SHETLAND ISLANDS COUNCIL

Shetland Energy Strategy

2024

Contents

Foreword

Councillor Emma Macdonald, Leader, Shetland Islands Council

I am delighted to present the interim Shetland Energy Strategy. With so many renewable energy projects either underway or being planned here in Shetland, it is important that we stand back and consider where energy transition will lead us to and what our community can do to shape that future. We can now see the extent of the Viking Energy Project, the huge change on our landscape, and we can now look to the future with the prospect of Shetland produced clean energy in all our homes and places of work. But such massive change poses important questions on social and environmental challenges as well as the economic opportunities. The vital requirement for Shetland people to achieve the fair electricity prices we deserve as the host community for this and so many other renewable energy developments is a particular focus for the Council at this time. Our campaign for affordable energy is a main priority in the Strategy and that promotion has begun already.

Another key need is to make the fullest use of the green energy being produced here for our own inclusive growth through adding as much value here as we can. We need to minimise our impact on climate change while providing the employment to keep an active skilled workforce in our community and stop the need to import expensive fuel.

The interim Shetland Energy Strategy sets out what our energy ambitions are, including the need to use less energy, use energy better as well as switching to clean energy. It describes the potential sources of green energy that could be developed here and gives some good examples of progress being made. Four Long Term Outcomes have been identified along with a list Action Areas which require further investigation or collaborative action. A Just Energy Transition will require cooperation and collaboration from a wide range of project partners, along with high levels of community engagement and participation.

History has shown us that places where major socio-economic change has been abrupt and unmanaged take decades to recover. Places which have faced such change involving high levels of engagement and participation with a clear link to community benefit fare much better. This is our opportunity to put in place a framework to support decision making on energy transition. The long term outcomes of energy transition are clear but the short to medium term actions are less clear and at times contradictory. We require a Shetland approach, which recognises our legitimate interests and concerns.

Glossary

An extended glossary is available in Annex 8.

Baseline	An exercise which establishes the level of emissions in a given year. Statutory emissions reductions of 50% by 2030 are measured against the baseline of 1990.
Biodiversity	The variety of living things in the natural environment. Improved biodiversity leads to stable ecosystems and a more suitable living condition for human beings.
Brownfield	Land or infrastructure that has been previously developed and can be reused for another purpose.
Clean energy	Energy, such as electricity or hydrogen fuel, that is produced without emitting greenhouse gases and therefore does not contribute to climate change.
Climate Change	The long-term shift in global climate patterns, including extreme weather events and rising sea levels, linked directly with the warming of the Earth's atmosphere. Climate change is rapidly accelerating due to human activities, such as burning hydrocarbons for transportation and energy.
Co-benefits	Social, environmental, and economic benefits that arise from undertaking climate action that are incidental to avoiding the worst effects of climate change. For example, undertaking more active travel will result in improved cardiovascular health for the populace.
Decarbonise	Altering an organisation, product, service, or investment so that it is delivered producing less emissions. Carbon is used as a stand-in for all greenhouse gas emissions.
(Greenhouse gas / GHG) emissions	Gases which, when dispersed in the atmosphere, trap the Sun's radiation within the Earth's atmosphere and cause global warming. This achieves a similar effect to a greenhouse, hence the name. Greenhouse gases include carbon dioxide, methane, nitrous oxide, and water vapour.
Empowerment	Equipping individuals and the community with the power and resources to undertake and accelerate the energy transition. Building knowledge, understanding, skills and capacity within the community will enable groups and individuals to undertake and accelerate their own activities.
Fossil fuels	Fuels such as oil, coal, and natural gas which derive from decomposed organic material – hence 'fossil' fuel. This organic matter is primarily made of carbon, therefore burning it releases carbon dioxide. See: hydrocarbons.
Fuel poverty	A household that spends more than 10% of its income on fuel costs is in fuel poverty. If this rises to more than 20%, the household is in extreme fuel poverty.
Generation	How energy is made before it is distributed, such as from wind turbines turning or hydrocarbons burning in a power plant.
Green skills / jobs	Skills and jobs which are related to renewable energy, climate change adaptation, or the circular economy. These are seen as future-proof skills and jobs because every industry will need to decarbonise in the coming years.
Upskilling	Is when an employee undertakes learning to expand their existing skill set with the aim to enhance the worker's performance in their current role.

Annexes

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Annex 2 – Action Areas

Annex 3 – Technical background information and case studies

Annex 4 – Current stakeholder Working Groups

Annex 5 – Consultation Summary

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Annex 7 – SWOT analysis

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Section 1 - Introduction

Certain groups within society will experience the transition to net zero more acutely than others. This is particularly the case for island communities such as Shetland, which are highly reliant on hydrocarbons for their existing industries and lifeline services.

History has shown that areas which have experienced poorly managed, abrupt and unplanned transitions of the past remain disadvantaged in relation to education, employment and income levels compared to the rest of the country. Due to our high vulnerability to change, the urgency to change and the opportunities which may come from change, it is essential that Shetland takes a considered approach to ensure a Just Transition to Net Zero.

The Energy Strategy sets out the components of energy transition. When taken together, these sections help to navigate energy transition in Shetland by describing the whole energy system opportunities and challenges that need to be considered[1].

Shetland has been an energy hub for over 40 years and with that comes a wide range of infrastructure and capacity within the community all of which will be key enablers for energy transition. Shetland will make a significant contribution to the UK and Scottish Government's energy security and decarbonisation ambitions, becoming even more strategically important.

Ambition and vision

Our ambition is to achieve secure and affordable energy future for Shetland while reducing carbon emissions to net zero.

Our vision is that by 2045:

- We will have full access to clean, affordable and secure energy produced in Shetland.
- Energy Developers will have fully engaged with the Energy Development Principles across all four themes through project development, delivery and decommissioning.
- Shetland continues to have a skilled workforce and strong supply chain, building on the foundations which are currently in place.

Purpose

The development of the Shetland Energy Strategy has been Council-led to date and aligns to and builds on other strategies. It expands on the objectives of the Shetland Climate Change Strategy and the Inclusive Growth Work Packages that are led by the Shetland Partnership. While Council-led, this strategy is to be adopted externally within Shetland, across partnerships and relevant organisations. The strategy has been structured to align to: Place, Planet, Prosperity and People with a number of draft "Action Areas" to highlight the short and medium term action required to achieve a Just Energy Transition for Shetland.

The intended audience for the strategy is the local community and any stakeholders we wish to engage in energy projects.

[1] Nothing (whether express or implied) in this Energy Strategy, or any of the annexures appended hereto, shall be construed as fettering the discretion of, or constituting a predetermination by, Shetland Islands Council in the exercise of any of its statutory rights, powers, duties, discretions or functions.

The Shetland Energy Strategy has three purposes, to:

1) provide information and awareness on how Energy Transition will impact Shetland,

2) act as a blueprint for developers, funders, and decision takers to consult

3) hold accountable the key partners that implement the actions

Our Strategic Scope

Given the scale of the challenge and proposition that we face, it is important that we begin by setting out what the terms of reference need to be for the Energy Strategy. The terms of reference are described below:

- To embed the Just Transition principles for Shetland society including sustainable work and affordable energy
- To identify the whole energy system led action areas, the timing for those actions and the funding for those actions
- To guide Shetland's fuel use to net zero carbon emissions in all economic and social activities,
- To put in place a governance and communications system to enable wide public engagement, representation with energy developers and with government agencies

Our Challenge and Proposition

Managing the response to Climate Change is the biggest challenge that the human race has faced. This is a huge proposition at international and national levels and impacts down to local scale. Such massive change presents us with the opportunity to transition to a fairer more affordable energy system for Shetland. Our work ties in with the need to reduce our emissions as set out in the Shetland Net Zero Route Maps (NZRM)[2] and the need for places such as Shetland to be prioritised in the planning and delivery of a "Just Transition", given our high dependency on hydrocarbons for our key economic sectors and essential lifeline services[3].

Challenges:

- Clean, secure and affordable energy in the short, medium and long term along with the infrastructure required to move, store and use the energy;
- The different scenarios which may play out;
- How to maximise opportunities and overcome challenges; The knowledge, skills and capacity required, and,

Our proposition is:

- Exploring energy transition for Shetland's whole energy system
- Creating pathways to enable a Just Transition to net zero.

[2] What are we doing? – Shetland Islands Council

[3] Shetland Islands Council Committee Information - Submission Documents

What is 'energy transition'?

Energy transition is the transformation of the global energy sector from fossil fuel based to zero carbon sources. For this to be successful, energy related CO_2 emissions have to be significantly reduced by the middle of the century in order to mitigate climate change and limit global temperature to within 1.5°C of pre-industrial levels.

The global outlook prepared by the International Renewable Energy Agency (IRENA) provides further information from a global perspective on the six components of energy transition[4]. These are:

1. Energy efficiency
2. Generate electricity from renewable sources.
3. Electrification.
4. Use of clean hydrogen and other derivatives for hard to decarbonise sectors and industrial processes.
5. Carbon Capture and Storage (CCS in industry – The UK's independent climate advisors, the Committee on Climate Change, predict it would be difficult to achieve climate change ambitions without CCS[5]).
6. BECCS (Bioenergy with Carbon Capture and Storage) and other carbon removal measures.

Energy transition in Shetland will touch on each of these six factors, which are discussed in further detail in subsequent sections.

What is 'Just Transition'?[6]

Energy transition can follow various routes to net zero but if it is to be successful it needs to be a "just transition". The Scottish Government report, Just Transition – A Fairer, Greener Scotland[7] (September 2021) defines a ***just transition*** as:

> *both the outcome – a fairer, greener future for all – and the process that must be undertaken in partnership with those impacted by the transition to net zero. Just Transition is how we get to a net zero and climate resilient economy, in a way that delivers fairness and tackles inequality and injustice (p.5)*

The three principles of social justice are[8]:

Distributional Justice - is there a fair distribution of impacts, including both burdens and benefits?

Procedural Justice- how are decisions made and what measures are in place to facilitate an inclusive process?

[4] Outlook (irena.org)
[5] EnQuest have been awarded 4 blocks and are currently undertaking investigations https://www.enquest.com/media/press-releases/article/enquest-plc-awarded-offer-of-carbon-storage-licences
[6] PB1_social_justice_V2.3.pdf (uhi.ac.uk) Full paper Diving into a just transition: How are fisheries considered during the emergence of renewable energy production in Scottish waters? - ScienceDirect
[7] To read the entire document, go to: https://www.gov.scot/publications/fairer-greener-scotland-programme-government-2021-22/
[8] PB1_social_justice_V2.3.pdf (uhi.ac.uk)

Recognitional justice - Who is represented or ignored and how can underrepresented groups be recognised?

As highlighted above we know from history that where a transition is abrupt and unplanned change can take decades to recover from. We also know that energy transition has to happen, fossil fuels are a finite resource and the emissions associated with their combustion are driving climate change.

In Shetland a "Team Shetland" approach is being taken. Specific groups are taking forward different aspects of energy transition, with the Shetland Partnership having an overarching role to promote inclusive growth. The Energy Strategy provides greater detail on how the different components link to ensure that there is a high level of communication and collaboration.

There is a wide energy ecosystem of working groups and organisations that hold interests in addressing the energy future of Shetland. This ecosystem is essential for driving the delivery of the energy strategy, but it is necessary to define how and where these groups best fit together.

One place to deliver this strategy across Shetland is under the Shetland Partnership. The Partnership has 5 different programmes of work:

- Local, Place based collaborative working
- Mitigation of & Adaptation to climate change
- Shifting the balance of care
- Reducing inequalities through promoting kindness
- Reducing inequalities through inclusive growth

We propose that the Shetland Energy Strategy is one of the first pieces of work to develop under the Inclusive Growth work package within the Shetland Partnership. This will become the body to monitor and assess the progress and gaps within the action plans across organisations and workgroups.

Long Term Outcomes

The long term outcomes of the Energy Strategy are as follows:

	Long term outcome	**Target**
1	Reduce Emissions*	Bring Shetland land and marine based energy emissions to net zero and contribute to national targets through the export of clean energy.
2	Secure affordable energy.	Secure all Shetland energy consumption from affordable islands-based generation
3	Create & Retain Local Wealth.	Generate £100m a year of diversified economic revenue to the Shetland economy
4	Skills and capacity development.	Local supply chain adapted and grown to support new industries in clean energy employing 500 people in Shetland

*Does not include the carbon emissions from our peatlands which needs to be addressed over a longer timeframe, and is not directly linked to energy transition.

Strategy Development and Structure

About this strategy

The vision and long term outcomes for the Energy Strategy look out to 2045 but, as there are many unknowns in the shorter term, the energy strategy will be iterative, developing as technology advances become more certain and infrastructure investment decisions are made.

Following the acknowledgement of a climate emergency by the Council back in 2020, the Council initiated the climate change programme. One of the first actions undertaken was to commission the NZRM[9] for Shetland. This study provides detailed information on the magnitude of the challenge to reach net zero in Shetland. This is however only part of the story. If Shetland is to remain a viable place to live and work it is essential that we support our existing industries to develop and transition in a diversifying economy. The third task relates to the cost of energy. We have faced the enduring challenge that, while we are a major energy hub, we pay the highest amounts for energy and have high levels of fuel poverty. This challenge has been magnified over the past two years when energy prices have increased significantly.

The energy strategy has been developed to look in more depth at the different components of energy transition and how we can achieve a just transition to net zero. Looking at the whole energy system for Shetland considering energy generation, infrastructure, energy use, the cost of energy, maximising the benefits of energy transition to the community along with the necessary skills both relating to our day to day lives and the jobs opportunities.

Research & Development

This strategy has developed through many conversations with contributions from third parties coordinated by the Future Energy Team with consideration for the existing and emerging energy related strategic frameworks.

See Annex 5 the consultation summary including a list of previous strategies.

Format

The document is split into sections that describe the main components of energy transition. Taken together, these sections help to navigate energy transition in Shetland by describing the whole energy system opportunities and challenges that need to be considered. The strategy is iterative because, while there is a general understanding about what needs to be done to mitigate against climate change, the challenge is how to do that and achieve the essential wider benefits. Section 2 considers the drivers for change and the future scenarios. Annex 2 Action Areas provides a summary of the short and long term actions required to meet our long term outcomes.

Stakeholder engagement

Work began on the Shetland Energy Strategy in early 2022, based on a wide range of continuing conversations with contributing organisations hosted by the Council's Future Energy Team. A comprehensive, although non-exhaustive, list of stakeholder working groups, partnerships and strategic frameworks are included in Annex 4 stakeholder working groups, to highlight the linkages of the Shetland energy ecosystem.

[9] What are we doing? – Shetland Islands Council

Having an awareness of the different groups and their reporting lines is important to reduce duplication and to ensure communication is efficient. Energy transition is a massive challenge which needs to be approached from a wide range of different angles, and there isn't the time or resource to duplicate effort.

We are grateful to all of the organisations who have provided case studies and support for the development of this strategy, further information can be found in Annex 2 and Annex 5 Consultation Summary.

Strategy Delivery

While the strategy development has been Council led, successful delivery depends on a large range of stakeholders and external organisations. This approach is based on Shetland's proven record of strong partnership working.

Action Planning

The Shetland Energy Strategy has identified four long term outcomes. Annex 2 Action Areas provides a summary of the short and medium term actions currently identified across the four themes of Planet, Place, Prosperity and People.

Action Areas - Introduction

1	Leadership and Governance	In progress. Dedicated Energy Steering Group (working title) and sub groups being designed. Updated Shetland Partnership Delivery plan 2023/28	**HIE and SIC (Future Energy and Economic Development)**	1. Review and streamline the eco system of energy stakeholder working groups.	1. Continue to review the energy strategy Governance arrangements for Shetland as priorities change.

Place

Section 2 – Drivers for Change and the Pathways to Change

Introduction

This section examines the driving forces that sit behind the four long term outcomes set out in section 1. These all relate to the international and national goals for reducing carbon emissions which we are obligated to meet. Energy transition in Shetland will have far reaching consequences for our community and there are various routes that we may take depending on a wide range of influences, some of which are beyond our control. The section begins with the international, national and local net zero targets that have been set, then explores the impact of climate change drivers on our long-term outcomes. We go on to discuss what a Just Transition means and to set out the Energy Development Principles that have been agreed to influence energy development projects. The section ends with a scenario planning exercise to show the difference between passive and active engagement as energy transition becomes an ever more prevalent part of our lives.

Net Zero Targets

International

United Nations Sustainability Goals

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs) see figure 2, which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

The UN goals fit with Shetland's own needs and priorities. Many communities and industries are already striving for sustainability, and these efforts are paying dividends to the health and connectedness of the community. We need to ensure that no one is left behind with economic progress, social justice and inclusion, protection of the climate, environment and biodiversity.

Figure 1 UN Sustainable Development Goals

International Energy Agency (IEA)

In May 2021, the IEA published Net Zero Emissions by 2050: A roadmap for the Global Energy Sector. This report was updated in September 2023[10] to reflect the many changes which have taken place, notably the global energy crisis. The report highlights that while global energy sector emissions have continued to increase there has been progress in the development and deployment of key clean energy technologies.

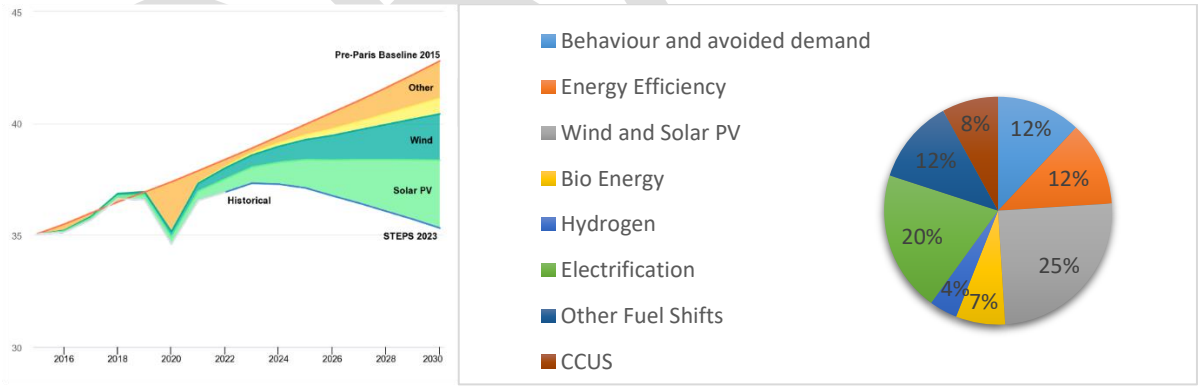


Figure 2 Cumulative CO_2 savings across a range of technologies Source IEA

Figure 3 above highlights the cumulative CO_2 savings and the range of technologies which will be required to meet net zero.

[10] Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach – Analysis - IEA

National

Both the UK and Scottish Governments have set a number of ambitious targets which are summarised in the table below. Many areas of energy policy are reserved to the UK Government. However, it is often unclear how these targets will be met, where these developments are to happen, along with the associated infrastructure that will be required to enable them to materialise.

Shetland's role in energy transition is of national importance, as it has been for the past 50 years. Shetland is at the heart of a highly productive energy region both for oil and gas and renewable energy, discussed further in section 3. Change is inevitable and, as many of the decisions in relation to energy are out with our control, the development and recognition of the Energy Development Principles is vital. Decisions in relation to energy need to be made in a holistic fashion to a specific geographic area, taking into consideration the resources available and the infrastructure required too. In addition to the high-level decisions on energy generation we must also find local solutions to the national targets. For example, the highly ambitious national target of reducing fuel poverty to 5% by 2040 or the targets for building performance. These targets will be difficult to achieve without a localised approach being taken.

Scottish Government Climate Change (Emissions Reduction Targets) Act 2019 (Scotland)	Net zero by 2045 Interim targets 75% by 2030 90% by 2040. Councils are required to reduce their operational GHG emissions to meet a net zero target by 2045 at the latest. Energy Strategy Position Statement 2021 Provided an overview of the Scottish Government's key short to medium term priorities.
Scottish Government	**Onshore wind** 20GW installed by 2030 **Offshore wind** 8-11GW installed by 2030 **Hydrogen** 5GW of renewable and low carbon hydrogen by 2030, 25GW by 2045
UK Government Policy paper Net Zero Strategy: Build Back Greener published in 2021 updated 2022[11] Policy Paper British Energy Security Strategy[12]	**Power** Decarbonise the UK power system (electricity) by 2035. Subject to security of supply 50 GW of offshore wind by 2030 Moving towards 1GW of floating offshore wind by 2030 Deployment of flexibility measures (like storage) to smooth out future price spikes **Hydrogen** Deliver 5 GW of hydrogen production capacity by 2030, whilst halving emissions from oil and gas **Industry** Deliver four carbon capture usage and storage (CCUS) clusters, capturing 20-30 MtCO2 across the economy, including 6 MtCO2 of industrial emissions, per year by 2030 **Heat and Buildings**

[11] net-zero-strategy-beis.pdf (publishing.service.gov.uk)
[12] British energy security strategy - GOV.UK (www.gov.uk)

	Set a path to all new heating appliances in homes and workplaces from 2035 being low carbon **Transport** Remove all road emissions at the tailpipe and kickstart zero emissions international travel **Greenhouse Gas Removals** An ambition to deploy at least 5 MtCO2 /year of engineered GGRs by 2030.

Climate Change Local

At a local level the Council has approved the Shetland Islands Council Climate Change Strategy[13] and Action Plan to set out how the Council will achieve its ambition of being net zero by 2045. The Council is also working in collaboration with local community planning partners to prepare the Shetland Climate Change strategy based on the Shetland Net Zero Route Map[14] completed in 2022.

Figure 3 Shetland Islands Council Climate Change Conversation Logo

Community led change and engagement

The Climate Change Conversation was set up to ensure the Shetland community is engaged in climate change and represented within actions to address it. This initiative provides opportunity and space for a flow of communication between the community, the Council and partner organisations.

