



Paper 9/2 Innovation session 1

For information

1. Purpose

1.1 To provide Commissioners with background information on agenda item 2, an information gathering session exploring the role of innovation in delivering a just transition.

2. Background

2.1 This note provides detail of the participants who have been invited to give evidence as part of this session along with a list of suggested questions. Further background information is also included in the Annex to help inform the session.

2.2 Participants have first-hand experience of working with many of the innovative projects underway in Orkney, with the exception of Mark Bustard from IBiolC who works across Scotland.

What	Agenda item 2: Innovation information gathering session 1
Who	<p>Mark Bustard, Industrial Biotechnology Innovation Centre</p> <p>Dr Gareth Davies, Aquatera</p> <p>Megan McNeill, Community Energy Scotland</p> <p>Neil Kermode, European Marine Energy Centre</p>
Why	<p>An opportunity to examine the role of innovation in delivering a just transition to net-zero.</p> <p>A selection of possible questions are included below:</p> <ul style="list-style-type: none"> • <i>What have been some of the key policy drivers behind innovation seen in the energy sector over the last ten years?</i> • <i>Looking across the funding and institutional landscape for innovation in Scotland, what are currently the key enablers?</i> • <i>How can we drive more investment in research and development - should any specific group be investing more? For instance public sector, private sector, or higher education?</i> • <i>Thinking about public support for innovation activities, does this currently generate enough public benefit in commercially successful projects? Should the public sector be more forceful in taking equity stakes etc. in projects they fund?</i> • <i>Does innovation/R&D spend necessarily deliver high value-added jobs? Does more need to be done to ensure that it does as new technologies develop and mature?</i> • <i>What more could be done to scale up and commercialise the many innovative demonstrator projects that can be seen in Scotland?</i> • <i>Where can we generate competitive advantage over other countries – are there export opportunities attached to energy system innovation underway in Scotland?</i> • <i>Is the institutional landscape (higher education, finance etc.) for supporting innovation in Scotland fit for purpose?</i> • <i>Is enough direction provided from the public sector in terms of setting the strategic direction/mission for innovation activity to follow?</i>



	<ul style="list-style-type: none"> • <i>What might the impact of events like Brexit, and the COVID-19 pandemic have on innovation activity/investment over the next five years?</i> • <i>Investment in innovation is done at risk, with a high failure rate in early stage companies and technologies. Is it right that government provides funding for innovation? What is the most appropriate form of support?</i>
<p>Additional background information</p>	<ul style="list-style-type: none"> • Annex A: IBioIC submission • Annex B: Aquatera submission • Annex C: Community Energy Scotland submission • Annex D: Orkney innovation projects examples

Annex A – IBioIC submission

The Industrial Biotechnology Innovation Centre (IBioIC) is of the view that there are many economic opportunities associated with meeting Scotland’s Climate Change targets. Industrial Biotechnology (IB) is one of the means to deliver the move to a greener and more sustainable economy, and it is also part of the solution to the current climate challenge.

IB is a means to manufacture chemicals, pharmaceuticals, consumer products, polymers, fuels, and numerous other materials, using innovative manufacturing techniques based on adaptation of natural processes, and using sustainable raw materials with a reduced carbon footprint. IB is delivering new products, new functionalities in existing products, and new markets as a whole new industry sector. The IB sector makes an important contribution to the Scottish economy while also minimising our impact on the environment, in particular by reducing emissions and sequestering atmospheric carbon.

The growth of IB will help Scotland transition from being an economy largely built on fossil fuels to one which is cleaner and fit for the future. Scotland is perfectly placed to become a world leader in IB, thanks to its unique geography and relevant natural resources – especially renewable energy, its existing infrastructure, a highly skilled workforce, and well-established and fast-growing IB companies of all sizes. Many IB companies within IBioIC’s network are seeking new methods of production that generate zero waste, as well as processes that capture and re-use carbon emissions to stop them getting into the atmosphere. We understand the term “renewable energy” and its connotations with reducing carbon emissions; IB enables the concept of “renewable carbon”, by which emitted carbon is recycled via biomass into high value products.

