cars on the road and therefore reducing the amount of journeys undertaken, reduction carbon emissions. Encouraging these businesses to use EVs would be highly effective in reducing the amount of ICE

vehicles on the road significantly reducing CO_2 and other greenhouse gas emissions and paving the way for a path to net zero.

Challenges

To date access to EV cars has been largely the preserve of higher income households. Both the cost of acquiring an EV, be it car or bicycle, and the costs of charging infrastructure and operating the vehicle has put it outside the pockets of low-income households. Until the second-hand vehicle market matures this situation will continue and large parts of the population are at risk of being left behind. Also to note, the price of leasing EVs has risen dramatically (+30%) in recent months with the increases in interest rates and inflation.

The business case for a car club has to be carefully considered; experience from WREN suggests some suppliers are looking for larger communities to operate within and so this may be more relevant for urban settings than villages or rural communities.

It should also be noted that simply swapping out an ICE vehicle for an EV, does nothing to reduce our dependence on road transport, at the cost of public transport. New EVs have equivalent embedded carbon in their manufacture as ICE vehicles, and swapping from fossil fuels to lithium dependency, itself an extractive finite resource, raises big challenges for the community committed to achieving a low carbon future.

8.3 Fuel alternatives

Hydrotreated Vegetable Oil or HVO is made by reacting vegetable oils with hydrogen at high temperatures and pressure.

In Cornwall, Mitchell & Webber have been trialling this new fossil-free fuel in commercial and agricultural settings and as an alternative fuel for domestic oil heating[24]. Using this fuel can offer net CO_2 reductions of up to 90%, and it appears that the fuel fairs better in cold-temperature performance, promoting better performance and a cleaner combustion[22]. The current process for producing HVO is energy intensive and involves the use of hydrogen which has been extracted from natural gas. The electrification of this supply chain would ensure a further reduction in CO_2 produced.

A community energy group promoting HVO as an alternative to mineral diesel would provide a good basis for educating individuals and companies across several sectors from farmers, to fishermen and leisure sailors and the owners of diesel cars. An example of this is being trialled by Other Oils in Falmouth (Instagram.com/other.oils) Obviously, this is based on the growth in availability of this alternative fuel. In their role as an educator as well as an intermediary, community energy groups could ensure that businesses within their local area are looking to lower-carbon fuel alternatives for the transition to net zero.

9 Community scale storage

9.1 Community Battery Energy Storage Technology

There is increasing interest in domestic-scale electric battery energy storage systems (BESS) due to the advantages which battery storage technology can hold for domestic consumers. The ability to use power which has been generated by solar PV at times of low or no generation is known as time-shifting of solar. For those consumers who can take advantage of cheaper time of use tariffs, battery storage may be an opportunity; a trial by National Energy Action fitted Tesla Powerwall batteries in properties using Economy 7 and night storage heaters[25]. The outcome of this trial wasn't a success for several reasons, according to the evaluation report, but the idea is indicative of the opportunities that are emerging. Currently the high cost of lithium-ion batteries indicate that BESS is unlikely to be an economic solution for most households for some time yet[26].

A community-scale battery storage therefore has a number of advantages in terms of scaled economic cost along with advantages to the balancing of renewable energy systems on the grid and opens the possibility of alternative technologies including flow batteries, for example the vanadium redox battery.

Due to the intermittent nature of renewable energy, notably wind and solar, the ability to harness this energy when these systems are not generating (during periods of low solar irradiation or at night, or during becalmed moments for wind energy) has a distinct advantage. Due to reduced transmission costs across the grid, a community BESS may prove to be an economically viable technology depending on the costs of the batteries and the materials used within the storage devices themselves.

Community energy groups may play a large part in facilitating these technologies through mediating between consumers, DNO and suppliers. Additionally, ensuring that enough members of the community sign up and are educated on the fundamentals of BESS would be a crucial first step for the integration of these technologies within the grid. Compared to domestic storage, community scale storage may provide economic benefits of up to 37% as well as technical benefits to the grid regarding discharge rates and higher round trip efficiencies[27].

Whilst integration on a community scale compared to a domestic scale has a number of benefits, in terms of financial gain and the balancing of the grid, there are difficulties when it comes to ownership and control. A recent study in Germany found that community ownership of large-scale battery technologies on the grid is preferable due to the control the community have over that commodity[24]. These preferences may differ within different communities.

