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Qualitative Study of Skills Needs for Community Energy Projects

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This paper presents a small-scale study of the picture of the current skills issues within the community energy sector in the UK. It is intended to highlight training needs to be addressed for a shortage-free transition to future clean local energy systems. We have carried out 12 semi-structured interviews with individuals from community energy projects and organisations who help communities build energy projects. Topics discussed include skills and knowledge required to develop community energy projects and skill shortages that exist now or are expected in the future as we scale up the number of energy projects. We also discuss barriers faced by the energy communities, factors that support the development of community energy projects as well as training provision needs. Through thematic analysis of the transcribed interviews 12 themes emerge. We find that within each theme, parallels can often be drawn between the discussion points. For example, financial barriers such as access to funding can be solved by the enabling factors including new business models. So too, the skills deemed to be in shortage such as financial modelling echo the issues that exist in these areas.

1 INTRODUCTION

1.1 Purpose of this study

As we transition towards a greener and cleaner economy, we see a rise in local energy suppliers ranging from councils to community groups to individual households. Consequently, the workers as well as users of the future energy systems will require updated skillsets. We will see newly emerging occupations, 'greening' of existing occupations as well as the transfer from conventional to low-carbon energy jobs. Furthermore, the numerous local energy projects will require expertise that match the needs of different regions given the suitability of the technologies across geographies.

A skills shortage is a genuine lack of adequately skilled individuals available in the accessible labour market with the type of skill being sought, leading to a difficulty in recruitment. This could result from basic lack of people (when unemployment levels are very low), significant geographical imbalances in supply (sufficient skilled people in the labour market but not easily accessible to available jobs), or a genuine shortfall in the number of appropriately skilled individuals – either at new entrant level, or for higher level skilled occupations.

To avoid skills shortages in the future, we must understand what the skill requirements are, whether any shortages currently exist and what the underlying trends are. In order to learn this, we engage with individuals from community energy projects and organisations who help communities build energy projects.

This paper is structured as follows: Section 2 provides a brief overview of the community energy sector and previous studies of knowledge and skills required in this area. In Section 3 we outline the methodology and discuss the findings from the interviews in Section 4. Concluding remarks and next steps are detailed in Section 5.

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2 BACKGROUND

Whilst there is no strict definition of community energy, the Department of Energy & Climate Change (DECC) provides the description: community projects or initiatives focused on the four strands of reducing energy use, managing energy better, generating energy or purchasing energy. This included communities of place and communities of interest. These projects or initiatives share an emphasis on community ownership, leadership or control which benefits the community [1].

Whislt solar PV is the most common renewable energy source for community energy projects, many utilise wind energy, biomass and heat-pumps as seen in Figure 1. However, the cuts and eventual closure of the Feed-in Tariff and cancellation of subsidies for onshore wind turbines led to a severe turn in the growth of community energy projects. As a result, the number of solar PV installations dramatically fell [2], investment in renewable energy dropped and consequently jobs in the sector dropped by 30% [3] leaving a skill surplus of solar PV installers.
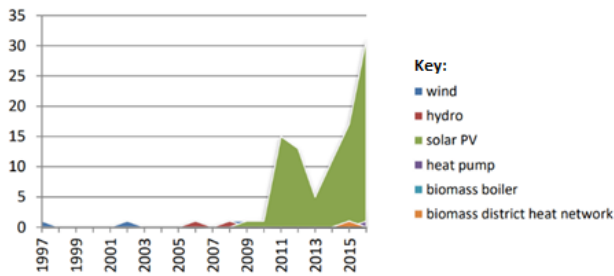

Fig. 1. Growth of community energy projects in England, Wales and Northern Ireland. [4]

Developing community energy projects provides the opportunity for members to learn new skills. Many groups offer training events for other communities as well as their own such as Dorset Community Action [5], using the skills they have learnt to help others. Some projects specifically engage young people through practical work experience such as Repowering London [6] who, along with several councils, developed the Community Energy Specialist Apprenticeship Standard. Apprentices are required to have a knowledge and understanding of the renewable energy technologies and energy efficiency, how the grid operates and how to manage a project, as well as being competent in the application of financial, legal and policy frameworks [7].

Although some communities may have the necessary expertise amongst members, in most cases there is a need to outsource certain operations or project management to other bodies. Unless communities are fortunate enough to be helped pro-bono, hiring the expertise can only be achieved with enough capital which is often enabled through grant funding, implementing business models or with the help of intermediary organisations. Big Local, an initiative created by the Local Trust, provides communities with the funds and tools to develop projects themselves according to their priorities and in doing so, they are able to explore topics or skills through peer learning [8].

2.1 Previous Studies

Community Energy England together with Community Energy Wales (CEW) produce an annual review of the community energy sector in England, Wales and Northern Ireland. The most recent

State of the Sector Report reveals that 2018 was the toughest year for community energy mainly due to unclear government strategy and subsidy reductions [9]. Their survey that was completed by 167 community energy organisations, identified 205 full-time equivalent (FTE) staff in the sector who are mainly employed by supporting organisations with significant core funding or innovation grants. However, 70% of organisations reported to have no paid staff, relying entirely on volunteers.

In addition, Community Energy Scotland (CES) and Local Energy Scotland (LES) are key organisations who provide guides, resources and support to help developers and communities to create energy projects but do not have studies related to skills as such.