Challenges around meeting the targets will include adjusting traditional ways of working; this includes the move away from using petrochemicals as the main source of our energy and chemicals. The biobased economy can become the main source, if it is supported. An additional challenge may arise where environmentally friendly technological solutions come at a higher price point, including the implementation period, than traditional methods. However, the transition to a greener economy must be done to address the current challenges posed by climate change.

The Industrial Biotechnology Innovation Centre (IBioIC) is of the view that a significant reduction in carbon emissions can be delivered by blending biofuels into petroleum transport fuel. However, Scotland currently imports all of its biofuel, in the form of ethanol, from abroad, of which the majority comes from France. In terms of volume, Scotland imports more than 50 million litres of ethanol per year. The demand for fuel ethanol will soon more than double to 10 per cent (E10 petrol). From a technical perspective, there is no reason why this ethanol cannot be produced in Scotland, with Scottish farms growing sugar beet and local conversion of the sugar beet to ethanol. This delivers an indigenous supply chain from farm to refinery benefitting many parts of society along the value chain. That value chain, including the jobs and skills associated, becomes a magnet for further external investment in Scottish biobased manufacturing using the same local sugar feedstock.

The fragility of international supply chains delivering pharmaceuticals, polymers and chemical reagents to the UK was clear during the COVID-19 pandemic. There is an opportunity for Scotland to reshore components to ensure greater security of supply. The critical aspect of kickstarting the economy is the importance of the manufacturing sector. Industrial Biotechnology (IB) is a low-carbon, sustainable and scalable platform that will future-proof manufacturing and contribute significantly to the net-zero carbon targets.

A successful transition to net zero emissions for the Industrial Biotechnology Innovation Centre (IBioIC) and the Industrial Biotechnology (IB) community in Scotland would be a fully functioning, and self-sustainable bioeconomy. The bioeconomy would sit at the heart of Scotland's Circular Economy with biorefineries supporting the work, and the bioeconomy would replace the petrochemical economy as one of Scotland's leading economies. Scotland's manufacturing industries would have transitioned fully to the uptake of IB within its carefully built supply chains.

The Industrial Biotechnology Innovation Centre (IBioIC) would like to see continued support from Scottish Government towards building the bioeconomy. Part of this support would be future financial support through the newly established Scottish National Investment Bank, in the form of grants for SMEs (all industries) looking to invest in biobased manufacturing, as well as access to funding for companies of all sizes in Scotland who will invest in IB that will help the just transition. By ensuring all industries can access funding or grants, this will encourage the uptake of cleaner technology. By ensuring everyone has access to innovation, this means no one industry will be left behind. Additionally, we would like to see the allocation (or re-allocation) of resources for investment in infrastructure to support the creation of biorefineries. In order to grow a scalable biobased low-carbon industry in Scotland, companies need support to transition from R&D into manufacturing. This is crucial to the success of the biobased economy which will support the transition.

The Industrial Biotechnology Innovation Centre (IBioIC) accepts that the just transition from traditional industry to a bioeconomy will mean that certain industries in Scotland will need to adapt and pivot to the future. As we move away from petrochemicals and expand the biotechnology sector, it is crucial to ensure that no-one is left disadvantaged. This means creating new jobs, training and re-training people, and ensuring the cost of living, including products and energy, doesn't rise as the transition away from petrochemicals takes place. It is crucial to understand that biobased manufacturing shares many skills associated with traditional chemical manufacturing – particularly in process engineering. This enables the existing companies and people who are dependent on chemical engineering to pivot towards this new sector with ease, providing support

Advising on a net-zero economy that is fair for all



is given in the form of skills and technology development. The new biobased industry builds upon more than 100 years of chemical manufacturing expertise in central Scotland.