Community led change in relation to energy transition is discussed further in Section 9 People Powered Change.

[13] What are we doing? – Shetland Islands Council

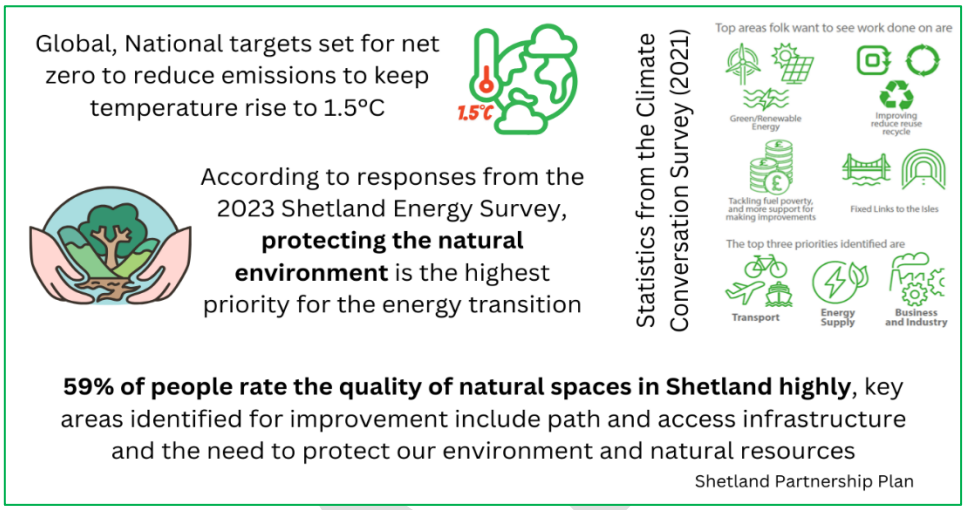
[14] https://www.shetland.gov.uk/downloads/file/6460/shetland-net-zero-route-map

Long Term Outcomes & Drivers for Change

Long term outcome 1 – Reduce Emissions

Target: Bring Shetland land and marine based energy emissions to net zero and contribute to national targets through the export of clean energy

Where we are now



A target has been set for Shetland to be net-zero by 2045, there are sections of the community that are easier to decarbonise than others and there are numerous "wicked" problems where there is no obvious solution. It is therefore essential that a place-based approach is taken to ensure no one is left behind.

Shetland has a precious marine and terrestrial ecology and bio-diversity. Long-term environmental protection and sensitive and balanced development are therefore imperatives.

Opportunities	**Challenges**
• We have a strong awareness of the need to change. • Shetland has an excellent renewable energy resource, good infrastructure and a strong and extensive supply chain. • High energy prices have brought into focus the need to reduce consumption and insulate ourselves from global energy markets. • Extensive experience of Marine spatial planning and environmental monitoring	• Changing government priorities • There are various routes to net zero, we need to find the one which suits Shetland. • Many decisions are out with our control, making communication and engagement essential. • How will it be paid for

Co – benefits
• Community participation and engagement
• Affordable energy
• Create and retain local wealth:
  ○ By supporting existing industries and households to decarbonise,
  ○ The development of new opportunities associated with the transition to net zero.	

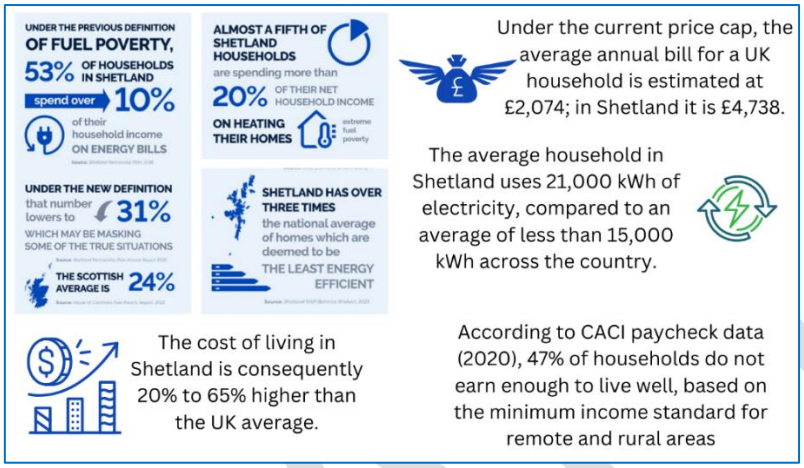
Indicators for change	

- The Net Zero Route Map provides a framework for the monitoring of emissions.
- Reduction in the amount of imported fossil fuels
- Reduction in energy consumption, bearing in mind changes in energy consumption such as the transition towards electric heating and electric vehicles.

Long term outcome 2 – Secure affordable energy

Target: Secure all Shetland energy consumption from affordable islands-based generation

Where we are



There are various routes to net zero and it is important that we take the opportunity to achieve the best outcome for Shetland.

The importance of a secure affordable energy supply has been acknowledged throughout history. For example, peat, as an abundant, largely free fuel contributed towards enabling people to live in Shetland in the past. Several factors led to its decline, but families having more money to pay for services was a factor in households deciding to transition to electricity and oil, which were cleaner and easier to use. We need to ensure that along with being clean, energy is secure and affordable.

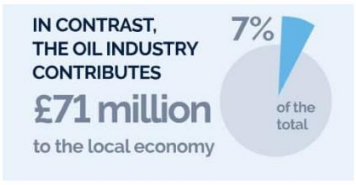
Opportunities	**Challenges**
• Have developed and operated one of the largest district heating schemes in Scotland, which could be replicated elsewhere. • Rebalancing control of energy supply so that Shetland communities become less attached to restrictive national energy policies, • Potential new electricity demand for hydrogen production and electrification of offshore installations. • High energy prices focus attention • There are ambitions from the UK Government for communities located close to energy generation to benefit from lower energy prices.	• Investment in infrastructure, these developments have a long lead time • Importing clean energy fuels to replace hydrocarbons will be more expensive making Shetland less competitive with higher still levels of fuel poverty, • Inability to reduce costs of alternative energy solutions, • Limited grid connection capacity • Key economic sectors and lifeline services are some of the most difficult to decarbonise.

Co – benefits • Reduced emissions • Grow our prosperity in an equitable way
Indicators of change • Reductions in the cost of energy • Reduction in fuel poverty • The Community feel they can influence decisions affecting their local area

Long term outcome 3 – Create & retain local wealth

Target: Generate £100m+ a year of diversified economic revenue to the Shetland economy

Where we are



Scotland's Census 2011 estimated that the administrative area of Shetland has a population of 23,167, with the main administrative centre being Lerwick which is home to roughly 7,000 inhabitants.

Economic performance in Shetland remains strong but energy transition will have a direct impact on existing industries, therefore these need to be supported both to decarbonise and to engage with project developers on a range of fronts, from the protection of our natural environment through to ensuring Shetland based businesses are best placed to maximise new economic opportunities. For further discussion see section 7.

Opportunities	Challenges
• Existing energy hub, for 50 years • Outstanding renewable energy resource • Extensive experience of marine spatial planning • Have a strong adaptable marine sector • Have existing infrastructure to build from • Cooperation and collaboration	• Direct competition on space and resources. • Limited labour force • Finance • Developers may stick with their existing supply chain and keep tasks in house, which will require expertise to be brought in rather than developing the local supply chain.

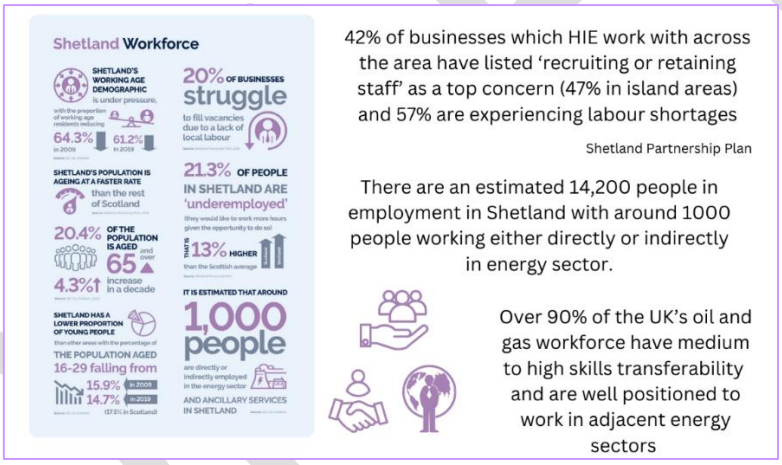
• New accommodation development and finance models.	
Co benefits • Supply chain and employment opportunities • Increased income is a key component of affordable.	

Indicators for change
• GRDP for Shetland.
• Balance between the economic sectors for:
  ○ Output,
  ○ Jobs, and,
  ○ Value added.	

Long term outcome 4 – Skills and capacity development to support energy transition

Target: Local supply chain adapted and grown to support new industries in clean energy employing 500+ people in Shetland

Where we are



Shetland has an established skilled workforce with many skills that are transferrable and adaptable. However, Shetland has an aging population and a shortage of workers across a wide range of occupations. The current labour market statistics highlight that the job density[15] for Shetland in 2021 was 1.12, the Scottish average was 0.81.

Opportunities • High educational attainment • Culture of innovation, inclusion and skills development • Cooperation and collaboration	**Challenges** • Low unemployment • Ensuring everyone has the same opportunities • Accommodation and services
Co benefits • Supply chain and employment opportunities • Increased income is a key to making life more affordable.	
Indicators for change • Shetland age demographic	

[15] The ration between the total jobs and the population aged 16-64

- Job density
- Household income CACI data
- Underemployment
- Employers struggling to recruit

Just Transition and Energy Justice

The importance of ensuring a Just Transition is recognised at National and International levels. Within Scotland, the Just Transition Commission provides a working definition of a just transition process as "Governments design policies in a way that ensures the benefits of climate change action are shared widely, while the costs do not unfairly burden those least able to pay, or whose livelihoods are directly or indirectly at risk as the economy shifts and changes". This definition recognises the principles of sharing benefits and burdens fairly to avoid future injustice and inequality due to an economic transition and could also be extended to considering climate impacts and the effects of adaptation interventions. However, this can only be achieved with an empowered community to support and drive change, ensuring no one is left behind.

> *Energy justice refers to achieving equity in both the social and economic participation in the energy system, while also remediating social, economic and health burdens of those disproportionately harmed by the energy system (frontline communities")*[16][17].

Energy Justice is therefore an important component of any discussion on achieving a just energy transition for Shetland.

Shetland Energy Development Principles

The Shetland Energy Development Principles is one of the main mechanisms being developed to help deliver a Just Transition for Shetland.

The Shetland Energy Strategy aims to rationalise energy transition, to help make the process easier to engage with. Shetland Islands Council recognises that it is not the consenting authority for many of the energy generation projects that will come forward in Shetland and its surrounding seas. Those powers sit with the UK and Scottish Governments and their agencies.

However, the Council is equally clear that it does have a very important role in community leadership including the obligation to promote and represent the Islands interests and facilitate and support all sectors of the community to understand and contribute to the energy transition we all have to make.

Therefore, we will encourage all stakeholders in potential development to recognise the principles set out below and commit to following them throughout the planning and delivery of projects; as well as full engagement in and compliance with all necessary consenting processes and any associated conditions.

Environmental Protection	Local Supply Chain Integration

[16] PB1_social_justice_V2.3.pdf (uhi.ac.uk)

Full paper Diving into a just transition: How are fisheries considered during the emergence of renewable energy production in Scottish waters? - ScienceDirect

[17] Section 1 - Defining Energy Justice: Connections to Environmental Justice, Climate Justice, and the Just Transition - Initiative for Energy Justice (iejusa.org)

• Climate Change impact and mitigation • Impacts and protection of wildlife and bio-diversity on and around Shetland • Protection of the Shetland landscape and seascape and containment of impacts on it	• Jobs in Shetland • Contracts and opportunities for Shetland businesses • Commercial Infrastructure • Skills and Training for current, and new, Shetland residents
Sectoral Co-Existence	**Benefits to the Shetland Community**
• Competition for mutually important locations • Impacts on the sustainability of our key natural resources • Any other beneficial or detrimental interactions between sectors	• Fair Share of value from all developments, offshore and onshore • Financial Benefits to the community • Product Benefits; e.g. affordable energy for Shetland households • Public Goods Benefits

Good communications and effective engagement will allow all parties involved in promoting and regulating proposed developments to understand the Shetland community, our aspirations and concerns and build strong and effective partnerships.

We are optimistic and confident that Shetland's successful track record of delivering technologically advanced, economically balanced and environmentally responsible developments can be replicated in the new energy transition we all have to make.

Future Energy Scenarios

The transition to net zero has many unknown aspects and there are various routes that we can take. We recognise that external factors will have a huge impact on achieving a Just Transition and the key to managing change most effectively will be through high levels of engagement and communication.

We will see local change and the need to develop local solutions in response to national guidance.

It is therefore necessary that we consider our energy future and what is feasible for a clean energy vision as there will be various opportunities and challenges associated with the decisions which need to be made.

The energy strategy uses 3 scenarios, Business as Usual (BAU), a high ambition Pathway A and a best case Pathway B - all building on the scenarios used in the Shetland Net Zero Route Map.

Scenario 1 – Business as Usual (BAU)

The BAU scenario is intended to show the changes that could occur if no additional local action was taken to mitigate emissions in the Shetland region, beyond those that are already planned and committed.

What does this look like?

Assumption: no additional local action is taken; no more energy developments beyond those in the construction phase

Reduce emissions	• No further energy generation in or around Shetland other than that already consented,

	• 600 MW interconnector to the UK Mainland with potential for further developments such as the electrification of oil and gas assets in line with national strategies • Minimal upgrades to the distribution grid, limiting community renewable energy connections or smart grid solutions locally. • No additional support for projects to reduce energy consumption. • No further upgrades to ports and harbours beyond that already consented
Secure & affordable energy	• No action and minimal engagement on affordable energy,
Create & retain local wealth	• Limited engagement with developers to maximise opportunities locally which would benefit the local supply chain. • Limited science backed research to support environmental protection and sectoral co-existence. • No active pursuit of competitive funding opportunities
Skills and capacity	• Limited communication and engagement, • Behaviour change limited to reactive change. • Jobs & Skills -

The BaU scenario assumes that no further energy generation will occur on island beyond what is in the construction phase of development in the year of publication. A Shetland resistant to an energy transition and the accompanying developments could look similar to the Shetland of the 1950s and 1960s before the North Sea oil & gas industry developed here. An active community and Council push back against energy projects both on and offshore could lead to a decline in the energy industry as other locations become more favourable.

This scenario is very unlikely as there is already a high level of engagement with the energy sector and more developments look like progressing.

There would still be national actions taking place such as offshore wind and oil and gas developments, which would change energy generation in and around Shetland. In this scenario we assume such developments would happen as decisions are made outside Shetland but with minimal local engagement.

Scenario 2 – Pathway A

Pathway A, is a 'best guess' at what a high-ambition, but nonetheless realistic, future might look like. Conceptually it is similar to the Climate Change Committee's 'Balanced' net zero pathway, which 'makes moderate assumptions on behavioural change and innovation and takes actions in the coming decade to develop multiple options for later roll-out (e.g., use of hydrogen and/or electrification for heavy goods vehicles and buildings).[18]' Due to Shetland's atypical emissions profile, multiple adjustments have been made to this to reflect local circumstances more accurately.

From the Shetland Net Zero Route Map

[18] https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

What does this look like?

Assumption: what we can realistically achieve with high levels of ambition, but investment and collaboration for energy transition projects is limited making them suboptimal.

Reduce emissions	• Local energy generation associated with demand on a range of scales • Engagement with developments in or around Shetland where consented are awarded by another party such as the Energy Consents Unit at the Scottish Government • 600 MW interconnector to the UK Mainland with potential for further developments such as offshore electrification in line with national strategies, • Upgrades to the distribution grid to enable further local renewable energy generation and electrification. • Additional support for projects to reduce energy consumption for buildings and transport. • Investment in port and harbour infrastructure following engagement with developers to understand what would be required for offshore wind, decommissioning and the use of future fuels within the marine fleet.
Secure affordable energy	• Action and engagement on affordable energy, • Local solution to the roll out of smart meters, widening the range of options available to customers.
Create & retain local wealth	• Engagement with developers to increase opportunities locally which would benefit the local supply chain. • Science backed research to support environmental protection and sectoral co-existence.
Skills and capacity	• Good communication and engagement but behaviour change is moderate due to the limits on wider transformational change required to enable behaviour change. • A Just Transition route map for Shetland prepared

This scenario will require high levels of local investment, and would be difficult to progress without the establishment of an Energy Strategy for Shetland. A good example of this is that there is still some local investment in the Viking Energy Project but at a vastly reduced level than the early ambition for a major community ownership.

Scenario 3 – Pathway B

Pathway B, explores the maximum reduction that could be achieved in a best-case scenario if key sectoral targets were met or exceeded. This would require higher uptake of more costly measures and the removal of various other practical obstacles. Because the aim is not only to reduce emissions, but also to reduce energy demands as much as possible, there are slightly different choices about the technology and fuel mix. Pathway B also assumes that all or most fossil fuel use in business and industry can be phased out, even where there is presently no information available as to the end use of those fuels, which makes it difficult to identify suitable mitigation measures at present. The other key difference is that Pathway B is more optimistic about opportunities to restore peatland and decarbonise agricultural activities.

From the Shetland Net Zero Route Map

What does this look like?

Assumption: How far could we go if money, risk aversion and engagement were no obstacle; doing the most; high levels of collaboration with strategic investment with a holistic approach.

Reduce emissions	• Community or shared ownership in energy generation. • Place based approach to reduce local energy consumption and develop new systems which make it easier for individuals, communities and businesses to transition. • A shared energy ecosystem for Shetland maximising the use of existing infrastructure and brownfield sites with full engagement to understand the capabilities required for offshore wind, decommissioning and the use of future fuels within the marine fleet. • Overall masterplan where Shetland is an energy hub fully integrated within a network of energy hubs across the North Sea.
Secure affordable energy	• Both long and short term solutions found to deliver affordable energy in Shetland. • Energy market reform results in long term stable and affordable energy prices, with a mixture of tariffs. • Community schemes insulating Shetland from global energy markets.
Create & retain local wealth	• Maximum community benefit through a variety of ownership models, supply chain integration, rental, displacement payments and direct community benefit. • Maximum local content in projects with Shetland becoming a centre of expertise in energy transition, enabling the replication of projects in other sites around the world. • Supply chain expanded and diversified. • Fully integrated science backed research to support environmental protection and sectoral co-existence. • Full engagement and collaboration between the community, developers and the consenting authorities in and around Shetland with a Masterplan for the area to enable sectoral co-existence.
Skills and capacity	• Good communication and engagement with high levels of behaviour change and participation in the energy transition. • A Just Transition route map for Shetland prepared

A shared energy island vision for Shetland is the basis for this scenario. Shetland's strategic location in the North Sea provides ample wind, wave, and tidal renewable resources that could be harnessed to help decarbonise beyond just the island's energy system. With existing energy infrastructure and established collaborative channels, Shetland could offer a strong opportunity to become a leading clean energy hub by generating renewable energy and producing clean fuels on island. Through a proactive approach, Shetland will be able to have a say in the changes that will inevitably be made.

Realising Shetland as a clean energy hub will require collaboration across organisations & enterprise (in Shetland and internationally), regulatory bodies, local & national governments, academia, and local community. The demand for clean fuels will grow alongside the production of the fuels. Demand comes from transport (both on land and marine), domestic consumption (for heating, etc), and industrial processes.

A variety of technologies will enable the transition for Shetland: onshore & offshore renewables, electrification, district heating, hydrogen & its derivatives for clean fuels, carbon capture & storage, etc. A **whole island approach** would centre energy development on existing industrial land. Strategic planning and development will reduce the amount of new infrastructure needed, increase the co-existence with existing economic sectors as well as generate and retain wealth & jobs in Shetland.

An energy transition at this scale requires the full utilisation of the capacities that Shetland based organisations have and can provide, aligning government policy with public and private investment, and willingness for substantial change within the population.

This scenario will require high levels of local investment and engagement, and could not progress without the establishment of an Energy Strategy for Shetland.

Conclusion of Scenario Planning Exercise

Meeting the four long-term outcomes set in the Energy Strategy in full requires Shetland's pathway to a Just Energy Transition to align with Pathway B. Pathway A would still be beneficial in parts but would lead us to outcomes that fall short of what should be achievable.

Action Areas - for Section 2 Drivers for Change and Pathways to Change

2	Data and Monitoring	Net Zero Route Map, Shetland Partnership annual report, Shetland in Statistics, Environmental baseline report. Previous studies and projects	**Energy Steering Group**	2. Establish a monitoring and review process based on the 4 long term outcomes.	2. Continue to monitor progress against the four long term outcomes.	All
3	Alignment with national etc. net zero targets	Ongoing.	**Led by Energy Steering Group with input from various organisations depending on the nature of the consultation.**	3. Engage with consultations which relate to energy transition and share challenges and opportunities to highlight our legitimate interests and concerns. 4. Lead and inspire collaborative action on energy transition across Shetland- providing social,	3. Ensure alignment with national and regional targets and best practice relating to energy. 4. Highlight and share challenges and opportunities to meet these targets. Find best practice to guide our approach to the challenge or opportunity. Develop the future energy scenarios for Shetland as	All

				economic and environmental benefits to local organisations, businesses and the community.	technology progresses and emerges to support strategy development and identify interdependencies.	
5	Embedding a Just Transition and social justice	Build on research on social justice undertaken by UHI Shetland. Improve the Energy Development Principles approved Dec 22 Develop links with community planning process.	**Energy Steering Group and UHI Shetland**	5. We will develop, promote and implement the Energy Development Principles. With ongoing strategic direction and monitoring provided by the Energy Steering Group	5. We will encourage engagement from the community, as a Just Transition can only be achieved with an empowered community.	

