Draft Energy Strategy and Just Transition Plan – delivering a fair and secure zero carbon energy system for Scotland

January 2023

Scottish Government
Riaghaltas na h-Alba

Ministerial Foreword

The evidence has never been stronger on the need for transformation of our energy system. We are publishing this draft Energy Strategy and Just Transition Plan at a time of unprecedented uncertainty and change in global and national energy systems. The imperative is clear: in this decisive decade, we must deliver an energy system that meets the challenge of becoming a net zero nation by 2045, supplies safe and secure energy for all, generates economic opportunities, and builds a just transition.

The current uncertainty in our energy sector, with global market volatility and high energy prices, is impacting Scotland's people, communities and businesses. This energy crisis has demonstrated how vulnerable our energy system is to international price shocks, as well as laying bare the need for structural reform of our energy system to ensure affordability for consumers. Whilst the Scottish Government does not have the powers to intervene in the energy markets to address these issues at source, we are taking action wherever we can to support those impacted through these difficult months. The delivery of this draft Energy Strategy and Just Transition Plan will reduce energy costs in the long term and reduce the likelihood of future energy cost crises.

It is also clear that as part of our response to the climate crisis we must reduce our dependence on oil and gas, and that Scotland is well positioned to do so in a way that ensures we have sufficient, secure and affordable energy to meet our needs, to support economic growth and to capture sustainable export opportunities. Unlimited extraction of fossil fuels is not consistent with our climate obligations. However, irrespective of the climate imperative, as an already established mature basin in gradual decline, planning for a just transition to our net zero energy system and securing alternative employment and economic opportunities for workers is essential if Scotland is to avoid repeating the damage done by the deindustrialisation of central belt communities in the 1980s, and to fully capitalise on our potential as a location for low carbon and renewable energy expertise.

For all these reasons, this draft Strategy and Plan supports the fastest possible just transition for the oil and gas sector in order to secure a bright future for a revitalised North Sea energy sector focused on renewables. This draft Strategy sets out policy positions on oil and gas, both offshore and onshore, and provides an opportunity for the public to give their views.

Scotland is at the forefront of the clean energy transition and Scotland's green jobs revolution is underway.

This draft Strategy sets out key ambitions for Scotland's energy future including:

- More than 20 GW of additional renewable electricity on- and offshore by 2030.
- An ambition for hydrogen to provide 5 GW or the equivalent of 15% of Scotland's current energy needs by 2030 and 25 GW of hydrogen production capacity by 2045.
- Increased contributions from solar, hydro and marine energy to our energy mix.
- Accelerated decarbonisation of domestic industry, transport and heat.
- Establishment of a national public energy agency – Heat and Energy Efficiency Scotland.
- Phase out the need for new petrol and diesel cars and vans by 2032 and reduction in car kilometres by 2030.
- Generation of surplus electricity, enabling export of electricity and renewable hydrogen to support decarbonisation across Europe.
- Energy security through development of our own resources and additional energy storage.
- A just transition by maintaining or increasing employment in Scotland's energy production sector against a decline in North Sea production.
- Maximising the use of Scottish manufactured components in the energy transition, ensuring high-value technology and innovation.

Through accessing global markets, Scotland can realise vast growth opportunities, including exporting our skills and knowledge in offshore energy and decommissioning. Fully realising these opportunities will require co-operation and action at a UK-level to facilitate smooth international trade, particularly in light of Brexit.

Recent global events have shown us how interconnected energy markets around the world are. To ensure we deliver climate-friendly, affordable and secure energy supplies here in Scotland, we must look to collaborate with others, particularly our neighbours around the North Sea, in creating mutual energy security and shared strategic advantage. The North Sea has the potential to be 'the battery for Europe' – we will look to work with others on how to realise this potential, and how best to create shared and mutually reinforcing systems and infrastructure.

This is also our first draft Just Transition Plan. Our draft Plan proposes a vision for a just energy transition that benefits communities and workers across Scotland, provides high-quality jobs and economic benefit, delivers affordability, and protects our environment and our energy security. This draft Plan is the result of collaboration between people from all parts of Scotland and all walks of life. We have highlighted how workers, businesses, communities and consumers have shaped this draft through our early co-design and set out the next steps in that process.

We will also show how this energy transition can lead to growth in employment in the sector through the development of new industries.

This draft Strategy and Plan presents the actions being taken by the Scottish Government under the current constitutional settlement. We have highlighted the key policy levers and decisions that are currently held by the UK Government and where, because of the reservation of powers to the UK Government, action is required by UK Ministers and regulators alongside that of the Scottish Government.

To ensure we succeed in delivering the level of ambition in this strategy within the current constitutional settlement, we need to work together with the UK Government. We invite the UK Government to work with us through establishment of an Energy Transition taskforce, to deliver tangible action to drive the energy transition.

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Contents

Ministerial Foreword 2
Executive Summary 7
Chapter 1: Our vision for a just transition to a net zero energy system 17
1.1 - Introduction 17
1.2 - Delivering the vision 22
1.3 - Bute House Agreement 25
1.4- Action the UK Government must take 26

Chapter 2: Preparing Scotland for a just energy transition 27
2.1 - People have access to affordable clean energy 33
2.2 - Delivering for communities and regions across Scotland 36
2.3 - Delivering a just transition for Scotland's energy economy 44

Chapter 3: Energy supply 53
3.1 – Scaling up renewable energy 57
3.1.1- Offshore wind 59
3.1.2 - Onshore wind 64
3.1.3 - Marine energy (wave and tidal) 66
3.1.4 - Solar energy 70
3.1.5 - Hydro power 73
3.1.7 - Hydrogen 75

3.2 - Reducing our reliance on other energy sources 80
3.2.1 - Onshore conventional oil and gas 80
3.2.2 - Onshore unconventional oil and gas 81
3.2.3 - Coal extraction 81
3.2.4 - Nuclear 81
3.2.5 - North Sea oil and gas 82

Chapter 4: Energy demand 101
4.1 - Energy for heat in buildings 105
4.2 - Energy for transport 109
4.3 - Energy for agriculture 114
4.4 - Energy for industry 115
4.5 - Carbon Capture, Utilisation and Storage (CCUS) 119
4.6 - Emissions trading 122

Chapter 5: Creating the conditions for a net zero energy system 125
5.1 - Ensuring energy security and resilience 127
5.2 - Energy markets and network regulation 135

Chapter 6: Route maps to 2045 140
6.1 - Our investment plan over this parliament 140
6.2 - Route map for policy and legislation 140
6.3 - Energy supplies route map 140
6.4 - Energy demand route map 140

Chapter 7: Action the UK Government must take 145

Annexes

Annex A - Responding to this consultation 150
Annex B - Consultation questions 152
Annex C - Engagement 157
Annex D - Research and analysis 161
Annex E - UK Government powers 167
Annex F - Monitoring and evaluation 170
Annex G - Draft marine and solar visions for Scotland 173
Annex H - Related policy documents 179
Annex I - Scottish Government energy sector funding and finance 183
Annex J - Support for the energy supply chain 186
Glossary 188

Executive Summary

To realise our climate change ambitions, we need to transform the way Scotland generates, transports and uses energy. We must seize the huge opportunity this presents and deliver maximum benefits to Scotland's people, workers, communities and economy from our vast renewable energy resource. This draft Energy Strategy and Just Transition Plan sets out the scale of that opportunity and provides clarity on how Scotland will prepare for a Just Energy Transition.

Our vision is that by 2045 Scotland will have a flourishing, climate friendly energy system that delivers affordable, resilient and clean energy supplies for Scotland's households, communities and business. This will deliver maximum benefit for Scotland, enabling us to achieve our wider climate and environmental ambitions, drive the development of a wellbeing economy and deliver a just transition for our workers, businesses, communities and regions.

In order to deliver that vision, this strategy sets out clear policy positions and a route map of actions with a focus out to 2030 that the Scottish Government will take and the changes that the UK Government must deliver.

The research underpinning that vision shows that if successful we can deliver a net zero energy system for Scotland that also delivers a net gain in employment in Scotland's energy production sector.

Preparing for a Just Transition: Scotland's first draft Just Transition Plan

To secure a just transition that benefits all of Scotland's communities, we must take steps to ensure that our national, regional and local energy economies are thriving, and that the Strategy and Plan delivers for all parts of Scotland.

We are committed to increasing access to affordable energy. We will continue to do all we can to support households and businesses, and to prioritise those in or at risk of fuel poverty. We urge the UK Government to reform the energy market to permanently break the link between the price of electricity and the cost of gas to help realise the benefits of the low costs of renewable electricity.

We are committed to maximising community benefits from, and ownership of, energy projects, and providing regional and local opportunities to participate in our net zero energy future. We are encouraging developers to offer community benefits and shared ownership opportunities to communities as standard on all new renewable energy projects, including repowering and extensions to existing projects.

For areas of Scotland with traditionally higher dependence on fossil fuel related economic activity, such as the North East, Grangemouth and Shetland, the transition will involve shifting investment and employment to renewable sectors such as wind and marine energy.

Maximising opportunities for growing net zero energy sectors and businesses, driving investment and increasing trade opportunities will be critical to delivering a just transition. Through government investment in the net zero energy economy and by providing a stable policy environment and clear market signals, our aim is to attract increased levels of private and inward investment into Scotland's energy sector. Boosting our skills base and domestic supply chain will support the creation of vital jobs across the economy.

We are already investing almost £5 billion in the net zero energy economy in Scotland over this parliamentary term, prioritising those projects that align with our vision as set out in this draft Strategy and Plan. Our capital investment is primarily focussed on the demand sectors of heat, transport and industry. Under the current constitutional settlement, the Scottish Government is unable to invest in many parts of the UK's liberalised energy markets. We will continue to use our capital funds to support those least able to pay, to maximise economic opportunities for communities across Scotland and to promote environmental protection.

Expanding our energy generation sector

We are taking action to transform and expand Scotland's energy generation sector. Scotland's rich renewables endowment means we can not only generate enough cheap green electricity to power Scotland's economy, but also export electricity to our neighbours, supporting jobs here in Scotland and the decarbonisation ambitions of our partners.

We are setting an ambition for more than 20 GW of additional low-cost renewable electricity generation capacity by 2030, including 12 GW of onshore wind, and we are consulting on setting a further offshore deployment ambition, and a new ambition for solar, wave and tidal deployment. Scotland already has 13.4 GW of renewable electricity generation capacity. An additional 20 GW of renewable generation will more than double our existing renewable generation capacity by 2030 generating enough power each year to power the equivalent of every home Scotland for over 7 years.[1] That is the equivalent of 48% of Scotlands current total energy demand.[2]

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[1] Calculations based on 10 GW offshore and 10 GW onshore operating at load factors of 51% and 37% (taken from BEIS Electricity Generation Cost Report 2020) to produce 77TWh of electricity. Assumes a home consumes 3,880kWh/year and an EV consumes 2,345kWh/year (sources: Energy Consumption in the UK, and EV Database)

[2] Calculations based on 10 GW offshore and 10 GW onshore operating at load factors of 51% and 37% (taken from BEIS Electricity Generation Cost Report 2020) to produce 77TWh of

There are tremendous opportunities ready to be seized over the coming years as our renewables capabilities and wider supply chains grow. As one of the cheapest forms of electricity, offshore wind has a vital role to play in decarbonising our energy demand and securing a just transition to net zero. Subject to planning and consenting decisions and finding a route to market, we have a current reported potential pipeline (subject to change) of over 38 GW of offshore wind projects. When projects which are awaiting construction, under construction or already operational are added to this, the total potential capacity reaches over 40 GW – the equivalent to produce enough electricity annually to power every home in Scotland for 17 years or every home in the UK for over a year and a half.

We have set a renewable and low-carbon hydrogen production ambition of 5 GW by 2030 - equivalent to a sixth of Scotland's energy needs by 2030 - and an ambition for 25 GW by 2045. Hydrogen is an emerging sector perfectly placed to support a just transition for existing oil and gas workforces and we have set out plans to rapidly grow Scotland's hydrogen economy.

Hydro power has the potential to play a significantly greater role in the energy transition and we are urging the UK Government to act now to ensure the clean energy and storage capability of Scotland's hydro resource can be realised by instituting appropriate market mechanisms. We are also clear that the UK Government plays a critical role in delivering carbon capture, utilisation and storage (CCUS) in Scotland, as we do not hold the necessary legislative and regulatory levers. UK Government certainty and support, including access to BEIS business models, is essential to accelerate the Scottish Cluster project. The development of CCUS infrastructure in Scotland's industrial clusters in Grangemouth and the North East could ensure a just transition for important domestic industries, protecting jobs and utilising existing skills.

We are taking action across all sectors of the economy to reduce our reliance on fossil fuels. The Scottish Government is clear that unlimited extraction of fossil fuels is not consistent with our climate obligations. Neither is it a solution to the energy price crisis people across Scotland are facing. We want to see the fastest possible just transition for the oil and gas sector.
We have finalised our position of no support for unconventional oil and gas in Scotland. We are finalising our policy positions on onshore conventional oil and gas, and coal extraction, as part of this Strategy and Plan. We have also updated our position on offshore oil and gas and are consulting on it.
The Scottish Government has devolved powers over onshore oil and gas (both conventional and unconventional), but powers over offshore oil and gas are reserved to the UK Government. These positions can be found in Chapter 3.

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electricity. Assumes a home consumes 3,880kWh/year and an EV consumes 2,345kWh/year (sources: Energy Consumption in the UK, and EV Database)

We do not support the building of new nuclear power plants, which due to the high costs of nuclear[3], as well as taking decades to build, will do nothing to address the urgent imperative of driving down energy prices.