Funding for these systems therefore may be realised through a share scheme or through community fund raising. Although due to the high investment costs, leasing of these battery technologies may be a more viable economic option as grid services mechanisms mature, with the DNO and battery supplier both receiving funds for the install and maintenance of the system. These may come from a standing charge which the consumer pays or taken out from their bills due to the cheaper rate of electricity coming from locally generated sources due to the negation of the transmission charges. At this stage it should be noted regulatory change is required to unlock these developments.

<u>Challenges</u>

The regulatory framework and legal models required for operating community scale batteries are yet to be fully established. Grid scale batteries are now more common and while frequency response grid services and flexibility arrangements are growing opportunities [28], it is unlikely that most community groups have either the expertise or capacity to take advantage of these innovations.

10 Microgrids

10.1 Peer- to-Peer (P2P)

Using locally generated electricity when it is generated is a way of ensuring that the community is benefiting from local supply. Companies such as Energy Local, use a model whereby a smart meter is installed within a consumers' home and whenever the local renewable energy resource is generating, this electricity is offered at a cheaper rate compared to the price from the grid[9]. This encourages the consumer to shape their energy usage around the times when energy is being generated locally; although they still are using grid supplied electricity, notionally the power used at that time is sourced locally from renewable resources. This model has scope for expansion to larger communities and may be an efficient way of incentivising consumers to be more aware of their energy usage and of the importance of renewable energy, not only on the grid but also contributing locally to their energy mix.

Example: WREN's Energy Equality Project is looked at a peer-to-peer scheme with solar PV. The study has two parts:

- Developing new solar PV generation installations
- Developing peer-to-peer electricity trading

The first is well established technology – putting solar panels in open space or on rooftops to generate electricity.

Peer-to-peer trading is new. It will enable people in the community who generate electricity, such as from their domestic rooftop solar panels or the new installations mentioned earlier, to trade their surplus generation with others in the community who do not have their own generation. The people selling would be looking to receive a better price than from commercial outlets and the people buying would be looking to pay less than from a conventional supplier. WREN (with partners) would be acting as the enabler for this to happen[29].

https://www.wren.uk.com/energy-equality/feasibility-study

For other community energy groups to enact this model, there needs to be an energy supplier on hand to facilitate the billing and settlement of the energy which is used by the consumer. A business model must be established which benefits the local energy generator, the DNO, the energy supplier and also the consumer. The energy supplier must ensure they can cover all the energy requirements for the consumer, as at present it is not possible to have more than one supplier registered to a single meter.

Due to the complexities of this business relationship between numerous parties this can be a difficult model to establish; these trails have proven that there is opportunity here ensuring that there is an incentive for more renewable generators within local communities, but again, regulatory change is needed to fully unlock the potential of these schemes.

10.2 Implementation of a Pseudo Microgrid

10.2.1 LV level

A pseudo microgrid which acts on a low voltage (LV) level would, in principle, enable renewable energy generators which are connected at the LV branch of the network to share renewable energy electricity generation between those connected on the LV network without additional charges levied by the DNO for distribution and transmission across the wider national grid. The principle of this concept is that pseudo microgrid is metered at the LV level, and therefore all the costs of operating the LV grid within the pseudo microgrid can be shared by all connected consumers and a tariff structure set up that supports everyone, including those in fuel poverty.

The charges for Transmission Network Use of System (TNUoS) and the Balancing Services Use of System (BSUoS) are levied by the DNO for transmission of electricity across the grid. By ensuring that electricity is generated within the LV grid and distributed accordingly, these charges potentially may be negotiated to a lower rate, ensuring that the saving can be passed on to the consumer. This is an innovative proposal and requires the licensing and regulatory framework to be amended to permit this operation, and likely a sandbox trial in a specific location will be the next stage to test the model before it can be made more widely trialled. For community energy groups interested in this concept, it is still "watch this space"! One of the projects emerging from the NZCom project is an Ofgem Sandbox looking at the use of heat pumps to balance peak demand.

What is a Sandbox?

Ofgem operate a Regulatory Sandbox, that enables innovators to trial new products, services and business models without some of the usual rules applying. Usually this a small scale, short term (under 24 months) opportunity to test ideas and concepts. The results from a Sandbox are then used by Ofgem to influence and shape policy development.

More information: https://www.ofgem.gov.uk/publications/what-regulatory-sandbox

Some distribution charges may still be applicable to the pseudo microgrid due to still using National Grid infrastructure, but the model could still result in savings for the consumer. The consumer would still be connected to the national grid and not be limited in their electricity supply, and when renewable energy generators are contributing to the pseudo microgrid, the consumer would be able to benefit from this cheaper rate for this electricity.