Section 3 - Energy Generation

Introduction

Our current energy system has evolved to reflect technological innovations in energy production and use. This section provides a summary of different types of energy generation including: oil and gas, renewables, bioenergy, hydrogen and its derivatives. Section 4, considers how these fit within the whole energy system and Section 6 considers the use of energy.

Shetland is in the middle of a highly productive energy region. The islands have been an oil and gas energy hub for over 40 years and the excellent renewable energy resources provide an opportunity for renewable energy from onshore and offshore wind and tidal. In addition, there is potential for the generation of hydrogen and its derivative fuels along with biofuels.

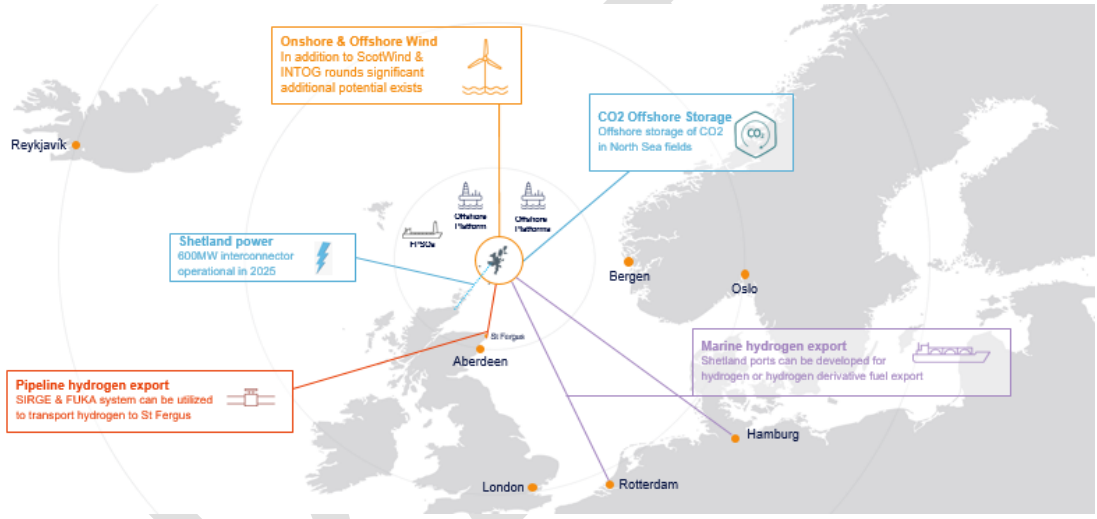


Figure 4 Shetland at the Centre of Europe's Energy Transition

The future Shetland energy system will be composed of a variety of technologies working together to cover all of our energy needs. The production of Oil and Gas is in decline and changing Government priorities make future predictions on the rate of decline unclear. We have an excellent renewable energy resource but technology readiness, the route to market for the energy and how the different components best complement one another is unclear. Therefore cooperation, collaboration and strategic planning are important to optimise all the available opportunities.

For more information on the following technologies, see Annex 3.

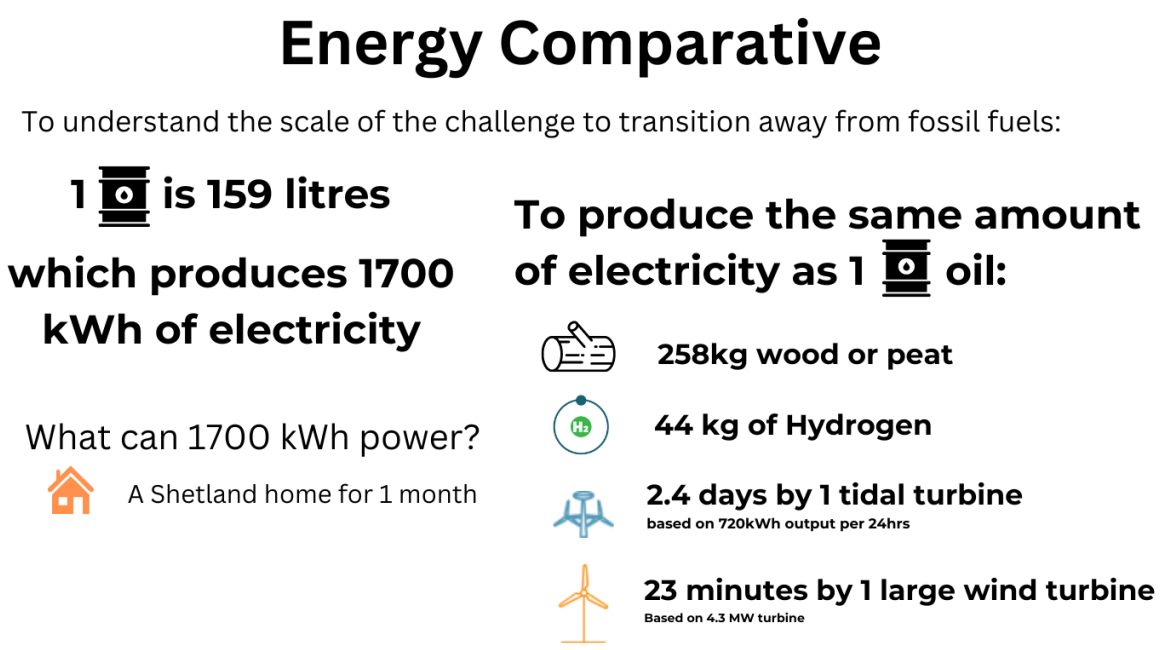


Figure 5 Energy comparator.

Oil & Gas

Current Situation

The islands have been an oil and gas energy hub for over 40 years. Over 8 billion barrels of oil have been exported from Sullom Voe since 1978. The Shetland Gas Plant did process 10% of the GB gas requirements when it opened in 2016, this has now reduced to 4%.

The infrastructure at Sullom Voe Terminal, the Shetland Gas Plant, to oil and gas fields east and west of Shetland with gas pipelines connecting Shetland to the UK Mainland forms a huge part of the UK's energy infrastructure. Lerwick's proximity to oil and gas activities, complemented by its deep-water capabilities mean the harbour is ideally placed to meet the needs of industry in the recycling and disposal of large structures. As a result Lerwick was one of the first ports in the UK to handle major offshore industry decommissioning projects. Following completion of recent capital developments Lerwick Port Authority have created a modern port to meet the sector's changing requirements.

In addition, our people have built up a wealth of knowledge and experience in engineering, logistics and other associated sectors, including environmental monitoring and marine planning.

Future

Shetland's involvement in oil & gas activities will depend on national politics, international supply and demand, regional competiveness and the state of the oil and gas reserves. However, the world needs to move on from oil and gas use as fast as it practically can.

The prospects for continuing oil and gas production through Shetland are uncertain at the time of writing. The staple Brent and Ninian systems are close to completion, and no decision has been taken on the future production of Clair oil through SVT beyond 2025. Shetland Gas Plant production is in decline. Should national energy policies continue to favour oil and gas production in the era of energy transition, Shetland could have a continuing nationally significant role. 40% of the remaining UK oil

and gas reserves lie to the West of Shetland. The reservoirs are well understood and it is unlikely that there will be any further large reserves discovered. This means that, irrespective of the climate emergency and the energy security agenda, we must plan for a Just Transition away from oil and gas. The eventual transition away from oil and gas is inevitable[19].

Many factors will affect political and commercial decision making in the oil and gas sectors determining whether oil and gas production will end in Shetland before 2030 or continue beyond 2050.

All of the Energy Majors have signed the UN Paris Climate Change Agreement to limit global temperature increase to 2°C in this century. We need to understand how they plan to meet this target, along with the opportunities and challenges for Shetland. We must ensure that these plans engage with the Energy Development Principles and the holistic energy solution for Shetland. As decarbonising offshore oil and gas facilities using shore power based on renewable energy presents a significant conundrum. Using that same energy to decarbonise UK homes or to produce hydrogen on Shetland would save more carbon emissions, contribute more to the net zero movement and provide a bigger economic impact. There would also be a wider impact as projects would require a clean source of power and a substation onshore to supply the power at the correct voltage and frequency, along with a cable network to connect to the assets. This is discussed further in annex 3 and the Scottish Government's Draft Energy Strategy and Just Transition Plan provides an illustration of the projected range of oil and gas production[20].

Reducing our dependence on oil and gas

In order to enable a just transition to net zero it will also be necessary to consider how we use oil and gas. Both as an energy source and as a key element in many manufacturing processes. Consumer demand will be a key driver for change.

The inevitable conclusion is that oil and gas production will still be required as part of the transition to clean energy. Oil & gas production and refinement will become cleaner and their industrial uses will reduce as the use of clean energy is prioritised but there will still be a global oil and gas industry in the net zero future.

Action Areas for oil and gas

6	Energy Generation - Oil and gas	Engagement with energy developers	**SIC, HIE, LPA, Supply Chain, Energy Steering Group**	6. Continue to engage with energy developers to encourage cooperation and collaboration	6. We will engage with oil and gas companies to contribute and encourage the progression of their general decarbonisation plans, within the	

[19] Draft Energy Strategy and Just Transition Plan (www.gov.scot)

[20] *https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/01/draft-energy-strategy-transition-plan/documents/draft-energy-strategy-transition-plan/draft-energy-strategy-transition-plan/govscot%3Adocument/draft-energy-strate*

					whole energy system for Shetland, using the Energy Development Principles as the basis for discussion. 7. We will emphasise that clean energy produced in and around Shetland should have priority use for achieving clean, secure and affordable energy for Shetland and for on-island wealth creation.	

Renewable energy generation

In addition to oil and gas, Shetland has an excellent renewable energy resource. The UK and Scottish Governments have set ambitious targets for renewable energy generation. Shetland will have a role to play in meeting these targets. However, due to our location, the development of renewable energy generation will be determined by the route to market for the energy. It is therefore essential that energy generation is considered within the whole energy system.

This section covers the different types of renewable energy generation that are applicable to Shetland.

Onshore wind

Current Situation

Shetland has an exceptional wind resource. With the highest average annual wind speed in the UK at 16.8mph[21] and the highest average capacity factor, meaning a turbine in Shetland will produce more power than an equivalent turbine on the mainland. This has been proven by the turbines at the Burradale Wind Farm which have an annual average capacity factor of 52%, compared to a UK average of 28%[22].

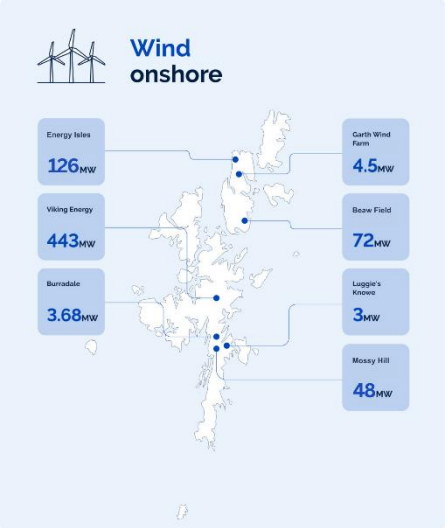


Figure 6 Onshore wind

At the time of publishing, Shetland has over 11MW of wind energy connected to the distribution network, all of which is locally owned.

While Shetland has this resource, the local electricity distribution and transmission networks are highly restricted, limiting the amount of renewable energy generation which can be connected. For further information on the whole energy system and associated infrastructure see Section 4.

The 443MW Viking Wind Farm is under construction with a further 246MW planned across 3 sites.

Future

Onshore wind will play a large role in decarbonising the GB energy system.

Any additional onshore wind will be considered in line with planning guidelines. However, due to the constraints on the Shetland electricity distribution and transmission networks, any additional onshore wind should to be considered within the whole energy system for Shetland.

We will seek to prioritise and support onshore generation on and around existing and consented sites rather than very large new developments in other areas, however Shetland Energy Development Principles must apply to all.

[21] Data from the Met Office can be found at https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/wind/windiest-place-in-uk

[22] The data about Burradale Wind Farm's capacity in comparison to the UK average: https://www.burradale.co.uk/

Opportunities

- Excellent wind resource
- Established technology
- £/MW to install a wind turbine has reduced
- Community benefit is voluntary but is established

Challenges

- Over development in a limited land area 1,466km2
- Need to protect and improve our existing natural resources e.g. peat bogs
- Route to market for energy
- Local supply chain support and back up from manufacturers
- Project finance.

Offshore Wind

Current Situation

Offshore wind is relatively new and floating offshore wind is another step in development. The world's first commercial floating offshore wind site is the 30MW Hywind Scotland project developed off Aberdeen, and commissioned in 2017. This was followed by the 50MW Kincardine Offshore Windfarm also off Aberdeen which became operational in 2021. This is the largest offshore floating wind farm in the world at the time of writing, and operates in depths between 60 and 80 metres. Further larger floating offshore windfarms are under construction and planned

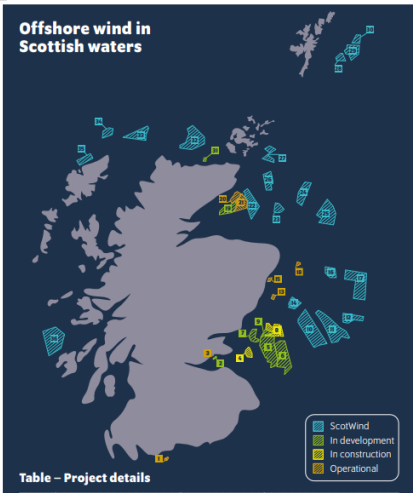


Figure 7 Current offshore wind projects source Crown Estate Scotland https://www.crownestatescotland.com/scotlands-property/offshore-wind/current-projects

The future

Option Agreements have been signed for 2.8GW by 3 developers on the NE1 site to the East of Shetland through ScotWind figure 8, with interest in further sites and further ambition from the Scottish and UK Governments to encourage further offshore wind.

It is expected that the scale up of offshore wind technology will happen rapidly. In order for this to happen extensive research is required: for technology development and site specific marine research.

The strategy acknowledges that offshore wind will impact marine biodiversity and other users of the sea. However, the Council has little control of the waters beyond 12 miles or projects over 50MW. As these decisions are approved by the Marine and Energy and Climate Change Directorates at the Scottish Government/ Crown Estate Scotland[23]. The Energy Development Principles are used to guide discussion with any prospective developers.

The route for taking all this energy to market is a key unknown and will be a significant factor in all future energy scenarios for Shetland. The options currently being considered include:

- An electric interconnector to the mainland UK.
- An electric interconnector to Shetland for conversion to hydrogen and potential further processing to ammonia, e-methanol or other synthetic fuels.

[23] Marine renewable energy - gov.scot (www.gov.scot) Sectoral marine plan for offshore wind energy - gov.scot (www.gov.scot)

- Conversion offshore at the wind farm to hydrogen, with either a pipeline or vessel to transfer to market.

The hydrogen economy is discussed in further detail in Section 4.

Opportunities

- Wind resource
- Existing onshore infrastructure for marshalling and assembly along with ongoing operation and maintenance.
- Onshore downstream activities to get the energy to market.
- Local works license consenting processes for cabling and interconnectors and the land sea planning interface.

Challenges

- Balance between different demands on our seas.
- Route to market for energy.
- Technology development
- Understanding all of the infrastructure required both direct and indirect.

Tidal

Current Situation

Orkney and Shetland are global leaders in tidal turbine technology with plans to scale-up production and spread knowledge around the world to deliver clean, predictable electricity generation.

Shetland has a good tidal resource, supported by a comprehensive 2011 marine resource survey, encompassing wave and tidal energy around Shetland[24]. This valuable data was integrated into the Shetland Marine Spatial Plan[25], serving as an indispensable resource for developers investigating suitable sites. See figure 9 from the Shetland Islands Regional Marine Plan.

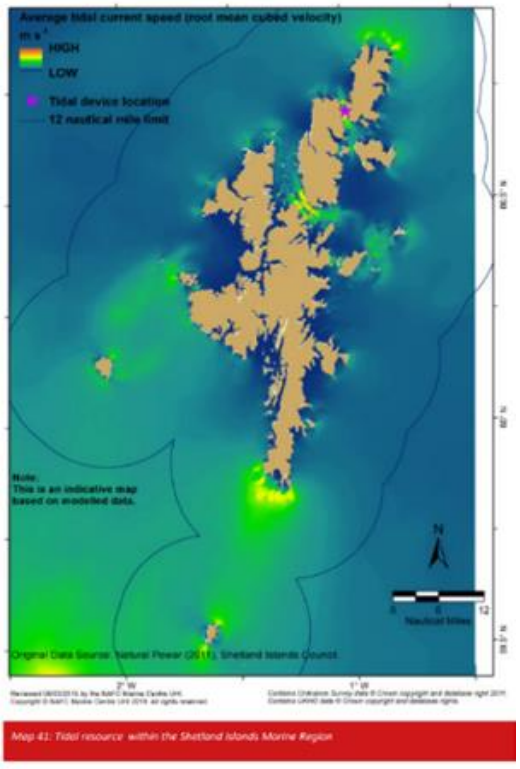


Figure 8 https://www.shetland.uhi.ac.uk/t4-media/one-web/shetland/research/document/marine-spatial-planning/sirmp/SIRMP_2021_Amended_Version.pdf Map 41

Future

The predictability of tidal power enables it to deliver system benefits, which are particularly important as the proportion of wind in our energy mix grows. Tidal energy can be more easily integrated with energy storage to provide baseload and dispatchable electricity than other intermittent renewable technologies (such as solar and wind).

Although tidal power companies like Nova are now making power reliably and moving away from

[24] untitled (shetland.gov.uk)
[25] SIRMP_2021_Amended_Version.pdf (uhi.ac.uk)

prototype demonstration towards mass manufacture, the cost of energy from the tide remains higher than wind or solar.

Over the coming decade we need to support tidal energy to further reduce their costs and support their journey towards commercialisation which will also help to diversify energy generation.

Opportunities

- Predictable
- Baseload electricity
- Not subject to the weather
- Cost reduction
- Range of technologies available to suit different sites
- Other renewables have gone before, lot of learning done already
- Tidal turbines typically smaller than a wind turbine of the same capacity

Challenges

- Technology still developing
- Sites limited geographically
- Route to market for energy
- Achieving competitive viability
- Need for steady support to allow the technology to mature
- challenging structural loads / vibration / biofouling

Wave

Current situation

A marine resource survey was commissioned in 2011 for wave and tidal energy around Shetland[26]. This data was combined into the Shetland Marine Spatial Plan to provide a valuable resource for developers investigating suitable sites[27]. See image 10 for summary.

Several wave developers have considered sites around Shetland but no projects have been developed to date.

The future

Wave technology is being investigated in other locations and may be developed in Shetland in the future.

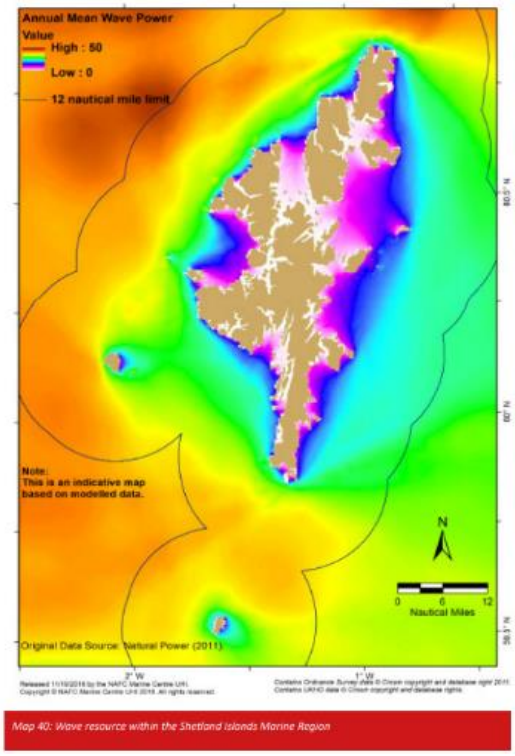


Figure 9 SIRMP_2021_Amended_Version.pdf (uhi.ac.uk). Wave resource Shetland

Opportunities

- Energy diversity
- Developing technology

Challenges

- Competition for marine space

[26] untitled (shetland.gov.uk)
[27] SIRMP_2021_Amended_Version.pdf (uhi.ac.uk)

Hydro

Current situation and future

Applications in Shetland are limited, various micro hydro sites have been investigated and the potential is low. Therefore, any projects need to be considered as part of a system. The Foula Electricity Scheme did have hydro as part of the energy mix on the island and have recently undertaken a study on the existing infrastructure to consider the options for reinstatement and connection to the island grid.

Figure 10 Quendale Mill

Solar

Current situation

Solar systems are a proven technology, which is highly versatile and scalable.

In Foula and Fair Isle, these systems have proven to be a good addition to the energy mix. The systems are most productive in the summer when there is less wind, providing a good balance with other renewables.

Figure 11 PV panels being installed on the roof of the Speldiburn Centre Bressay, picture Bressay Development Ltd website

The future

Solar energy will play a role in the future energy system for Shetland. As it is versatile, benefits from minimal maintenance and can operate on a range of scales. The Net Zero Route Map for Shetland includes targets of deployment of roof mounted solar technologies on c. 25% and c. 40%[28] of buildings for pathway A and B respectively. Targets have also been set within the Shetland Islands Council Climate Change strategy and solar is included within LHEES.

Similar to other electricity generation technologies the deployment of solar will be limited by grid capacity. Therefore, it is anticipated that the main application will be to reduce the amount of power a property requires from the grid. In addition, properties can benefit from the Smart Export Guarantee if they have a Smart Meter installed.

Opportunities

- No moving parts
- Minimal maintenance
- Wide range of applications.

Challenges

- Matching electricity generation with demand
- Upfront cost of purchase and installation
- Afterlife & recycling of panels

Geothermal

Current Situation

[28] Shetland Islands Net Zero Routemap (NZSR)

A study was undertaken in 2013[29] for SHE&P to explore options for expanding the district heating scheme in Lerwick. The results of the research was that a deep geothermal borehole to create a direct heat source is unlikely for Scalloway or Lerwick but there was some potential for Brae. Further investigation would be required to determine the suitability and match to a suitable heat load. As this study dates back to 2013 it would be necessary to re-evaluate the cost and business model. Geothermal energy is also being investigated offshore[30].