Changing the way we use energy

We must change the way we use energy – reducing demand across our heat and transport sectors and replacing fossil fuel demand with zero carbon technologies. Low cost, renewable electricity will be critical for decarbonising our energy use, along with significant volumes of renewable and low-carbon hydrogen in harder-to-decarbonise sectors.

We are taking action so that by 2030 the vast majority of the 170,000 off-gas homes that currently use high emissions oil, LPG and solid fuels, as well as at least 1 million homes currently using mains gas, convert to zero emissions heating. We are also reducing emissions from our non-domestic buildings.

We are bringing forward a Heat in Buildings Bill which will outline proposals for regulating for energy efficiency and zero direct emissions heat in Scotland's homes and buildings.

Recognising the pace at which we must act to decarbonise heat in our homes and buildings Heat and Energy Efficiency Scotland - our National Public Energy Agency - will play an important role in co-ordinating this huge transition and help to ensure it is a just and fair one.

We have committed to reduce car kilometres by 20% by 2030 and to help people on lower incomes and in remote rural and island communities to switch to zero emissions vehicles through our consumer focussed incentive schemes. We are developing a Just Transition Plan for transport that delivers for people, places and communities across Scotland.

While we expect oil and gas to remain a component of Scotland's energy system while it transitions to a zero carbon system, particularly in industrial energy usage, we are clear that overall use of fossil fuels across heating and transport sectors must decline and that alternative technology and energy solutions are available.

We will continue to support industry to work towards 43%[4] decarbonisation by 2032, through match funding for industrial energy efficiency and decarbonisation, including through the Scottish Industrial Energy Transformation Fund and the Low Carbon Manufacturing Challenge Fund.

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[3] For example, £92.50 per megawatt hour for Hinkley C compared to £37.65 per megawatt hour for offshore wind

[4] From 2018 levels

To drive essential CCUS deployment, we will continue to work with the North East CCUS industry led alliance to support the delivery of the CCUS industry in Scotland; support the Scottish Cluster through the UK Government's cluster sequencing process; continue to build the evidence base to underpin this; and explore the international opportunities afforded by Scotland's vast CO_2 storage assets, alongside a prioritisation of domestic hard to abate emissions. We will also continue to work with the UK Government, Welsh Government and Northern Ireland Executive to align the UK Emissions Trading Scheme with our net zero targets; ensuring a strong carbon price to incentivise business investment in decarbonisation.

We are providing a suite of support and advice services, such as the Farm Advisory Service, to help farmers and crofters reduce their energy demand and decarbonise energy use, as well as highlighting the range of ways farmers and land managers can participate in the net zero energy economy.

Creating the conditions for a net zero energy system

By 2030, our energy system will be in the midst of a major transformation, integrating new ways of producing, transporting and using energy. Our energy supplies need to be secure, reliable and affordable for people and businesses across Scotland. This draft Strategy and Plan sets out how we are working with the UK Government on key areas of energy security, network investment and market regulation to ensure we have the infrastructure and market design that will enable the transformation of Scotland's energy system in line with our vision. Our energy infrastructure must also be resilient to the impacts of climate change in Scotland.

Working with the UK Government

Many of the key decision-making powers in energy sit with the UK Government, with responsibility for making or changing legislation and regulations reserved under the Scotland Act. Critical areas where the UK Government must take action to secure the full benefits of the energy transition for Scotland's people and businesses include:

- electricity market reform;
- support for carbon capture and storage;
- action on energy affordability;
- reforms to consenting of offshore wind and regulation of the offshore marine environment; and
- the development of new market mechanisms to support clean energy technology deployment.

We have set out in Chapter 7 the key issues where actions by the UK Government and UK regulatory bodies are required to meet the ambition outlined in this strategy. We will invite the UK Government and those relevant bodies to join us as part of an Energy Transition delivery group to drive this

strategy forward, identify and remove barriers, harness the opportunities and track progress in delivering a net zero energy system for Scotland.

Summary of policies set out in this draft Strategy and Plan	
A Just Transition	
	We are setting out actions in this Strategy and Plan to ensure that • People have access to affordable clean energy. • Communities and places can participate and benefit in the net zero energy transition. • We have a supportive policy environment, maximising the impact of government expenditure and attracting private investment. • Scotland is home to a multi-skilled energy workforce, boosting our domestic supply chain and manufacturing capabilities. • Scotland's net zero energy system is continuously innovative and competitive in domestic and international markets.
Community benefits and shared ownership	We have set an ambition for 2 GW of community owned energy by 2030. We will encourage developers to offer community benefit and shared ownership opportunities as standard on all new renewable energy projects – including repowering and extensions to existing projects. We are currently updating our Good Practice Principles for Community Benefit from Offshore Renewable Energy Developments, and will consult on new draft guidance in 2023. We will engage with the UK Government to consider mechanisms for maximising opportunities for community benefit and shared ownership for renewable energy developments.
Energy supplies – Scaling up renewable energy	
Offshore Wind	The Offshore Wind Policy Statement, published in 2020, set out our ambition to achieve 8-11 GW of offshore wind in Scottish waters by 2030. This consultation seeks views on whether the Scottish Government should set an increased ambition for offshore wind deployment, and what the level of ambition should be, by 2030 and 2045. The draft Strategy and Plan also acknowledges that the major expansion of offshore wind will impact marine biodiversity and other users of the sea, and describes the action we are taking to balance those impacts.
Onshore Wind	In the Onshore Wind Policy Statement, published in December 2022, we set an ambition for a further 12 GW of onshore wind by 2030, increasing from 8.78 GW as of June 2022 to 20 GW by 2030, more than double our existing capacity. Our draft Strategy and Plan restates our ambition and provides clear positions on community benefit and shared ownership,

	including how communities can benefit from repowering of existing sites. The Onshore Wind Policy Statement sets out how we will work with industry to deliver an Onshore Wind Sector Deal in 2023, to ensure we maximise deployment and the economic opportunities that flow from it.
Marine	The draft marine vision consults on a new ambition for marine deployment and presents the opportunities for the sector, and potential actions to enable the continued growth of both wave and tidal energy. This will support the delivery of a secure and low carbon energy system and a new industrial opportunity for Scotland.
Solar	We will support the sector to minimise barriers to deployment, aiming to maximise the contribution solar can make to a just, inclusive transition to net zero. We are keen to see the number of solar installations offering community benefits increase and continue to encourage the sector to consider what packages of community benefit it can offer communities local to developments, in line with our Good Practice Principles.[5]
Hydro power	Hydro power has the potential to play a significantly greater role in the energy transition – both at small-scale in co-operation with local communities as part of a diverse resilient energy supply in remote parts of Scotland, and at larger scale, providing flexibility services to the grid and helping to ensure a continued resilient and secure electricity supply. We urge the UK Government to provide appropriate market mechanisms for hydro power to ensure the full potential of this sector is realised.
Hydrogen	The Hydrogen Action Plan and this draft both reaffirm policy support for hydrogen, and our strong ambitions for Scotland's hydrogen economy. They highlight our intention to capture the supply chain and infrastructure benefits to the Scottish economy from taking a leading role in hydrogen production. Previous ambitions on hydrogen production have not changed: • 5 GW installed renewable and low-carbon hydrogen production capacity in Scotland by 2030 • 25 GW installed renewable and low-carbon hydrogen production capacity in Scotland by 2045
Energy supplies - Reducing our reliance on fossil fuels	
Fossil fuel electricity generation	We are opposed to the continued use of unabated fossil fuels to generate electricity. The deployment of CCUS for the Scottish Cluster must demonstrate decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero.
Oil and Gas – Offshore	This draft sets out our support for the fastest possible just transition for the sector and consults on the principles on which decisions for future extraction would be based.

[5] Community benefits from onshore renewable energy developments

	The UK Government has introduced a checkpoint to ensure any future licensing is compatible with the UK's climate objectives before a licensing round is offered. In line with advice from the Climate Change Committee (CCC)[6] Scottish Government policy is that climate compatibility checkpoints for oil and gas licensing should extend beyond new licensing rounds to cover fields that are consented but not yet in production. Further, we consider that any checkpoint should also include an assessment of the proposed production's contribution to international climate commitments. Whilst licensing is reserved to the UK Government, the Scottish Government is consulting on whether, in order to support the fastest possible and most effective just transition, there should be a presumption against new exploration for oil and gas.
Oil and Gas - Onshore	The draft reaffirms our preferred policy position of no support for the exploration or development of onshore conventional oil and gas in Scotland and position of no support for unconventional oil and gas.
Coal	The draft reaffirms our preferred policy position of no support for coal extraction in Scotland.
Nuclear	The draft reiterates our firm position on traditional nuclear energy, that we do not support the building of new nuclear power plants under current technologies.
Energy demand for heat, transport, industry and agriculture	
Heat in Buildings	This draft reaffirms our ambitions to decarbonise 1 million homes by 2030, and to reduce emissions from our non-domestic buildings and invest over £1.8 billion in decarbonising homes and buildings, through Heat and Energy Efficiency Scotland - our national energy agency.
Transport	This draft reaffirms our ambitions to reduce car kilometres by 20% and sets out the significant investment in sector decarbonisation.
Industry	The draft sets out how we will continue to support industrial energy efficiency and decarbonisation including low carbon manufacturing over the course of this parliament and sets out our work to deliver a Just Transition Plan for Grangemouth.
CCUS	The Scottish Government remains supportive of CCUS as part of the energy transition. In particular it remains committed to supporting the delivery of the Scottish Cluster. However, we agree that any strategy for deployment of these technologies must enable decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero.
Agriculture	This draft sets out how we are building our evidence base through research on opportunities for the sector to decarbonise their energy usage and our continued support through a suite of advice programmes.

[6] Letter: Climate Compatibility of New Oil and Gas Fields - Climate Change Committee

This consultation document

This draft Strategy and Plan presents the vision for Scotland's future decarbonised energy system and the actions we and others need to take to deliver it.

It sets a vision to 2045, and a route map of ambitions and actions that, coupled with detailed sectoral plans and the forthcoming Climate Change Plan, will guide decision-making and policy support over the course of this decade to 2030. The Strategy and Plan provides policy certainty for consumers, businesses and investors and sets a clear direction for the future of Scotland's oil and gas sector.

Chapter 1 describes our vision for this energy system transition, with a focus on the interim milestones we must achieve by 2030.

Chapters 2-5 set out how we will prepare for a just transition and the action we will take to achieve the vision. This includes proposals for how we can secure maximum social and economic benefit from the transition for Scotland, working with business and investors to attract additional capital and inward investment to support our net zero ambitions and export potential.

Chapter 6 sets out a consolidated route map of actions, and **Chapter 7** describes the changes needed at UK level to realise the vision.

Throughout the document, you will find boxes that set out the positive impacts that the energy transition will deliver for Climate and the Environment (green boxes), for our Economy (orange boxes), and for Scotland's Communities and Regions (blue boxes). This draft Strategy and Plan describes the actions we and partners - including industry, the wider public sector and the UK Government - must take to achieve those positive outcomes.

This consultation provides an opportunity for communities, workers, citizens and businesses to engage in the process of co-designing Scotland's energy transition. In consulting on this draft vision and route map, our purpose is to:

1. seek views on our vision and the actions we are taking to transition to an affordable, resilient and clean energy system; and
2. understand how we secure the maximum social and economic benefits from the energy transition for Scotland.

You will find **consultation questions in Annex B**, along with information on how to respond to this consultation. We invite you to respond to these questions by 4 April 2023. We will use the consultation responses received, and the continuing engagement we will be carrying out, to further develop the Strategy and Plan, before a final version is published in late 2023.

Engagement

We have conducted a series of intensive stakeholder engagement workshops throughout the production of this draft Strategy and Plan to gather ideas and evidence on the actions that we can take to ensure this is a just transition – see Annex C.

You will also find references to the Just Transition Commission's interim report recommendations[7] (in purple).

Just Transition Commission recommendations

And the feedback from engagement through the initial stages of the co-design process that informed this draft (in turquoise).

Feedback from engagement

[7] Making the Future - Second Just Transition Commission: initial report

Chapter 1: Our vision for a just transition to a net zero energy system

1.1 - Introduction

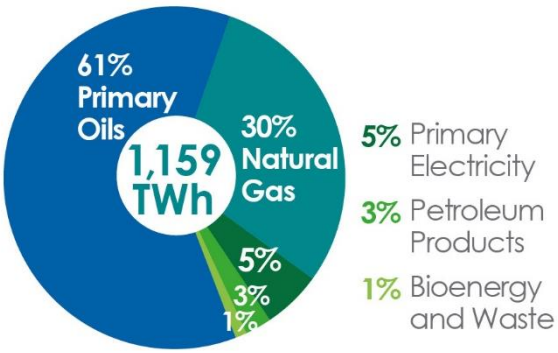
Our vision is that by 2045:

Scotland will have a flourishing, climate friendly energy system that delivers affordable, resilient and clean energy supplies for Scotland's households, communities and business. This will deliver maximum benefit for Scotland, enabling us to achieve our wider climate and environmental ambitions, drive the development of a wellbeing economy and deliver a just transition for our workers, businesses, communities and regions.

Scotland is an energy rich nation, benefitting from significant renewable energy resources the length and breadth of the country. We have a highly skilled workforce and innovative businesses across a globally renowned supply chain.

Scotland produces over 1,000 TWh of energy per year made up from oil and gas production, primary electricity, and bioenergy and waste (see figure 1)[8].