Community energy projects are at the forefront of innovation across energy generation, management and use. Current groups are exploring peer-to-peer energy trading, demand-side response and grid flexibility services, all of which will require new knowledge and skills. The UK Government has begun setting up Local Energy Hubs across 5 regions in England with the hope that the support, leadership and knowledge provided by the hubs will support the growth of community energy throughout the regions [10].

A less recent but nonetheless relevant review was carried out by John Egan in 2004 which specifically addresses skills for sustainable communities [11]. Figure 2 illustrates the seven components that together constitute the common goal of sustainable communities.
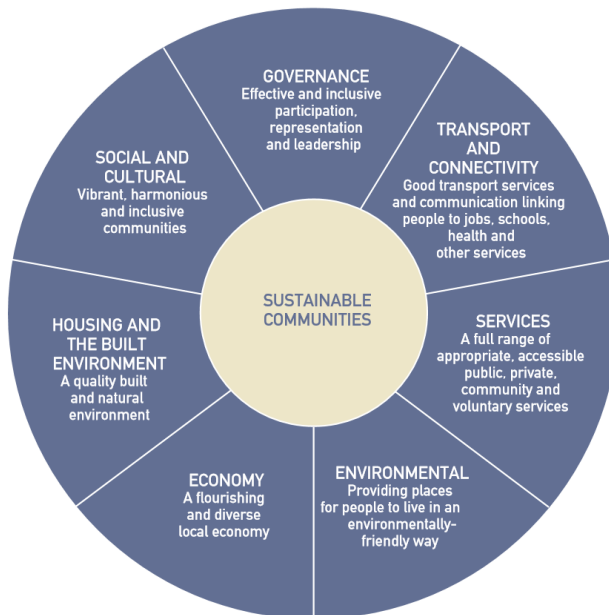

Fig. 2. Components of Sustainable Communities. Figure obtained from the Egan Review [4]

Although the focus of the review was initially on professional built environment skills, it became evident that a significantly broader spectrum of skills is required to create sustainable communities:

"We believe that it is the generic skills, behaviour and knowledge that will make the difference between successful delivery and failure. Skills such as the ability to create a vision, leadership to achieve buy-in to the vision, communication, teamworking, project management, process re-engineering, understanding sustainable development, effective financial management, understanding the economics of development and the processes of local democracy. . . an understanding of delegated responsibilities and greater delegation skills, particularly from national to local government level. We also need high quality brokering skills in government regional offices and agencies."

In order to achieve a sustainable community, it was realised that all the relevant skills will be needed to varying extents by all those with a role to play in its creation. Roughly one hundred occupations were identified to be engaged with the goal of delivering sustainable communities.

Key skills and knowledge areas were identified for the core occupations. These are displayed in Table 1. In terms of skills shortages, the main problem was found to be a lack of cross disciplinary learning. For example, whilst the disciplinary skills were apt for project planners, the wider areas of professional and managerial skills were in shortage.

Table 1. Skills and knowledge areas identified by the Egan review [11]

Skills	Knowledge Areas
- Inclusive visioning - Project management - Leadership - Breakthrough thinking - Team working based on shared sense of purpose 'Making it happen' given constraints - Process/ change management - Financial management and appraisal - Stakeholder management - Analysis, decision making, evaluation, learning from mistakes - Communication - Conflict resolution - Customer awareness	- The 7 components and their interconnectedness - Sustainable development & best environmental practice - Housing and built environment - Wider national and local economy - Governance, citizenship and processes associated with local democracy - Transport and connectivity - Spatial planning and master planning - Urban design and urban coding - Attracting financial capital - Development processes

The key take-home message from the Egan review is that attempting to upskill professionals in silos will not deliver successful sustainable communities. Rather, we need to change the behaviour, attitudes and knowledge of everyone involved, many of whom may not have realised in the past that they had anything to do with each other, or with sustainable communities. This echoes the idea of the mindset transition which describes the notion of behavioural change as a necessary key to a low-carbon transition. Community energy groups are essentially a subset of sustainable communities and many of the skills detailed in the Egan Review will be needed to deliver community energy projects. However, there are plenty of skill areas that are not mentioned in the Egan review that are valuable for community energy projects.

2.2 Policies & Schemes

The Sustainable Communities Act was introduced in 2007 and provides a channel whereby local people can ask their local authority to pass suggested actions to central government if they are considered to improve economic, social or environmental well-being in their locality [12]. After the first round in 2008, several proposals concerned support for renewable energy and low carbon heat generation including feed-in tariffs as well as schemes for businesses to reduce their carbon footprints and green transport [13].

In 2014, the Department of Energy & Climate Change published the Community Energy Strategy under the Conservative and Liberal Democrat coalition government. The ambition was: every community that wants to form an energy group or take forward an energy project should be able to do so, regardless of background or location. In the same year, the Urban Community Energy Fund was established to financially support urban communities across England wanting to set up renewable energy generation projects in their area [14]. However, in 2015 the Conservative government cancelled subsidies for onshore wind turbines a year earlier than originally planned in the coalition agreement [15] despite onshore wind being the cheapest low-carbon energy source at the time and despite there being positive public attitude towards it.