Annex B – Aquatera submission

I have been involved with marine energy since 1987 and Aquatera has been at the forefront of the growing sector since 2000. We are based in the Orkney Islands at the heart of the global activity in wave and tidal energy. We have undertaken over 40 studies and projects relating to marine energy, supporting over 50 technology developers, 10 testing sites, governments, agencies and working with 20 or so communities. This work has taken us to over 40 countries around the world and we now have offices in 5 of those countries. Our team of 25 staff and another 20 associates work tirelessly to investigate the needs for energy transition, considering where, when and how best for marine energy to make a contribution and then helping to deliver suitable marine energy solutions at the technology proving and energy system integration level. Underpinning all this activity is our ever-deepening understanding of marine science, engineering, ecological, social and economic issues within a broad sustainability framework

As a company we have generated around £25 million of turnover over the last 20 years and have invested some £5 million back into sector understanding, technology support and project development. We are currently launching two new investment funds aimed at, amongst other things, supporting the optimal development and deployment of marine energy generation and enabling technologies and deployment projects.

Aquatera's work and contribution sits alongside that of a cluster of organisations located in and using Orkney as a base for their activities. This cluster has led marine energy activity for over 20 years. It includes over 20 individual companies and organisations, some 350 people involved locally, has accumulated over 6 million hours of effort directed at marine energy matters and has collectively invested around £100 million in marine energy endeavour. This investment has come from the local authority, from local businesses from local people and from local agencies.

More has happened in Orkney related to marine energy than has happened in the rest of the world put together. Orkney is revered across the globe as a centre of excellence, a place where: things happen and get done; where experts understand the sea, working on and in the sea and sea life; where metal gets wet; where the community is engaged; where visitors and collaborators are welcomed and where new ideas, concepts and designs are imagined and crafted. Orkney and its adjacent waters in Caithness and Shetland have been home to the first, the biggest, the longest, the most, the best, the most cost effective and the most energetic in so many aspects covering environmental conditions, technology deployment, project development, support vessel development, oceanographic advances, insights into ecology, demonstrating economics and living with social consequences.

This understanding, experience and insight has then been shared and exported across the UK and around the whole world. There are particularly strong links between Orkney and its neighbours in Shetland, the Outer Hebrides and Highland Region. There is good collaboration with the metropolitan centres of Aberdeen, Edinburgh and Glasgow. There are especially strong links with North and South Wales. There are well established working relations with the Isles of Man, Cumbria, South West, Isle of Wight, Humberside, the North East as well as with numerous academic institutions and industrial companies. Alongside this collaborative endeavour Orkney has worked diligently and consistently with governments of all hues and at all levels to help understand and deliver the undoubted benefits that can arise from marine energy. These national, regional and local benefits include:

- New, more and better jobs in remote and island communities
- Wider employment opportunities in the established economy
- Sources of energy which have a competitive advantage in serving the blue economy
- Energy which can help balance other forms of renewable generation
- Creation of local, regional and national innovation ecosystems which can help deliver on a range of key societal challenges
- The spin-off benefits of new and expanded, expertise, experience and capacity that has been applied to offshore founded wind, offshore floating wind, onshore wind, hydrogen, floating solar, integrated energy systems, EVs, charging infrastructure, decarbonised ships, decarbonised aircraft, oceanographic sensors, ROVs, AUVs, foundation and anchoring systems, cable laying and securing, aquaculture, electrical transmission and distribution cables, offshore oil and gas, ecotourism, tourism, education, community development and so many other areas of sustainable and industrial development.

If all of the aspects of marine energy and renewables are rolled up together in and around Orkney, connected with the islands there has been over £1 billion invested over the last 20 years, giving rise to a major explosion of innovation, industrial and community development capacity and delivery. Looking forwards over the next 10 year there are plans being explored and delivered for a further £20 billion of investment.

The world is full of options and choices. The options associated with tidal and wave energy and with powering the blue and onshore economies of the UK and the wider world are many and complex. But it is very hard to conceive of any future where tidal and wave energy will not play a significant and competitive role in certain energy markets where these sources of energy have a competitive edge. There are markets where tidal and wave energy are likely to offer the most cost effective and best solutions. The optimal marine energy markets do not embrace all markets, but no energy source is suitable for all energy markets. They do include major and, as yet, difficult to serve energy markets particularly associated with transportation in general, water production and the breadth of the blue economy. These are areas where marine energy is likely to have, or has already got, a competitive advantage.

The simple question in the end is whether we want to have a role in and a part to play in such markets.