Figure 1: Energy production in Scotland (2019)



Source: Scottish Energy Statistics Hub

Figure 2 Exports and consumption (2019)

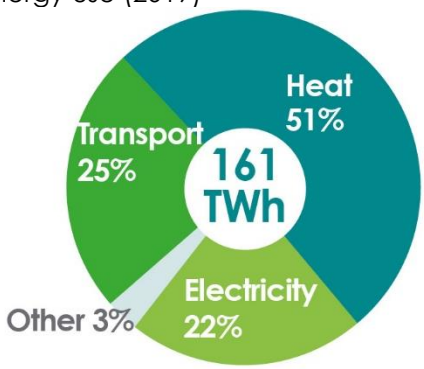
Source: Scottish Energy Statistics Hub

We export the vast majority of the energy we produce and our total consumption is approximately 161 TWh (see figure 2)[9]. Scotland's energy use can be broken down into requirements for heat, transport, electricity and other energy uses within sectors such as public administration, commercial and agriculture. Figure 3 shows how our energy use can be attributed to those sectors with heat accounting for around half of our requirements, and electricity and transport making up around a quarter. Figure 4 shows the fuels

[8] Up to date energy statistics can be found on Scotland's Energy Statistics Hub
[9] Loss relates to electrical energy lost through the transmission and distribution networks

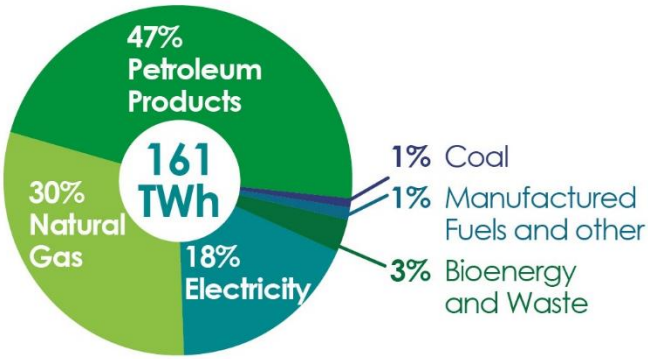
that make up the consumption of our energy. In the 2017 Scottish Energy Strategy, we set a target for the equivalent of 50% of the energy for Scotland's heat, transport and electricity to come from renewable sources by 2030. In 2020, renewable energy met around a quarter (26.7%) of the energy required for Scotland's heat, transport and electricity use.

Figure 3 Breakdown of Scottish energy use (2019)



Source: Scottish Energy Stastics Hub

Figure 4 Fuels that make up our consumption of energy (2019)



Source: Scottish Energy Statistics Hub

The volume of available renewable energy in Scotland continues to grow. Since 2000, Scotland has increased its renewable electricity capacity almost 10 times[10] and the current pipeline could more than double capacity. Looking ahead to 2045, this could increase further (see figure 5).

The significant increase in installed capacity of renewable generation over the coming decade could mean Scotland's annual electricity generation is more than double Scotland's electricity demand by 2030, and more than treble by 2045.

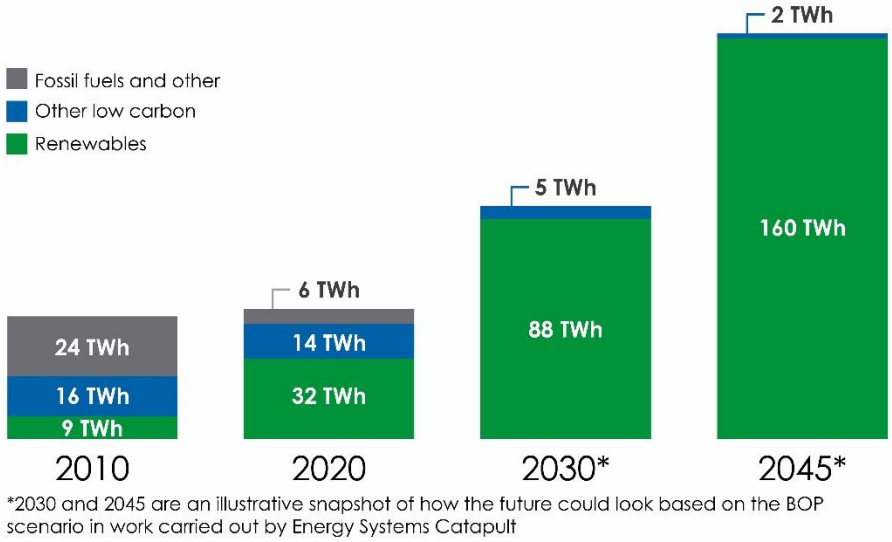
For example, ScotWind, the world's largest floating offshore leasing round, represents a massive step forward in delivering an energy revolution with market ambitions to deliver up to 27.6 GW of capacity - more than double our renewable energy generation capacity currently in operation[11].

This is in addition to almost 2 GW of existing operational projects, a 3.8 GW pipeline of projects consented or under construction, 4.2 GW of projects with lease options ahead of ScotWind leasing results, as well as INTOG[12] – a new leasing round designed to enable development of a potential further 5.7 GW of new offshore wind projects targeting oil and gas decarbonisation, plus further potential 0.5 GW of offshore wind innovation projects. This means that, subject to planning and consenting decisions and finding a route to market, we have a current reported potential pipeline (subject to change) of over 40

[10] Scottish Energy Statistics Hub
[11] Scottish Energy Statistics Hub
[12] Innovation and Targeted Oil & Gas (INTOG) is a leasing round for offshore wind projects that will directly reduce emissions from oil & gas production and boost further innovation

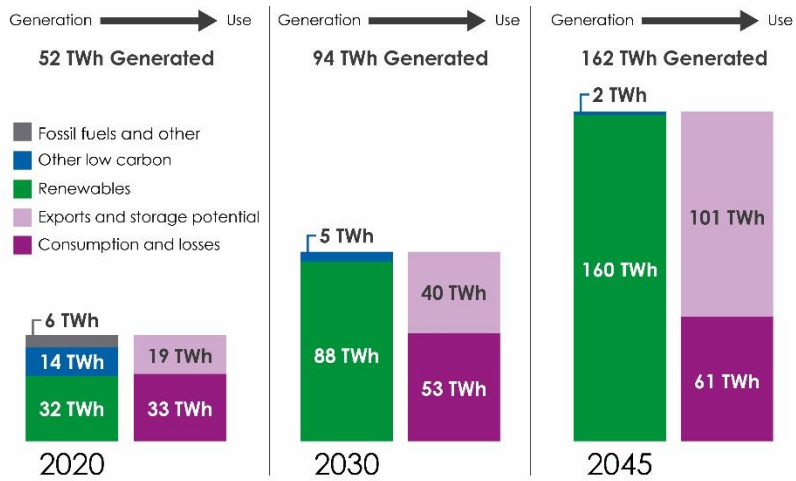
GW[13] of offshore wind projects – the equivalent to producing enough electricity annually to power every home in Scotland for 17 years or every home in the UK for over a year and a half.[14] This growth in renewables will enable Scotland to meet a large proportion of demand through renewables alone, while creating an export opportunity for our surplus[15] - see figure 6.

Figure 5: Electricity generation – past, present and future.



Source: Scottish Energy Statistics Hub and Scottish whole energy system scenarios

Figure 6: Electricity generation and use and export potential.



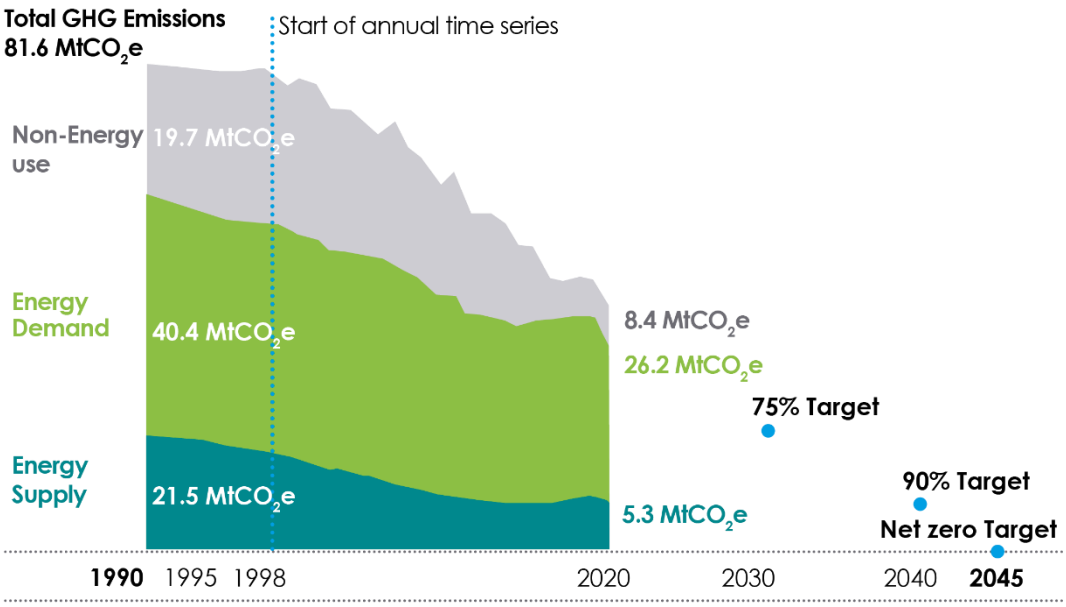
Source: Scottish Government

[13] This is 38 GW of potential pipeline coming from ScotWind and INTOG plus 3.8 GW that is in the pipeline recorded in the Renewable Energy Power Database (REPD)
[14] Calculations based on 40 GW new offshore wind capacity operating at 51% load factors, powering homes with consumption averaging 3,880 kWh/year. Figures taken from: BEIS Electricity Generation Costs (2020) - GOV.UK (www.gov.uk);
[15] https://www.climatexchange.org.uk/research/projects/scottish-whole-energy-system-scenarios/

The majority of Scotland's greenhouse gas emissions come from our energy system (79%) but since 1990 total emissions have reduced by half, with energy supply making the largest reduction in emissions (see figure 7).

With increasing levels of renewable electricity and the closure of coal fired power stations in Scotland, the CO_2 intensity of the electricity system has reduced by 90%[16] . By 2030, Scotland must reduce its overall emissions by 75%, as compared to 2019 levels, and 90% reduction by 2040.

Figure 7 : Energy related greenhouse gas emissions $MtCO_2e$ (1990 -2045)



Source: Scottish Government

To ensure this happens, in addition to building our renewable capacity, we also now need to focus significant efforts on decarbonising energy for heat, transport and industry, on reforming markets to ensure energy security and affordability, and on maximising the benefits from the transition to net zero for our economy and our communities. The opportunities that creates are immense.

[16] Scottish Energy Statistics Hub

Scotland's Journey to Net Zero –Where are we now (Figure 8)

2010

Where have we come from?

In **2010, Scotland's total energy consumption** was approximately **178TWh**

In 2010, renewables met 7% of the **energy demand** for heat, transport and industry

In 2010, Scotland **produced** an estimated **766TWh** of crude **oil** and natural **gas** liquids

In 2010, 50TWh of electricity was generated in Scotland, with **19%** generated from renewable sources. **11TWh** of electricity was exported

In **2010**, Scottish source **emissions** of the basket of seven greenhouse gases were estimated to be **64MTCO$_2$e**

In **2010**, there were **1,407** ULEVs licenced in Scotland

2020

Where is Scotland now?

In **2019, Scotland's total energy consumption** is approximately **160 TWh**

In 2020, Renewables met 24% of the **energy demand** for heat, transport and industry

In 2019, Scotland **produced** an estimated **628 TWh** of crude **oil** and natural **gas** liquids

In 2020, 52 TWh of electricity was generated in Scotland, with **62%** generated from renewable sources. **18 TWh** of electricity was exported

In **2020**, Scottish source **emissions** of the basket of seven greenhouse gases were estimated to be **40 MTCO$_2$e**

As of **September 2021**, there were **38,634** ULEVs licenced in Scotland, making up **1.3%** of all vehicles licensed in Scotland

Source: Scottish Government / Scottish Statistics Hub / EY

Delivering the vision (Figure 9)

2030

Preparing Scotland for a Just Energy Transition. By 2030, Scotland will have an energy system that provides maximum community and economic benefits on route to delivering a net zero energy system.

5GW of hydrogen production by 2030

Oil and gas production levels expected to be around **35% of 2019 levels by 2035**

Increase the level of renewables by a further **20GW**

Reduce greenhouse gas emissions to **20 MTCO$_2$e**

2GW of community and locally owned energy

Phase out the need for new petrol and diesel cars and vans by 2032

The equivalent of **50%** of the energy for Scotland's **heat, transport and electricity** use to come from **renewable** sources

2045

A net zero future. By 2045, Scotland will have a flourishing, climate-friendly energy system that provides affordable, resilient and clean energy supplies for Scotland's households, communities and businesses.

25GW of hydrogen production by 2045

Oil and gas production is around **3% of 1999 peak by 2050**

Net zero greenhouse gas emissions

2045 - **Zero emissions** heating systems used in all homes

1.2 - Delivering the vision

Chapter 2: Preparing Scotland for a Just Energy Transition - By 2030, Scotland will have an energy system that provides maximum community and economic benefits. We will have seen investment in green energy that delivers economic opportunities. Workers will have the training, skills and opportunities to access the good, green jobs that come with this. The energy market will be fairer, and costs will be distributed equitably. Home-grown clean energy provision will be maximised, limiting our exposure to the effects of global energy price shocks.

Chapter 3: Scotland will be a renewable powerhouse - By 2030, domestic production of renewable electricity and renewable hydrogen will have increased significantly, helping to address climate change by substantially reducing the emissions of our energy sector. By 2030, the total electricity produced in Scotland over the course of a year will allow us to continue to benefit from exporting electricity and open up the huge opportunities of vast renewable hydrogen production for use in Scotland and for export. This will contribute to economic growth, jobs and investment.

Scotland will be a renewable powerhouse, exporting renewable hydrogen and electricity to support decarbonisation in Europe as part of an integrated system with the rest of Europe. There will be an additional 20 GW of renewable electricity capacity and 5 GW hydrogen production, as well as substantial growth in marine and solar capacity. Oil and gas in the North Sea is becoming less plentiful and harder to extract. There will be no nuclear power, coal extraction or use of unconventional oil and gas or exploration of onshore conventional oil and gas.