A scheme that is still active is the Renewable Heat Incentive (RHI) but although community energy groups have noted an interest in low-carbon heat networks only 30 groups are currently involved with heat generation. Factors contributing to this are the lack of heat project demonstrators in the community sector as well as high installation and running costs involved [9].

Other government incentives such as the Energy Company Obligation has helped people, especially those on low incomes to reduce their domestic heating costs by offering free insulation and subsidised boiler replacements [16]. In addition, the Welsh government has supported over 250 community energy initiatives and continues to lead on local energy in Wales [17].

3 METHODOLOGY

3.1 Interview Study

We interviewed 12 individuals; 4 community energy project members and 8 community energy project 'enablers'. Enablers are representatives from organisations that help to facilitate and develop community energy projects. See Table 2 for more detailed demographics of participants.

Through semi-structured interviews we cover the following topics to develop a clearer picture of the skills issues within the community energy sector:

- **Required knowledge and skills**
  What one needs to understand (knowledge) and to be able to do (skills) to create a community energy project. This covers stages from establishing a group to legal and regulatory compliance to maintenance of energy supply and the grid.
- **Current and future knowledge and skills shortages**
  A lack of knowledge or skill that has been experienced by members of the community or in those who have been procured to develop the energy project.
- **Barriers faced in the development of community energy projects**
  Any issues that arose during the creation of the project or continue to post challenges in the upkeep of the project.
- **Factors that support the development of community energy projects**

Table 2. Interviewee Demographics

Enabler/ Energy group member	Role	Years of experience	Region	Size of team/ project
Enabler	Director	4	London	1-10
Enabler	Researcher	4	South West	1-10
Enabler	Consultant	10	South West	1-10
Enabler	Consultant	10	South West	1-10
Enabler	Project manager	10	South West	1-10
Enabler	Project manager	2	South West	51-70
Enabler	Manager	12	South West	11-20
Enabler	Project manager	2	South West	21-50
Group member	Team leader	2	Yorkshire	11-50
Group member	Chairman	15	South West	1-10
Group member	Director	10	South West	11-20
Group member	Project member	10	South West	100+

Matters that have helped or would help to deliver and maintain a community energy project successfully.

- **Project Stakeholders**
  Stakeholders involved in the projects and their roles.
- **Training provision needs**
  Workshops, short courses, university degrees or any other type of training that needs to be offered to educate individuals with respect to community energy.
- **Energy transition scale-up**
  Enabling factors and hampering barriers to a transition to smart local energy systems as well as skills and training issues outside of the community energy sector.
- **Most pressing issues** presently in the low carbon energy transition
  This question was asked in the form: "If you had an endless sum of money, how would you invest it to drive the low carbon energy transition".

3.2 Data analysis

The interviews were all conducted in English and were carried out in person where possible or using video or telephone calls. Recordings of the interviews were then transcribed and analysed drawing on thematic analysis [18] to identify key themes.

4 FINDINGS

This section provides a discussion of the information gathered through the interviews and brings together the key issues that emerged under the following themes:

- Workforce, skills and training
- Attitudes towards energy
- Local councils
- Government and policy
- Legal services
- Funding and finance
- Business models

- Technology and technical expertise
- Project management and delivery
- Project scale-up
- Collaboration
- Building and retrofit

4.1 Workforce, Skills and Training

This theme covers the overall considerations, observations and issues related to knowledge and skills, training, procurement of expertise and employment. Specifically, how skills and training enable community energy projects to be created successfully and how they may have acted as barriers, reflections on procuring external expertise and how training can be delivered.

Opportunities for skills and training through participation in community energy projects

A community energy project is a great way to increase the skills amongst residents and for residents to realise their potential. Two groups that we spoke with have a very strong focus on this. Being part of an energy project builds the capacity of the community and through participation, the management, financial and technical skills can be developed which would be useful in future projects and generally for participants' futures. Furthermore, group members can become experts themselves from being part of the development of such projects and can offer consultancy services or training for other teams as a result. It was also found that providing the opportunity to learn about the energy system in one way resulted in eagerness to learn more and build on that knowledge.

Nature of volunteering in community energy projects

Building a community energy project requires a lot of time for internal learning and the support of willing and skilled volunteers or pro bono services. Although people are willing to volunteer their time initially, the reliance on volunteers makes it difficult to retain skilled individuals. This would be solved by being able to employ paid staff as there are often interested people who are unable to participate as they need to work full-time and do not have enough hours in the day to spare. Additionally, this would make working for your community more attractive and could help to transition the knowledge and skills from the private sector.

Balance of people and skills

When some members of the projects work full time and others volunteer, there tends to be unbalanced workloads as several groups are led by the vision of a few people or by an individual in a chairing position. What is needed is a balance between having a cohesive group with enough in common and a diverse group with a range of skills and backgrounds, effectively managing the gap between skills and time available.

Extent of skills needed within the community

Skill-gaps were closed quickly, and most skills needed were found amongst the community energy groups. Groups usually have at least one engineer amongst their members who can provide a degree of technical knowledge and skills but having funding and being able to build and grow over a few years provides a group with a range of skills and capability. It is important for there to be an understanding of the energy generation technologies installed since if the technology is not working, there is no revenue. It is often the community you maintain the installed equipment yet, when it comes to the technical parts of the project planning and delivery process, there is a limit to the level that community energy project members need to be involved.