A community energy network may be able to function as the intermediary between the DNO, renewable energy generators and the community themselves to facilitate the implementation of this "private network", additionally the community may be able to take ownership of exporting equipment within the LV substation so as to negate additional maintenance levies from the DNO.

10.2.2 HV level

Pseudo Microgrids may also be able to act on a higher voltage distribution network. High Voltage distribution networks are typically 11,000 volts with larger transmission lines and HV substations defining the boundaries. A microgrid which acts upon not only the LV network but also extends to the HV network would ensure that the Renewable energy benefit of local generation is experienced throughout a further geographic area. This ensures that the community would benefit from a lower

price per unit of electricity within the HV distribution network and additionally would increase the scale of renewables which can be connected to the network ensuring economies of scale.

This would be an ambitious project for a community energy group or network of groups and would require a high degree of coordination amongst a number of parties. Notably the National Grid would have to amend the transmission and distribution charges and negotiate a rate for using a smaller geographical area of the network.

The benefit to consumers would be felt throughout the community due to the renewable energy benefit being absorbed through the microgrid and distributed evenly throughout the geographic area providing fair and equal distribution to the community at a lower price per kWh.

11

12 Grant Funding for households

Among the limited range of funding mechanisms currently available for retrofit improvements for insulation and renewables to note are the following. (Note this summary was produced in October 2022 and subsequently new initiatives are likely to be announced).

11.1 Energy Company Obligation

The main objective of the fourth iteration of the Energy Company Obligation (ECO4) grant scheme is to improve the least energy efficient housing often occupied by low income and vulnerable households, this is also specified as homes which have an EPC of D to G. Additional information can be found for this grant through the Ofgem guidance for local authorities[30].

Of the 13,408 properties within the WPCNA only 5,267 have an active EPC rating. Among these 5,267 properties, 3,400 have an EPC rating of a D-G; this is around 65% of properties which may be accessible to the ECO4 scheme and available for fabric improvement measures.

ECO4 funding is linked to households in receipt of specific benefits and so difficulties can emerge as some households may be excluded from support due to them being just above the qualifying threshold. The ECO Flex mechanism allows local authorities to apply local knowledge and enable the grant to be extended to members of the community that may miss the requirements.

Local energy networks and community energy groups may have an advantage in their ability to connect with members of the community and to educate and inform on grants which may be available to them. Using community funds, these groups may be able to offer discounted EPC assessments for properties which would likely qualify. Having a number of connections with vetted local installers and suppliers would also be a way in which community energy groups can ensure that members of the community, who are eligible for this scheme, are being protected as well as supporting local business.

11.2 Home Upgrade Grant

The Home Upgrade Grant (HUGs) enables local authorities to support low-income households which are not connected to the gas network to upgrade the energy efficiency of their properties[31]. The grant can provide up to £25,000 per home which may be used for a number of measures, including but not limited to, cavity and solid-wall insulation, underfloor insulation or the installation of an air source heat pump if applicable.

Community energy groups may have the capacity to act as an educator and to help facilitate the delivery of these grants to ensure that no one within the community is left behind. Reducing the amount of energy used within a home is one of the most effective ways in which to reduce carbon emissions, therefore ensuring that properties within the community are efficient and have an appropriate level of thermal insulation is paramount for the journey to net zero.

11.3 Boiler Upgrade Scheme

Another grant which may be available for members of the community to ensure that they are reducing their energy usage and therefore reducing carbon emissions is the Boiler Upgrade Scheme (BUS)[32]. This government grant is used to help property owners with the initial upfront cost of low carbon heating technologies. A £5,000 grant is available for the cost and insulation of an air source heat pump or a biomass boiler and £6,000 for a ground source heat pump; noting that typical costs

for the installation of an air source heat pump is over £12,000 and a ground source heat pump over £30,000 these grants leave a large gap for a home owner to fill. Community energy groups may again act as an educational outlet to ensure that members within the community know what additional funding is available to them and to educate on the technology itself.

12 Financing community activity

12.1 Legal structures

One of the critical issues for financing proposals is to ensure that the correct legal structure is used. The activities of the energy group, its constitution and the sources of income required to develop a project, both at the start-up phase and when full operations are under way will all impact the choices a group must work through at the development stage. Some funding is restricted to certain legal entities, whilst for an enterprise to be able to raise community shares, they must be registered as a Co-op for the benefit of the Community (Community Benefit Society)[26].