The future

Further research is required to understand the potential of deep geothermal in Shetland and how this energy could be best used.

Nuclear

The Scottish Government is currently opposed to the building of new nuclear stations using current technologies.

Existing nuclear is expensive and the construction of new nuclear plants take decades. As Shetland is highly restricted on energy export routes and there are various other alternative options nuclear would appear more suited to sites close to population centres.

Action Areas - renewable energy generation

7	Energy Generation – renewables	Engagement with energy developers	**SIC, HIE, LPA, Supply Chain, Energy Steering Group**	8. Continue to make strong connections with renewable energy development projects. 9. Prepare Full Business Case for Island Growth Funding.	10. We will support and encourage research and development of renewable energy generation in and around Shetland. 11. We will support and encourage further research to understand the physical capacity and capability for future energy generation projects across all technologies both onshore and offshore. 12. We will seek to prioritise and support onshore generation on and around existing and consented sites rather than very large new developments in other areas, however Shetland Energy Development Principles must apply to all.	

[29] CluffGeothermalReport.pdf (districtheatingscotland.com)
[30] Study to test geothermal energy at North Sea oil field (agcc.co.uk)

Alternative Fuels

Hydrogen and its derivatives

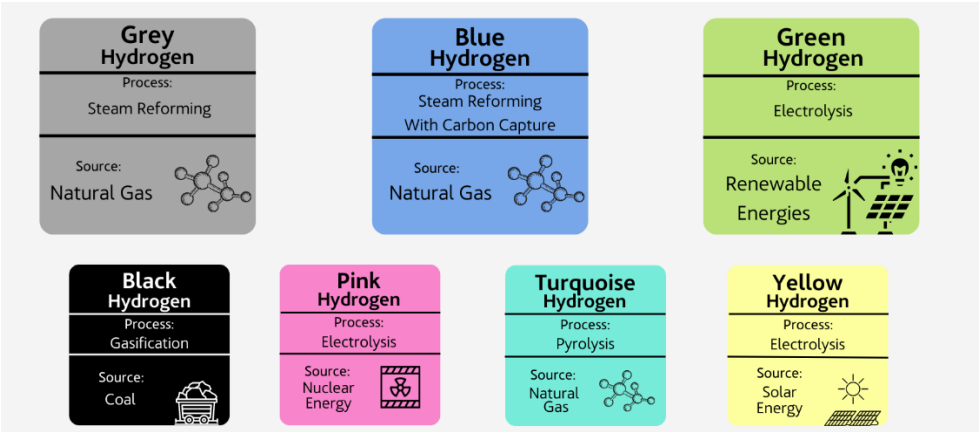


Figure 12 Summary of the hydrogen rainbow[31]

Current situation

There is considerable hydrogen production knowledge in Shetland already, provided by the Unst-based Pure Energy Centre (Pure)[32], both a manufacturer of hydrogen systems used in many countries and a hydrogen systems advisor. Pure works on the development of wider renewable energy projects including green energy storage technologies.

There is currently no hydrogen generation or use in Shetland. Hydrogen production has the potential to be significant due to the abundance of clean base energy and it is versatile. There is massive international interest in developing green hydrogen production both as a clean fuel and as a feedstock for industry. Further discussion on the use of hydrogen in the whole energy system can be found in section 4 and section 6 covers the use of hydrogen.

Future

Hydrogen production in Shetland could create a new economic market through local use, the further processing to synthetic fuels, as well as export nationally and internationally through the existing connections to the UK mainland and Europe.

Currently, there are a number of projects planned that aim to produce industrial quantities of hydrogen, which would form part of Shetland's future energy industry. The successful bidders of the NE1 offshore wind site could be a key part of that future industry.

Potential benefits include:

- associated jobs and local skills development,
- direct community benefit funds,
- Local supply-chain development and capacity building,

[31] https://www.acciona.com.au/updates/stories/what-are-the-colours-of-hydrogen-and-what-do-they-mean/?_adin=02021864894

[32] Pure Energy Centre - Hydrogen And Renewable Energy Solutions

- And secure and affordable energy.

There is significant demand developing in Europe, especially in Germany[33] and the Netherlands[34], which will benefit from the quantities of hydrogen that can be produced in Shetland.

Opportunities

- Opportunities to use Oxygen and surplus heat
- Potential route to market for electricity from offshore wind
- Can take a phased approach
- Economic diversification

Challenges

- Policy & regulatory barriers
- Chicken and the egg of matching supply and demand
- Need to reduce costs
- Viewing hydrogen within the wider whole energy system.
- in the early stages it would be best to locate production near demand

More information on hydrogen derivatives can be found in Annex 3.

Synthetic Fuels and biofuels

Synthetic fuels also known as e-fuels, are manufactured fuels like the production of methanol discussed in Annex 3 from the combination of hydrogen and carbon dioxide. In addition there are biofuels which are produced from plants or bio-waste, these are discussed further below. Both synthetic and biofuels can be a drop–in replacement for fossil fuels with the same chemical formula.

The future

The Scottish Government's Draft Energy Strategy and Just Transition plan states the following on bioenergy:

> *Our aim is to see bioenergy used only where it can best support Scotland's journey towards net zero. In the short- to medium-term, bioenergy should only be used where it can be most effective in reducing emissions and where there is greatest need for alternatives to fossil fuels. In the longer-term, we want to encourage the use of bioenergy with carbon capture technology where possible.*

In the short to medium term biofuels could be used in Shetland to help reduce our reliance on fossil fuels for some of our hard to decarbonise sectors such as our marine fleet.

Biofuel production needs further investigation in a Shetland context and to consider the wider benefits such as the development of the complementary industry of kelp farming to provide a sustainable feedstock for biofuel production and a range of other products for other applications.

Opportunities **Challenges**

[33] https://www.bmwk.de/Redaktion/EN/Publikationen/Energie/the-national-hydrogen-strategy.pdf?__blob=publicationFile&v=6

[34] https://www.government.nl/documents/publications/2020/04/06/government-strategy-on-hydrogen

- Near direct replacement of their hydrocarbon equivalent.
- Circular economy / Waste reduction.
- Co products for cosmetics, nutrition natural fertilisers and carbon trading opportunities
- Volume of fuel required, particularly for marine applications.
- Secure feedstock to ensure continued supply.

Action Areas - alternative fuels-

8	Energy Generation – Future Fuels	Encourage projects that seek to produce clean fuels in Shetland	**SIC Future Energy, HIE, Energy Steering Group**	7. Investigate the technical and non-technical barriers associated with producing clean fuels in Shetland **8.** Continue to engage with the NZTC on Phase 2 of Energy Hubs and Hydrogen Backbone projects. **9.** Prepare Full Business Case for Island Growth Funding.	13. We will support and encourage research and development of future fuel production and use in Shetland. 14. We will promote the production of fuels and chemical feedstocks that may be used locally to increase island resilience and decrease dependency on imported fossil fuels	

Section 4 – Whole Energy System

Introduction

Our current energy infrastructure networks have evolved through time to reflect a pattern of centralised generation and distributed use. Section 3 looked at energy generation. How that energy will be used and the infrastructure required is of equal importance. This section examines the need to ensure a future energy system which is clean, secure and affordable, the infrastructure required, and the right policy and regulatory frameworks which are a necessary part of a whole energy system.

Technological innovations in energy are a continuing and rapid process. There are no certainties around the 'best' way forward. However, the International Energy Agency (IEA) report advocates "The path to net zero emissions is narrow: staying on it requires immediate and massive deployment of all available clean and efficient energy technologies"[35]. Following that advice will inevitably require places to take risks on technologies by making decisions now to optimize our future energy arrangements.

Current situation and the future

We know the current situation is unsustainable, that change is required and a coordinated approach needs to be taken. Targets have been set, these are summarised in annex 3 in their relevant sections. How we got here and placing blame is of minor importance, now we must make a plan on how to achieve these targets.

A large number of decisions have to be made on the generation and use of energy, along with the associated infrastructure required. A geographic approach would allow us to understand how Shetland can best contribute to targets and ensure a strategic approach to decisions on large scale infrastructure projects.

National Planning Framework 4 (NPF4), the Local Development Plan, the role or planning and community planning are and will be very important for considering strategic land use and marine planning to help guide future development and enabling infrastructure. Shetland as an energy hub has been recognised within NPF4 National Development 1.

Energy Systems

Components of the Electricity Network

The electricity network has a significant role in the transition to net zero, either supplying renewable electricity directly to power homes, vehicles and other applications, or being used to supply clean fuel production plants. Improvements and reinforcement of the network must occur as efficiently as possible to maximise the capabilities of the network and reduce upgrade costs. The Great Britain (GB) electricity network is split between the high voltage transmission network and low voltage distribution network.

Transmission Network

Current Situation

[35] Net Zero by 2050 - A Roadmap for the Global Energy Sector - Summary for Policy Makers (windows.net)

There has never been a transmission network in Shetland. It has been an islanded grid, separate from the GB network, but this is due to change in the coming years.

A 600MW High Voltage Direct Current (HVDC) interconnector cable is currently being installed, which will connect Shetland to the GB electricity network for the first time. This 257km subsea cable will connect a substation and converter station at Kergord to a switching station in Noss Head, Caithness. This is being built on the same timeline with the Viking Energy Wind Farm.

Future

Once we are connected to the GB network via the HVDC interconnector, the distribution and transmission networks on Shetland will need to be connected at a new substation, known as the Grid Supply Point (GSP). Construction of the GSP began in December 2022 at a site near the Lerwick Power Station and is expected to be completed in 2024 in time for the transmission grid connection.

In addition to Viking Wind Farm, the three other large wind farms currently planned for Shetland will require transmission connections to the Kergord substation. SSEN Transmission are responsible for providing connections for these wind farms, and are proposing new 132kV lines between the three wind farms, Kergord and the GSP, along with an associated switching station to connect the two wind farms to be constructed in Yell.

The Council is currently involved in various projects to champion a holistic power solution for Shetland. This is to avoid unnecessary infrastructure and support the delivery of better integrated projects. At present there are a number of transmission and distribution projects being planned for Shetland. The concern is that, without a strategic overview of these projects, the outcome will be sub-optimal and we could end up with a web of networks. Particular consideration needs to be given to the route for power to electrify offshore oil and gas assets and from offshore wind farms such as NE1 which is currently investigating their options.

Distribution Network

Current Situation

The distribution network in Shetland is composed of approximately 1,650km of overhead lines and underground cables. The cable voltages are 11kV and 33kV and the system is not currently connected to the main GB electricity network, which means we rely entirely on local sources of generation. Currently, this is from Lerwick and Sullom Voe Power Stations along with a small proportion of renewable generation, as described in Section 4.

In order to maintain a secure supply, the overall electricity system must match supply and demand to the second. Supply and demand of electricity in Shetland is balanced locally, making the electricity distribution network highly constrained. For more information about the Shetland distribution network see here[65].

The islands of Fair Isle and Foula are not connected to the Shetland distribution network, having their own grids supplied by local generation.

Future

Once the new 132kV transmission network is in place, this will supply Shetland's distribution network and the Lerwick Power Station will operate in standby mode. The two networks will be connected via the Grid Supply Point (GSP). While local renewable energy generation will supply Shetland's electricity

needs for the vast majority of the time, a standby solution[36] is required during transmission system outages, such as maintenance or a fault. This system will react quickly to keep the power on while the Lerwick Power Station starts up, as the process could take around 30-60 minutes. The standby solution will consist of energy storage, stability and voltage support to prevent a blackout.

The distribution network in Shetland will remain largely constrained due to the limited demand within Shetland, particularly during the summer when the demand for heat is less.

Smarter Systems and Digitalisation

Current Situation

The five year Shetland based Northern Isles New Energy Solutions (NINES) project[37], led by SSEN Distribution, was completed in 2016.

This created an Active Network Management (ANM) system in Shetland, which automatically controls and manages energy demand, generation and storage. At the time, there were restrictions on the electricity infrastructure on Shetland, meaning no further intermittent renewable generators could be connected to the grid. This project allowed a further 8.5MW of renewable generation to connect to the distribution grid, due to a digitally smart grid optimising demand and generation.

Demand side management (DSM) was also investigated as part of the project. DSM is where consumers are encouraged to use electricity at certain times. Generally when demand is low or renewable generation is high, this in turn reduces curtailment and strain on the system.

Future

As more intermittent renewable generation is added to the grid and we strive for greater efficiency, systems need to become smarter and more connected to enable better, quicker decision making and flexibility. Understanding how electricity demand will change is integral to developing a smart electricity network.

Private Wire Systems

Current Situation

At present there are minimal private wire arrangements in Shetland.

Future

Private wire networks are likely to be a component of any future energy system in Shetland. Both for hydrogen production and as a route to market for offshore wind.

[36] Microsoft Word - Shetland Standby Pre-Qualification Pack - For Issue v1 (sse.com)
[37] More information about the NINES project can be found on a dedicated project website: https://www.ssen.co.uk/news-views/2017/2017-northern-isles-new-energy-solutions-project/

Shetland's electricity grid is changing:

- From 2024 we shall no longer be an island grid. However, the distribution grid will remain highly constrained.
- Upgrades will be required to the distribution network to cope with the uptake of electric vehicles and vessels and the transition to electric heating.
- Smart grids, active network management, grid stabilisation and energy storage will become more common to maximise grid efficiency and allow greater flexibility.
- Potential for additional interconnectors, particularly associated with offshore wind to connect with the energy market.
- Electricity market reform to allow a closer connection between the energy generation, distribution and the customer to encourage use at times of low demand and discourage at times of low generation or high demand.

Energy Storage

Current Situation

Lerwick Power Station currently has an 8MW Lithium Ion battery, which was installed in 2021, replacing a 1MW lead acid battery. The original battery was installed as part of the NINES project.

Future

An application for a battery energy storage system (BESS) with up to 100MW[38] generation capacity has recently been submitted to the Energy Consents Unit at the Scottish Government. The BESS is planned in association with the Lerwick GSP to ensure grid back up in the event of an outage with the interconnector. This is to provide a standby solution to keep the power on in Shetland until the Lerwick Power Station is powered up, expected to take up to an hour. Zenobe who are applying to undertake the work have approximately 435MW of batteries operating or in construction across the National Grid.

Action Areas - the electricity network

		Whole energy system – Electricity network	Promote the need for a future electricity network that meets Shetland's requirements	**SIC Future Energy SSEN Transmission**	Work with SSEN Transmission to establish the most beneficial holistic transmission and distribution network in Shetland.	15. We will support and encourage the development of a holistic whole energy system for Shetland which makes full use of existing and planned infrastructure. 16. We will engage with the development and refinement of future energy scenarios for Shetland	

[38] Scottish Government - Energy Consents Unit - Application Details

Hydrogen and the Hydrogen Economy

Site Location for H2 Production

Selecting the most suitable site for hydrogen production is a balance between small projects located close to demand, as is the case for most green hydrogen projects at present, or larger sites associated with larger electricity connections and export routes.

Scottish Enterprise undertook a desk-based study to consider the technology and site cost reduction opportunities[39] to highlight the features of a 1GW hydrogen production site based on current available technology. The findings are summarised here with a comparator for Shetland.

Ideal Green Hydrogen Production Site	**Detail**	**Advantages in Shetland**
Renewable Electricity Resource	Electricity is the largest cost contributor, an ideal site will have a source of low carbon, low cost electricity at scale to meet production. 1GW electrolyser will require up to 24,000MWh per day	Excellent renewable energy resource from onshore wind, offshore wind and tidal.
Water	Requires purified water from either fresh or processed seawater. 1GW electrolyser will require 3,840 t/day of purified water. Using seawater the consumption is around an additional 50% or around 5,760 t/day	Island location limiting fresh water availability. Sea water available but consideration required for sea water extraction and safe brine disposal. Investigate opportunities for value added products from the brine.
Site size and availability	The footprint required for 1GW green hydrogen must be greater than 15ha. This includes electrolyser and desalination. In addition, sites need to be specifically zoned for industrial use and classified within the COMAH Upper Tier Market for oxygen 1GW scale H_2 production will produce 3,225t/day O_2 roughly 8x the weight of hydrogen produced.	Site availability – various sites available including brown field sites at Sullom Voe Terminal and the former Scatsta Airport. Opportunities for the use of surplus heat. Demand for O_2 from the aquaculture and space industries.
Local Activity	Skilled local workforce (gas processing / power plant type skills. Local demand to negate the cost of export	Skilled workforce through existing oil and gas, marine engineering along with electricity generation and management

[39] Development of early, clean hydrogen production in Scotland - Net Zero Technology Centre (netzerotc.com)

		Currently no demand but this is set to change as H_2 becomes available.
H_2 export	Access to natural gas pipeline network 1GW hydrogen electrolyser can potentially produce around 92,000Te/year[40].	Various studies to examine the factors for consideration on H_2 export. One recent report is the Hydrogen Backbone project by the Net Zero Technology Centre[41]

Note – all of the figures on water and electricity required along with the amount of hydrogen and oxygen produced will depend on the efficiency of the electrolyser, the electricity source and the percentage of time the system is in operation.

The table above highlights the site requirements for hydrogen production but it will also be necessary to match supply and demand. Consideration should also be given to the whole value chain as space may also be required for the production of ammonia or e-methanol, or the equipment required for exporting hydrogen. This means that there are a wide range of factors which must come together to enable a hydrogen ecosystem to be initiated and for it to be sustainable.

More information on the hydrogen value-chain and costs can be found in Annex 3.

Action Areas for the hydrogen economy

	Whole energy system hydrogen economy	Establishing the production opportunities and demand for green hydrogen in Shetland	**Energy Developers SIC Future Energy, HIE, Energy Steering Group**	10. Continue to engage with the NZTC on Phase 2 of Energy Hubs and Hydrogen Backbone projects. 11. Prepare Full Business Case for Island Growth Funding.	17. We will continue our participation in research to determine the economics and impacts of the hydrogen economy in Shetland. 18. We will develop a clearer roadmap on the current and future demand for hydrogen locally, and elsewhere, to accompany the pipeline of planned projects for hydrogen production. 19. We will progress the hydrogen economy in Shetland when production and demand are aligned.	

[40] Development of early, clean hydrogen production in Scotland - Net Zero Technology Centre (netzerotc.com)
[41] Hydrogen Backbone Link project report

Carbon Capture, Utilisation and Storage

Current

244 million tonnes of CO_2 was captured in 2022 across 30 facilities, with a further 164 facilities under construction or in development[42]. Currently these are based around large point sources, before the CO_2 is compressed and transported to its end location.

Future

The UK has one of the greatest CO_2 storage potentials in the world, with a huge geological advantage. 25% of Europe's storage potential is in the UK Continental Shelf[43]. In September 2023, The NSTA announced the 14 companies that accepted licences during the UK's first ever carbon storage licensing round. 21 licences were awarded in total across the North Sea. SVT operator EnQuest were awarded 4 licence areas, at the Magnus, Thistle, Eider and Tern fields to the North East of Shetland. There is an existing gas pipeline that connects SVT to Magnus. This could enable SVT to become a hub for importing CO_2 to export via pipeline to these offshore reservoirs.

Action areas for CCUS

	Carbon Capture and Storage (CCUS)	Understand the prospects for CCUS in Shetland	**EnQuest, SIC Future Energy, HIE, Energy Steering Group**	12. Work with EnQuest as and when required.	20. We will engage with EnQuest to understand their plans for CCUS and the opportunities which may arise. 21. We will continue research into the development of the carbon economy in relation to trading schemes, carbon pricing, and taxation.	

District heating

Current Situation

SHE&P are responsible for 40km of pre insulated pipes which stretch across Lerwick, supplying 900 domestic properties, including around 300 social housing, along with 300 non-domestic customers. These include the hospital, Clickimin Leisure Centre, and Mareel which form the anchor loads for the system. The last major expansion served the Hjaltland Housing Association (HHA) development at Quoys in 2012, with around 148 properties connected. There is an agreement in place to extend the network and connect to the HHA Staney Hill development bringing in an additional 300 customers in the next 10 years.

Peak demand on the system is around 11.5MW and over 40GWh of heat is supplied annually to the community.

[42] Global Carbon (globalccsinstitute.com)
[43] Carbon Capture, Usage & Storage - great.gov.uk international

The recent refurbishment of the Council owned incinerator has increased the efficiency from 85% to 90%, meaning that more energy from burning the isles' domestic waste is converted to heating for homes and offices in Lerwick.

A ground breaking system has recently been installed to recycle surplus heat from the Lerwick Power Station into the district heating scheme. The system was designed using Danish district heating expertise and delivered under a tight schedule by local contractors[44]. For the majority of the year, the energy recovery plant provides sufficient heat to meet the town's heating requirement. However, in the winter diesel is required to meet the shortfall. The combination of the additional heat from the Lerwick Power Station and the upgrade to the energy recovery plant, has made a significant reduction to the amount of diesel required to meet peak demand, saving around 600,000 litres of diesel over the course of the year.

SHE&P have been able to keep their rates stable for several years, with an increase on the 1st April 2023 to 7.5pkWh and 9.5p/kWh for prepayment customers, at a time when other energy prices have risen dramatically. This offers a huge saving to the community both directly to the households connected to the system and indirectly as large energy users such as the Council and the Shetland Recreational Trust are able to keep their heating costs stable. Further discussion on energy costs can be found in Section 8 Affordable Energy.

Future

In Denmark there are a number of micro district heating schemes serving 100-200 houses. This suggests that there is potential in Shetland to investigate micro district heating schemes in rural centres, provided a source of low cost low carbon heat can be identified.

Opportunities

- Energy Security
- Flexible, other heat sources can be plugged in when available
- All revenue generated or saved stays within the local economy
- Replicable
- Local service
- Heat exchanger requires minimal space, low maintenance and rarely malfunctions
- Reduces the amount of electricity required by a property freeing up headroom.
- Thermal storage is a small proportion of the cost of batteries.