Issues in procurement of contractors and consultants

Several groups have experienced contractors being money-driven and not working in the best interests of the project through making bad decisions or by sub-contracting to unskilled practitioners. The issue of procurement is noticed in consultancy services where many skilled consultants are part of large companies who cannot provide for community-scale projects. Generally, in procurement there is a wide range of quality of skills. Additionally, some very essential expertise such as legal services are very expensive to procure.

Training needs and methods

There is a specific need to train the younger workforce by providing wider work experience and to have a faster response to training needs. Shorter training courses are preferable as most people cannot commit much time and it is important to have locally available training that is accessible to the community as well as investment in this area to be able to actually pay residents to upgrade their skills. For some, skills and training are not given much attention and there is value in 'learning by doing' such as through apprenticeships which is supported by the view that the necessary expertise will only come from years of experience in practice. Indeed, there is no point in teaching knowledge or skills without the route to a paid career where you would use them. Several interviewees highlighted the most important issue currently as sponsorship of training and education supported by work experience or apprenticeship schemes.

In conclusion, being a member of a community energy project is a great way to learn new skills but understandably, not every community project will have all the required skills amongst members. Indeed, this is not necessary as there are some tasks that require years of training and expertise that make more sense to buy in. Although procurement can pose some problems, the strong reliance on pro-bono services and volunteers can be eased through better financing. See Table 3 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Management • Financial • Technical • Procurement • Negotiation		• Lack of funds /cost of expertise • Retention challenge • Access to skilled consultants • Expensive legal skills • Contractors not aligned with community needs	• Short courses • Located in community • Supported by funding • Apprenticeship style • Clear career path • Mass education to uplift population skill level

Table 3. Summary of workforce, skills and training.

4.2 Attitudes towards energy

Whilst community members have a great deal of enthusiasm to deliver low carbon projects, there is a perception of elitism around sustainability and also a sense of scepticism around renewable technologies.

Behavioural Change

Mass behavioural change is needed and can only be engendered through communicating the climate emergency in a language that makes sense for various audiences. Scepticism exists around the renewable technologies and the benefits of energy efficiency until they are seen working in practice and the only way this can be resolved is through communicating, scaling up and learning from demonstrators. On the whole, this is something that the media currently does not help with. A hard-hitting marketing campaign to encourage individuals to think more locally and sustainably would be a way to tackle this although it would need to be supported by the infrastructure to maintain sustainable lifestyles.

A low carbon transition for all

An integral part of the transition to a low carbon and local economy is inclusivity to bring in all sectors of the population. Many projects run by community energy groups include spreading awareness of the actions to take to fight the climate emergency. Those particularly at risk of getting left behind are older generations who may find the technologies and smart systems confusing. Additionally, those on lower incomes who find it hard to pay energy bills need support to help them out of fuel poverty alongside tools for healthier lives and information about the energy system in a way that makes sense and is relevant to them.

Skills within the community to be proactive in the transition

A key skill gap amongst the members of the community is confidence to engage in the energy system, professionally or recreationally, and talk about this topic with others. Through training to learn and upskill as well as being involved in energy projects, the level of confidence in individuals has significantly increased and more opportunities for working in the energy sector are possible as a result.

In conclusion, the attitudes towards community energy projects are affected by demographic factors, with citizens from white, relatively well-educated groups taking more interest, while older citizens or those from under-privileged backgrounds or ethnic minorities are often at the risk of being left out. With a hard-hitting media campaign and improvement of communication and engagement skills wider citizen participation could be achieved. See Table 4 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Communication • Inclusion • Understanding context of diverse groups	• Communicating and engageing with different demographics • Technology skills (older residents) • Confidence to make a change	• Language used • Media • Willingness to engage	• Learning from demonstrators • Upskill through engagement • Effective and inclusive communication

Table 4. Summary of attitudes

4.3 Local councils

Local authorities can be a main stakeholder in community energy projects and have the ability to influence the sector hugely by employing all of their powers. This theme discusses the ways in which collaboration with local authorities can enable successful projects and overcome barriers as well as where the skill shortages lie in local authorities from the perspective of the community energy practitioners.

Structure of local authorities from the community energy perspective

Some councils are more supportive and proactive than others but declaring a climate emergency has been influential more recently – although it may not be enough. Councils are also reported to be very risk-averse and to have little understanding about the energy system or the role of community energy projects. Councils outsource skills through tenders but because of the low background knowledge of energy projects, have sometimes been charged unreasonable fees for a service. There is support for local authorities to 'in-source' skills by training current officers or hiring energy specialists which can assist them in being leaders for local projects. Additionally, there needs to be a less siloed structure of council departments as this is one of the causes of an uneasy relationship with community groups.

Collaboration between local authorities and community energy groups

There is a communication skills gap in local authorities although often, the interests of the two parties are very much aligned. There should be a mapping of council objectives with community energy projects' activities and a breaking down of barriers to allow more collaboration as the council may be able to offer free skills to the community project, such as technical expertise, procurement, local land knowledge, access to community buildings, etc. This can also make projects simpler for groups by using council estates instead of private buildings for domestic generation sites, as this requires one legal contract instead of one for each landowner.