Chapter 4 : Our future energy use will be climate friendly - By 2030, Scotland's main energy-using sectors - heat in buildings, transport, industry and agriculture - will be using energy more efficiently, and the energy they do use will be largely decarbonised, helping to deliver against our economy-wide statutory climate change targets. We will see significantly reduced demand for energy overall and at least 1 million homes decarbonised. Car kilometres will have reduced by 20% and Carbon Capture Utilisation and Storage will be on its way to being an established technology in Scotland. At least the equivalent of 50% of our energy across heat, transport and electricity demand will come from renewable sources. By 2032, industrial emissions will have decreased 43% from 2018 levels, and industry remains globally competitive.

Chapter 5: Creating the conditions for a net zero energy system - By 2030, Scotland's energy supplies will be secure, reliable and affordable for people and businesses across the country. The total electricity produced in Scotland will contribute to increasing energy security and limit the impacts of global energy shocks.

Maximising benefits to climate and the environment

By 2030, we will significantly increase domestic production of renewable electricity and hydrogen, and our energy use will be largely decarbonised. The transformation of Scotland's energy system will help us to achieve our net zero and interim climate targets. Our biodiversity, habitats and natural environment will have been protected and enhanced as part of the energy transition.

Maximising benefits to our economy, businesses and workers

By 2030, Scotland's energy sector will have net positive employment in a range of zero carbon industries. The net zero energy sector will continue to be a key driver of Scotland's economy in terms of gross value added (GVA), trade, supply chains, investment and prosperous businesses. The sector will be innovative and competitive, will attract investment to Scotland and will enable businesses to set up and grow sustainably.

By 2030 the volume of renewable electricity produced in Scotland will open up huge opportunities for electricity export, and vast renewable hydrogen production for use in Scotland and for export, contributing to economic growth, jobs and investment.

Maximising benefits to our communities and regions

By 2030, regions and communities will be empowered to participate in the energy transition in a way that meets their needs including increasing the number of community owned energy projects.

By 2030, the costs and benefits of the growth in our clean electricity generation will be shared equitably across society.

By 2030, regions across Scotland will have thriving local energy economies. Scotland's energy sectors will provide fair work that recognises equalities, respect, voice and pay, and will create opportunities for local energy employment with a focus on supporting opportunities in vulnerable and deprived places and communities.

In developing the vision set out in this draft Strategy, we have drawn on insights from industry and communities, academia, civil society, as well as from research. In order to inform our understanding of Scotland's possible energy futures, we commissioned a series of energy scenarios that represent different pathways to a fair and affordable net zero energy system. These scenarios are explained in detail in Annex D and have helped inform our vision and the steps we will take to achieve it.

To achieve this vision, we will:

- Significantly scale up renewable energy production, including on- and offshore wind power, renewable hydrogen, marine energy, solar and hydro
- Increase access to affordable energy by urging the UK Government to take stronger and more targeted action for fair energy market reform, and by continuing to support those most in need to reduce their energy costs.
- Maximise community benefit from energy projects, including through community ownership and shared ownership of renewables.
- Continue to invest in the net zero energy economy and provide certainty through clear market signals to attract increased private investment.
- Increase support for skills development to help workers to play their full part in Scotland's transition to net zero.
- Boost our domestic supply chain and realise international opportunities through the expansion of our Supply Chain Development Programme and our support for export of low carbon energy goods and services.
- Set out finalised policy positions on fossil fuel energy, such as onshore conventional and unconventional oil and gas, offshore oil and gas, and coal, as well as nuclear.
- Continue to support the fastest possible just transition for the sector, including through the Energy Transition Fund and Just Transition Fund.
- Reduce demand and decarbonise our energy use across the heat and transport sectors, including taking actions to enable rapid decarbonisation of buildings through our Home Energy Scotland, Businesses Energy Scotland and Warmer Homes Scotland support schemes.
- Provide access to support to change how we heat, and use energy in, our homes through our new national public energy agency – Heat and Energy Efficiency Scotland.
- Support the switch to low and zero emissions vehicles through targeted investment in public transport and EV charging infrastructure.
- Support industry through the Scottish Industrial Energy Transformation Fund, the Energy Transition Fund, and the Emissions Trading Scheme to reduce demand and decarbonise energy use, including support for low carbon manufacturing.

- Continue to build the evidence base for carbon capture and storage deployment in Scotland and explore the international opportunities afforded by Scotland's vast CO_2 storage assets, although we will prioritise domestic hard-to-abate emissions.
- Support farmers and crofters to reduce demand and decarbonise energy use through a suite of support and advice services, such as the Farm Advisory Service.
- Press the UK Government and the Office of Gas and Electricity Markets (Ofgem) to drive energy market reforms, including on network charging and regulation, decoupling electricity prices from the cost of gas, and ensuring market mechanisms are in place to deliver our ambitions in areas such as hydro and marine energy.
- Ensure the energy transition supports Scotland's ambitions for restoring nature and reversing biodiversity loss, including through avoidance of negative impacts and promotion of nature-based solutions.
- Continue to deliver and develop the UK ETS in line with our ambitious net zero target through the UK ETS Authority (made up of Scottish Government, Welsh Government, UK Government and Northern Ireland Executive).

Details on these actions are set out in Chapters 2-5.

Achieving our vision will be a national endeavour and will require a collective effort from government and agencies at local and national levels, industry, the research and innovation sector, our communities and civil society.

1.3 - Bute House Agreement

The Bute House Agreement, which came into effect on 31 August 2021, is an agreement between the Scottish Government and the Scottish Green Party Parliamentary Group (SGP). The Bute House Agreement commits the Scottish Government and SGP to work collaboratively to build a greener, fairer, independent Scotland, in a spirit of cooperation and consensus building.

The draft Strategy and Plan builds on the commitments made in the Bute House Agreement in relation to delivery of our ambition for 8-12 GW of additional onshore wind by 2030, support for the growth of marine renewables and the offshore wind sectors, the setting of a vision for solar energy, a strengthened heat in buildings policy framework, and a 10 year Just Transition Fund.

This draft Strategy and Plan draws on the programme of work that we are undertaking, announced by the First Minister in 2021, to better understand our energy requirements as we transition to net zero. The draft Strategy and Plan sets out our support for the fastest possible just transition for the sector and consults on principles to underpin a robust climate compatibility checkpoint

on which decisions for new production should be based. The final Strategy and Plan's position on oil and gas will take account of the consultation process and any additional analytical work undertaken.

While we do not have an entirely shared vision for the role of hydrogen and carbon capture, utilisation and storage across the whole economy, we recognise – albeit to different extents – that these technologies will play a part in a just transition. The Scottish Government remains supportive of these technologies as part of the energy transition and in particular it remains committed to supporting the delivery of the Acorn project. However, we agree that any strategy for deployment of these technologies must enable decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero.

1.4- Action the UK Government must take

To deliver this Strategy and Plan we need action from the UK Government across a large number of reserved policy areas (summarised in Annex B), and in particular:

- energy affordability
- electricity market reform
- support for CCUS in Scotland
- support for the renewable electricity and hydrogen sectors through the continuation of existing, and introduction of new, market mechanisms that are fit for purpose, enable the necessary growth in scale and provide energy security
- extension of the powers of the Scottish Parliament in certain reserved areas, such as consenting and the offshore marine environment
- unlocking of mechanisms to allow communities to benefit directly from local renewable developments
- use of available powers to support international trade in renewables and renewable hydrogen
- reform of the climate compatibility checkpoint so that consent is only given for exploration or new production that is consistent with our international climate commitments and demonstrates clear economic and social benefit
- provide more support directly to the decommissioning sector to ensure as much of this growing area of work as possible is carried out in Scotland, creating and protecting jobs and economic opportunities.

These actions are set out in the relevant Chapters of this draft Strategy and summarised in Chapter 7.

Chapter 2: Preparing Scotland for a just energy transition

By 2030, Scotland will have an energy system that provides maximum community and economic benefits. We will have seen investment in green energy that delivers economic opportunities. Workers will have the training, skills and opportunities to access the good, green jobs that come with this. The energy market will be fairer, and costs will be distributed equitably. Home-grown clean energy provision will be maximised, limiting our exposure to the effects of global energy price shocks.

Beatrice Offshore Wind Farm
Photo credit: Highlands and Islands Enterprise

The energy transition offers significant opportunities for Scotland, including domestic and international businesses and industries investing in Scotland, and is essential to delivering on our wider net zero ambitions. We must also make sure that it delivers for the people, workers, communities and economy of Scotland.

This chapter sets out the actions we will take to prepare Scotland for a Just Energy Transition. The actions are part of a draft Just Transition Plan for the energy sector which we will develop and refine with businesses, trade unions, workers and communities in the coming months.

The purpose of Just Transition Plans is to:

- maximise the economic benefits of Scotland's transition to net zero, including ensuring a pipeline of skills for net zero jobs;
- ensure fair distribution of opportunities, benefits and risks, including consideration of community benefits, and how to adapt to the impacts of climate change; and
- ensure an inclusive and fair process via co-design with stakeholders, trade unions and the public.

In Scotland, our Just Transition Planning Framework sets out eight national Just Transition Outcomes[17], these have been distilled into the energy sector specific outcomes which can be found in Annex F. These outcomes will be shaped further through additional co-design with stakeholders, trade unions and the public, and through the consultation on this draft Strategy and Plan.

Given that this is a joint Energy Strategy and Just Transition Plan, this document will look quite different to other sectoral Just Transition Plans. In the first half of 2023, a series of outline draft Just Transition Plans for Buildings and Construction, Land Use and Agriculture and Transport will be published. These drafts will then be tested and refined following an extensive co-design process. All Just Transition Plans will demonstrate how we will maximise the economic opportunities for Scotland.

This draft Energy Strategy and Just Transition Plan outlines how we will do this including growing net zero energy sectors, supporting communities, workers, citizens and businesses, driving investment and increasing trade opportunities. The people of Scotland must reap the economic benefit of the energy transition, and this chapter sets out how we will leverage government expenditure to support these ambitions. We are also working with partners across the Grangemouth Future Industry Board to deliver a Just Transition Plan for the Grangemouth Industrial Cluster.

This chapter should be read alongside further sector detail in Chapters 3-5 and specifically the Just Transition section of the North Sea Oil and Gas section in Chapter 3.

[17] National Just Transition Planning Framework - Just Transition - A Fairer, Greener Scotland: Scottish Government response - gov.scot (www.gov.scot)

We will take the following actions:

Delivering a just transition for communities and regions across Scotland	
People have access to affordable clean energy	We have doubled our Fuel Insecurity Fund this year to £20 million, helping households who are at risk of severely rationing their energy use or self-disconnecting entirely.
	We will boost the **Home Energy Scotland (HES) advice service** and have widened the eligibility criteria of the **Warmer Homes Scotland fuel poverty programme**.
	We continue to call on the UK Government to take stronger and more targeted action: • A **windfall tax should apply fairly** to all companies benefiting from significantly higher profits. • Additional support needs to be delivered to **support vulnerable energy consumers** who are already struggling to pay their bills and heat their homes. • More needs to be done to support **households across Scotland who rely on alternative[18] fuels** to heat their homes. • Accelerate the review on identifying 'vulnerable non domestic customers' and **offer all vulnerable SMEs guaranteed support** past March 2023.
	We also continue to call on the UK Government to ensure continued incentives to support investment in renewable generation as well as enabling consumers, communities and businesses in Scotland to share the benefits of low-cost renewable power. (See Chapter 5 for more details).
Communities and places can participate in and benefit from the net zero energy transition	We will work with the renewables industry to explore ways of **increasing the amount of shared ownership projects** in Scotland.
	We will encourage developers to **offer community benefits and shared ownership opportunities as standard** on all new renewable energy projects – including repowering and extensions to existing projects.
	We are also **working with the Scottish National Investment Bank** to assess the pipeline of shared ownership opportunities and the ways in which they could be financed.

[18] Alternatives to natural gas such as heating oil, LPG, coal and biomass (wood pellets)

	We are providing a **tailored package of support to remote and rural off grid communities** through CARES (Community and Renewable Energy Scheme), helping them to upgrade their energy systems.
	We will commission a review to assess the current approach, identify examples of best practice for community benefits, and consider how we might further strengthen our approach and **maximise the benefits** flowing to communities.
	We are currently updating our **Good Practice Principles for Community Benefit** from Offshore Renewable Energy Developments, and will consult on new draft guidance in 2023.
	We will engage with the UK Government to consider mechanisms for maximising opportunities for community benefit and shared ownership for renewable energy developments.
	We welcome UK Government proposals to consider how local communities can **benefit from electricity infrastructure**. We will work closely with the UK Government to ensure this policy reflects the diverse needs of industry and community stakeholders across Scotland.
	We will work with **enterprise agencies** to help facilitate support to **realise the vast regional socio-economic opportunities** of the transition.
	We will support six communities through the **Carbon Neutral Islands programme** to take net zero action locally.
	We will carry out research on the **net zero skills gap on islands across** Scotland.
	Through our **Climate Action Hubs and Climate Action Towns,** we will provide a vehicle for communities to come together to identify local solutions and build a pipeline of investible projects and opportunities at a regional level.
	We will support local authorities to produce their **Local Heat and Energy Efficiency Strategies and Delivery Plans** by providing capacity support training in partnership with Zero Waste Scotland.
	We are taking forward research **into how to accrue maximum economic benefits to Scotland's households, communities and our economy** at regional/local and national levels from Scotland's anticipated surplus low carbon energy.