The groundwork has been laid, the UK leads the world in many areas of marine energy sector development and delivery. Generation technology is a part of that story and a part of that opportunity but there are also many other areas of technology provision, service delivery, investigation and innovation, project management and finance where the UK has a major role to play, if its wants to.

How many times has it been said that as a country we should never repeat the mistake we made with wind energy, for example, where we invested in it, led it and then gave up and walked away just when it was getting interesting.

The country faces a similar choice again, the opportunity is there for the UK to fully embrace marine energy, to lead the exploitation of the blue economy, to power the blue economy and to accrue immeasurable benefits across so many of the policy priorities that exist. Such a prospect is no pipe dream or distant prospect - it is a reality that has been demonstrated, nurtured and exploited very successfully over the last 20 years. The last 8 years have been especially difficult

but the sector has not gone away or given up, it has shaken itself down, broadened the base of what it is offering, looked carefully at where and how it can best contribute to local, national and international priorities.

Tidal stream and wave technologies have progressed at different rates leading to them being viewed as two distinct sectors but with a strong crossover between many elements of the supply chain. Tidal stream energy is now ready to deploy a scale, the technology has produced over 30GWh and 124MW of shovel ready projects are poised for development in the UK. Many more technology and related energy systems developments are underway and the need for energy transition within the blue economy are forever increasing.

This is an excellent time to be supporting the marine energy sector and along with our partners in the sector we commend the following measures.

The Opportunity to Deliver a £1.4bn Net Cumulative Benefit to the UK by 2030

Aquatera sees tidal stream and wave energy as an exciting growth market, that we want to be at the forefront of, along with other UK companies to create a robust UK supply chain. We have invested around £5M in working in the sector so that we can secure the future opportunities. This will help us understand how we can accelerate the understanding, project development and technology along a commercialisation pathway and ultimately ensure that we, as a UK supplier, can be competitive on a global level.

By taking positive action now, the UK can secure a realistic majority share of a global market and assist in the green recovery and ambitions for the Government to reach Net Zero. The tidal stream industry could generate a net cumulative benefit to the UK by 2030 of £1.4 bn, including considerable exports. Importantly this future business can build upon the excellent commercial and academic foundation already established nationally and internationally by the existing sector clusters such as those in Orkney, Shetland, Scotland, Wales, South West, South and North East. This cluster-based type of industrial development adds further value to this sector by facilitating development in specific locations and regions as part of the levelling up initiative. Future prospects for the sector have been predicted to encompass billion pounds turnover and 10,000s of jobs (ORE Catapult Report, 2018).

Due to the UK's marine and maritime nature and heritage, it is uniquely positioned to support the powering of the blue economy and the supply of additional energy to the onshore energy markets as well. This activity can help to grow, develop existing and create new UK companies as part of world class national and global marine energy supply chain.

A Path Towards Commercialisation

Crucially, in the current climate, strategic support for this sector would help deliver three key objectives – a boost to domestic manufacturing and jobs; practical application of the 'Green Transition' as a route to post-pandemic recovery; a major exporting opportunity in technologies where we currently lead the world.

That lead will only be maintained if there are appropriate measures in the domestic market to support commercialisation of the technologies, which have advanced greatly with Government support in recent years. We believe this is now a critical moment in ensuring that support mechanisms are geared to the specific needs of the marine renewables sector.

There are 124MW of tidal stream sites that are in an advanced stage of development in Scotland, Wales and England, preparing to bid into AR4 [Contracts for Difference, Allocation Round 4] and each subsequent auction rounds thereafter. To secure the global lead and £25bn export market, encourage competition, drive down cost of energy to below £90/MWh and distribute economic benefits across the country, the tidal energy sector requires a minima of 100MW to be established within AR4. To support the build out of this 100MW of tidal energy within AR4, an Administrative Strike Price of £250/MWh is required.

Combined with a signal of similar support structures in AR5 and AR6 and beyond, at the sites already under development alone, hundreds of MWs could be ready to bid in the next few CfD rounds, with GWs in the 2030s as further sites are developed. Entering into the 2030's, this roll out trajectory would see tidal energy well on the way to deploying at sub £90/MWh and have secured the UK a £25bn global export opportunity.