In conclusion, local authorities are both a key stakeholder and a potentially very strong partner for community energy projects. The siloed structure of council departments, however, makes it more difficult for productive engagement of the council with community energy projects. See Table 5 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Procurement	• Energy systems understanding • Leadership for Smart Local Energy Projects • Communication and engagement with wider public	• Risk averse attitude • High costs of procurement • Amount of industry knowledge • Siloed structure of council departments	• In-sourcing of skills and upskilling over procuring external skills • Understanding the needs and roles of different council departments and communities.

Table 5. Summary of local authorities.

4.4 Government and Policy

Navigating the regulatory environment is a challenge for many. This theme details the points raised that refer to how national government could enable community energy groups and society in general to be a part of the energy transition.

Regulatory uncertainty

The feed-in tariff provided confidence for small investors that there would be a stable income stream and its removal left many potential projects in doubt. Coupled with the moratorium on onshore wind, an entire sector has been drastically reshaped, including all the expertise supporting it. Clear government policy and support is needed to overcome the barrier of regulatory uncertainty that is currently faced. There is also concern about the cost of renewable generation technologies as a result of Brexit given that much of the technology is manufactured in Europe.

Controlled funding and schemes

There needs to be significantly more funding going into renewables and building retrofit as well as better publicity for schemes such as the RHI. However, there is also a fear that government funding will be uncontrolled and open to exploitation from groups who will not actually implement energy efficiency measures so schemes need to be well managed to ensure that benefits are maximised and that they are accessible to smaller initiatives rather than big business.

Power to the communities

Strong value is also seen in giving the communities more power in deciding how we transition. This can be achieved through citizens coordinating and collaborating to optimise for their community as well as giving councils more authority to make changes in their localities.

In conclusion, lack of stability and certainty in renewables policy has a negative impact on the ability of the communities to deliver on the local energy systems agenda. Citizens would like to learn how to better access available funding schemes as well as how to better cooperate in shaping their local transition agenda for the benefit of their communities. See Table 6 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
	For government: • Policy change impact assessment (e.g., removal of PV tariffs, onshore wind moratorium and Brexit) • Long-term thinking **For communities:** • Access to funding • Citizen coordination and collaboration	• Divergent political agendas of parties • Controlled access to funding • High risks due to political uncertainty • Short-term policy making	

Table 6. Summary of government and policy.

4.5 Legal services

Legal services are a key aspect in developing community energy projects and often must be bought in unless there is a lawyer in the group. Some issues have been faced with procuring legal skills but there is a crucial need for them.

Expensive procurement of legal services

Although legal expertise was available to procure for groups who did not have lawyers amongst their members, it was found to be very expensive. Legal services are one of the fundamental areas of expertise needed for any community energy organisation and covers areas such as insurance, land leases, contracts, intellectual property rights and generally navigating the regulatory framework.

Dependence on legal skills

Technical contractors can be profit-driven and as a result, there is a need for lawyers to ensure that contracts are robust. However, lawyers were also found on occasion to overcharge for their time and not give clear advice which would then require more of their time to receive clarity in order to move forward.

Upskilling for community group members on understanding legal agreements

No need for training was mentioned for legal professionals although there has been a shortage of understanding around non-disclosure agreements in the past. The need is for having clear legal agreements to avoid facing complications if anything were to go wrong.

In conclusion, community energy groups find legal advice adequate and available, but very expensive. See Table 7 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Insurance • Land use contracts • Intellectual protection rights	• Setting up robust contracts	• Expensive services • Level of expertise within groups	

Table 7. Summary of legal services.

4.6 Funding & Finance

Grant funding is commonly the source of capital for community energy groups and writing grant applications is in itself a skill. However, for many groups, access to finance and financing the project has been a challenge. This theme describes those challenges, how to overcome them and key skills within this area.

Lack of funding vs. old business models

Whilst financing projects has been a difficulty, there is also a lot of success in getting grants. Access to money is a definite unlocking factor but there are reports that enough money exists and rather, the issue lies with adopting good business models or flexible financing options.

Skills for financing projects

Key skills in this area for community energy groups are accountancy, financial modelling, grant, bid and proposal writing and fundraising. Financial modelling was reported to be a skill shortage in community project teams and accounting expertise was said to be difficult to find which would indicate a need for training in this area. However, the only training suggested with respect to finance was basic financial education that should be part of the school curriculum to provide the understanding of the steps to setting up and running an organisation. For other groups, it appears that at least one member has financial expertise on the board.

Accessing finance

The underlying issue in financing projects may be down to the catch-22 around applying for loans. If an individual's or organisation's board members track record is not flawless, there may be difficulties in receiving a loan which automatically puts many at a disadvantage. The risk is the same reason that few banks in the UK fund community projects. Organisations are trying to solve this problem by creating a platform for social and sustainable investment where the outcome of the investments are seen in the development of communities and community energy projects.

Aligning community values with financial robustness

It is especially difficult to get hold of funding for fuel poverty projects and as a result, the expertise around fuel switching and energy billing has become less relevant. This has left organisations working in this space to have to find other ways to fund their services. For some groups, the balance of community values with financial stability is a barrier that has been faced i.e., using funds to outsource work to experts at the instead of providing a free service that may not be as professional but contributing profits from a venture to a community fund.