Delivering a just transition for Scotland's energy economy	
Creating a supportive policy environment and maximising the impact of government expenditure	We are investing **almost £5 billion in the net zero energy economy** in Scotland over this parliamentary term. Details can be found in Chapter 6 and available funding can be found in Annex I.
	Our **£75 million Energy Transition Fund** supports five key transition projects in the North East and our **£100 million Green Jobs Fund** provides capital across Scotland to support green industries and the green jobs associated with them. Our **£500 million Just Transition Fund** will support the northeast and Moray to become one of Scotland's centres of excellence for the transition to a net zero economy.
	The 2021-22 to 2025-26 Infrastructure Investment Plan (IIP) includes details of around **£26 billion of major projects** and prioritises enabling the transition to net zero as the first of its three core priorities. It provides a robust pipeline of public sector infrastructure work, with almost **£9 billion for environmental sustainability** and the **net zero transition.**
Attracting private investment	As part of our route map to a net zero energy system, we will **develop an investment prospectus** to support critical milestones. We will develop this in consultation with key stakeholders, including financial institutions, trade bodies and business, ahead of the finalised Strategy and Plan.
	We will work with our enterprise agencies, business and investors to attract the required capital and inward investment to deliver Scotland's net zero ambition and export potential.
	We have established the **Green Heat Finance Task Force**, working with partners to develop the additional financial products and services needed to unlock the heat in buildings transformation.
	We will expand our **Green Investment Portfolio** to bring together **market-ready projects worth £3 billion** in 2022.
	We will work with stakeholders, including the **Scottish National Investment Bank**, to ensure infrastructure investment is aligned to Scottish Government energy policy priorities and leverages private capital to help tackle climate change and support local economic growth.
	In line with our National Strategy for Economic Transformation, an **Investor Panel** chaired by the First Minister has been established to bring market intelligence to Scotland's capital investment opportunities and will attract a

	pipeline of projects in Scotland that support our transition to net zero. The Panel met for the first time in Dec 2022.
	We will publish an updated **Climate Emergency Skills Action Plan** (CESAP) in 2023.
Developing a multi-skilled green workforce, boosting jobs , our domestic supply chain and manufacturing capabilities	We are supporting the **reskilling** of oil and gas workers by funding an offshore skills passport through our Just Transition Fund.
	To inform the updated CESAP, we are undertaking research on **skills needs for hydrogen, heat in buildings and on Scotland's islands**.
	We have committed **£100,000 in grant funding** to support just transition capacity within the trade union movement.
	We are making a **£75 million investment** in the National Manufacturing Institute Scotland (NMIS).
	We are expanding our **Supply Chain Development Programme** to improve the capacity, capability and development of Scottish supply chains.
	We are developing our understanding of Scotland's existing strengths in net zero goods and services and the renewables sectors, looking at **opportunities for internationalisation**.
The net zero energy system is continuously innovative and competitive in domestic and international markets	We will continue to **improve our understanding of Scotland's renewable sectors' trade and investment needs** and opportunities in order to set those out in the final Strategy and Plan, and are seeking views through this consultation.
	We will publish our **Renewables Export Plan** in early 2023, to grow exports of renewable energy goods and services.
	We will implement our **Hydrogen Action Plan** which was published in December 2022.
	We will continue to urge the UK Government to create a frictionless trading environment for renewable energy, goods and services by using trade agreements and policies **to address tariff and non-tariff barriers to trade.**
	We are calling on the UK Government to take the action necessary at a UK-level to **facilitate the smooth international trade of hydrogen**, in line with Scottish export ambitions.
	We have funded an industry led study into the regulatory, infrastructure and economic requirements and benefits to **establishing a CO_2 shipping industry** centred on Peterhead port.
	We urge the UK Government to seek the development of a **common international standard on CO_2 storage** that focuses on storing emissions from essential industries.
	We will publish our **Innovation Strategy,** which highlights energy and low carbon as a key priority, in early 2023.

2.1 - People have access to affordable clean energy

Feedback from engagement

Stakeholders highlighted the importance of fairness and affordability, of ensuring that every household would get the energy they need at a fair price, and of providing support for those on lower incomes and those in, or at risk of, fuel poverty.

Recent increases in energy prices have had profound negative impacts on households and businesses across Scotland. In the absence of government support via the Energy Price Guarantee, the latest Ofgem price cap would see the typical GB household paying £4,279 per year. With government support, this will be £2,500 per year until April. This compares to £1,042 in winter 2022, an increase of over 100%. Most of the recent rise in fuel bills has been driven by prices increases in the wholesale energy markets, especially gas[19]. Prices for non-domestic consumers have also risen substantially, particularly for large industrial consumers in the UK who now pay some of the highest prices in Europe.

Impact of wholesale gas and oil prices on energy bills

Scotland is part of the GB energy system and GB gets around 35%[20] of its electricity demand from gas-fired power stations. The cost of gas therefore has a strong impact on the cost of electricity.

In 2022, wholesale natural gas prices increased more than 6-fold from their long-term average, resulting in upward pressure on household energy bills. Independent analysis[21]showed that gas generation is approximately 9 times more expensive than renewables. Even assuming the highest cost estimates for grid integration of intermittent renewables (£30/MWh), gas generation was still almost 6 times more expensive than renewables[22]. We are clear that, as set out in Chapter 5, longer-term, the UK Government must reform the energy market to permanently break the link between the price of electricity and the cost of gas and enable the benefits of home grown low-cost renewable power.

[19] Default Tariff Cap | Ofgem
[20] Scottish Energy Statistics Hub (shinyapps.io)
[21] Analysis: Record-low price for UK offshore wind is nine times cheaper than gas - Carbon Brief
[22] Analysis: Record-low price for UK offshore wind is nine times cheaper than gas - Carbon Brief

Scotland's status as a fossil fuel producer has not insulated Scotland from the associated energy cost crisis because prices are set by international markets and Scotland's offshore gas reserves are too small to meaningfully change global gas prices. Scotland was responsible for 1% of global oil and gas production in 2019.23 Oil and gas prices have surged since countries started to recover from the Covid pandemic and Russia invaded Ukraine.

Although bill payers remain protected from the full increase by the UK Government's Energy Price Guarantee and Business Energy Bill relief schemes, the increase in energy bill costs is still putting significant pressure on household and business finances, with many unable to afford the energy they need. Thousands of families and businesses are facing an acute crisis, with risks of escalating debt, self-disconnection, self-rationing of vital energy services, and businesses being forced to close temporarily or collapsing completely.

Consumer Scotland[24] has a key part to play in our journey to net zero. Their strategic plan and work plan due to be published in 2023 will have net zero as a key priority. Their recent energy affordability tracker[25] found that:

- 36% of consumers reported that they are not managing well financially
- 43% cannot heat their homes to a comfortable level
- 69% are finding it more difficult than last year to keep up with energy bills – rising to 82% for prepayment customers
- 68% are reducing the use of electrical appliances because of financial concerns.

We will continue to do all we can to support households and businesses, and our priority is those in or at risk of fuel poverty[26]. A number of our delivery programmes have been escalated to respond to the cost of living crisis. We have:

- Doubled our Fuel Insecurity Fund to £20 million for 2022-23, which we know is making a real and tangible impact on the ground now, through our delivery partners, towards helping the most vulnerable in society. This has been, and continues to be a lifeline for thousands of

[23] UK NBP Natural Gas Futures | ICE (theice.com)
[24] Consumer Scotland
[25] Consumer Spotlight: Energy Affordability Tracker 1 November 2022 | Consumer Scotland
[26] Based on scenario modelling by Scottish Government, with the October 2022 price cap of £2,500 for an average household, we estimate there will now be 860,000 (35%) households in fuel poverty and 600,000 (24%) in extreme fuel poverty. Raising the price cap to an average £2,500 instead of freezing it at its previous level of £1,971 means an additional 110,000 Scottish households will be in fuel poverty, and around 150,000 more in extreme fuel poverty.

households, against rising energy prices which will only continue into this year.

- Expanded the Home Energy Scotland (HES) service, increasing its capacity by 20%, supporting an additional 12,000 households. Boosted HES Energy Carers, more than doubling capacity (to support 1,400 vulnerable households).
- Increased per-property funding limits within our local authority-led Area Based Schemes to enable more projects to go ahead despite inflation impacts on materials and labour, and to keep customer contributions down.
- Introduced an insulation-only stream to our Warmer Homes Scotland (WHS) Programme for working-age people without children on low-income benefits, who were not previously eligible.
- Widened the eligibility criteria for Warmer Homes Scotland (WHS) to more households in the 60+ yrs age groups.
- Launched a national marketing campaign over winter 2022-23 to raise awareness of Home Energy Scotland and the support on offer for energy efficiency.
- Introduced a standalone grant to replace the cashback element of Home Energy Scotland (HES) Loans for domestic owner occupied properties. The new grant provides funding for heat pumps up to £7,500 and for energy efficiency improvements – up to 75% of the combined cost of the improvements and up to the maximum grant amount of £7,500.
- Applied a rural uplift of £1,500 to both the heat pump and energy efficiency grants. This uplift increases the heat pump grant flat rate and the maximum limit of the energy efficiency grant to £9,000.
- Invested an additional £300,000 to improve the capacity of Business Energy Scotland. We have also committed to introduce a stand-alone grant this financial year to improve financial support to SMEs to help them decarbonise.

We continue to call on the UK Government to take stronger and more targeted action to support households and businesses:

- A windfall tax should apply fairly to all companies, not just energy companies, benefiting from significantly higher profits.
- We have highlighted repeatedly the need for extra support for vulnerable energy consumers who are already struggling to pay their bills and heat their homes.
- More needs to be done to support households across Scotland who rely on alternative fuels[27] to heat their homes.

[27] Alternatives to natural gas such as heating oil, LPG, coal and biomass (wood pellets).

The UK Government's higher price cap from April 2023 (proposed average of £3,000) for domestic consumers is still unsustainable for many households, and we estimate that it will put around 970,000 Scottish households in fuel poverty. We continue to call on the UK Government to provide additional support, especially for consumers reliant on alternative heating fuels. It is essential that those households and businesses not classified as fuel poor or vulnerable, but for whom soaring costs remain a huge concern, continue to receive some support. We also call on the UK Government to ensure continued incentives to support investment in renewable generation, as well as enabling consumers, communities and businesses in Scotland to share the benefits of low cost renewable power. (See Chapter 5).

The current market volatility and the ongoing reserved nature of powers on energy regulation and the energy market mean that now is not the right time for a retail-based public energy company.

A national public energy company that is involved in major energy generation would only be possible in an independent Scotland where we had full powers over the energy market and full access to borrowing.

2.2 - Delivering for communities and regions across Scotland

This is a national Strategy and Plan, but much of the action to deliver Scotland's energy transition will happen at a local and regional level. Scotland has diverse communities with differing needs, and the draft Strategy and Plan must deliver for all parts of Scotland.

The just energy transition needs to meet the needs of different communities and workers, and deliver on the opportunities offered by different geographies and infrastructure assets. For areas of Scotland with traditionally higher dependence on fossil fuel related economic activity, such as the North East and Shetland, we will shift investment and employment to clean sectors such as wind and marine energy.

The opportunities that the transition creates are immense. This section sets out actions to support communities to ensure they derive maximum benefit from the energy transition, including through supporting regional hydrogen hubs and by getting involved in wider local and community energy projects, with the support of schemes such as the Community and Renewable Energy Scheme (CARES)[28].

The regional opportunities map (figure 10) highlights areas of activity across the energy system, demonstrating the diverse, Scotland-wide opportunity that the transition to net zero presents. For example, the energy transition presents strategic opportunities for the Highlands and Islands. The natural

[28] Local Energy Scotland programme CARES - Energy Saving Trust

advantages offered by unparalleled wind, wave and tidal resources have made the region attractive to developers, and the past 20 years have seen significant growth in on- and offshore wind and notable advances in marine energy.

The waters around the coastline played host to the world's first deepwater offshore wind project – The Beatrice Demonstrator – ultimately leading to commercial-scale leasing rounds; most notably ScotWind. ScotWind puts the region at the global forefront of offshore wind, particularly floating wind. This will support the creation of highly skilled jobs, attracting new talent to the Highlands and Islands.

The Highlands and Islands also has significant opportunity for renewable hydrogen production, through repurposing and diversifying key oil and gas terminals, and capitalising on the region's vast offshore wind resource. With that comes huge potential to create green, fair and high-value jobs in remote, rural and coastal communities.