Furthermore, implementing a complementary proposal that would support technology developers; the *Innovation Power Purchase Agreement (IPPA)*. The IPPA is designed to keep costs off consumer bills whilst putting the risk on the private sector for delivery. Under the IPPA scheme, a project would sell electricity to an electricity supplier at a strike price agreed with BEIS. The supplier would be entitled to offset the annual difference to market prices against tax. Payments are only made on delivery of power and, unlike grants, if the technology does not deliver payments are not made. By embracing this concept, we could enable the creation of 15,000 jobs and secure the net GVA of £25bn by 2050, just for tidal stream energy, to benefit the wider economy; far beyond the £50m per annum cost of the proposed IPPA over the next twenty years.

Aquatera believes that the IPPA is a particularly important and critically required tool for supporting the next 5 years of sector development.

We hope that our contribution has demonstrated that support for the marine sector will:

- Help us as a company to enable a green recovery from Covid-19
- Unleash the deployment of tidal stream technologies which are already demonstrating at high technology readiness levels and with the correct early support in place will enable a realistic target of 4GW being deployed within the UK by the 2030s and support efforts to meet the Net Zero target;
- Achieve cost reductions through technology innovation, economies of scale, and commercial factors and risk profiles which face investors;
- Embed domestic supply chains through delivery of early projects to assist in the 'levelling-up' agenda and the creation of technologies for export.

Annex C: Community Energy Scotland

CES have asked for the following summary of their recent report – [Next Steps in Community Energy](#) – to be included as their submission for the session.

The new context

The COVID-19 pandemic and lockdown has disrupted all aspects of Scottish life, creating a full economic recession and signs of a fundamental shift in perspective, from GDP growth to wellbeing as the primary indicator of a successful and sustainable society.

The pandemic has revealed the weaknesses of long global supply chains in a time of crisis, sharply exposed inequalities in our society and highlighted the importance of local infrastructure and community support networks. Governments across the world are implementing unprecedented economic interventions to stimulate recovery, within which resilience and decarbonisation should be central and urgent considerations. These factors require an urgent re-think of the role of community energy, and have re-set the context for action.

Community resilience and energy decentralisation

Strengthening resilience at the local level is part of the UK's national resilience strategy but, in practice, localisation has been in decline. Also, resilience is not just a question of being able to 'bounce back' from an adverse impact. Personal vulnerability, whether physical or mental, lack of capacity, lack of agency and control and lack of a supportive social environment are key issues which need to be addressed.

The crisis has revealed how local community organisations can play a vital role in connecting with and helping local people, especially those who are the most vulnerable. Decentralisation and a general transition from passive consumption dependent on long fragile supply chains to informed 'prosumption' – production and consumption at a local or household level are similarly key elements of resilience.

Planning for a new local layer of community-based energy action

The UK energy system was already undergoing a period of significant change, transitioning from a centralised fossil-fuel based system to a more decentralised, low carbon system. Lockdown had a huge financial impact on the global fossil-fuel business, and resulted in what has been described as a 'postcard from the future'; with much lower demand and resulting in a higher proportion of renewable energy, but also the need for urgent balancing measures by the National Grid.

An essential pillar of the green recovery will now be investing in building our future low carbon energy system. The role of community energy may be most important not in terms of community owned energy generation but in enabling the transformation of energy demand, enabling energy users to become active and empowered components forming a new 'local' layer in our energy system.

As yet this 'local' is a largely overlooked scale in analysis of the changes needed for decarbonisation. The DSO transition represents networks beginning to address this shortfall, but there is no 'DSO transition' equivalent for energy supply companies or many of the other elements of the energy system. Failure to engage at a local level is already becoming a substantive barrier to decarbonisation of heating, transport and the creation of electricity demand flexibility; all of which require locally attuned actions and significant behaviour change by energy users. Scotland

lacks local level democratic institutions, leaving community anchor organisations (and especially Development Trusts), as the only viable organisations able to act effectively at this finely tuned scale.