In conclusion, no training needs were mentioned for improving financial skills and finance was not a problem for some groups. However, for many groups a lack of capital has been a challenge which poses the question of whether the issue lies in a shortage of available funding or the types of business models used. See Table 8 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Grant writing • Accountancy • Financial modelling • Fundraising	• Adopting good business models • Management i.e., how to set up and run an organisation • Financial modelling • Accountancy	• Access to finance – due to a shortage of funds; – due to background of applicants • Shortage of flexible financing options • Risk of investment (faced by banks) • Financial stability vs. community values	• Creating platforms for social and sustainable investment

Table 8. Summary of funding finance.

4.7 Business Models

Many community energy projects based their business models on solar PV due to the feed-in tariff. As a result of its closure, there has been a need for projects to adopt novel business models to keep going.

Role of intermediaries in business model implementation

The cuts to the feed-in tariff has been a definite barrier to the development of recent community energy projects which had a knock-on effect on installation jobs and the entire installation market. This has resulted in a need for new business models such as revenue stacking in the energy market to ensure a sustainable range of income sources. As this is still relatively new, there may not be an abundance of this skill in community energy groups, but it is offered by intermediaries and indeed, business model planning is a key skill mentioned amongst the enablers.

Adaptability to new technologies and systems

For a community project, it is important to not rely on one technology or income stream and to be flexible to respond to opportunities that may arise. Flexibility in shifting models and patience are skills that can support the dynamism of emerging business models. In order to employ new models, there is an element of innovation required in how we apply new techniques and get rid of the bad or old ones.

Demonstrator projects and risk

With new models especially in the renewable energy sector there is considerable uncertainty due to the lack of demonstrator projects. One way to overcome the resistance to change is through new risk sharing models.

In conclusion, flexibility and openness to new opportunities is needed. Business models was mentioned more amongst enablers than community project members which may mean there is a space for knowledge sharing or may simply be the case that community project members view the project from less of a commercial standpoint. See Table 9 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Business model development • Flexibility to respond to opportunities	• Skills for innovations • Understanding new risk sharing models	• Uncertainty due to the lack of demonstrator projects • Cannot rely on one technology or income stream	• Understanding new business model approaches

Table 9. Summary of business models.

4.8 Technology and Technical Expertise

Barriers in this area are less about the technology itself which is considered to be mostly available for the transition to a low carbon economy. Rather, the issues arise in related factors such as policy, skills and finance.

Effect of the feed-in tariff on Solar PV

Solar PV is the most common technology used in community energy projects and solar installers were easy to source. As a result of the Feed-in Tariff cuts, there is a surplus of solar installers but they are of varying standards.

Balancing technical skills in communities and intermediaries

Whilst the construction of a smart energy system may be outsourced to professionals outside of the community, there is a need for training community members to operate and maintain the system. This will ensure any faults can be identified and fixed whilst also providing individuals with new skills.

Just transition for professionals

Engineers, energy assessors and electricians are always needed on community energy projects and whilst they are easy to procure now, there will be a higher demand for these skills in the future. It is also important to consider the pathways for those currently in conventional energy occupations to transition to renewable energy jobs as well as the opportunities for career progression for those in the renewable energy sector such as heat-pump and solar PV installers.

Practical training in universities, colleges and communities

It has been noticed that university graduates in engineering often lack the practical hands-on skills as teaching is mainly based in lecture halls rather than on sites. Additionally, the colleges and institutions are mainly geared to the domestic rather than the commercial market which has caused problems for companies who wish to expand but cannot source the right calibre of engineering expertise. This is an area that community energy projects want to work on by facilitating learning about renewable energy technologies in practice on the sites where they are installed. There is also a lack of teaching around how elements of the energy system interact with each other in multifaceted systems and how they can be combined with other energy efficient practices such as building retrofit and sustainable farming.

Basic technology understanding for all and the importance of communication

Another core skill for engineers is communication of their work to different audiences e.g., explaining how a heat pumps works and how to operate it to a homeowner. With the rising use of smart technologies, explaining how they function is ever more important and should not be left to the installers who fit them in the properties of individuals who are already aware that they exist. In order to guarantee a just transition, there needs to be more education about smart technologies to the wider population to ensure no individuals are left behind. There is also significant scope for data analysis and data modelling with the use of smart technologies which is seen by community enablers currently.

Regulatory certainty for the renewables sector

A government funded investment program is needed to develop the renewables energy sector and make the use of certain technologies more viable and affordable. Certainty around the cost of technologies manufactured in Europe post-Brexit is also needed to provide assurance to project developers and investors. By developing the renewable energy sector in the UK, this uncertainty can be lifted somewhat.

According to the interviewees, the most important technical issues in the transition to smart local energy systems include:

- Upgrading the transport systems;

- Developing renewables to eliminate GHGs rapidly whilst, on a local level ensuring the proceeds are returned to communities;
- Developing hydrogen for use as power;
- Upgrading the grid capacity and efficiency;
- Investing in the infrastructure on a large scale to support the progress of the transition.