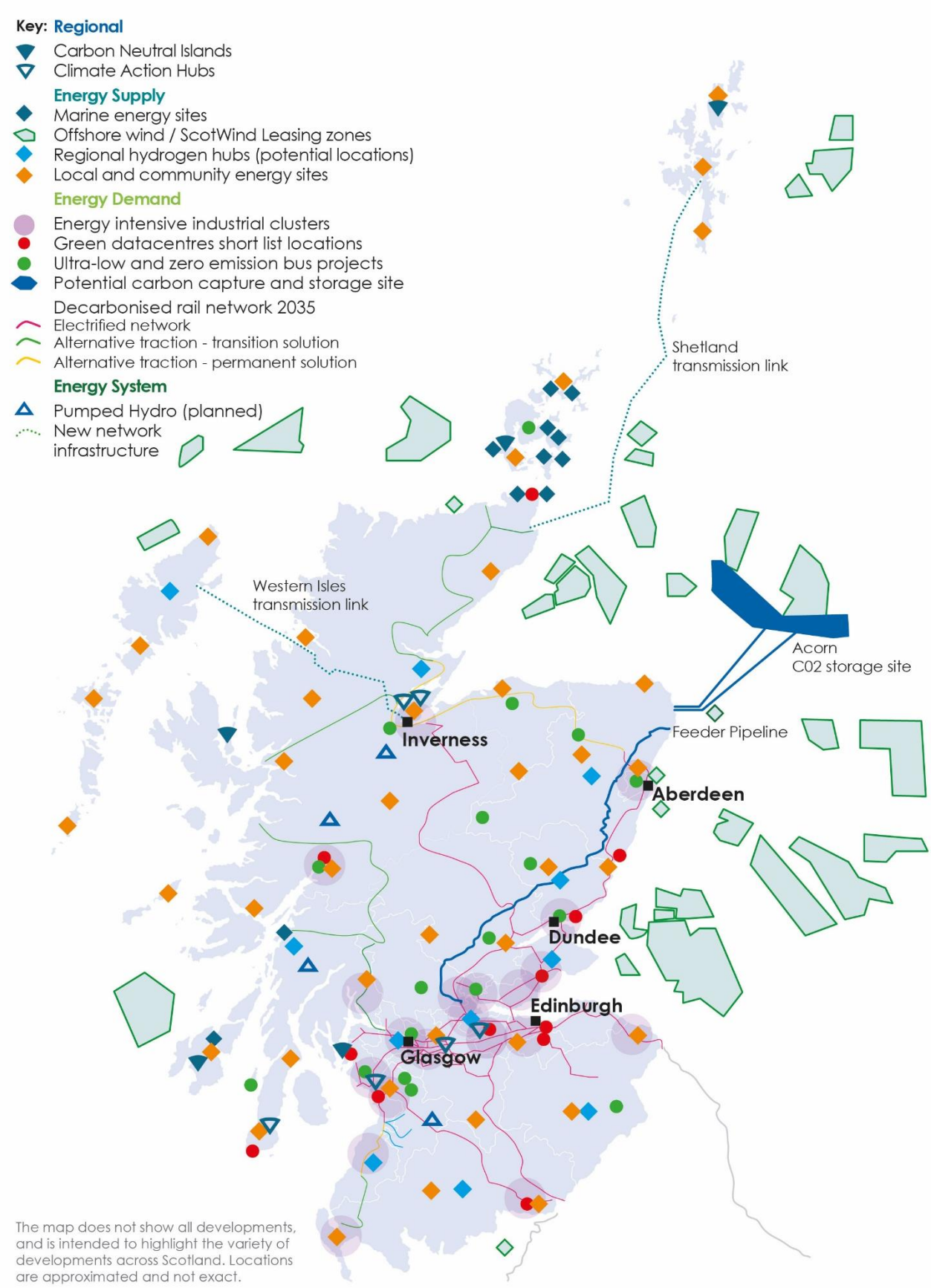
There are 93 inhabited islands in Scotland, with a population of 103,700[29]. The Islands of Rum, Eigg, Muck, Canna, Foula and Fair Isle are some of our smallest islands and all completely 'off-grid' (not connected to the national electricity or gas networks). These remote islands are looking at innovative ways to supply, distribute and generate energy including opportunities to ensure local maintenance and supply chain opportunities are realised. Our Carbon Neutral Islands programme will support some of this activity. We are supporting communities across Scotland to make the transition to low carbon and climate resilient living through regional climate hubs.

The North East of Scotland is a global centre for the energy industry. With more than 50 years of knowledge and experience in offshore energy, exploration and production, the area is recognised as a hub for energy innovation. As the energy industry evolves, the region is well placed to harness and deploy the existing skill set by securing new jobs and investment through the energy transition. Chapter 3 provides an updated Scottish Government position on North Sea exploration and extraction.

The South of Scotland is home to critical cross-border energy transmission infrastructure, has the potential to house hydrogen infrastructure, and is a significant exporter of power but imports hydrocarbons for heat and transport. The region's Energy Transition Plan will seek to use the South's green electricity strength to place the region in the vanguard of decarbonising heat and transport, production of green hydrogen, and securing supply chain jobs. South of Scotland Enterprise is leading development of a Net Zero Route Map for achieving the region's just transition prior to 2045, and the first related sectoral transition plan will be for Energy.

[29] Inhabited islands analytical report | Scotland's Census (scotlandscensus.gov.uk)

Figure 10 : A Just Transition for Energy: Regional and National Opportunities



Benefits to climate and our environment

A just transition must support Scotland's ambitions for restoring and regenerating biodiversity and improving the health and quality of our natural environment. Any trade-offs between the energy transition and nature goals must be carefully assessed and managed. Our Environment Strategy sets out the Scottish Government's commitment to tackling the twin climate and nature crises. It highlights that these crises are intrinsically linked, and it is essential to take a joined-up approach to tackling them. This includes adopting nature-based solutions to energy that also support biodiversity.

Securing positive effects for biodiversity is one of six statutory outcomes for our National Planning Framework 4 (NPF4), which signals a turning point for planning.

2.2 - Community energy and shared ownership

Feedback from engagement

Stakeholders called for communities to be empowered by, and supported through, the energy transition. This includes exploring models of shared ownership, mandating a level of local content in every major energy project, delivering community-owned energy generation through local authorities and establishing a community benefit framework with clear criteria to make sure the right benefits reach the right communities.

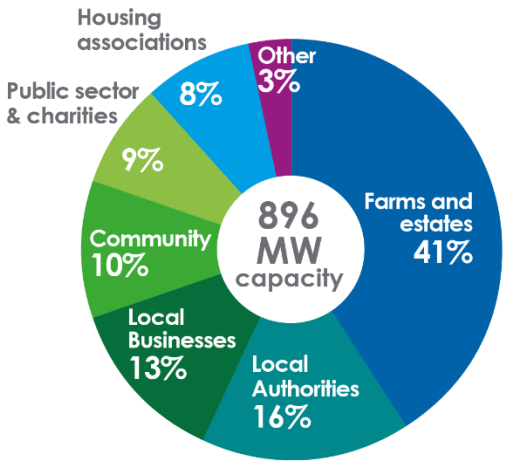
Communities across Scotland must get maximum benefit from the energy transition, and community and shared ownership of renewables is an important tool to help achieve this. Scotland already has a positive legacy of community and local ownership of energy which provides a firm foundation to build on. (See figures 11 and 12 overleaf).

Community and shared ownership of energy provides revenue that can be directly invested back into the local community, and community benefit from renewables projects can make a real and lasting difference to local communities. Whilst the Scottish Government does not have powers to mandate community benefit – or shared ownership – our voluntary community benefit register [30] indicates that a community benefit

[30] https://localenergy.scot/community-benefits-map/

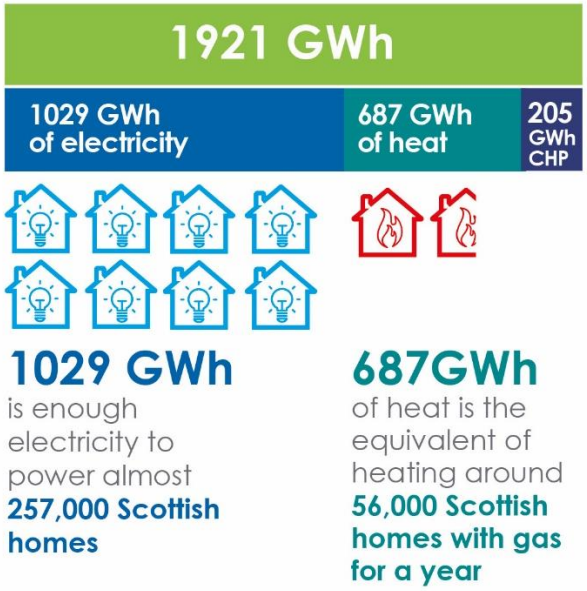
commitment of around £24 million will have been paid out from renewable energy projects in Scotland over the past 12 months.

Figure 11: Community and locally owned energy in Scotland (June 2021)



Source: Community and locally owned energy in Scotland report[31]

Figure 12 : Community energy powering homes



Source: Community and locally owned energy in Scotland report[32][33]

Case study: Strathnairn community benefit fund.

Strathnairn Community Benefit Fund (SCBF) was set up in 2004 to receive and distribute community benefit payments from the developer of the Farr Windfarm, Npower UK (now owned by Ventient Energy) and the Farr Hydro Scheme. The annual fund value was over £230k in 2018. SCBF has funded projects, including: community transport provision, after-school activities for children, and running costs for community halls. It has also provided grants to make homes of residents more energy efficient, install renewables, and to help residents pay their fuel bills through The Energy Grant, which was introduced in 2015.

[31] Community and locally owned energy in Scotland: 2021 report - Energy Saving Trust
[32] CHPs provide both heat and electricity and the ratio will depend on the characteristics of each individual site. The precise split of heat and electricity isn't known, and therefore equivalents have not been provided for this proportion of total community energy
[33] Community and locally owned energy in Scotland: 2021 report - Energy Saving Trust

All developers of renewable energy developments and local communities in receipt of community benefit payments are encouraged to use and input to the register. The community benefit map and register, which provide a breakdown by project, can be viewed via the following link: https://localenergy.scot/community-benefits-map/

We are working with the renewables industry to explore ways of increasing the amount of shared ownership projects in Scotland. We are encouraging developers to offer community benefit and shared ownership opportunities as standard on all new renewable energy projects – including repowering and extensions to existing projects.

Case study: Shared ownership of renewables – Crossdykes wind farm

Crossdykes Wind Farm is a 48 MW onshore wind power project. It is located 11km North-West of Langholm and 13km North-East of Lockerbie. It has the capacity to generate enough green electricity to power 45,000 homes.

Developed by Muirhall Energy, Crossdykes Wind Farm is the first in Scotland where the community have a share in a subsidy-free wind farm. It will also deliver £7,000 per MW in community benefit fund payments each year, leading the way in developer-led community investments.

Photo credit: Local Energy Scotland

Muirhall Energy's Community Shared Ownership scheme, with the local community taking a five percent stake in the project, will ensure a significant income stream of around £4 million over the lifetime of the wind farm and is the largest community investment in renewables since 2017.

Residents local to Crossdykes Wind Farm will also benefit from an annual pot of £322,000, amounting to £8 million over the lifetime of the project.

Our CARES scheme provides support to communities and developers that are interested in shared ownership of a renewable project. This includes:

- Free, expert and impartial advice, including guidance on Financial Services and Markets Act and Financial Conduct Authority requirements
- Access to webinars
- Support to apply to funders e.g. Scottish National Investment Bank and Social Investment Scotland
- A shared ownership module in the CARES Toolkit
- The Indicative Finance Model – an interactive tool to give communities a better understanding of the project's viability

We're also working with the Scottish National Investment Bank to assess the pipeline of shared ownership opportunities and the ways in which they could be financed. Stakeholders agree that action is needed to further increase the benefits reaching communities. We will commission a review to assess the current approach, identify examples of best practice, and consider how we might further strengthen our approach and maximise the benefits flowing to communities.

We will continue to engage with the UK Government to consider mechanisms for maximising opportunities for community benefit and shared ownership for renewable energy developments.

We also welcome UK Government proposals to consider how local communities can benefit from electricity infrastructure. We will work closely with the UK Government to ensure this policy reflects the diverse needs of industry and community stakeholders across Scotland.

Supporting the global transition to net zero

We place great importance on Scotland being a good global citizen by playing our part in tackling global challenges including poverty, injustice and inequality. Energy plays a critical part in tackling these challenges, as it restricts human and economic development. Sustainable Development Goal 7[34] aims to ensure access to affordable, reliable, sustainable and modern energy for all.

There are currently 733 million people worldwide who lack access to electricity[35]; 77% of these live in sub-Saharan Africa[36]. In our partner countries the situation varies with only 15% of the population of Malawi, 45% of

[34] Goal 7: Sustainable Development Knowledge Platform (un.org)
[35] International Energy Agency – The Vaultz News
[36] Access to electricity – SDG7: Data and Projections – Analysis - IEA

Zambians and 47% of Rwandans having access to electricity[37]. Energy provides economic and societal opportunities and clean energy is therefore at the heart of tackling climate change, whilst seeking to eradicate poverty. The Scottish Government's Global Renewables programme is seeking to support the global energy transition.

Case study: Global Renewables Centre

EASE Microgrid Project
Photo credit: Aran Eales

The Scottish Government has committed to establishing the Global Renewables Centre (GRC). The GRC aims to support our international development partner-countries (Malawi, Zambia and Rwanda) in their transition to renewables. The focus of the collaboration is partner-country led, based on the needs they have identified. Our online hub will act as a knowledge sharing exchange between stakeholders in the partner countries and the Scottish renewables sector, opening up opportunities for networking and shared learning. In-country partnerships will support partners to access knowledge and support. As the GRC develops, we hope to open up the platform to a wider group of partners.

In September 2022 the Scottish Government signed up to the 24/7 Carbon-Free Energy compact (CFE), supporting rapid decarbonisation. We committed to treble the world-first Climate Justice Fund to £36 million over this parliamentary term and support the Women's Environment Development Organisation with £50,000 provided annually to support capacity building

[37] https://trackingsdg7.esmap.org/

and training for women to engage in UNFCCC[38] talks and integrate gender equality considerations into the outcomes.

2.3 - Delivering a just transition for Scotland's energy economy

The energy transition offers significant opportunities for Scotland's economy, providing benefits for Scotland's people and communities. To maximise these benefits, we will secure private investment and seek to strengthen and support Scotland's companies, equip workers with the skills and opportunities to access good, green jobs, and explore opportunities to boost international exports.

Feedback from engagement

Stakeholders highlighted the need for action on supply chains and exports – with many voices calling for the Scottish Government to help provide the correct market signals and to propose a timetable for when critical components of the energy system are needed. This would ensure that home industries can scale up and invest to deliver transformation of the energy system, as well as harness the opportunities to export products and expertise around the globe.