Local level action does not supplant the need for coordinated action by national government, but should be carried out in partnership with local authorities and other public and private sector organisations, guided by a National Community Energy Plan.

Community energy and the demand side

Community-led energy action now needs to be seen as a key element for influencing the demand side in the energy system, not just a minor player in power generation. Community anchor organisations, if supported to operate at scale, are key to this process, given their position and influence in the community. Key actions which are a basis for community-based action are identified: promoting energy demand reduction & 'prosumption', local supply, community transport and community capacity building.

Part 2 of our report examines these actions in detail, setting them in the context of current policy and activity and the issues involved in driving change. The overarching issue of demand reduction is challenging. Although energy consumption in Scotland is falling, most energy consumption (over 80%) is still attributable to the burning of fossil fuels. The rate of installation of energy efficiency and low carbon heating measures needs to massively increase if Scottish targets are to be met.

Expanding the scope of Energy Efficient Scotland

The flagship Energy Efficient Scotland programme urgently needs expansion in a way which can reach hitherto untouched places. Levels of prosumption remain low and the 2020 renewable heat target is unlikely to be met, with just 15,224 accredited domestic Renewable Heat Incentive (RHI) installations at the end of March 2020, out of 2.46 million Scottish households. Effective solutions for tenement properties are not emerging quickly enough. Fuel poverty has been decreasing but still affects 25% of households, with those in homes below EPC level C far more likely to be affected.

Progress to date has been based on the easier measures, but the bulk of households in the 'able to pay' sector have not been addressed and there needs to be a different approach to encourage householders to act – and there is little incentive for private landlords to act either.

Citizen Advice Scotland argue that the current range of financial incentives should be increased as they are not sufficient to encourage people, especially owner occupiers, to upgrade their homes, especially fuel poor households. There should be a major new public information and awareness campaign via a 'one stop shop' system. In our view, there is plenty of behavioural evidence that demonstrates that local community-led initiatives are far more likely to be successful than centralised national campaigns or call centres in this process.

Harnessing the role of local groups

The embedded and trusted role of local community organisations should be harnessed for this - just as they have been in the COVID crisis. The challenge for local groups is to be able to convert this into action at scale within their communities and to overcome the argument that it is too expensive to deliver the required outcomes through multiple small players, rather than national contractors. We believe that the answer to this lies in striking a better balance between the two, with local organisations being empowered to do what they do best – work with and support local

people in the uptake of measures. We highlight a number of approaches by which local groups could have greater impact through collective procurement approaches.

Wider factors affecting energy consumption

However, it is important to note that energy consumption in the home only accounts for around one quarter of total energy consumption by households – the rest arising through consumption of products and services. We highlight energy supply and transport as two key areas to address. Local renewable energy supply in the form of electricity and heat could play a very significant role in strengthening community resilience and energy security and community groups have a key role to play in this.

Speeding up the transition

The decentralisation of the energy system is underway but is proceeding very slowly and community engagement in the process is negligible. Legislative hurdles mean that local electricity supply is rarely a viable option and there are very few community-led heat networks. There have been important pilots that have demonstrated technical viability and there are routes to speed up progress, such as license exempt sale and 'split metering' for electricity supplies, but for both electricity and heat approaches are currently limited to small pilot projects. This might change rapidly if a right to a local supply is established in law, for which support is growing.

In the absence of a conducive regulatory environment, local supply projects typically are swimming against the current, marginal, and relegated to the 'off-grid' category. In fact, with the right metering, smart grid and local market arrangements they could play a useful role in a more efficient national grid. In some ways, low carbon heat has the opposite problem: consumer protection regulations are undeveloped & there remain significant technical challenges with low carbon heat networks. In both cases, however, local community organisations have the potential to play a significant role.

Unlocking community-level flexibility

The other key aspect of energy security – 'flexibility' – is not well developed at the community or domestic level, but needs to be. There is an unparalleled opportunity emerging for consumers to engage in and support the transition to a low carbon and flexible energy system which rewards demand reduction and enables local supply arrangements in ways that contribute to its integrated operation. Communities could be empowered through improved legislation and 'demand side response' mechanisms to provide a significant contribution to local and national balancing of the electricity system, harnessing significant unused and growing potential and enabling a greater emphasis on renewable supplies in the energy mix.