In conclusion, at present most community energy groups are able to find the engineering expertise amongst their membership or outsource it for the commissioning of an energy project. However, they note that constraining factors for scaling up the community energy enterprise are policy, finance, and skills focused. See Table 10 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Solar PV installation • Outsourcing project delivery • Engineering • Energy assessment	• Standards to verify quality of installers • Lack of understanding around the commercial and technical aspects of a project • Procurement: e.g., how to choose amongst the tendering suppliers. • Operation and maintenance of the community energy system • Practical hands-on skills in new university graduates • Communication skills for engineers • Lack of knowledge on how elements of the energy system interact • Data analysis and data modelling with the use of smart technologies	• Government incentive schemes • Siloed engineering and commercial, financial professionals (engineers do not understand the commercial issues and vice versa) • Government funded investment program to make some technologies more viable • Pathways for transition to renewable energy jobs • Opportunities for career progression • Engineering expertise geared to domestic rather than the commercial market • Investing in the infrastructure on a large scale	• Education about smart technologies to the wider population • Training for community members to deliver operation and maintenance • Scale up of currently used skills • Facilitating learning about renewable energy technologies on sites • Cross-element impact and integration in multifaceted energy systems training • Practical hands-on training at the university level

Table 10. Summary of technology and technical expertise.

4.9   Project Management and Delivery

Creating community energy projects requires a great deal of management and organisation. Here we discuss the relevant skills, their issues and opportunities for training.

Working with the community not for the community

For community energy projects, knowing the local community and area is a key requirement. Communities will face different issues and there is a strong need for engagement with the community to work together in developing a project that suits their needs. Building trust between stakeholders requires communication skills that some think are in shortage. Often consultancy services are procured as well as or instead of intermediaries or 'enablers' who help to develop the projects. These organisations or individuals must be focused on working bottom-up from community level, developing design briefs and conducting feasibility studies. They are a useful partner in delivering change as their mission is aligned with community values without having primary commitments like councils or universities do.

Management of projects

As mentioned previously, confidence and leadership are skills that are lacking in some communities and a need for training in leadership was raised. In delivering the project, these are important along with organisation, negotiation and decision making. Such skills are usually seen in a project manager, coordinator or entrepreneur who usually is part of the team. The ability to be flexible and shift business models is of high value and an understanding of the various technologies can support this although there is a reported lack of whole-systems integration and a niche for a training program that encompasses several themes.

Components of engagement

Business management experience can be applied to various types of organisations whether they are CICs, charities or cooperatives and within this, procurement skills are useful. This is supported by having a network of other community groups who can provide advice and recommendations on previously procured expertise. On this note, networking and social skills are highly important to build working relationships with other groups and practitioners where there is mutual trust. These skills can also come in handy if trying to market the project. Indeed, for some groups marketing is a key area of the project and using social media has been proven to engage more young people. A need for more sophisticated marketing methods has been raised as traditionally community groups would rely on door-knocking and there has been a lack of publicity in some communities about the energy projects.

In conclusion, project management is an ever-present foundation for any community energy project, and while management skills are sufficiently available within most communities, the empowerment and engagement of the communities into and around the project is the main challenge. The projects succeed where the host communities have sufficient leadership and confidence within, and the building of capacity to engage and increase own confidence is still a challenge to many communities.

4.10   Project scale

As small-scale projects, there are barriers in procuring specialist skills from commercial experts but there are also issues forecasted in scaling-up the number of community energy projects.

Skills in use	Skills in shortage	Shortage factors	Training needs
- Build trust - Consultancy services - Developing design brief - Doing feasibility studies - Project management (including organisation, negotiation, decision making) - Flexibility in business model use - Understanding of technologies - Procurement - Networking skills - Marketing - Using social media	- Communication and engagement skills - Confidence - Leadership - More sophisticated marketing methods	Lack of publicity	- Working bottom-up from community level - Whole-systems integration - Engagement, marketing and communication - Leadership

Table 11. Summary of project management and project delivery.

Economies of scale-up

It has been acknowledged that for real change to occur, there needs to be collaboration on a wider scope such as city level. Larger scale projects are also cheaper and have found to be successful perhaps because consultants and landlords tend to want to work on larger projects and provide better terms for projects on commercial levels. However, the length of time and resources that small-scale projects take would mean an increased amount of capital would have to go into larger projects. The need for commercialised intermediary services can fill this gap and deliver on the communities' enthusiasm with their commercial understanding.

Demonstration of success

Without enough demonstrator projects, large scale smart energy projects may give rise to challenges with investors as there tends to be considerable scepticism around smart and renewable energy projects until they are seen up and running successfully. Part of alleviating this uncertainty is also a matter of behavioural change which is not easy but given the connectedness of the world, we can learn fast from international projects. Additionally, with new risk-sharing models can provide better reinsurance on innovative projects.

Role of the private sector in energy projects

Whilst there is confidence in the private sector to deliver in terms of driving down prices, there is awareness that the private sector is also still developing with many new entrants. To be working on smart local energy systems (SLES) during this transition, it is beneficial to understand the old and new energy systems and the differences between the two.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Intermediary services • Applying industry knowledge of new and old energy systems	• New risk-sharing models	• Landlords and consultants prefer larger scale projects • Number of demonstrator projects • Scepticism around renewables • Lack of insurance on innovative projects (high uncertainty)	• Learn from data on international projects • Working with private sector

Table 12. Summary of project scale-up.

In conclusion, scaling up local energy projects is seen as both economically beneficial and socially easier than setting up new smaller local energy projects. Some community energy practitioners see the private sector as gaining a larger role in this in the medium-term, but still consider private sector involvement to be relatively young.

4.11 Collaboration

Community projects are collaborative in their nature. Here we discuss which skills are vital in further enabling collaboration between community groups and various stakeholders as well as the supporting factors.