Delivering a just transition requires an all-Scotland approach; it cannot be delivered by the Scottish Government alone. Our National Strategy for Economic Transformation, Inward Investment Plan and Global Capital Investment Plan show that working with businesses and investors, as well as public agencies, will be key to attracting the required high quality capital and inward investment, and technologies to deliver Scotland's net zero ambition and export potential. This inward investment will create opportunities for Scottish businesses and supply chains, increasing their access to global markets, technology and talent.

To harness the additional investment required to fund the just transition, where appropriate we will scale up activity to move from a funding to a financing policy model. This will more effectively leverage private sector investment and action to better amplify the impact of public investment.

This investment in Scotland's renewables potential will mean that we can ensure green energy self-reliance and also export increasing amounts of low carbon energy to our international neighbours, supporting the wider security of supply needs and decarbonisation ambitions of our neighbouring nations.

[38] UNFCCC United Nations Framework Convention on Climate Change

Creating a supportive policy environment and maximising the impact of government expenditure

We will use all the levers of government, including policy, investment and engagement with the UK Government to support Scotland's energy transition. We are already investing almost £5 billion in the net zero energy economy in Scotland over this parliamentary term (see Investment Route map in Chapter 6 for further details). We want to align our energy system outcomes with our investment, ensuring that we prioritise those projects which align with our future vision.

Our capital investment is primarily focussed on the demand sectors of heat, transport and industry. Under the current constitutional settlement, the Scottish Government is unable to invest in many parts of the UK's liberalised energy markets. We will continue to use our capital funds to support those least able to pay, to maximise economic opportunities for communities across Scotland and to promote environmental protection.

The public sector cannot do this alone: we need the private sector to work in partnership with the public sector to deliver the scale of investment required to enable the net zero energy transition. Investment should be anticipatory and coordinated to ensure we are building a future energy system that is fit for purpose and maximises strategic opportunities.

Maximising the benefits to our economy, businesses and workers

The National Strategy for Economic Transformation sets out the priorities for Scotland's economy, as well as the actions needed to maximise the opportunities of the next decade to achieve our vision of a wellbeing economy.

The 2021-22 to 2025-26 Infrastructure Investment Plan (IIP) sets a long-term vision for infrastructure, supporting an inclusive, net zero carbon economy in Scotland. It includes details of around £26 billion of major projects and national programmes.

Attracting private investment

The Office for National Statistics (ONS) estimates that private investment in UK energy infrastructure reached £6.4 billion in 2020[39] (show in figure 13). Investment in our energy system generates wider supply chain benefits. For

[39] Infrastructure in the UK, investment and net stocks - Office for National Statistics (ons.gov.uk) . Energy infrastructure relates to activities falling into SIC 35 (Electricity, Gas, Steam and Air Conditioning Supply)

example, Offshore Energy UK (OEUK)[40] estimate for every £1 million of oil and gas GVA, £2.1 million is generated elsewhere in the economy. ScotWind will deliver over £750 million in revenues for the public purse through the initial awards alone, and developers have committed to invest an average of £1.4 billion per project, equating to more than £ 28 billion of potential investment in Scotland's supply chain.

We will work with stakeholders, including the Scottish National Investment Bank, to ensure infrastructure investment is aligned to Scottish Government energy policy priorities and leverages private capital to help tackle climate change and support local economic growth.

Figure 13 Private investment in energy infrastructure

Source: Office for National Statistics [Infrastructure in the UK, investment and net stocks - Office for National Statistics (ons.gov.uk)]

We are already working with industry on financing solutions. As well as the investment in hydrogen, CCUS and industrial decarbonisation set out below (see Chapters 3 and 4), we have established the Green Heat Finance Task Force, where we are working with partners to develop the additional financial products and services needed to unlock the heat in buildings transformation.

In line with our National Strategy for Economic Transformation, an Investor Panel chaired by the First Minister has been established to bring market intelligence to Scotland's capital investment opportunities and will attract a pipeline of projects in Scotland that support our transition to net zero. The Panel met for the first time in December 2022.

[40] https://oeuk.org.uk/product/economic-report-2022/

We will also expand our Green Investment Portfolio to bring together market-ready projects worth £3 billion in 2022. By assessing these projects before they go to market, the Portfolio provides investors with the confidence they need to back credible and sustainable projects in Scotland. As part of our route map to a net zero energy system, we will develop an investment prospectus to support critical milestones. We will develop this in consultation with key stakeholders, including financial institutions, trade bodies and business, ahead of the finalised Strategy and Plan.

As set out in the National Islands Plan, Scotland's islands will also play a key part in delivering net zero. The Scottish Government Carbon Neutral Islands (CNI) project will support six islands to progress towards becoming fully carbon neutral by 2040, including by developing investment strategies to leverage existing public funds, promote public-private partnership and drive private investment. Our delivery partner Community Energy Scotland is working locally on each island where community development officers have been employed to personally support the audit and plan phase of the Carbon Neutral Islands project.

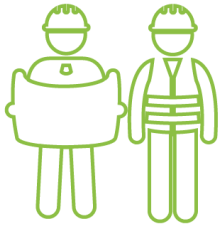
Equipping our workforce with the right skills at the right time

Feedback from engagement

Stakeholders called for a clear plan, direction of travel and timetable for when the correct skills and jobs are required to deliver the energy transition at both a local and national level. They also asked for sustained and sufficient alignment between professional bodies, industry and bespoke training providers to deliver the workforce of the future.

The National Strategy for Economic Transformation set a 'Skilled Workforce' as one of the five policy programmes of action. Through this programme, we are committed to ensuring Scotland's workforce and employers have the skills they will need in the future, including the skills to support the transition to net zero. We recognise that sectors of the economy, and roles within these sectors, will face different challenges in the coming years, and that many individuals will need to upskill and retrain at various points in their career. This will put new demands on Scotland's education and skills system, as whole sections of the workforce may need support to transition into new or altered job roles.

In the immediate term, our priority actions, as set out in NSET, include:



- Establishing the purpose and principles for education and skills system reform and continuous improvement, and ensuring that they align with our wider socio-economic vision for Scotland;
- Enhancing the content and reach of the Green Jobs Workforce Academy;
- Developing a stronger, simplified lifelong learning system, including support targeted at those who need it most; and,
- Launching a Talent Attraction and Migration Service to help employers recruit workers from outside of Scotland to help address labour and skills challenges.

The Climate Emergency Skills Action Plan (CESAP) is central in defining our ambitions to create a future workforce that can support our transition to a net zero economy.

Just Transition Commission recommendation

A plan on the future of energy sector jobs must provide a clear picture of what the new energy economy will look like. This will help identify future opportunities, what skills will be prized, and where jobs will be located.

We will publish an updated CESAP in 2023, reflecting this draft Strategy and Plan, and setting out next steps for the Green Jobs Workforce Academy. All sectoral Just Transition Plans will expand on the actions we will take to deliver the priorities of our updated CESAP.

We are already seeing the employment benefits from the development of Scotland's offshore wind sector. Scotland is the best performing UK region in the Green Jobs barometer[41], a tool to track job creation, wider employment benefits, job loss, carbon intensity of employment, and worker perceptions with relevance to the green transition.

There are an estimated 20,500 people employed in the Low Carbon and Renewable sector in Scotland, which has an estimated turnover of over £5 billion[42]. Further information on the employment trajectory of the energy

[41] https://www.pwc.co.uk/who-we-are/our-purpose/building-trust-in-the-climate-transition/supporting-a-fair-transition/green-jobs-barometer.html
[42] Low carbon and renewable energy economy, UK - Office for National Statistics (ons.gov.uk)

production sector, as part of the programme of work conducted on the future of the North Sea, can be found in Chapter 3.

Case study: AMTE Power

Photo credit: AMTE Power

AMTE Power Plc took over the dormant AGM Batteries Ltd factory in Thurso with the support of Highlands and Islands Enterprise. Their vision focussed on the key role that new battery cell technology would play in the transition to net zero. AMTE now have over 70 employees and have announced an agreement with the UK Battery Industrialisation Centre for the manufacture of its Ultra High Power cells to support commercialisation into the automotive market.

Case study: Scottish Trade Union Congress (STUC) funding for a just transition

We have committed £100,000 in grant funding to support just transition capacity within the trade union movement. The unions – primarily through the Just Transition Commission – have been fundamental to our policy thinking about a just transition. This funding will provide dedicated worker engagement roles within the STUC to support just transition planning across all Just Transition Plans, delivering enhanced levels of worker engagement in the next phase of co-design for the Energy Strategy and Just Transition Plan. It will also help to bring fair work considerations more fully into our work.

Boosting our domestic supply chain and manufacturing capabilities

Strong supply chains are crucial to ensure we capitalise on the economic opportunity from the transition to net zero. Manufacturing accounts for over half of Scotland's international exports, 47% of businesses' expenditure on research and development (R&D) and 178,000 jobs[43]. We must maximise the use of Scottish manufactured components in the energy transition and ensure high-value technology and innovation.

Making Scotland's Future draws together enterprise and innovation support from across the public sector with an explicit focus on strengthening supply chains. Supporting Making Scotland's Future is our £75 million investment in

[43] Scottish Energy Statistics Hub (shinyapps.io)
Scottish Annual Business Statistics 2019 - gov.scot (www.gov.scot)

the National Manufacturing Institute Scotland (NMIS), an industry-led international centre of expertise aimed at making Scotland a global leader in advanced manufacturing. NMIS is already working with firms across Scotland to transform manufacturing skills, productivity and innovation.

Our National Strategy for Economic Transformation (NSET) sets a number of priorities for action, including supporting Scottish supply chains, and laying the foundations of a Net Zero Industrial Strategy (Project 6), with actions to: expand our Supply Chain Development Programme to improve the capacity, capability and development of Scottish supply chains, including identifying Scottish companies with the skills, capacity and capability to bid for, win and deliver contracts in key industries; adopt a cluster building approach to strengthen our position in new markets; and, review our strategic approach to public ownership so that public companies are managed, developed and initiated for the public good, and work collaboratively to provide support and advice to establish successful public companies.

Case study: Manufacturing in Scotland

Photo Credit: Invinity: (Left) Invinity's VFBs at Scottish Water Perth site and (Right - Credit, Colin Keldie, EMEC) Graeme Harrison HIE, Neil Kermode EMEC and Cabinet Secretary for Net Zero, Energy and Transport, Michael Matheson MSP at EMEC in front of Invinity's flow battery

Invinity Energy Systems' vanadium flow batteries (VFB), manufactured and assembled at the company's Bathgate facility in West Lothian, are accelerating global progress towards net zero at sites all over the world, including two ground-breaking projects in Scotland. Invinity's VFBs are fully recyclable and are a leading alternative to lithium-ion technology. The company has a strong commitment to a just transition to renewable energy with no-one left behind and employs a growing number of highly skilled staff who were previously employed in the oil and gas sector, bringing their fossil-fuel expertise into the green economy.

Our Supply Chain Development Programme seeks better economic impact from Scotland's annual £13 billion public sector procurement spend and focusses on opportunities that will arise in the energy transition. Current priorities include the manufacturing opportunities from heat pumps, hydrogen electrolysers and component parts. See Chapter 4 for support for low carbon manufacturing.

International opportunities – trade and inward investment

The energy transition offers significant trade and investment opportunities, including through trade in energy, services, technology and supplies, and inward investment. This is embedded in the Scottish Government's key trade and investment plans, and our vision of the future for our economy. Energy is a critical sector for export growth within A Trading Nation. We are developing sector export plans on renewables and hydrogen, which set out how energy can continue to be a critical export growth sector as we make the transition to net zero.

Our inward investment plan, Shaping Scotland's Economy, commits to taking a values-led approach to inward investment and includes energy transition as one of the nine opportunity areas for Scotland. Inward investment makes a disproportionately positive contribution to Scotland's economy by attracting the high-quality technologies, know-how, skills and jobs required in emerging areas of energy transition and the decarbonisation of transport, underlining its importance in achieving a just transition.

Scottish Enterprise's Framework for Net Zero sets out how we are mobilising enterprise agencies' expertise, influence, networks and funding to help shape and accelerate Scotland's net zero economic transition. This includes unlocking key net zero market opportunities for Scottish businesses including decarbonised heat, the hydrogen economy, heavy duty electric vehicles and offshore wind.

Scotland's Vision for Trade included a commitment to end all Scottish Government's routine overseas trade support and promotion activities solely focused on fossil fuel goods and services in time for COP26 (1 November 2021). This is a refocussing of support, not a reduction, and is designed to support businesses transitioning away from solely fossil fuel related exports.

We will continue to improve our understanding of Scotland's renewable sectors' trade and investment needs and opportunities in order to set those out in the final Strategy and Plan, and are seeking views through this consultation.

We will publish our Renewables Export Plan shortly after this draft Strategy and Plan, to grow exports of goods and services. This will include international sales of goods, and the provision of services to customers outwith the UK, related to energy produced from renewable sources, including hydro power, marine energy, solar energy, wind energy, bioenergy, and renewable heat

(such as geothermal). We also published our Hydrogen Action Plan in December 2022.

We are urging the UK Government to create a frictionless trading environment for renewable energy, goods and services by using trade agreements and policies to address tariff and non-tariff barriers to trade. We are also calling on the UK Government to take the action necessary at a UK-level to facilitate the smooth international trade of hydrogen, in line with Scottish export ambitions.

Innovation

Just Transition Commission recommendation

Clusters of test and demonstration sites that build on existing capabilities and deliver supply chain diversification should be established to accelerate innovation, and develop affordable solutions fit for design, manufacture and installation in Scotland.

We want to promote Scotland as an innovation test bed for new technologies and markets. Our forthcoming Innovation Strategy will describe how we will stimulate innovation in renewable and hydrogen technologies, and in the decarbonisation of transport, heat and energy efficiency.