Electric vehicles, home battery systems, storage heaters and heat pumps all involve an element of energy storage and are often flexible in when they can be charged, which could be in response to market or grid operator signals. Aggregation of small scale energy storage and demand is key to this and it is possible to envisage a community-led aggregation service, which could complement the large-scale commercial aggregators currently in operation. Local direct matching of supply and demand is also technically viable and is particularly relevant in areas where the grid is constrained and surplus power cannot be exported.

Local energy: de-carbonising local transport

The massive drop in travel and the likelihood of an even greater 'bounce-back' in car use owing to the COVID risk with public transport raises important questions relating to our hyper-mobility and

the community, energy and carbon advantages of greater localisation of services and community transport and active travel options. There are important positive links to build on between community led energy measures and the development of better and more sustainable local transport options which also help to circulate funds in the community. Community led electric vehicle clubs, local supply to charging stations and bulk purchase and installation of domestic chargers, as well as collective procurement electricity supplies are all routes to get a step change in uptake. Whilst some of these measures have been piloted by some community organisations, progress so far has been disparate and piecemeal. The urgency of recovery from COVID-19 and the Climate Emergency demands a shift to a more comprehensive and planned programme which brings together all the key players in well planned local projects.

Strengthening community groups' capacity and coverage

Whilst there is a good foundation of experience in some community groups, coverage is patchy and can be skewed to more affluent areas. Also, community leaders need help to get up to speed on recent developments in the energy system and how they can engage in the sorts of measures outlined here. Whilst there are good sources of project advice and training courses for energy advisers, there is no capacity-building provision for community groups other than Community Energy Scotland's pilot 'Community Energy Futures' programme, which provides a structured approach to learning about community energy and the smart energy transition.

Measures required

Part 3 of our report outlines a set of measures which we believe would be significant in helping community groups expand the scope and scale of their energy action. A strategy is now needed which rewards communities for their role in reducing energy demand, developing local supply, increasing flexibility, developing local sustainable transport options and strengthening community capacity to act. It needs to place more significance on their role in the energy transition. Pilot projects, general support measures, policy and regulatory measures, capacity-building and geographically defined approaches all have a part to play in this strategy. Key measures include:

- **A new National Community Energy Plan**, which takes account of the new context for community energy
- **'Local energy zones'** in the Western Isles, Glasgow & Dumfries & Galloway, to take forward the full range of measures in an integrated way
- **A Community Energy Demand Reduction Incentive** that, if set correctly, could stimulate creative approaches to local energy demand reduction
- **A large-scale, community-led bulk procurement and energy efficiency retrofitting scheme**, to reinforce current Energy Efficient Scotland provision
- **Support the right to local electricity supply**, lobbying Westminster to enable local trading on electricity distribution networks
- **A 'Community Contracts for Difference' in Scotland** – Investigate potential for procurement of power from community generators by public sector bodies
- **Unlock PV on tenement buildings** and develop the scope for local generation and supply from vacant and derelict land
- **Fossil fuel substitution with renewable energy**, to drive local development in grid constrained areas
- **A more supportive regulatory framework**, to enable community level flexible demand response

- **Formal recognition of EV car clubs as an essential public service**, with area EV & e-bike hire targets
- **A national 'Community Energy Futures' programme** to build community group capacity to take forward local 'smart' energy demand reduction measures

Conclusion

Finally in Part 4 of our report, we conclude that there is an urgency in acting to address the vulnerabilities and inequities exposed by COVID. If taken together, the measures will help lever the role of community organisations in the development of a more sustainable and resilient energy system, whilst reinforcing community resilience and a Just Transition.

Annex D – example innovation projects underway in Orkney

ReFLEX Orkney

The ReFLEX Orkney project is aiming to integrate electricity, transport and heat networks in the Scottish Islands, using advanced software to balance supply and demand.

The project is part of the UK Government's investment in research and industry in order to develop smart energy systems through the Industrial Strategy Challenge Fund – Prospering from the Energy Revolution.