Challenges

- Need an affordable low carbon heat source
- Need a heat distribution network
- Need sufficient heat density
- High capital cost for the infrastructure
- Heat is currently supplied to the Lerwick District Heating Scheme by the Energy Recovery Plant changes to waste legislation may have an impact

[44] Surplus heat from power station to be diverted into district heating scheme | Shetland News (shetnews.co.uk)

Action Areas - district heating

	Whole energy system – District heating	Understanding how the District Heating technology, successfully deployed in Lerwick for 25 years, can be developed in other places in Shetland.	**SIC Future Energy and Climate Change Teams**	13. Rural energy hubs project active to investigate district heating opportunities for Brae	22. We will support the continued operation and development of the Lerwick District Heating Scheme. 23. We will investigate opportunities for additional district heating schemes outside Lerwick. 24. We will promote the success of the Lerwick district heating scheme to other communities seeking to develop similar projects. 25. We will explore alternative sources of low carbon low cost heat suitable for integration into a district heating scheme.	

Enabling Infrastructure

Ports and Harbours

Current Situation

Shetland's ports are a key enabler for many industries on the island, such as fishing, aquaculture, energy and tourism. As Shetland seeks a Just Transition towards a net zero future, and we enter a period of global change in transport and energy, it is clear that ports will retain their huge importance to many existing and emerging activities throughout Shetland.

Shetland has several ports that contribute significantly to major industries on and around the islands, and they each have many unique selling points. While fishing remains the largest industry, Shetland has supported vast activity in the offshore energy sector, centred around its ports. This has led to an incredibly knowledgeable and skilled workforce with valuable experience.

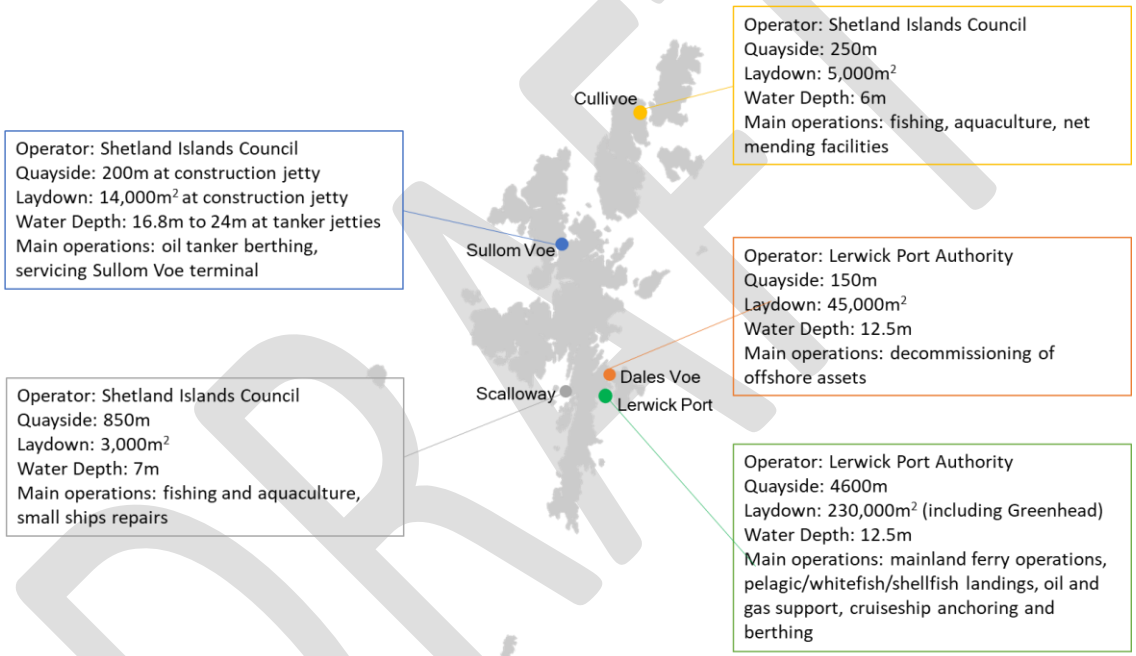


Figure 13 Some of Shetland's ports and harbour infrastructure

The Future

Our ports have played a vital role in our economic prosperity throughout history and will continue to be vital for any future energy scenario which plays out.

We need to understand how our existing industries will develop and change. For example, during decarbonisation which fuels will vessels transition to and what infrastructure and storage will be required? It is also necessary to consider these natural community hubs in a wider context. For example, changes to the marine industry may result in changes to road traffic as marine vessels seek to travel shorter distances to save on fuel. This change could result in a need for further vehicle charging facilities. Similarly changes to ferry operations and fixed links will change the way people travel.

For the new industrial opportunities, such as offshore wind and hydrogen production, we need to understand the scale of infrastructure required for the marshalling and assembly of turbines and the number and types of vessels which may be required for the operation and maintenance of offshore wind farms and where these may be based. The infrastructure required for the import and export of hydrogen and its derivatives, along with CO_2 transfer, must be developed in line with these industries emerging within Shetland. Better grid infrastructure at ports will also open up new opportunities for decarbonisation. To retain Shetland's status as a main energy hub built on our natural resources, existing energy infrastructure and highly experienced energy skills base, our ports must transition to support these existing and future industries.

Airports and aviation

Current situation

Highland and Islands Airports Ltd (HIAL) have created the UK's first low carbon aviation test centre embedded at a commercial airport at Kirkwall in Orkney. In phase 1 they opened a dedicated hangar with office space for technology developers and facilitated a number of demonstration flights. Sustainable Aviation Test Environment 2(SATE 2) aims to expand on the success[45][46][47][48].

Figure 14 Windracer autonomous drone undergoing tests in Tingwall 2022

In 2022, Tingwall Airport was used as a test site for the Windracer autonomous drone see figure 15. The drone can carry loads of up to 100kg and could potentially carry mail, medicine or other supplies to remote communities.

Future

Aviation in and around Shetland is set to change significantly over the next 20 to 30 years. Reasons include:

- Changes to sub regional travel patterns
- Managed decline and decommissioning of the oil and gas industry.
- Development of new industries including offshore wind,
- Alternative fuel options, which are likely to be a combination of hydrogen, electric and sustainable aviation fuel[49].
- Alternative aviation options including the greater use of drones.

Regional flights and airports are likely to be at the forefront of energy transition in aviation. The aeroplanes are smaller and routes shorter making them easier to decarbonise. However, it is likely that the aviation industry will be one of the last to reach net zero due to safety requirements and lack

[45] Cranfield, Britten-Norman Map Out Plans As Hydrogen Aircraft OEM | Aviation Week Network
[46] Sumburgh Airport – Highlands and Islands Airports Limited (hial.co.uk)
[47] Commercial – Energy Services - Highlands and Islands Airports Limited (hial.co.uk)
[48] Sustainable Aviation Test Environment (SATE) 1 & 2 : EMEC: European Marine Energy Centre
[49] Net zero aviation fuels: resource requirements and environmental impacts | Royal Society

of mature technology. This doesn't take away from the fact that aviation is a heavy polluter, and work needs to begin now to allow it to reach net zero.

Shetland will also benefit from the development of the Saxa Vord Space Port in Unst[50], which is set to be an internationally recognised site. It has already delivered a step change to the Shetland economy through its construction and is set to open the doors to a range of opportunities in the future.

Action Areas - enabling infrastructure

	Whole Energy System - Enabling Infrastructure	Understanding the developments required for essential ports and aviation infrastructure.	**LPA, SIC Ports and Harbours, Zetrans Energy Steering Group**	Keep up to date with technology developments and support projects that seek to improve transport infrastructure.	26. We will engage with developers and port users to understand the investment required in our ports and harbours and the timescales (to deliver decarbonisation and renewables projects). 27. We will engage with the aviation industry to better understand future developments.	

[50] SaxaVord – UK Space Port

Planet

Section 5 – Natural Environment

Current Situation

Shetland has rich and varied natural heritage, being home to many significant species of animal and plants and internationally important habitats, such as blanket bog. The geology of Shetland is diverse, particularly when considering the relatively small land area of the Islands, with rock types spanning almost 3 billion years.

The natural environment in Shetland is the product of over 5,000 years of interaction between people and nature. All aspects of the environment, natural capital, landscapes, ecosystems services and habitats are both natural and cultural, so it is important to ensure that decision making should be properly informed and should ensure all aspects of the environment are considered, protected and, as possible enhanced.

As we face a biodiversity crisis in addition to the climate crisis, it is essential that our natural heritage is carefully managed and considered.

This is backed up by the overarching policy principle of National Panning Framework 4: *To encourage, promote and facilitate development that addresses the global climate emergency and nature crisis.*[51]

It is therefore critical that environmental protection is taken into consideration at an early stage in the planning of all energy development projects.

Shetland has led the way in the past, with the world leading Shetland Oil Terminal Environmental Advisory Group, see Annex 3 for further details. More recently the Shetland Islands Regional Marine Plan has been drafted and is currently sitting with the Scottish Ministers for adoption[52].

Future

The natural environment and environmental protection must be taken into consideration at an early stage in the planning of all energy development projects and throughout its delivery and subsequent decommissioning.

We also want to ensure that a holistic approach is taken to maximise opportunities for cooperation and collaboration which would therefore reduce the overall cumulative impact of the developments and their associated infrastructure.

As highlighted above the Council approved a set of Energy Development Principles back in December 2022. One of the principles is environmental protection. Work is currently underway to develop this principle into a set of guidelines that can be used to engage with developers. These are in addition to the legislation that the Council and developers are bound by and would not supersede.

Opportunities

- There are number of data sets and frameworks in place to build from
- Increased biodiversity health
- End of life planning and circular economy

Challenges

- Identifying best use of land and sea
- Incompatible, non-standardised data sets that are not shareable
- Capital cost of rehabilitation projects

[51] Part 2 – National Planning Policy - National Planning Framework 4 - gov.scot (www.gov.scot)
[52] Marine Spatial Planning - Shetland Islands Regional Marine Plan (uhi.ac.uk)

- Creating a resilient Shetland
- Competition for workforce to carry out work, monitoring and data analysis

Action areas - Environmental Protection

	Environmental Protection	Build on the Energy Development Principles approved Dec 22	**SIC Climate Change Energy Steering Group**	14. We will develop the Energy Development Principle on Environmental Protection into a set of Guidelines to engage developers.	28. We will seek to steer projects towards sites that are the least environmentally disruptive. 29. We will encourage developers to follow and go beyond national guidance on EIAs and environmental monitoring where possible. 30. We will encourage collaborative monitoring to the benefit of increasing biodiversity gains and ecosystem health. 31. We will advocate to the policy makers and national bodies to adopt a holistic approach to energy developments and licensing regionally as opposed to current piecemeal planning approach	1,3,4

Section 6 – Changing Energy Use and Reducing Emissions

Long term outcome 1 – Reduce emissions

Target: Bring Shetland land and marine based energy emissions to net zero and contribute to national targets through the export of clean energy

Use of energy

Energy Security

The IEA defines energy security as "the uninterrupted availability of energy sources at an affordable price"[53]

A secure and affordable fuel source has always been essential to life in Shetland. When the first people settled in the isles, the native woodland would have been the main source of fuel leading to the woodland cover being removed. Eventually peat provided abundant fuel and covers most of Shetland.

Several factors led to the decline of this largely free fuel. Coal was imported from the 19th century, giving better heat than peats. The second factor was islanders' living standards improved after the middle of the 20th century: by the 1970s even rural communities were abandoning peats in favour of oil and electric central heating[54][55].

How we currently use Energy

The Shetland NZRM[56] has highlighted the magnitude of the challenge to decarbonise energy use in Shetland. Now we must look systematically across the different energy use sectors and energy types to reduce these significantly.

Energy/Mitigation Hierarchy

When aiming to reduce emissions, it is essential that we follow the "mitigation hierarchy," similar to the waste hierarchy, demonstrated by the inverted pyramid in figure 16. This illustrates the importance of reducing energy usage before relying on technology such as renewables-generated energy or emissions offsetting. This is because reducing energy use is cost-saving, does not rely on technology, and is the only method of mitigation that is guaranteed to reduce emissions. This is

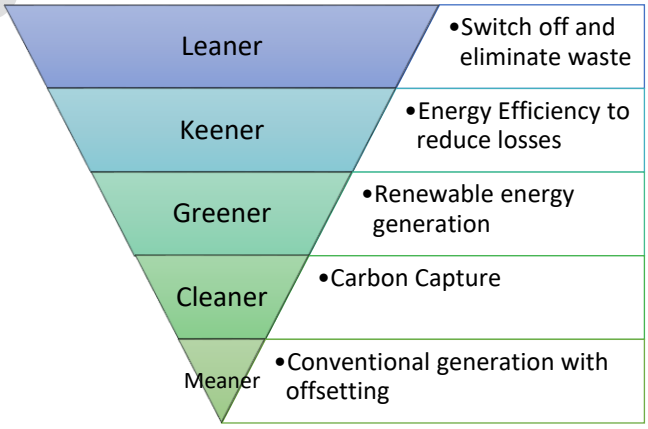


Figure 15 Energy Hierarchy

[53] Energy Security – Topics - IEA
[54] Why burn peats? | Shetland Museum & Archives (shetlandmuseumandarchives.org.uk)
[55] Peat Cutting | Between Islands
[56] What are we doing? – Shetland Islands Council

the case no matter which technology produces the energy.

Doing each of these parts in isolation will not be enough to reach our net zero targets, so all five approaches must be taken together to make the lasting changes that are so important.

Action Areas - use of energy

	Use of energy	Changing energy use and reducing emissions	**SIC Future energy, Energy Efficiency and Climate Change teams, Islands Centre for Net Zero**	15. Shetland Climate Change strategy to be drafted and will link to the Shetland Energy Strategy.	32. We will support the most appropriate use of energy following the **energy hierarchy**, matching supply and demand to maximise efficiencies. (encourage a diverse energy ecosystem) 33. Implement and ensure alignment to the actions within the SIC and Shetland Climate Change strategies. 34. Communicate the need for action across a range of fronts including: behaviour change, customer expectation and empowerment to maximise carbon saving opportunities.	

Electrification for Decarbonisation

Current situation

As electricity is relatively easy to generate from renewable sources, certain applications that have traditionally been powered by fossil fuels are becoming electrified, including cars, vessels, heating and some industrial processes.

Electric vehicle ownership in Shetland continues to grow and three Shetland based companies have developed or are developing an electric boat. We are also seeing an increase in the uptake of heat pumps to replace other heating systems and the number of marine vessels using shore power to reduce the use of auxiliary power while in port.

At present the Sullom Voe Terminal (SVT) and Shetland Gas Plant have their own power stations, with the SVT Power station also supplying the Shetland grid.

Future

Battery electric vehicles, vessels and planes are very efficient and are quiet. However, their energy storage density is poor compared to other fuels, making the technology better suited to smaller vehicles, vessels and planes and for travelling shorter distances. Along with the necessary improvements in battery technology it will be necessary to upgrade charging infrastructure across the roads network, airports and ports.

In order to facilitate the electrification of transport and heating in Shetland, research must be undertaken in conjunction with SSEN Distribution and Transmission to understand where reinforcement works are required to allow new or larger grid connections. Future Energy Scenarios are discussed in Annex 3.

Electrification for decarbonisation of oil and gas

Future

Locally onshore oil and gas assets will need to be electrified, if the operations of the terminals are to continue for future decades. The power station at the Sullom Voe Terminal is due to be decommissioned in 2025, with options currently being considered for obtaining an electricity supply from the local electricity grid. In addition, the decarbonisation of oil and gas installations is being investigated by oil & gas companies as a key requirement to meet emissions targets set by the North Sea Transition Authority by 2030.

An announcement has already been made by developers BP, Equinor and Ithaca Energy that they have signed a Memorandum of Understanding (MoU) on 7th December 2022 to explore electrification options for the region covering the Clair, Rosebank and Cambo fields to the west of Shetland[57]. The energy requirement for these three fields is around 220MW and would require a significant amount of infrastructure onshore in Shetland, along with electricity cables between Shetland and the installations. Figure 17 provides a summary of the system requirements. At the time of writing no final decision had been made.

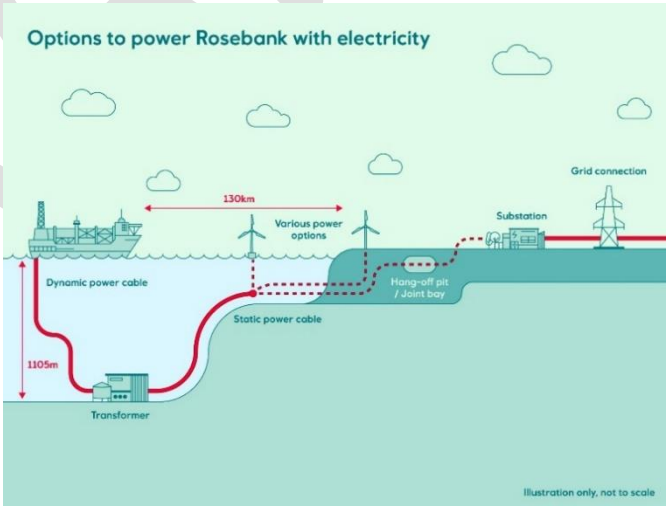


Figure 16 Page 5 Investing in energy security and powering a just transition, exploring the anticipated socio-economic impacts of the Rosebank oil and gas field 0c0ac22fa94009344190f5cdad065ba88b4404ed.pdf (sanity.io)

[57] bp, Equinor, Ithaca explore electrification options for North Sea fields (offshore-technology.com)

Hydrogen for Decarbonisation

Current Situation

At present there is no production or use of hydrogen in Shetland but there is a great deal of development interest. The heavy reliance on fossil fuels and constrained electricity grid mean that clean fuels will be a requirement for reaching net zero, particularly for large on and off road vehicles, aviation, marine and rural heating applications.

Governance, policy and framework

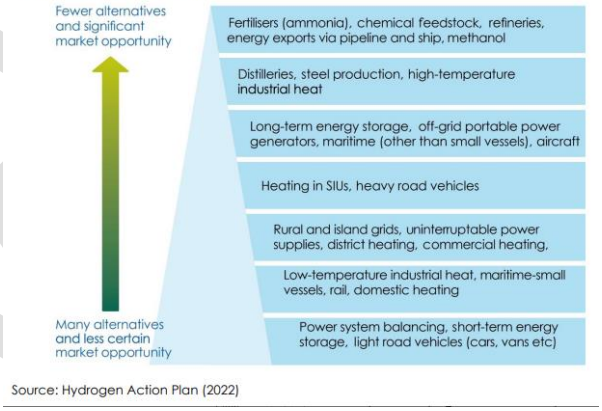
Governance on the use of hydrogen relates to the sector seeking to use the hydrogen. For example, the NEPTUNE Project[58] provides a summary of the decarbonisation targets for Shetland's marine sector along with detailing the approval bodies that must be satisfied.

Through its Hydrogen and Energy Strategies, the Scottish Government has emphasised the deployment of hydrogen as a solution to the decarbonisation of various industry sectors, because it is such a versatile fuel. However, green hydrogen is relatively difficult to produce and the electricity required has a cost. It is therefore expensive, and so we need to have a Shetland approach to the deployment of hydrogen and related synthetic fuels. As affordable hydrogen can't be a like for like fuel switch with our existing hydrocarbon based fuels.

Future

While electrification is a recognised, proven option for decarbonising a range of sectors, there are situations where it is not a viable solution. Large industrial processes, certain transport and heating applications and a range of other scenarios need another solution to transition away from fossil fuels, where electrification isn't possible due to technology availability, power requirements or grid constraints. In addition, biofuels are either not available or can only provide a short to medium term solution. This is where hydrogen, or its derivatives, come in.

Figure 21 : Hydrogen hierarchy



Source: Hydrogen Action Plan (2022)

Figure 17
https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/01/draft-energy-strategy-transition-plan/documents/draft-energy-strategy-transition-plan/draft-energy-strategy-transition-plan/govscot%3Adocument/draft-energy-strate

Figure 18 from the Hydrogen Action Plan 2022 provides a summary of the Scottish Hydrogen use hierarchy. It is important that we understand how demand will grow in Shetland over the next 10 years and where hydrogen may facilitate other opportunities such as the production of synthetic fuels.

Figure 19, tries to give a high level overview of how the split could happen in Shetland.

[58] NEPTUNE Project | Orion Clean Energy Project

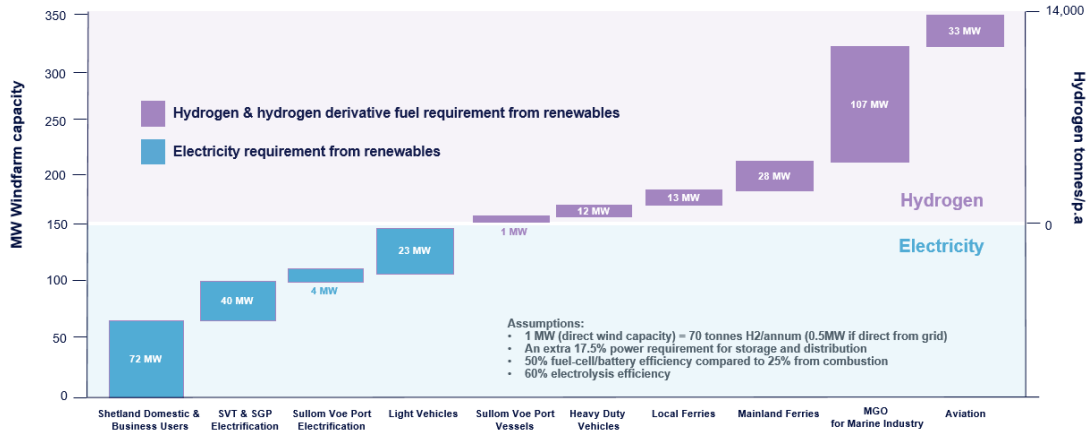


Figure 18 Flying bricks diagram produced by SIC Future Energy

Opportunities

- Green
- Highly versatile
- Learn from other areas
- Reduces additional strain on electricity network

Challenges

- Cost
- Associated infrastructure
- Safety and regulatory approvals
- Not currently available in Shetland

Action areas for decarbonisation

	Decarbonisation	Identify methods to reduce energy consumption.	**SIC Energy Efficiency Energy Steering Group**	16. Support the year 1 implementation and delivery of LHEES. 17. We will develop a Local Area Energy Plan (LAEP) for Shetland. 18. Continue to promote knowledge exchange around marine and ports decarbonisation	35. Continue to implement the LHEES delivery plan and develop the LAEP to support scenario planning on the electricity distribution grid. 36. We will seek to find local solutions to the delivery of energy efficiency measures. 37. We will prepare a local approach to the use of hydrogen in Shetland aligned to other local strategies such as for heat and transport.	1,2, 3,4

Applications

Buildings - Heating for a Net Zero Future

As highlighted in figure 20, emissions from domestic and non-domestic buildings make a significant contribution towards emissions. They also represent an area which is comparatively easy to decarbonise as there are known solutions.