This may result in a community energy group running two or more separate organisations, each with a different status and role. A good guide to understanding and selecting the appropriate legal structure can be found here: www.mycommunity.org.uk/choosing-the-right-legal-structure-for-your-group.

Example: The Wadebridge Energy Company (WEC) has been established by WREN in order to enable Wadebridge to take control of its energy needs through locally owned generation, and the two organisations work collaboratively.

https://www.wren.uk.com/wren-the-facts/wadebridge-energy-company

It is important to take on sound legal advice before making important decisions in the formation of a community energy group. There is help available online; the following organisations have extensive resources online to educate on the correct legal structure to use and will offer follow up support tailored to the local situation.

- Locality - www.locality.org.uk
- National Council of Voluntary Organizations (NCVO) - www.ncvo.org.uk
- Coops UK - www.uk.coop

Many smaller community energy and climate action groups will operate at the education and information level without the need to incorporate. However if funding of whatever type is required a bank account is necessary and a constitution is needed. This will help shape the group adopt a formal decision making structure, but need be no more complicated than many groups managing community assets or running clubs and societies.

For groups that have more ambitious plans forming a Community Interest Company, Charity or Incorporated Charitable Organisation is the next step and both Locality and NCVO can direct you to local advisers who can direct your decision making.

Where projects are planned that involve the community developing and owning assets, especially solar PV and wind turbines, a Community Benefit Society (Co-op) is the main structure that will allow community participation through community share offers.

Communities for Renewables https://cfrcic.co.uk/ develop, finance and manage megawatt-scale solar and wind projects which are run for the benefit their local communities. They work with community enterprises, landowners, councils and charities; if there are opportunities for large scale development in your area they will advise on appropriate structures and ways to engage with partners.

12.2 Raising funds

Before considering the various funding options noted below it is vital to ensure the right structure and governance is in place and in order, before trying to access funding. The majority of funders of whatever sort, require significant administration to apply for, manage and report on activity.

It is important to understand the scale of finances required to enable a project to proceed and this will help shape the decisions about the funding model to be used and who will help fund you. Also be aware that many community energy projects have struggled to get off the ground because they have very limited experience of handling large sums and quite rightly, funders need assurance that a group is competent to handle what they aspire to manage. Up to date accounts, lodged on-time, and records of meetings and decisions are an essential pre-requisite. Again, developing partnerships with charities and other groups locally with prior experience may help secure a project's funds.

Often establishing a record through managing small grants (under £10,000) for a number of projects will enable a group to consider applying for larger programmes and be successful.

Crowdfunding works well if you already have an established 'crowd' of supporters to get enthused with your plans – working with a local sports group to get solar PV on a club house or working with a community hall committee where many different groups use the hall each week will make crowdfunding an obvious route. Note however that the sums raised can be relatively small (£20,000 is often the upper limit and under £10,000 is more typical). Community share offers are hard work and are a carefully regulated activity, so note the links in the section below, but if the offer is attractive across a wider locality, these do have potential for raising significantly larger funds.

People participating in both crowdfunding and community shares schemes expect some sort of return. Co-ops offering shares are likely to need to pay an annual dividend, a financial return. Some crowd-funding schemes will offer non-financial benefits which can be as creative as the team putting the offer together can make them. Community shops have raised capital and offered discounts and free offers when their shop opens – this may be more difficult for community energy groups to shape but with some thought can make the offer fun and attractive.

Grants for community groups

Based in the south-west, the Grants Resources Information News (GRIN) is an excellent source of information of a wide range of grant funding opportunities, https://grin.coop/. Many of the grants and funders they list have time-limited funding windows, so it is recommended to bookmark this site and check regularly. For those actively looking for funds, GRIN have a daily email update available for a low annual fee and subscription services for more extensive directories of funding.

The Directory of Social Change, www.dsc.org.uk, offer Funds Online, https://fundsonline.org.uk/, a comprehensive resource for grant and trust funding.

Community Foundations have access to a range of funds and grants that can be targeted at specific outcomes and for any venture requiring support, a direct conversation with them about proposals is recommended. Information about your local community foundation can be found here: www.ukcommunityfoundations.org.