The Challenge

Despite Orkney having significant renewable energy resources and producing 130% of the electricity it needs through existing installed renewable generation, a constrained electricity network is causing high levels of 'curtailment' – where wind turbines are switched off to protect the network from overloading.

This limits the economic efficiency of existing turbines, and the ability to install more capacity that will be required as the demand increases to support electric vehicles, and electrified heating systems.

Energy prices for residents are typically very high partially due to the amount of fuel needed for heating and transport. Plus there is no gas network and therefore homes and businesses rely on either electricity or oil to provide heat. This, in conjunction with Orkney's older housing stock and the cold local climate, mean the area has one of the highest fuel poverty ratings in the UK (63%).

The Orkney's independent location means it is the ideal location to demonstrate the capabilities of a self-contained smart energy network. The opportunity to harness the excess renewable energy generated that is currently wasted, along with a will to increase the amount of low carbon energy and reduce fuel poverty, forms the main driver for the Reflex demonstration project.

The ReFLEX Orkney project

ReFLEX Orkney is install FLEXible technologies to address the constraints in the energy network that cause system inefficiencies and demonstrate a Responsive Virtual Energy System which links these networks together.

The aim is to allow electricity production to be maximised, efficiencies to be recovered, and new business models to be proven, meaning energy can be supplied at minimum cost to the consumer.

The project will last for 36 months and include the installation and operation of multiple technologies including:

- Hydrogen Fuel Cell for the provision of electricity and heat
- Domestic energy storage
- Commercial energy storage
- Vehicle to grid charging infrastructure
- Ground source heat pump systems
- Building management systems

- Integrated Grid-smart community-led transport system and infrastructure

A Virtual Power Plant System will combine the above infrastructure alongside existing infrastructure on Orkney to demonstrate the capabilities of a smart energy system; linking together the electricity, heat and transport energy networks to create a system of maximum efficiency and value for consumers, generators, suppliers and operators within the energy system.

Work is also underway to set up a new local energy company to offer advice to local consumers and businesses on their energy needs, as well as providing affordable leasing options for new domestic and commercial batteries, electric vehicles and charging points in Orkney, with reduced upfront cost for end users.

Funded by UK Research and Innovation (UKRI) through the Industrial Strategy Challenge Fund, ReFLEX Orkney is one of 25 Smart Local Energy System projects that formed part of the Prospering from the Energy Revolution programme.

Surf 'n Turf

The Ambition

The concept behind the Surf 'n Turf project is to enable Orkney to both make and use more electricity locally; to reduce fossil fuels imports and CO2 emissions; and to support Orkney communities and companies to harness locally sourced energy.

How?

The European Marine Energy Centre (EMEC) has invested in an electrolyser to use power from tidal turbines operating at the company's test site off Eday to produce hydrogen by splitting water.

To build on this, Community Energy Scotland and partners created Surf 'n' Turf, so that power from Eday Renewable Energy's community wind turbine can also be used to produce hydrogen using EMEC's electrolyser.

Hydrogen can be stored, so it is shipped to Kirkwall where a hydrogen fuel cell is housed on Kirkwall Pier. The fuel cell converts the hydrogen back into electricity by mixing it with oxygen from the air. This electricity can power facilities in the Harbour area, and the ferries when docked.

In addition, the Surf 'n' Turf project is building this fuel cell to marine standards, as it would be on a ship, which will create a unique UK facility to allow mariners to train in Orkney for any future hydrogen powered vessel.

And the future?

Through Surf 'n' Turf, Orkney is pioneering practical uses of hydrogen. Training and new opportunities with clean fuels are potentially of significance to shipping and other industries – as well as to communities that are rich in renewable energy resources, but have grid issues of their own.



The Surf 'n' Turf project has attracted £1.46 million in development funding from the Scottish Government's Local Energy Challenge Fund. It is co-funded by the European Union Horizon 2020 programme, under the Fuel Cells and Hydrogen Joint Undertaking.

The project is led by Community Energy Scotland, alongside partners EMEC, Orkney Island Council, Eday Renewable Energy and ITM Power.