It is widely acknowledged that the *fabric first* approach should be taken. This means the performance of the building should be maximised first, before considering the use of mechanical and electrical building service systems.

Heat pumps and district heating will be key to the decarbonisation of heat. However, further deployment of district heating schemes will require the identification of low cost, low carbon heat sources such as surplus heat from green hydrogen generation.

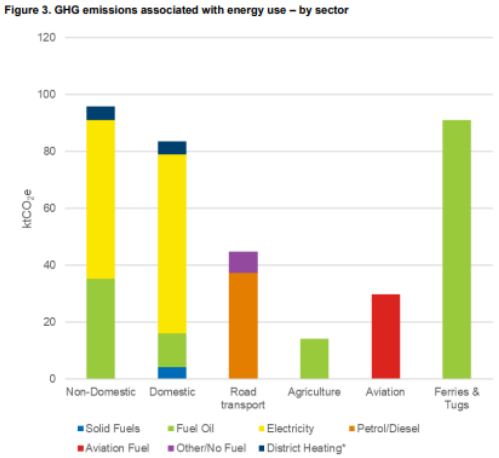


Figure 19 Figure 3 from the Shetland Net Zero Route Map https://www.shetland.gov.uk/downloads/file/6460/shetland-net-zero-route-map

The main challenge relates to undertaking the works across the whole building stock and the associated cost. The Council is currently preparing the Local Heat and Energy Efficiency Strategy (LHEES)[59], which will provide a detailed strategic plan on heat and energy efficiency for Shetland. In addition, the Scottish Government are currently consulting on the social housing net zero standard, which will replace the second Energy Efficiency Standard for Social Housing[60].

The use of heat will also play a wider role in energy flexibility to help balance supply and demand. This will be of particular importance as the use of electricity grows.

The Cost of energy efficiency and heat

The Shetland NZRM[61] presents an estimate for the resource costs required to reduce energy consumption in Shetland. Upgrading the building fabric and replacing fossil fuel heating systems in domestic buildings is estimated to be in the region of £360-600 million. For non-domestic buildings it is estimated at £190-230 million. While these measures would result in energy bill savings, these may not necessarily be proportionate to the amount of money spent per household.

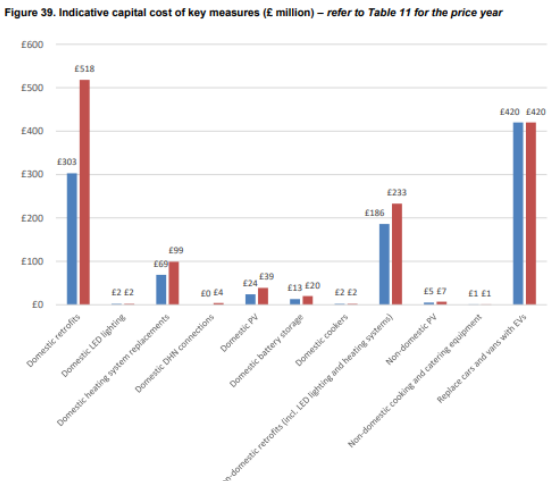


Figure 20 Figure 39 from the Shetland net zero route map

[59] What are we doing? – Shetland Islands Council
[60] Social housing net zero standard: consultation - gov.scot (www.gov.scot)
[61] Shetland Islands Net Zero Routemap (NZSR)

Paying for energy efficiency

Funding is available from a range of sources, and the link below provides a summary[62]. However, as highlighted above, the overall cost is significant. This means that finance from a range of sources will be required to deliver the level of change required in Shetland.

One of the key actions is to build up on-island expertise to apply for external funding in support of energy transition projects. This can be best achieved by having a clear understanding of all the projects required, backed up by data.

The other side of the challenge is having the workforce and supply chain available to undertake the work required. Many of the funding schemes are highly bureaucratic and have been developed based on a centralised delivery model, better suited to an urban setting. It is therefore necessary to find local solutions which enable our local supply chain to be able to deliver projects as the funds and data alone can't deliver change.

Insulation

Opportunities

- Reduce energy consumption
- Improved comfort

Challenges

- Condensation and ventilation problems if not installed properly
- Retro fit measures do cause upheaval

For more information and advice on the cost of living crisis and support available to households, communities and businesses see[63] Cost of Living – Shetland Islands Council

One of the challenges is to help people find the best pathway forward with the resources that are available to them. With so many different options available and a confusing number of funds to apply for, there is a possibility of individuals giving up before they even begin the process or spending a lot of time going in circles. There is a pressing need to simplify the systems in place to support the domestic switch to net zero.

An example of a resource available, is the Greener Homes Network[64] a database of case studies of homes which have installed energy efficiency and renewable energy technology.

[62] Support for Households – Shetland Islands Council
[63] Cost of Living – Shetland Islands Council
[64] Energy Saving Trust | Green Homes Network

Types of heating systems

Fuel Option	Strengths	Weaknesses / limitations	Unknowns
Storage heaters	• Affordable to install. • Available now. • Once we are connected to the UK Transmission network it can be classed as green. • Opportunities for smart grid and demand side management.	• Can have high running costs. • Benefits from a suitable electricity tariff and high building performance.	• Requires a suitable electricity tariff.
Heat Pumps	• Efficient. • Proven technology. • Financial support available.	• Benefits from being installed in a well-insulated property. • High upfront cost.	
Hydrogen	• Green. • Versatile.	• Not currently available.	• Government policy is currently moving away from the use of hydrogen as a heat source. • Rules and regulations for use in heating.
District heating	• Green. • Affordable. • Insulated from global energy markets. • Scottish Government have set targets to support increased deployment and uptake.	• Geographically limited to pipe network.	• Affordable clean heat source. • Business model development for deployment.
Biomass and biofuels	• Direct or near direct replacement for fossil fuels. • Short to medium term alternative to reduce carbon emissions. • Available now for some applications. • Future fuel sources include seaweed, willow and agricultural crops.	• Sustainable feedstock. • Emits greenhouse gasses. • From 1st April 24 SG will bring in regulations to prohibit the use of direct emissions heating systems in new buildings with plans for all buildings by 2045.	• Long term sustainability. • Technology development for carbon capture at all scales.
Wind 2 Heat	• Based on known technology. • Low carbon. • Flexible. • Can operate on a range of scales. • Can integrate with the electricity network to provide wider benefits.	• Difficult to finance route to market. • Higher capital cost than a grid connected project.	• Regulatory approval of innovative system set up.

Fossil fuels **Oil, gas, coal**	• Available now.	• Emits greenhouse gasses. • From 1st April 24 SG will bring in regulations to prohibit the use of direct emissions heating systems in new buildings and the phasing out the need for fossil fuelled boiled with a target of no replacement boilers by 2025 with plans for all buildings by 2045.	•

Storage Heaters

Future

Storage heaters are a common type of heating in Shetland. As electricity becomes greener they will be classed as a green heating system and have a role to play in grid balancing. However, the challenge for storage heaters relates to ensuring they are affordable to run.

Heat Pumps

Current situation

A wide range of heat pumps have been installed throughout Shetland. Air source Heat Pumps are the most noticeable as they have an external unit installed outside the property. One of the largest heat pump installations in Shetland is at the Sumburgh Lighthouse. This system includes 14 boreholes each around 120m deep connected to two heat pumps to provide heat to the whole site. The site also benefits from a solar array to meet a significant proportion of the energy needs of the site.

Future

Heat pumps will play a significant role in the decarbonisation of heat in buildings. The Scottish Government have highlighted them in the Heat in Buildings programme[65] with various strands of action to accelerate deployment. The largest challenge in the transition of heating systems is the initial upfront cost with grants and low interest loans available. However the maximum benefit will only be achieved if the energy efficiency of the building is also improved.

Wind to Heat

Current situation

Wind to Heat projects were installed in community buildings throughout Shetland but there were a range of technical challenges, particularly with the robustness of the early technology used and the backup to servicing.

[65] Heat in Buildings programme - Energy efficiency - gov.scot (www.gov.scot)

Future

Wind to heat installations are going to become more important and widespread as capacity on both the distribution and transmission networks decrease. The installations are based on known technology and there are many opportunities to develop this further.

Biomass

Current situation

Biomass heating systems are used throughout Shetland on a range of scales but a key limitation is the need to import biomass.

Future

Biomass heating will have an important role in the short to medium term, but the Scottish Government has set targets to phase out the use of direct emissions heating systems in Scotland by 2045. The first significant target is to end the use of direct emissions heating systems in new build homes warranted from 2024.

In the short to medium term biomass can displace some hydrocarbon-based heating systems across the isles but a key challenge is finding a sustainable local source of biomass.

An expansion of the industry would increase the fuel demand and therefore allow the direct importation of wood pellets in bulk by sea, which would in turn reduce the carbon footprint further and end the need to import on the ferry from Aberdeen. Fuel would be stored in a quayside silo and distributed by road tanker.

Hydrogen for heat

Future

It is unlikely that there will be a hydrogen gas grid in Shetland but there are many opportunities to maximise the benefits of hydrogen use in Shetland through co-location and consideration of the whole energy system.

Action areas buildings and heating see decarbonisation above

Transport

Current Situation

Transport is a significant source of emissions in Shetland. Our remoteness means a higher dependency on sea and air transport and the linear geography of our settlements on 14 islands requires high levels of road and ferry travel. Road transport is an area where there is advancing technology available, such as electric cars, to transition away from using petrol or diesel. That may help to replace certain vehicles in some uses but there are questions with future global sustainability due to finite mineral resources such as lithium. The technologies for other clean fuel solutions are beginning to emerge such as hydrogen or biofuels but there is a long way to go before these can be generally deployed in road and sea transport. Keeping our communities resilient in such complex circumstances is of paramount importance but our future transport system will not be a like for like switching of

technologies. In the course of change we must support improvements to public health through reducing emissions and overcome other challenges such as rural and island inequalities.

We must achieve lower levels of car ownership with more active travel[66], use of public transport and the adoption of different vehicle ownership models such as car pools and increased car sharing. Improved digital connectivity is required to reduce the need to travel. We must also consider the logistic challenges for our businesses and the delivery of services as these are vital for our long-term sustainability.

ZetTrans are currently undertaking a full revision of the Shetland Transport Strategy, to take account of new environmental, societal and economic challenges and strategic and technological developments[67]. For that reason, the Energy Strategy will be confined to transport fuel requirements.

To reduce emissions, all vehicles need to utilise 100% renewable/clean energy, whether that is renewable electricity, clean hydrogen, biofuels or synthetic fuels[68]. The transition will increase electricity consumption both directly through the charging of electric vehicles and for the production of clean fuels such as green hydrogen and its derivatives. The transition will also require new charging and refuelling infrastructure.

Fuel types for Propulsion

Fuel Option	Strengths	Weaknesses/ Limitations	Unknowns
Hydrocarbons – Diesel, Petrol, MGO, LPG	• Available now. • Current use and enabling infrastructure in place.	• Legislation and targets in place to reduce emissions. • Shetland is highly reliant on fossil fuels for transport.	• How transition will be managed.
Batteries	• Very efficient. • Available now. • Rapid technology developments.	• Range/Duration is very limited. • Charging infrastructure. • High demand for batteries for a range of other applications. • Safety.	• Maximum economic range. • Recycling and the circular economy.
Hydrogen	• Various use options including dual fuel, and fuel cells.	• Availability of hydrogen. • Significant space required to store the fuel limiting range. • Safety concerns. • Cost of fuel cells or efficiency of direct combustion.	• Cost trajectory • Standardisation of rules and regulations
Ammonia	• Cost-effective long-range fuel. • Already transported on tankers in large quantities. • Existing market for ammonia. • Known risk profile.	• Significant safety concerns around its toxicity.	• Standardisation.

[66] Shetland Active Travel Strategy 2021-2026 | ZetTrans
[67] Shetland Transport Strategy 2022-2042 Development | ZetTrans
[68] Shetland Islands Net Zero Routemap (NZSR)

Methanol	• Easy to retrofit. • Relatively safe.	• Source of affordable green carbon to make the fuel. • Production efficiency.	• Cost of green carbon capture
Biofuels	• Easy to retrofit.	• Limited availability.	• Optimum use of feedstock.

Table information sources[69] [70]

Future

Fuel for transport is likely to be a mixture of the fuels listed above. What we need to understand in the coming months and years is how fuel usage will change, the volumes and the associated infrastructure required. The Neptune Project[71] was a feasibility study that aimed to develop a desk-based decision modelling and support system digital tool to help analyse, scope and develop Shetland marine fuel opportunities. It looked at how to model the current situation within Shetland and how to identify the correct path to decarbonise the marine sector.

While transport will remain essential, there may be alternative options which reduce the need to travel and transport goods to help achieve a Just Transition to Net Zero. We must also look at the wider enabling infrastructure for these solutions. Examples include fixed links reducing the need for ferries and digital connectivity enabling remote working.

Vehicles

Small electric vehicles are becoming more common and are a proven technology.

In September 23 the UK Government updated their targets for the path to zero emission vehicles by 2035. 80% of cars and 70% of new vans are to be zero emission by 2030 and 100% by 2035[72]. A minimum of 22% of new cars sold in 2024 are to be zero emission.

The Council are currently preparing an EV charging infrastructure strategy[73] to set out a strategic plan for increasing Shetlands charge point infrastructure.

In addition to electricity, other fuel options such as biofuels and synthetic fuels are also options, particularly for larger vehicles or those with a long range, as discussed earlier.

Vessels

Shetland hosts a particularly diverse marine fleet. These include ferries to the mainland, inter island ferries, offshore service vessels, pelagic fishing boats, white fishing boats, along with shellfish and inshore boats. For further details on the vessels based and operating around Shetland please see the

[69] NEPTUNE Project | Orion Clean Energy Project Low carbon fuel options for shipping report by Babcock, table 4

[70] Decarbonisation of mobile agricultural machinery in Scotland – an evidence review (climatexchange.org.uk)

[71] NEPTUNE Project | Orion Clean Energy Project

[72] Government sets out path to zero emission vehicles by 2035 - GOV.UK (www.gov.uk)

[73] What are we doing? – Shetland Islands Council

recent Neptune study for further details[74]. The Neptune study also includes details on the key organisations driving, promoting and approving change in the marine industry. The International Maritime Organisation (IMO) for example has recently (in 2023) adopted a revised emission reduction strategy for global shipping[75].

In addition to projects on vessels and in ports and harbours other actions can be undertaken to reduce vessel steaming time, to help maximise their efficiency. The Land in Shetland campaign[76], run jointly by Lerwick Port Authority and the Council, with support from other local partners was launched to inform fishermen about how landing their catches in Shetland could save time, fuel and money.

Figure 22 below from the Decarbonisation of Scottish Maritime Transport study, provides a summary of the short and long term actions for marine vessels. These actions will be complemented by associated works at ports and harbours to ensure electricity and other fuels are available. Ammonia, for example is highly toxic, and, while it is widely used and has a known risk profile, it will be necessary to ensure safety precautions are in place and all staff are fully trained.

Further information on fuel for transport can be found in section 3.

	Type	Ongoing Action	Short Term (next five years)	Long Term (10 - 15 years)
	Small Ferry	Optimise efficiency	Diesel - electric hybrid / battery electric	Battery Electric
	Large Ferry	Optimise efficiency	Biofuels or Diesel - electric hybrid	Ammonia combustion
	Fishing Boat	Optimise efficiency	Biofuels	Ammonia or methanol combustion
	Inshore Service Vessel	Optimise efficiency	Biofuels / Electric / Diesel - electric hybrid	Battery electric / Ammonia or methanol combustion
	Offshore Service Vessel	Optimise efficiency	Biofuels / Electric / Diesel - electric hybrid	Electric / Ammonia or methanol combustion
	Large Cargo Vessel	Optimise efficiency	Biofuels / LNG	Ammonia combustion or fuel cell / SMR

Figure 21 From Decarbonisation of Scottish Maritime Transport published March 23 Document details | Reading Room for Scottish Enterprise (evaluationsonline.org.uk)

Aviation

Aviation is covered in Section 4, Whole Energy System.

Action areas Transport

	Transport	Build on transport	**ZetTrans**	19. We will support the full revision of the Shetland	38. We will support	All

[74] NEPTUNE Project | Orion Clean Energy Project
[75] Revised GHG reduction strategy for global shipping adopted (imo.org)
[76] Land in Shetland

		strategies and linked strategies such as active travel.		Transport Strategy 2022-2042, being undertaken by ZetTrans.	delivery of the transport strategy.	

Lifestyle

Everyone uses energy and therefore everyone will be impacted by energy transition. Some changes won't be noticeable. Such as, when the Lerwick Power Station switches to standby mode and the Shetland Distribution Grid is connected to the Grid Supply Point, our home appliances will continue to operate as before but our emissions will be lower. We do, however, acknowledge that other changes will be very noticeable and the impact on households and communities will not be uniform. Similarly, as everyone uses energy is different ways, the impact of change will not be the same across the board.

Research has shown that energy transition will have a quicker uptake if the changes required have minimal impact on the daily lives of individuals.

> *"polling suggests that support for net-zero policies drops if there are financial or lifestyle costs for individuals" LGIU report (email from 13-June-2022)*

It will be necessary to demystify some of these new mechanisms and technologies to create a willingness for individuals to adopt them. There is already a wealth of information and resource available Cost of Living – Shetland Islands Council.

Emissions associated with heating and cooling are significant and have been discussed in detail earlier. However, behaviour change and technology advances will also help reduce emissions further.

Behaviour change

Reducing energy use within the home will require behaviour changes. Behavioural change has become one of the key measures that society can take forward to address climate change and energy transition targets.

The Carbon Literacy project defines behaviour change in environmental terms as:

> *"the individual actions one needs to undertake and the lifestyle changes one needs to make in order to lead a more sustainable lifestyle. It also refers to the change in our way of thinking"*

As individuals, behaviours are learned primarily from the circumstances in which we live. These behaviours become engrained and form habits that we must work to break or shift. However, there must be a willingness to change which can be derived from awareness raising and provision of pathways forward for individuals. How we use and interact with energy will have to change in order to reduce our use.

Some simple examples of behaviour change around energy include:

- Changing the temperature at which we heat our homes.
- The frequency we use certain appliances.
- Turning off lights and outlets when not needed.
- Reducing the number of car trips and/or carpooling.

It will be necessary to engage more and differently with energy. Use of smart meters can help instantly connect individuals to their home energy use. They also enable access to alternative electricity tariffs, this is discussed further in Section 8 Affordable Energy.

Advancing Technology

Technology development will be a big component of improving energy efficiency. However, there must be willingness for the change by individuals, especially for those early adopters of technology. Consumer demand for energy efficient products will be a driver for the production of these technologies. Knowing what to ask for and how to use the technology once obtained, is of great importance. Individuals can consider whether they need to own an item or if it can be borrowed or rented for the time it is required. Different ownership models such as joining a car club as an alternative to car ownership are being explored for Shetland.

Combining Technology and Behaviour

While the low carbon and net zero technologies are advancing, there is a large degree of involvement needed by individuals to engage with emissions reductions. According to the Climate Change Committee, the role of societal and behavioural changes needed to achieve their balanced net zero pathway will be as follows:

- 16% largely societal or behavioural changes
- 41% Low carbon technologies or fuels
- 43% Measures with a combination of low-carbon technologies and societal/behaviour changes

The largest proportion of emissions abatement will come from some degree of change by consumers through the up-take of low-carbon solutions such as driving an electric car or installing a low carbon heating system. The technology alone does not decrease emissions, but individual choices to use that technology and the expectation that low carbon processes and a circular economy are used does. Individuals are the decision-makers across industries and economic sectors and can promote decarbonisation in their organisations' procurement policies.

Technology change and behaviour change in isolation will not decarbonise the UK.

Action areas for lifestyle

	Lifestyle	Improve communication with the Community as the route to net zero intensifies	**SIC Future Energy Climate Change Teams and Community Development Teams, Community Planning Board**	20. Draw up a communications plan for the Rural Energy Hubs project.	39. We will work to ensure that the impact of energy transition on our lifestyles is positive and equitable. 40. We will empower behaviour change within the community through raising awareness and understanding of climate change and	

					its link to energy transition. 41. Following completion of the Rural Energy hubs project in October 2025 share lessons learnt and continue to develop the concept.	

Prosperity

Section 7 – Economic Opportunity

Long term outcome 3: create and retain local wealth, with a target to generate £100m+ a year of diversified economic revenue to the Shetland economy.

Energy Transition presents a range of economic opportunities for Shetland at all scales from improving the performance of all our buildings through to large scale energy developments such as offshore wind and the local production of Hydrogen and synthetic fuels.

Retaining local wealth

Economic performance in Shetland remains strong[77], with the three key economic sectors being fisheries, oil & gas (O&G) and engineering. Energy transition will have a substantial direct impact on these sectors.