Local authorities may be willing to support actions, as many have declared climate emergencies but still are struggling to turn this into meaningful action. There are great opportunities for local groups to engage with local councillors who may have the connections or access to initial funds to kick start projects.

More funding is also now available for climate emergency related voluntary activities. Getting in contact with the local Voluntary Sector Forum for guidance and information on what is available is a great step for local energy groups – to find your local voluntary and community sector organization go to the NAVCA website: www.navca.org.uk

Community Energy England have a range of resources that are relevant to community energy groups of all sizes and their Funding Database page has an extensive list of support options, that are regularly updated (bookmark this page):

https://communityenergyengland.org/pages/funding-opportunities-2

There are a number of national organisations that are worth investigating including Power to Change, the Energy Industry Voluntary Redress fund, Green Heat Network Fund, Nature-save Trust, National Lottery, and the Community Ownership Fund.

12.4 Borrowing

Lenders are often hesitant to invest within community energy groups unless they are well established and have a proven portfolio of projects and track record. Having up-to-date accounts is essential and a portfolio of successful projects is therefore highly beneficial for establishing connections with lenders. There are a number of financial institutions which offer “green loans” as funding for renewable energy and sustainability projects; security is usually required as well as the potential for high interest rates depending on the length of the loan which is why mainstream lenders have had a limited presence in the community energy space. Community Energy England have a comprehensive list of opportunities: https://communityenergyengland.org/pages/funding-opportunities-2

Pure Leapfrog also have relevant experience and resources to guide decision making: https://www.pureleapfrog.org/

Lendology CIC, www.lendology.org.uk, the southwest based social finance institution has worked extensively with local authorities across the southwest region. Their focus on supporting retrofit means they could be worth discussing collaborative ventures with local authorities and community energy groups.

12.5 Crowdfunding

Crowdfunding is the idea of using small amounts of capital from a large number of individuals to finance business ventures. Accessing vast networks of individuals through social media or crowdfunding websites is an efficient way of raising funds for projects and ensuring that investors are actively involved and educated throughout the lifetime of the project. Crowdfunding can also encourage community ownership.

Fal Energy Partnership crowdfunded their solar PV installation at the Draceana Centre in Falmouth following prior support from the Rural Community Energy fund for feasibility studies. As a result they were able to install a sizeable area, supporting this important community space in part of Falmouth's more deprived communities

https://www.falenergy.co.uk/

Triodos is another good example of ethical banking supporting community endeavours including growing community energy: https://www.triodos.co.uk/articles/2020/the-triodos-community-spirit

GoFundMe is a website which can be used for fundraising purposes for a charity - https://www.gofundme.com/c/charity-fundraising

12.6 Community shares

Community shares enable a co-op to raise funds in the form of an equity investment from individuals or organisations. Shares are withdrawable, non-transferrable equity investment in which the investors get a share of the organisation and may share in the profit delivered as dividends.

Community shares encourage community ownership of projects and benefits which can be tangibly felt and monitored locally.

A number of community energy groups have shaped their offers to make the share scheme more attractive to low-income individuals and connect them directly with benefits from renewable energy generation – some have set the minimum amount of investment at a relatively low level - £50 and make a number of other decisions to benefit the local community.

Example: Egni Co-op develops rooftop solar energy in Wales and has over 4.5MWp of capacity on 88 sites, including schools, community buildings and businesses. The largest rooftop solar co-op in the UK they have achieved some impressive results from their community share issues

https://egni.coop/

Details of their 2019 share offer can be found here: https://egni.coop/wp-content/uploads/2019/05/EGNIShareOfferDoc.ENG_.pdf ; the community benefits listed on page 10 of their prospectus are an inspiring set of outcomes.

In considering the options for making a community share offer consult the **Community Shares Handbook**: https://www.uk.coop/resources/community-shares-handbook. **This** is the go-to handbook to guide you through the process.

13 Conclusion

13.1 Recommendation for action

As will be evident a variety of options have been presented in this paper that any community group could consider that could be used to support their own goals to promote the transition to a low carbon community. We were also tasked to make a recommendation for a specific action that WREN can take forward.

Having reviewed the challenges that this community faces, together with the capacity of WREN to take up the options presented, we are making a recommendation to the group about how to take advantage of the opportunities to promote further action.

Our recommendation is that WREN seek grant funding and appoint a Low Carbon Energy Adviser, to work with the Board and volunteers, and the residents of the Wadebridge & Padstow Community Network Area. An outline Business Case proposal has been produced as an addendum to this Options paper.

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