Benefits of collaborating with other groups and organisations

Making links to other businesses and the private sector has been challenging for community energy groups. A hub for intermediaries, businesses and other community groups to network can enable knowledge and skills sharing with a community focus. According to one interviewee, this is the most important issue at the moment with the added element of giving a platform and shared space to communities who don't have energy plans or are less skilled. Working symbiotically with other groups and stakeholders is a constructive way of problem solving and including more members of society in tackling the climate emergency. Furthermore, the best way to learn is by working alongside other groups who can provide advice on challenges that they have already overcome.

Community and university relationship

Some projects are partnered with universities but there is an opportunity for universities to reach out to their neighbouring communities more to solve problems together, share knowledge and collaborate on projects.

Skills to support collaboration

All forms of collaboration require communication skills and specifically being able to communicate with people from different backgrounds and to really engage with each other. There were no reported skills shortages with respect to collaborating specifically but the lack of confidence within

some communities may undermine their ability to collaborate and build relationships with other people.

In conclusion, community energy projects are very collaborative and engage citizens with their own community, as well as with other projects, universities and institutions. Improved confidence of the project members would lead to even deeper collaboration and engagement. See Table 13 for an overview of this theme.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Working symbiotically with stakeholders • Communication	• Confidence	• Hub for intermediaries • Platform and shared space for "early" communities (i.e., with no energy projects) • Links with universities	• Learning by working alongside other community groups • University-community collaboration

Table 13. Summary of collaboration.

4.12 Building and Retrofit

As home heating and electricity is one of the most energy demanding areas, communities are very engaged in measures to limit energy consumption in their homes. Although there are not skills specifically used in the community, shortages of skills were identified in the construction sector and the factors contributing to the shortages were discussed.

Standards and project structure

Retrofits, regeneration and tackling fuel poverty are all project areas of community energy groups. However, there is a clear shortage of zero-carbon building and retrofit practitioners as well as a lack of skills in insulation. Architects are far removed from the building process and the builders do not have the design skills which leads to siloed responsibilities and poor insulation jobs. Part of this problem is down to the lack of standards in building and building training, where what is needed is post-delivery certification to confirm that the energy performance of a building has improved. This would help to overcome unprofessional companies offering cheap services for poor quality delivery.

Tackling the challenges around building and retrofit

There was not enough publicity around the RHI and the benefits of retrofit. Currently there is a 'chicken and egg' situation where there are not enough retrofit projects happening and not enough people to build zero carbon housing in order to reach net-zero carbon emissions by 2050. Until there is a higher demand for these skills, there is no incentive for practitioners to invest in training, but the skills will not be available until training is widespread and accessible. The main reason why there are not enough projects is because the cost of retrofit is too high but, by training builders to deliver new builds and retrofits to Passivhaus standard, the cost can be brought down. Indeed, there needs to be more institutions who offer courses in this area as well as in more modern methods

of building such as off-site modular housing. Moreover, there needs to be government funding primarily to subsidise the service but also into a campaign to encourage more homeowners to take measures to make their homes more energy efficient and see the benefits in doing so.

In conclusion, building and retrofitting activities are directly relevant to energy efficiency and therefore are key to many community energy projects and a main factor for successful GHG emissions reduction. Yet, training of retrofitters and zero-carbon builders has not been sufficiently supported so far. The community energy practitioners called for standards in post-delivery validation of the quality of the completed retrofit and/or building projects and funding support from the government towards both training provision and funding of zero-carbon building and retrofitting projects.

Skills in use	Skills in shortage	Shortage factors	Training needs
• Building assessment • Advice on retrofit measures • Fuel poverty advice	• Zero-carbon building • Retrofit • Post-delivery certification to confirm the energy performance of a building	• Siloed responsibilities (between architects and builders) • Lack of building standards • Publicity on the benefits of energy efficiency • Demand for zero-carbon housing • high cost of retrofit • Need for more government funding to subsidise zero-carbon building	• Training before high demand hits • Offer courses locally • Educating home owners on benefits of retrofit

Table 14. Summary of building and retrofit

5 CONCLUSION

This paper presents the findings from an interview study with a small set of community energy group members. The interview analysis has resulted in twelve summary tables, reporting on which skills the interviewees see as currently used, which skills they consider to be in short supply, which factors cause these shortages and what kind of training and context they think needs to be provided to address the noted shortages. Whilst a skill shortage indicates a need for training and vice versa, we have kept these to how they were mentioned in the discussions.

Our summary tables cover several broad areas:

(1) **Professional skills** such as legal, financial and business modelling
(2) **Practical skills** such as project management, building and retrofit and technical skills
(3) **Policy areas** involving local and central government
(4) **Softer skills** such as education, workforce development, attitudes and collaboration

There are some overarching key skills and issues that span across all these areas:

- **Engagement**: communication, marketing and awareness
- **Leadership**: vision, planning and confidence
- **Management**: procurement and negotiation
- **Training provision**: length, accessibility and affordability
- **Funding and fundraising**: grant writing and business model development
- **Collaboration** across sectors and regions

The immediate next step in this work is to establish a consensus on these findings between the interviewees, and carry out a survey of the wider community energy community to validate or refute these findings. The summary tables will be used to carry out the consensus building, and the survey will be distributed immediately thereafter to a wider cohort of community energy representatives.

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