Our marine sector has the dual challenge of being both comparably more difficult to decarbonise and reacting to the demands for sea area made by renewable energy projects. A high level of engagement is therefore essential to ensure all interests are considered and balanced as far as is possible.

The prospects for continuing O&G production through Shetland are uncertain at the time of writing. For further discussion please see Section 3. However, the maturing basin reserves and the need to transition away from fossil fuels mean that the eventual end of O&G production here is inevitable.

Shetland has a strong supply chain in engineering and that local engineering sector will be key for maximising local benefit in any future energy scenario. It is therefore essential that we ensure our local engineering supply chain has the skills and capabilities to engage in any new opportunities.

Creating Local Wealth

Figure 23 below provides a summary of the current pipeline of projects that we are aware of, the timeline and the scale of the opportunity. There are still many uncertainties associated with these projects and further information on the specific technologies can be found in Sections 3 and 4.

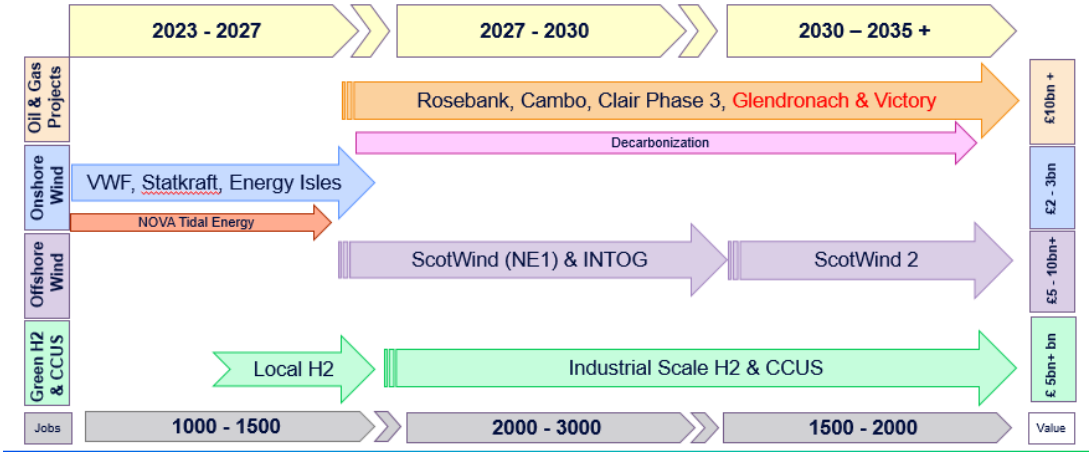


Figure 22 Project pipeline to be updated for final version with a regularly updated resource for strategic planning

The overarching opportunities for Shetland fall under four headings:

[77] Shetland Economic Accounts 2017 | FAI (fraserofallander.org)

1. Local supply chain opportunities
2. Land and seabed rents and option payments
3. Compensation for any activity displaced by development
4. Direct community benefit as the local host, including local or shared ownership.

Local supply chain

Shetland benefits from a highly skilled, diverse supply chain that understands our key sectors and has been involved in a number of large-scale projects in recent years. The local supply chain is a key component of maximising the opportunities of any project, large or small and spreading the benefit across the isles. The greater the proportion of project costs which can be recirculated into the Shetland economy through contracts and jobs, the more growth will result in the local economy.

For this to be achieved, it is critical that early and close engagement takes place between energy developers and our existing industries. This will help shape future projects, capture local benefit and support successful delivery of projects in Shetland's challenging remote environment. Local supply chain integration is one of the Energy Development Principles, and further information on these can be found in Section 2. The Crown Estate have asked offshore wind developers in the ScotWind round to provide Supply Chain Development Statements, which provide a structure for project specific supply chain information to be communicated with government and industry[78].

Shetland's Oil & Gas midstream activity has supported the development of a highly skilled and capable local supply chain with a track record of supporting the delivery of major energy projects. In most cases, the local supply did not lead delivery, but supported critical elements on large-scale projects. The energy transition offers the opportunity to flip this model and try to capture greater local control of delivery which would lead to the retention of more local economic and community benefit.

Each of the developments detailed above in Figure 23 will require an extensive supply chain to progress the projects through the different stages of development from feasibility to end-of-life and decommissioning. Shetland currently has the capability to service many of these project stages but will have to upscale its capacity to be able to deliver on the number and size of these pipeline projects.

Maximising Supply Chain Opportunities

Shetland's supply chain stakeholders (public sector and industry) are taking a coordinated 'Team Shetland' approach to engagement with developers and promoting Shetland's capability and capacity to deliver large-scale energy transition projects.

The aim of this approach is to provide a first level supply chain forum (The 4Shetland Forum further information here) to engage with developers and facilitate a strategic framework (based on the Energy Developers Principles) and action plan that will enable Shetland to maximise local supply chain content.

Depending on the scale, status and timelines of projects the 'Team Shetland' approach will continue to take different forms of engagement, support and activity.

This will range from raising awareness to infrastructure development and will focus on:	These areas will focus on ensuring the local supply chain:

[78] SCDS Summary (crownestatescotland.com)

• Developer/Investor and Supply Chain Engagement • Raising awareness of opportunities • Capability and Capacity Building • Infrastructure Development • Collaborative Approaches	• gains early stage engagement, insights and input into large-scale projects; • identifies opportunities and gaps; • addresses barriers to delivery; • identifies and delivers infrastructure requirements; • works collaboratively together and with developers; and • secures necessary funding packages to deliver projects from or in Shetland.

Land and Seabed rents and option payments

The seabed around Scotland is owned by the Crown (the "landlord") and managed by Crown Estate Scotland; consequently all onshore and offshore project payments will be made to them. Approximately 15% of ScotWind acreage is inside the 12mile contour and 85% are between 12 and 200 miles.

The surplus generated by Crown Estate Scotland for the lease of seabed within the zone up to 12 miles from shore is transferred to the relevant local authority via the Scottish Government. The formula for how these funds are distributed is the subject of bi-annual review and negotiation with COSLA on behalf of local authorities. Adjusting the 12 – 200 mile arrangements would require more fundamental overhaul by the UK and Scottish Governments.

Compensation for any activity displaced by development

Displacement of onshore activity has primarily concerned crofting and agricultural tenancies and is addressed by arrangements agreed between developers, landowners and tenants.

There are other users of the areas of interest for offshore energy, most notably fisheries. While the landlord – tenant relationship is different in detail at sea, the issues and solutions around compensation for displacement can be guided by the principles and practice developed onshore.

The seas around the islands have historically been and still are used for a wide range of purposes; those important to Shetland being fishing, navigation, aquaculture and leisure.

Fisheries and associated activity remain the most significant and enduring component of the Shetland economy. Fisheries related income, jobs and supply chain activity has remained more significant than Oil & Gas and remains the logical foundation for much of the island's future sustainability and well-being.

Oil & Gas developments interfered with fisheries activity in the direct vicinity of platforms, but that was a relatively contained area. As of January 2018, there were 184 offshore rigs in the North Sea, with these much less concentrated than proposed offshore wind farms. Oil & Gas developments saw less restrictions over a large sea area compared to future offshore wind development.

Floating offshore wind has the potential to exclude current fishing activity from much larger areas, for NE1, c0.6% of Shetlands surrounding seas in one development, with further developments expected through future leasing rounds.

Beyond the direct impact of excluding catching activity, the wider impacts of offshore generation on fish stocks and other marine species are not well understood at this time as there is limited evidence available. It is not clear how far the ScotWind round has fully assessed fisheries impact in its design. While the later INTOG round was accompanied by fisheries heat maps, among many other marine spatial maps, its inherent design was focused on other factors, i.e., Oil & Gas decarbonisation.

There is no substantive locus in offshore decision making for Local Authorities, affected sectors or other community representatives. That creates great uncertainty as to how local dependencies, interests or priorities will be recognised in any decision-making processes. This is why the Council has included Sectoral Co-Existence and Environmental Protection as two of the Energy Development Principles. We need to ensure developers commit to making disturbance payments during construction and compensation payments for the loss of fishing access and income (throughout development lifespan), along with scientific research and ongoing independent scientific monitoring.

Direct Community Benefit to Shetland as the local host

Shetland Charitable Trust (SCT) was set up in 1974 to accept money from the Sullom Voe Oil Terminal. This was initially set at 1p/barrel until the agreement ended in 2000. This fund dispenses millions of pounds a year to the Shetland community, providing services such as support for the elderly and infirm as well as funds for local cultural and sporting activities. As a charity, SCT is restricted in what it can do.

The Scottish Government set out the expectation that energy developers should continue to offer meaningful community benefit as set out in the community benefits from onshore renewable energy developments[79], this publication provides the good practice principles.

These principles recommend that Community benefit packages for onshore wind developments should have a value to the equivalent of at least £5,000 per installed megawatt per annum and be index-linked for the operational lifetime of the project. In addition, they also suggest that other onshore technologies should aspire to this level.

The updated document is expected to have a larger focus on shared/local ownership as well as community benefits. The 2.8GW NE1 ScotWind site presents a huge opportunity for the Shetland community to receive significant benefits.

The Scottish Government's National Marine Plan (NMP) Renewables Policy states that "Good Practice guidance for community benefit from offshore wind and marine renewable energy development" should be followed by developers. The Scottish Government are currently consulting on Good Practise Principles for Offshore Renewable Energy Developments, focusing on community benefits and local ownership, with publication due in 2023.

Their draft included three key principles:

- Designing a Community Benefit Package
- Identification of Community
- Maximising Impact

[79] Executive Summary - Community benefits from onshore renewable energy developments - gov.scot (www.gov.scot)

Following a review of the current community benefit payments delivered by offshore wind sites in the UK. There is a significant range in payment size, with the lowest being £20/MW per year, and the highest being £1,634/MW per year at Walney Extension. If this higher value was replicated at the NE1 site it would result in an annual community benefit payment of £4,575,200. It is worth noting that the two current floating offshore wind sites in the UK (Kincardine and Hywind) do not offer a community benefit fund.

Although the provision of community benefit is voluntary at this point (onshore and offshore), we believe that it is a fundamental component of any agreement developed between the community and the developer. Shetland recognises the future significance of offshore wind in global decarbonisation and is open to the potential to development of a successful offshore renewable energy industry in an environmentally responsible manner. However, we are equally determined that must be done in a balanced fashion, is aligned with just transition principles and that it has to deliver benefits locally as well as nationally.

For this reason Benefits to the Shetland Community is included as one of the Energy Development Principles. With the key points:

- Fair Share of value from all developments, offshore and onshore
- Financial Benefits to the community
- Product Benefits; e.g. affordable energy for Shetland households
- Public Goods Benefits

Identification of Host Community

Community Benefit is accepted as being intrinsically local, and the Scottish Government have stated they will not set up any fund or arrangements with central management or administration in order to avoid confusion with statutory provision and possible state aid issues.

It is widely accepted that land proximity is used to demarcate sea boundaries and to identify the most adjacent community. Shetland residents and businesses have long been active across all the waters within the area identified as the Shetland Exclusive Economic Zone (EEZ). Figure 24 highlights the Shetland EEZ, or the part of the United Kingdom's EEZ adjacent to Shetland, the dashed line indicates the area within 50 nautical miles of Shetland's coastline. Those boundaries have been identified in line with that principle of geographical proximity. In addition, Shetland fishermen operate in all these waters.

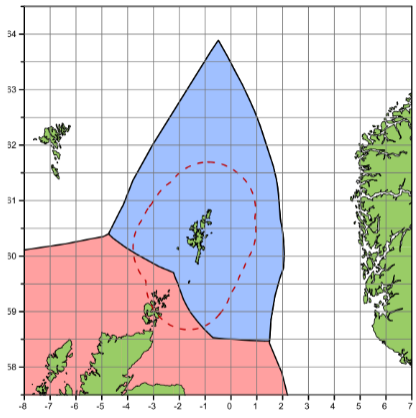


Figure 1 The 'Shetland EEZ': that part of the United Kingdom's Exclusive Economic Zone (EEZ) adjacent to Shetland (north of a median line between Shetland and the rest of the UK). The dashed line indicates the area within 50 nautical miles of Shetland's coastline.

Figure 23 https://www.shetland.uhi.ac.uk/t4-media/one-web/shetland/research/statistics/eez-reports/Shetland-EEZ-2020-11-04.pdf figure 1 - Map to be reviewed for final version

Shetland has historically depended on our surrounding waters for economic, social and cultural activity and has a long track record of interest, activity and dependence on the seas around the islands. Offshore renewables is another chapter in the productive history of those seas and one which the Shetland community has a fundamental right to share in.

There are comments in Scottish Government guidance around whether developments would be visible or not. A large offshore turbine of the type under development within 40 miles of the Shetland coastline would be visible from the islands and many sea areas commonly visited. Further technical development may extend those ranges. In any case, we do not believe that visibility is a material component in defining host community; the host community is simply the one that is geographically closest.

Onshore Community Benefit arrangements have been negotiated on the basis of Shetland as a single overall community. However, there are provisions within the agreements for differences in detailed benefit values and decision making arrangements for specific geographical communities deemed to be most immediately identifiable as the explicit host for turbine siting.

We would suggest that these principles are also replicated for offshore development. Umbrella arrangements should recognise all of Shetland as the host community, although variations in detailed benefits could be agreed for different communities within the islands if that was deemed appropriate by the Shetland community as a whole.

Community Ownership

Community energy refers to the delivery of community-led renewable energy, energy demand reduction, and energy supply projects. Community energy puts people at the heart of the energy system. To achieve a Just Transition to net zero, we need to consider all the options, but key to success will be high levels of community engagement and demonstrating community benefit from an early stage.

There are many different opportunities for community ownership of energy projects.

- Wholly community owned
- Joint venture with a commercial or public sector partner
- Co-operative where members of the community can own a share of the business
- Community scale projects which are privately owned, but where community benefit may occur

There is no 'one size fits all' solution.

Community groups are uniquely placed to influence and ensure that the new developments help their people. It is important that the community approach is built on and wider challenges such as the local supply chain and skills availability are considered.

Community Energy Scotland state of the nation report[80]

Action areas creating and retaining local wealth.

	Energy Development Principles	Advance the Energy Development Principles approved Dec	**SIC Economic Development, Climate Change and Future Energy**	21. Complete Community Wealth building research.	42. We will develop, promote and implement the Energy Development	

[80] Our Voice - Community Energy Scotland

		2022 as guidelines for engaging with Energy Developers. Measure economic and social impacts.	**Teams, HIE, Energy Steering Group**	22. Undertaking the maximising of economic opportunity research. 23. Measure the socio-economic impacts of producing green hydrogen from onshore wind.	Principles. With ongoing strategic direction and monitoring provided by the 4Shetland Forum. 43. Updated Shetland Regional accounts 44. We will investigate the technical and non technical barriers to local businesses developing and engaging in opportunities relating to energy transition.	
	Enhanced powers	Restart the Our Islands Our Future campaign led by the three island local authorities, Aiming to work together to secure more decision making at a local level and greater economic prosperity for island communities.	**SIC Corporate Services, MP, MSP**	24. Prepare project to investigate enhanced powers.	45. We will investigate options for enhanced powers	

Securing external funding

The scale of investment required to transition to Net Zero is significant especially at a time of budget cuts both locally and nationally. We would like to see a change to the current inefficient competitive approach to funding that has no guarantee of success and is often unsuccessful. Switching to an alternative model with greater cooperation and collaboration between areas would be preferable. But until a more logical system emerges we must build our expertise to apply for external funding, develop a pipeline of projects in line with the priorities identified through the Shetland Net Zero Route Map and stakeholders to help streamline the grant application process, which is often reactive and operates at very short notice.

Action Areas securing external funding

	External funding	Build capacity to seek the	**SIC Future Energy, HIE,**	25. Use the existing governance	46. Ongoing to continue to build	1,2, 3,4

		external funding that energy development projects will require.	**Energy Developers, Energy Steering Group, Islands Centre for Net Zero**	structures and stakeholder working groups as a mechanism to build a pipeline of projects and consortia required for external funding bids. 26. Promote Shetland Energy Hub credentials to main funding bodies.	the pipeline of projects and an updated list of potential consortia partners. 47. We will support and encourage applications for external funding which align with the four long term outcomes.	

Section 8 – Affordable Energy

Long term outcome 2 ***Secure Affordable Energy: Secure all Shetland energy consumption from affordable islands-based generation***

The current high cost of energy combined with the cost of living crisis are emphasising how important it is that we get the transition right. People on the lowest income are being effected the greatest, and have the least opportunity to make change themselves.

One of the overarching themes of ensuring a Just Transition is:

> *Spreading the benefits of the transition widely, while making sure that the costs do not burden those least able to pay.*

The transition to net zero is an opportunity to make things fairer. Shetland has been an energy hub for over 40 years, yet we pay the highest prices for energy in the UK and that is unfair. It is therefore essential that, while we build on our past successes, we also learn from past problems.

Delivering affordable energy will require engagement with a wide range of stakeholders, throughout the energy supply chain, along with regulatory change. We must also consider the significant cost of transition and how it will be paid for. There is a close relationship between energy transition and the ability to meet the costs of the transition at all levels from individual households through to the enabling infrastructure projects.

Cost of living and the role of energy

Current situation

The cost of living is rising. Partly driven by energy costs and international conflict, but also by factors such as the cost of raw materials, supply chain issues and recruitment challenges. For further information on support available see Cost of Living – Shetland Islands Council.

The cost of living in Shetland is between 20-65% higher than the UK mainland. The rising costs of fuel, food and other essentials are combining with existing disadvantages and vulnerability within our community to put many households at greater risk of both immediate hardship and reduced opportunity and wellbeing.

Route to Affordable Energy

Energy and other costs have increased, and are projected to remain volatile for the foreseeable future. The current situation is set to continue and we are going to see changes to energy consumption as electric vehicle use increases. There are also wider health implications, as households ration their energy to keep costs down and make the impossible choice between eating and heating. This can cause or exacerbate existing physical and mental health problems which will lead to wider health and social care challenges.

As part of Shetland Forward[81], Energising Shetland sets out the ambition to achieve the outcome of a Shetland Tariff. It sets out how the Council wishes to enter discussions with the Scottish Government, the UK Government and with industry stakeholders, with a view to negotiating a new settlement and

[81] Shetland Forward – Shetland Islands Council

receive a fair return on energy costs given the substantial contribution Shetland is making to clean energy generation.

The Council also agreed on a new programme in September '**Energising Shetland – Affordable Energy and a Shetland Tariff**' to investigate mechanisms of achieving lower energy costs for Shetland homes and businesses. Some of these potential mechanisms are discussed below.

Action areas - Affordable Energy:

	Affordable energy	Continue work on the Affordable Energy project approved by Council November 2023	**SIC Future Energy Team**	27. Support the roll out of Smart meters and ensure it is equitable. 28. Develop a project to ensure households have access to support to transition to Smart Meters. 29. Engage with the UK Governments ongoing consultation on REMA (Review of electricity market arrangements). 30. Further investigation of affordable energy options build relationships with other Local Authorities and agencies with similar challenges to maximise the impact of engagement.	48. Continue to engage with REMA and the roll out of smart meters 49. We will have full access to clean, affordable and secure energy produced in Shetland. 50. We will engage with energy suppliers to understand the challenges to the roll out of smart meters in Shetland and engage with regulators to find options for Shetland and other areas which face similar challenges.	1,2, 3,4

People

Section 9 – People Powered Change

People are at the heart of this strategy. The energy transition and the work to be done to achieve a fully just transformation will be undertaken by people at home, at work, and in the community.

Section 6 talked about aligning technology with behaviour change to achieve emissions reductions. This section will look at the building capacity in the workforce through jobs and skills as well as exploring how participation and working together will drive transformation.

Workforce

Beyond domestic lifestyle changes, the energy transition will impact Shetlanders in their professions and careers in a myriad of ways. Shetland should supply a range of offerings for studying, learning, and working in the energy transition in order to maintain population, retain wealth, and maximise opportunities.

Current

Some of the key statistics for Shetland's current workforce can be found in Section 2 Drivers for Change. Shetland has a limited capacity within its existing workforce across all sectors due to low unemployment, and an aging workforce.

There are an estimated 14,200 people in employment in Shetland[82] with around 1,000 people working either directly or indirectly in the energy sector.

However, this workforce is aging. There has been a decline in the number of young workforce coming in to fill roles across Shetland even with 96% of 16-19 year olds[83] in education, employment, training and personal development.

Future

It is estimated that there will be 2,000 jobs in the energy sector (direct & indirect) in Shetland at the peak of the energy developments, mostly during construction phase. After the peak, during the operations & maintenance phase, the number of jobs will level out to around 1,500 longer term roles. Based on these predictions, the number of jobs increases by 1.5x by 2035.

The exact number and type of jobs that will be required will depend on which developments do make it through to the development stage. Aligning a project timeline with the general job statistics to deliver each can provide some ideas of the types and number of jobs that will become available.

Opportunities

- Showcasing the skilled workforce and companies with a track record on the delivery of projects in Shetland
- Positioning Shetland as a centre for excellence

Challenges

- Low unemployment rates
- High underemployment rates
- Competition for jobs in existing sectors
- Understanding which jobs and skills will be needed and when

[82] Indicators – Shetland Partnership
[83] Indicators – Shetland Partnership

- Growing the training sector through the development of a wider range of academic routes and courses
- Supporting innovation and opportunities attractive to youth
- Encouraging people to live, work, and study in Shetland
- Higher cost of living creates the need for high-skilled/higher-paid jobs
- High cost of doing business
- New entrants dependent on limited accommodation
- Flexible childcare arrangements

Jobs

Shetland has an established skilled workforce and companies with experience delivering energy projects. With an increase in energy projects, an increase in the workforce capacity will be required to maximise the local opportunity. These new roles can be filled in a number of ways:

- Promoting Shetlanders in key industry roles – capturing the long-term, high-paid jobs by the existing workforce in Shetland and reducing the number of roles that are filled externally
- New Entrants – growing the existing energy workforce capacity to eliminate competition with other economic sectors (link to education, gender, and bringing new talent/repopulation)
- Workforce pathways – encouraging apprenticeships and non-university paths to enable quicker uptake up available roles.

One of the challenges for Shetland will be ensuring a just transition and expansion in employment from our existing sectors to include renewable energy and clean energy jobs. This will require strategic planning and alignment to no one is left behind.

There are many studies about how to create this balance, but they are at a regional and national level. The predictions for the future of Scotland's energy sector show the possibilities for jobs and roles during the transition to renewable and low-carbon energy. Hydrogen production and offshore wind may be the biggest future energy employers. Shetland will need to create its own roadmap for transitioning jobs and skills based on the unique circumstances of a rural, remote island.

Promoting Shetland in Industry roles

To maximise the benefits to Shetland, it is essential that the existing Shetland workforce access the long-term, high-paying roles that could come along with the transition. With new opportunities arising across various parts of new energy developments and auxiliary services that will be needed to enable these developments, there will need to be a plan to identify roles and pathways.

New Entrants

Due to the large number of jobs that will become available with the transition, not all of these will or can be filled by the existing Shetland energy workforce. The workforce capacity will have to grow to eliminate competition with other important local economic sectors. There are a number of ways to grow the workforce in-line with the job supply.

The young workforce is one way to increase new entrants into the transition workforce. Pupils can be engaged throughout their education and curriculum to spark enthusiasm. However, it is essential to let schools and parents know the opportunities that are coming down the pipeline. Teachers and

parents will encourage the younger generation to work towards a career in a sector that can provide long-term opportunities and economic stability. There is a drive across the energy industry to promote gender diversity into roles that have traditionally been male dominated. The demographics of women in energy roles is increasing, but there is now an opportunity to encourage more women to become part of the energy workforce. This will increase the capacity of Shetland for transformation projects, and also increase household income. Establishing Shetland as a great place to live, work, and study will encourage families and workers to move to Shetland to fill new roles and build capacity for the transition.

Beyond empowering women to take on these roles, we aim to increase diversity broadly across the energy industry.

Pathways

There are high rates of youth going into the higher education in Shetland already. Many pupils leave Shetland to receive degrees; however, a number decide not to return directly after obtaining them. In order to address our aging workforce, we must encourage the young workforce to return.

Provision of relevant courses in Shetland is one way to retain some of the leave-takers. Signalling to competitive jobs in Shetland's energy sector may be another way.

A wide range of job types are required to achieve a just energy transition. Not all of these roles and careers require a university route to employment. Apprenticeships have been a key pathway for the supply chain to train and secure their workforce by placing workers into the field for on the job training. These will continue to be valuable. While companies are looking to increase their workforce, there are limitations on the number of apprentices that they can train at one time.

Shetland Green Skills Group

The Shetland economy is particularly reliant on a few key sectors that employ large numbers of the population including fishing, aquaculture, and O&G. Though Shetland has a significantly lower unemployment rate compared to the rest of Scotland, there is a labour and skills shortage.

The Shetland Green Skills Group has been established with the specific role of ensuring skills issues, from education to industry are well understood, and an effective and timely response developed to ensure a skilled workforce and appropriate training provision is in place to address challenges and capitalise on opportunities that will arise as Shetland progresses its energy transition ambitions.

Skills

The energy transition will make some roles and careers obsolete. There will not be an immediate shift from O&G to renewables. Instead, a balanced approach will be required to reduce redundancies. The phase out of O&G must match a scale up of low-carbon developments. Skills development will enable the just transition of workers and businesses in Shetland.

Transferability

In the future, O&G as a fuel and means of energy will become obsolete and replaced with other greener options. With O&G as a large employer in Shetland, there is a fear of the workforce also becoming obsolete. However, many of the roles and skills in the energy sector will be transferrable across technology type and worker experience. According to a report by Robert Gordon University,

"Over 90% of the UK's O&G workforce have medium to high skills transferability and are well positioned to work in adjacent energy sectors."[84] Figure 65 provides a summary of transferability.

New Skills

There are new technologies that are not equivocal to what we have today. This means that the skills and experiences of the existing workforce may not match what is needed to progress these technologies. The workforce that do not have transferable skills can be reskilled or upskilled to match emerging low-carbon roles and opportunities thereby creating local capacity. LinkedIn has generally defined[85] upskill and reskill:

- Upskilling is when an employee undertakes learning to expand their existing skill set with the aim to enhance the worker's performance in their current role.
- Reskilling involves an employee learning new skills outside of the worker's existing skill set which may be geared toward a different path entirely.

Each allow an employee to expand their knowledge; however, the difference lies in the nature of the new skills learned and the end goal.

In terms of the energy transition specifically, reskilling means "acquiring skills for careers and industries that are net zero by leaving behind old practices that are emissions-intensive and acquiring new ones that are suitable for future industries." Upskilling mean "acquiring skills for careers and industries that are net zero, ideally by adapting skills that have already been learned and are applicable to new jobs and needs."

Training and Certifications

Low-carbon and energy efficiency works will require workers and businesses to obtain certifications and trainings to carry out specific mitigation measures. Many funding streams and grants require these certifications to take on the projects.

While there are many benefits to obtaining these, there are 3 main barriers to acquiring training and certifications: Cost, Time, & Availability. The certifications are expensive, large time commitments, and are generally not available in Shetland. Additionally, there is little motivation for with businesses' backlogs of work to take these on as they already have healthy workloads for the near to medium term

However, in the long-term these trainings and certifications will be required to transition our economy and our usage of energy. Without them, we will miss opportunities to decarbonise and to obtain national funding measures. We must establish mechanisms to diminish the risks to businesses. Some options are:

- Shared trainings – multiple businesses are working with the same technologies and constraints. Sharing the cost can disperse the risk to businesses that undertake trainings together.
- Training bodies – some national training organisations have mechanisms in place for sharing the risks with businesses. Locally, UHI Shetland can provide courses for training and skills development.

[84] powering-up-the-workforce.pdf (rgueti.com)
[85] https://learning.linkedin.com/resources/upskilling-and-reskilling/upskilling-reskilling

- Policy change – many of the policies and targets from the national governments are targeted at populated city centres. Advocating for island specific measures and policies can allow for different approaches to trainings and change the certification requirements.

Employers need indicators on future projects and the opportunities to reduce the risks associated with training. Policy drivers are key for directing organisations and employers towards the trainings and skills that will be required at the national level to obtain funding.

Education

One part of behaviour change is education at younger ages to change the habits learned and engrained from a young age. Primary & secondary education has been broken out as separate measure. Education will be essential for teaching the younger generation a new/different mind-set about how we use and generate energy. However, we need to maintain the momentum from an early age. This is underway in multiple ways including:

- Primary and Secondary school curriculums already include climate sciences with a focus on climate change mitigation and adaptation. The ambition of including these topics during primary and secondary education will encourage an uptake of interest of the youth who will be the innovators, leaders, and key energy workforce in the future.
- The uptake of other types of extracurricular school activities that focus on green skills and climate change should be encouraged beyond just the curriculum. Parents will be essential to ensuring engagement with topics at home and keeping up the momentum.

Today's youth and younger generations will be the persons most impacted by climate change, but they will have a large part to play in the solutions and uptake of technologies to address the challenges that will arise. The climate crisis and energy transition will require innovative thinking and a diversified workforce. New ideas from the young workforce will be valuable in mixing up the current energy workforce and spark new solutions.

Action Areas workforce

	Workforce	Investigate the educational and skills services required for energy transition equal opportunities.	**Green Skills Group, UHI Shetland, Energy Steering Group, SIC Economic Development and Future Energy Services**	31. Project pipeline resource for different technologies to collate data on how technologies and projects may develop. 32. Skills survey 33. Shetland will need to create its own roadmap for transitioning jobs and skills based on the unique	51. We will undertake further research to understand the pipeline of upcoming projects to ensure we have the skills and capacity to handle the predicted change in employment. 52. We will encourage and support diversity	4,1, 2,3

				circumstances of a rural, remote island.	within the workforce.	

Participation

While climate change is attributed to years of misuse of the world's resources, it is not a useful to place blame on the WHO and HOW this has happened. Now is the time for action to progress our ambitions, transform the way that we interact with our world, and redefine how we use our resources without disadvantaging future generations.

This is a task that everyone should participate in to drive Shetland's clean energy future.

Empowerment

Every person has a part to play in the energy transition and changing how we use energy. However, tackling this is not something we can do in isolation. We must empower ourselves and those around us to make our clean, affordable, secure energy vision a reality.

Empowerment is equipping individuals and the community with the power and resources to undertake and accelerate the energy transition. Building knowledge, understanding, skills and capacity within the community will enable groups and individuals to undertake and accelerate their own activities.

Energy is complex, and the transformation is daunting. This strategy contains information on how different parts of the energy system interplay and fit together as a first tool to breaking the energy system into more understandable parts and increasing knowledge. The provision of informational resource and knowledge sharing with individuals and the community will not stop at this strategy.

One pathway for empowerment is already established and will be utilised for progressing the conversation about Shetland's energy future. The Shetland Climate Conversation is led by the Council with the aim to engage with the community to understand what individuals, businesses, and volunteer groups think, feel and say about climate change. The Climate Conversation is a way to raise awareness around climate issues and positive climate action happening around Shetland. For more information on climate conversations see here[86]

Now that there are development opportunities in play in and around Shetland our efforts need to be switched from promoting opportunities towards making the most of those opportunities for the Shetland community. That is why a set of Energy Development Principles has been prepared to form the basis of future discussions with energy developers whether in renewables or in the remaining new oil and gas ventures to the West of Shetland.

Decision-making & Policy Change

As citizens of the UK and contributors to the national economy, it sits with us to help drive the decisions that are made that affect our futures. While Shetland has the potential to be a powerhouse of energy generation, national decision-makers do not always put the needs of remote islands at the

[86] Shetland Climate Conversation – Shetland Islands Council

centre of their policies. We must assist with and be involved in the vision planning for the future that we see for our islands.

National decisions tend to be focused on technology type without granularity on how targets will be achieved and what will be required across the country. Shetlanders hold the local knowledge required to drive transition in our region and should be centre to identifying pathways and technologies that are best suited to our geography and circumstances.

Our local elected members are essential to ensuring that Shetlanders are not disadvantaged by the policies at a national level and that the most local benefit possible can be obtained. Choosing politicians that support and represent our ambitions are key to delivering the mechanisms required to create transformative change.

This strategy is intended as a tool to help local decision-makers and national policy-makers make choices that progress the transition in alignment with our unique circumstances and our vision.

Action Areas participation

	Participation and empowerment	Improve the opportunities for Community Empowerment	**SIC Community Development, Economic Development and Future Energy Teams, HIE, Energy Steering Group, Community Planning Board**	34. Raise awareness and understanding of energy transition along with facilitating and supporting community-led action, building capacity within the community.	53. We will empower the community through raising awareness and understanding of energy transition and facilitating and supporting community-led action, building capacity within the community. 54. We will empower the community by highlighting opportunities to influence decisions relating to energy transition. 55. Support engagement in energy throughout the community, including outreach projects and contextual learning.	

Working Together

Imperative in the transition to net zero is the need for cooperation and collaboration. We do not have the time or resource to tackle all of the challenges on our own but as there is no one size fits all solution we need to understand what has worked and what hasn't worked in other places and why.

Mentioned throughout the Energy Strategy is the uniqueness of the Scottish island communities and the challenges they face unlike other regions. The weather and connectivity require resilient practices and build resilient people. There is a comradery (and competitiveness) amongst island communities as they face similar circumstances.

Islands and remote communities have their own unique challenges and solutions in contrast to areas with a higher population density. This holds especially true for the Scottish Isles. Many of the policies and solutions that are proposed by the UK and Scottish Governments do not hold the answers for the islands.

Ensuring a Just Transition to Net Zero with secure and affordable energy will require cooperation, collaboration and joined up thinking. The current chaotic nature of development and discussion requires a measured approach. The route to net zero is unclear, we need to ensure that all projects we are involved in and the stakeholders we engage with all add value to the work already started and align with the four long term outcomes as set out in the Introduction.

We must also ensure that any lessons learnt from one project feedback to test our scenarios for the future, as any updated information on infrastructure could change our thinking on the skills or the shape of a future workforce.

With the monumental tasks ahead, we do not have the time or resource to duplicate effort.

Regional Challenges & Learning from others

The main challenges that islands share:

- Harsher weather (colder average temperatures, heavier winds, more rainfall)
- Less physical connectivity (i.e. dependency on ferries and planes)
- Less broadband connectivity
- Dependency on fossil fuels

These challenges require island-proofing in national policy and tailored solutions. What works on the mainland or in other regions may not be applicable or the best way forward for islands.

Being bordered on all sides by water defines the geographic boundaries and maintains self-contained smaller-scale systems. Those conditions provide an opportunity for islands to become the test beds for new systems before they are rolled out wider.

Some of the most well- established and experienced energy organisations in the country are based in the islands and therefore have a strong start on the road to Net Zero. However, the islands also have some of the most challenging environments and barriers to overcome. The Shetland Energy Strategy aims to support people to really think about what role island communities and local energy projects can have in instigating and sustaining change, and how the greatest impact can be achieved to enable islands and Scotland to reach Net Zero.

See Annex 3 for further information on specific projects relating to working together.

Action Areas - working together

	Working together	Seeking strength and cohesion by developing shared working with	**Energy Steering Group, Islands Centre for Net Zero (ICNZ), various working groups associated with specific topics across islands and rural communities**	35. Complete the ICNZ Shetland clean energy business case. 36. Strengthen and embed the ICNZ shared approach into Shetland service plans and work programmes.	56. We will work within ICNZ to produce an action plan to prioritise actions. 57. We will learn from others and collaborate when there is opportunity to do so. 58. We will collate a resource to facilitate action planning and collaborative working.	

Section 10 – Communications

There is much to be done to make sure that Shetland gains the most benefits from the energy transition for the prosperity of its community and environment. A big part of this comes down to communicating with wide range of stakeholders.

Communications around energy should aim to engage in 3 ways:

- ***Inform*** – Providing party(s) with balanced and objective information about energy transition options to build knowledge and skills in the community and across partners in order to assist decision making
- ***Involve*** – any processes where adaptation and mitigation strategies are negotiated through the party(s) actively engaging in energy transition decision-making and policy planning
- ***Empower*** – party(s) take forward their understanding of how energy transitions will affect them, and take action to improve resilience (Net Zero Nation) by sharing decision making power to achieve lasting change

Informative and transparent communications are essential for the Shetland Energy Strategy to:

Inform

- Raise awareness of key issues around energy use, generation, distribution, etc.
- Provide resources for enabling the transition and achieving tasks in this strategy

Involve

- Open dialogue and start conversations about what will most impact the local community and businesses in Shetland
- Receive feedback from stakeholders

Empower

- Advocate and input into national government policy
- Identify achievable pathways forward for Shetland's energy future

What are the strategy's main messages about Shetland's energy future?

The main messages that we hope to share across the Council and its partners align with those in the Climate Change Strategy. Figure 25 below connects Energy with the other climate change themes to expand on how energy interacts across all themes.

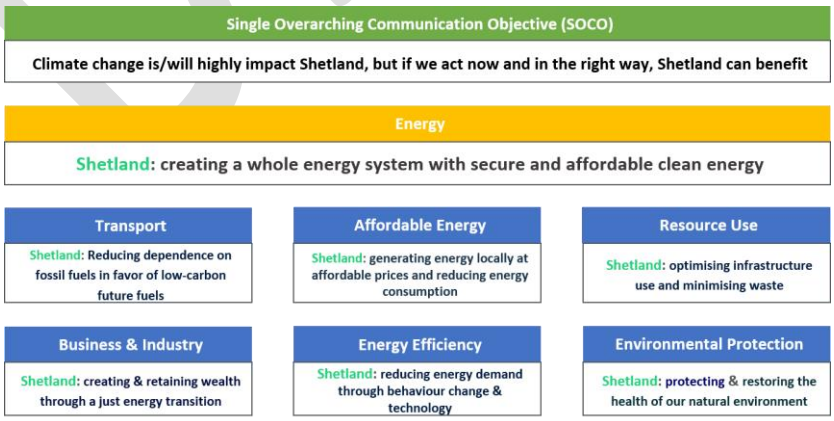


Figure 24 Main messages about Shetland's energy future - to be updated following consultation

Stakeholder mapping – Who are we communicating with?

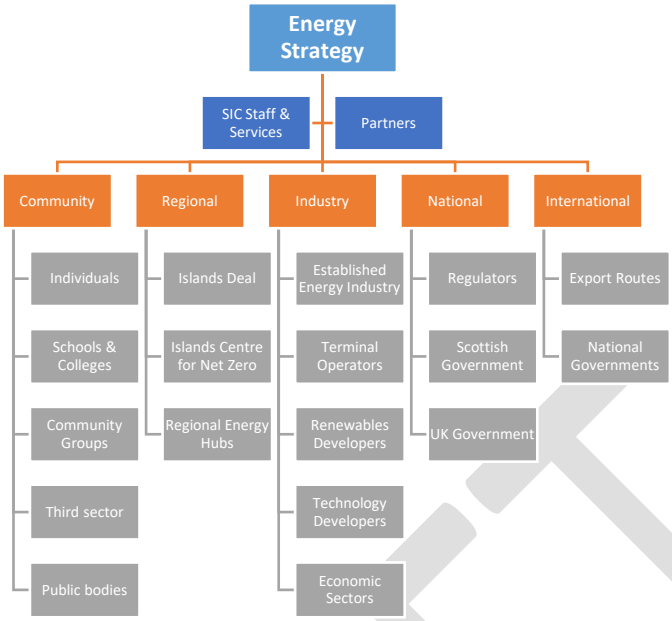


Figure 25 Stakeholder mapping - who are we communicating with - to be updated following consultation

What are we hoping to achieve?

The staff of all organisations that deliver this strategy are the enablers taking forward the communications from this strategy. It is therefore important that internal communication channels are strongly aligned to carry the same messages to our stakeholders.

There are additional benefits to strong internal communications amongst our staff, services, and partners to play a large role in the success of any strategy for Shetland by:

- Aligning work packages and avoiding duplicated work
- Efficiently using resources (personnel, money, and time)
- Empowering staff & partners to take forward their own energy initiatives within and beyond their service areas.

With such a wide range of stakeholders, engagement for each must be customised by what outcomes we hope to achieve with each stakeholder group. Our objectives across the various high-level stakeholders are:

Stakeholder Group	**Objective**
Community	Inform: raising awareness of various energy initiatives and topics Involve: co-creating a clean energy vision for Shetland Empower: support the community in their own initiatives
Regional	Inform: Info-sharing innovations and sharing limited resources in island regions Involve: Promoting collaboration to link each island hub into a regional hub
Industry	Inform: showcasing Shetland's capacity and capability as the ideal local for renewables development and investment
National	Inform: promoting Shetland's resources as a benefit to the national energy system Empower: Advocating for Shetland input into national targets and the challenges for island communities to achieve them
International	Inform: broadcasting Shetland's location as ideal for exportation of future fuels

Action Areas - communication

	Communications	Build on existing communications plans to advance a specific communications plan for the Energy Strategy.	**SIC**	37. Updated overarching communication plan based on the Shetland Energy Strategy with clear alignment to other strategies. With specific communication plans for any project progressed. 38. Recognising that Clear and effective communication is essential to accelerate action on energy transition. It is required to raise understanding and awareness, to increase commitment and to manage expectations.	59. Set clear communication objectives. 60. Use the governance structures as a mechanism to strengthen and streamline the network of stakeholder working groups. 61. Engage with stakeholders to share the narrative. 62. We will promote at a national level the scale of the challenge for Shetland in reducing our emissions and the need for a local approach.	

Section 11 – Conclusions

The Shetland Energy Strategy contains information on the different components of energy transition relevant to Shetland. It describes the current energy situation, predicting what is likely to happen through energy transition and the actions that need to be taken to secure our energy future.

The need for a Just Transition is recognised nationally and internationally, but can only be achieved through high levels of local engagement, collaboration and cooperation. Energy transition is inevitable and the process has already started. We know from past transitions that where change has been abrupt and unmanaged communities take decades to recover. It is therefore essential that we put a plan in place.

The Shetland Energy Strategy has three purposes, to:

1) provide information and awareness on how Energy Transition will impact Shetland,

2) act as a blueprint for developers, funders, and decision takers to consult

3) hold accountable key partners that will drive implementation of actions

Overarching

Governance and Leadership - In progress. Dedicated Energy Steering Group (working title) and sub groups being designed.

Communication - Good communication is key to enabling engagement and collaborative action on energy transition. A revised communications plan will be developed following approval of this interim energy strategy.

Delivering on the four long term outcomes

Reduce emissions – work on this has been initiated through the Shetland Net Zero Route Map which provides an overview of the magnitude of the challenge ahead and the level of action required to meet the target of net zero by 2045.

Action – Follow the energy hierarchy to ensure the most appropriate use of energy across all of the different sectors.

Secure affordable energy – work on this has been initiated through the Energising Shetland campaign. However the route to affordable is complex with various technical and regulatory challenges.

Action – Ensure we have full access to clean, affordable and secure energy produced in Shetland.

Create & retain local wealth – Work has been initiated on the Energy Development Principles, which were approved by Council in December 2022. These are now being developed into guidelines with strategic oversight provided by the Energy Steering Group.

Action - Advance the Energy Development Principles approved Dec 2022 as guidelines for engaging with Energy Developers.

Skills and capacity development – The Shetland Green Skills group led by UHI Shetland has already been established, with a wide terms of reference to support the skills pipeline for green skills development in Shetland. Further work is required to ensure alignment on capacity development.

Action – Build our own roadmap for transitioning jobs and skills based on the unique circumstances of a rural, remote island.

Annex 2 provides a summary of the action areas across all of the sectors of energy transition considered within the strategy.

Energy Transition will impact everyone and we must ensure no one is left behind.