Case study: energy systems innovation – whole energy systems accelerator (WESA)

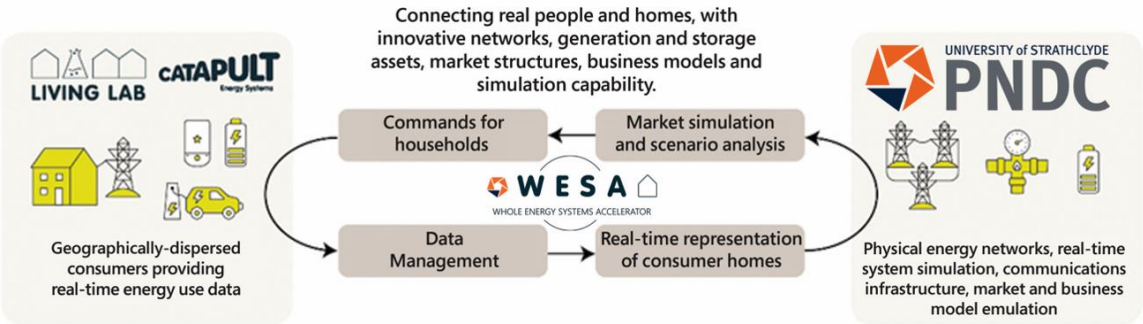


Image credit: PNDC

The WESA project is a collaboration between Energy Systems Catapult 'Living Lab' and the University of Strathclyde's Power Networks Demonstration Centre. It aims to build and operate a first-of-a-kind, agile and scalable real-world trial and demonstration. It estimates that within 10 years around 90 companies (mainly SMEs) will have been supported and 39 new products commercialised, creating over 2,900 highly skilled jobs and over £129 million gross value added in Scotland. This project has been supported through the Scottish Government Green Jobs Fund.

Chapter 3: Energy supply

Scotland will be a renewable powerhouse

By 2030, domestic production of renewable electricity and renewable hydrogen will have increased significantly, helping to address climate change by substantially reducing the emissions of our energy sector. By 2030, the total electricity produced in Scotland over the course of a year will allow us to continue to benefit from exporting electricity and open up the huge opportunities of vast renewable hydrogen production for use in Scotland and for export. This will contribute to economic growth, jobs and investment.

Scotland will be a renewable powerhouse, exporting renewable hydrogen and electricity to support decarbonisation in Europe, as part of an integrated system with the rest of Europe. There will be an additional 20 GW of renewable electricity capacity and 5 GW hydrogen production, as well as substantial growth in marine and solar capacity. Oil and gas in the North Sea is becoming less plentiful and harder to extract. There will be no nuclear power, coal extraction or use of unconventional oil and gas or exploration of onshore conventional oil and gas.

This chapter sets out the scale of the opportunity to transform Scotland's energy supply, with energy increasingly provided from climate-friendly renewable electricity and hydrogen.

To achieve this transformation, we will:

Scale up Renewable Energy	
Offshore Wind	We have set out an ambition to have **8-11 GW** of installed offshore wind capacity by 2030 and are consulting on setting a further offshore deployment ambition.
	We continue to call on the UK Government to **devolve the powers necessary** to enable us to deliver our ambitions on offshore wind.
	We are currently updating our Good Practice Principles for Community Benefit from Offshore Renewable Energy Developments, and will **consult on new draft guidance in 2023.**
	We will **revise Scotland's National Marine Plan (NMP)** (2015) following the outcome of the earlier (2021) review. This new NMP will update our planning framework and help to facilitate sustainable delivery of offshore renewable energy.
	We will use the **Sectoral Marine Plan (SMP) Iterative Plan Review** to consider and assess new information relating to

	ScotWind and Innovation and Targeted Oil and Gas Decarbonisation (INTOG), providing an up-to-date evidence base to assist consenting and future planning.
	We will **deliver up-to-date critical research** through the Scottish Marine Energy Research (ScotMER) programme to address key consenting and planning risks with increased funding for projects over the next five years.
Onshore Wind	We will take action to deliver an **additional 12 GW of installed onshore wind by 2030,** as set out in our Onshore Wind Policy Statement, published in December 2022. This will take us to a total of 20 GW.
	We will work with industry to deliver an **Onshore Wind Sector Deal** in 2023 to ensure we maximise deployment and the economic opportunities that flow from it.
	We will ensure that the **community energy sector** is represented on the forthcoming onshore wind strategic leadership group.
	We will convene an **expert group**, including representatives from industry, agencies and academia. This will provide advice to the Scottish Government on how guidance could be developed to support both our **peatland and onshore wind aims.**
Wave and Tidal	**A draft vision for Marine** is set out below, and we are seeking views on this as part of the consultation.
	We will support the delivery of the 2021–2025 business plan for **Wave Energy Scotland with £18.25 million of investment,** and work with stakeholders to explore the longer-term needs of the wave energy sector.
Solar	We are setting out a **draft vision for Solar** and are seeking views on this, and options for setting a solar deployment ambition, as part of the Strategy and Plan consultation process.
	Through the solar vision, we are setting out action to **reduce barriers** to enable and encourage greater solar deployment.
	We are keen to see the number of solar installations offering **community benefits** increase and continue to encourage the sector to consider what packages of community benefit it can offer communities local to developments, in line with our Good Practice Principles.[44]
Hydro	We will continue to urge the UK Government to provide **appropriate market mechanisms for hydro power** to ensure the full potential of this sector is realised.

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

Bioenergy	We are reviewing the potential to scale up domestic biomass supply chains, with the support of a Bioenergy Policy Working Group.
	We will develop a strategic framework for the most appropriate use of finite bio-resources, which will be published in a **Bioenergy Action Plan**.
Hydrogen	We will take forward the actions in our **Hydrogen Action Plan**, including: • set out an ambition of 5 GW of renewable and low-carbon hydrogen production by 2030 and 25 GW by 2045. • £100 million funding towards the development of our hydrogen economy.
	We are taking forward a collaborative project with key stakeholders to streamline consenting procedures and reduce consenting timescales.
	We will work with key partners to provide targeted support to **develop skills programmes** and to help people, companies and communities to connect to the opportunities created by the growing **hydrogen economy.**
Planning and Consenting	We will **place climate and nature at the centre of our planning system** in line with the Revised National Planning Framework 4, making clear our support for all forms of renewable, low-carbon and zero emission technologies, including transmission and distribution infrastructure.
Economic benefits	In 2023, we will establish a **Green Datacentres cluster builder** to increase renewable energy adoption by datacentres.
Economic benefits from exporting energy	We are taking forward research into ways of maximising the economic benefits to households, communities and regional economies from Scotland's anticipated low carbon energy surplus.

Reduce our reliance on other energy sources	
North Sea Oil and Gas	We are calling on the UK Government to support the fastest possible just transition for the oil and gas sector.
	We are calling on the UK Government to take forward a **more rigorous package of tests** than those recently introduced by the UK Government for the 33rd licensing round to align with global climate goals.
	Whilst licensing is reserved to the UK Government, the Scottish Government is **consulting** on whether, in order to support the fastest possible and most effective just transition, there should be a **presumption against new exploration for oil and gas.**

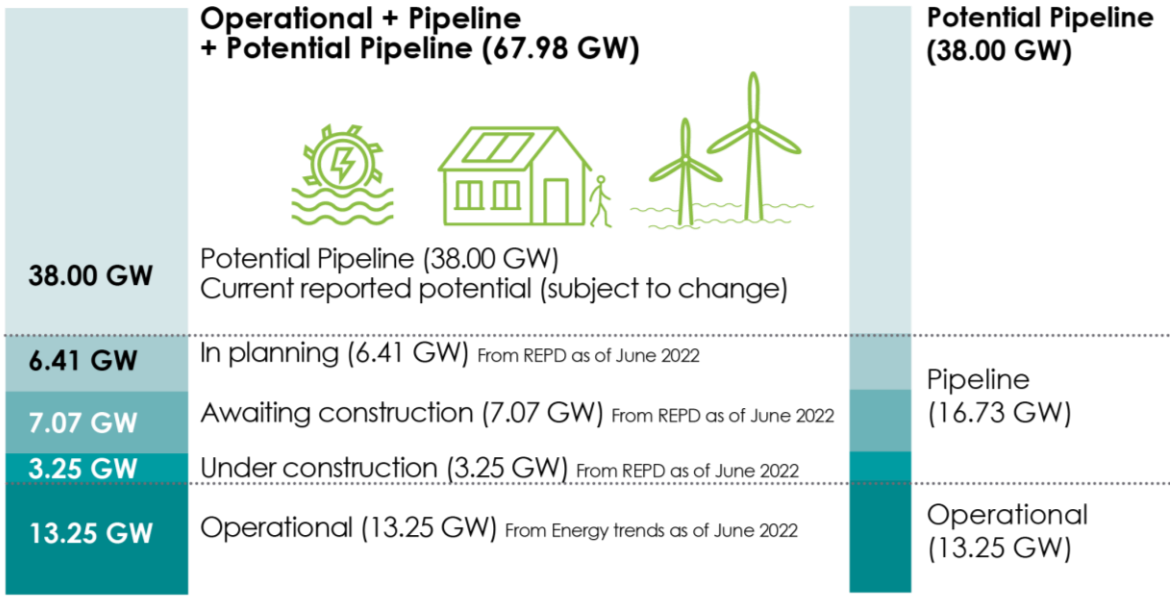
	To take action to build a **skilled, resilient energy workforce of the future,** we are supporting **reskilling** of oil and gas workers through an offshore skills passport as part of our Just Transition Fund.
	Our **£75m Energy Transition Fund** supports five key transition projects in the North East and our **£100m Green Jobs Fund** provides capital across Scotland to support green industries and the green jobs associated with them.
	Our **£500m Just Transition Fund** will support the North East and Moray to become one of Scotland's centres of excellence for the transition to a net zero economy.
	We will support Scotland to become a decommissioning centre of excellence. We **have announced our intention to invest £9 million in the development of an ultra-deep-water port at Dales Voe,** Shetland through the Islands Growth Deal to increase the competitiveness of the decommissioning sector in Scotland.
	We urge the UK Government to provide more support directly to the decommissioning sector to ensure as much of this growing area of work as possible is carried out in Scotland, creating and protecting jobs and economic opportunities.
Onshore conventional oil and gas	Ministers confirm a **preferred policy position of no support** for the exploration or development of onshore conventional oil and gas in Scotland. The relevant statutory and other impact assessments will now be undertaken, and the finalised policy position will be confirmed on conclusion of this process.
Unconventional oil and gas	Ministers have announced their **finalised position of no support** for unconventional oil and gas.
Coal	Ministers confirm a **preferred policy position of no support** for coal extraction in Scotland. Impact assessments for this policy will follow a similar approach as outlined above for conventional oil and gas; the finalised policy position will be confirmed on conclusion of this process.
Nuclear	The Scottish Government's position on traditional nuclear energy has not changed. **We do not support the building of new nuclear power plants under current technologies.**

3.1 – Scaling up renewable energy

Scotland is endowed with vast renewable energy resources including significant offshore wind potential, substantial tidal energy resources and a well-developed onshore wind sector. We will continue to build a diverse renewable energy mix, with significant offshore and onshore wind deployment supported by technologies such as hydro and solar.

Increasing levels of home-grown renewable supply will make energy more affordable and ensure it is always available when we need it. Alongside investment in electricity networks and flexible responsive technologies, such as storage and smart appliances, our boosted renewables sector will support the continued and rapid decarbonisation of energy use across Scotland's economy, including expansion in electricity demand. Figure 14 shows Scotland's renewable electricity capacity (operational, pipeline and potential).

Figure 14 : Scotland's renewable electricity capacity (operational, pipeline and potential pipeline)



Source: REPD and Energy Trends (June 2022)

Maximising benefits to communities and regions

The Scottish Government has an ambition of 2 GW of community and locally owned renewable energy by 2030. Community and shared ownership of renewables have a key role to play in helping communities across Scotland gain maximum benefit from the transition, and form an important source of revenue that can be directly invested back into the local community.

As set out in Chapter 2, we are encouraging developers to offer community benefits and shared ownership opportunities as standard on all new renewable energy projects – including repowering and extensions to existing projects.

Maximising benefits to our economy, businesses and workers

Overall, we are a net-exporter of electricity and Scotland's abundant supply of renewable generation exceeds Scottish demand. This presents significant opportunities for businesses and communities in Scotland, in terms of economic growth, expansion of the supply chain and employment in high-quality, green jobs.

Scotland has the potential to be a powerhouse for renewable electricity and renewable hydrogen for Europe, exporting clean electricity as part of an integrated system with the rest of Europe, and supporting decarbonisation of industry across the continent.

The significant increase in installed capacity of renewable generation over the coming decade could mean Scotland's annual electricity generation is more than double Scotland's demand by 2030, and more than treble by 2045. This will enable Scotland to meet a large proportion of our demand through renewables alone, while still creating an export opportunity for our surplus[45].

We are taking forward research into ways of maximising the economic benefits to households, communities and regional economies from this anticipated surplus.

[45] Scottish whole energy system scenarios (climatexchange.org.uk) This projection relates to the TEC scenario

The expansion in renewables offers wider opportunities to the Scottish economy. An example of this is the linking of Scotland's datacentre industry with sources of renewable energy. The Scottish Government's Green Datacentres and Digital Connectivity Vision and Action Plan[46] sets out how we can position Scotland as a leading zero-carbon, cost competitive, green data hosting location. In 2023, we will establish a Green Datacentres cluster builder to increase renewable energy adoption by datacentres.

3.1.1- Offshore wind

Beatrice Wind Farm
Photo credit: Highlands and Islands Enterprise

As set out in the Offshore Wind Policy Statement, published in 2020, the Scottish Government currently has an ambition to achieve up to 8-11 GW of offshore wind in Scottish waters by 2030.

We recognise that this now needs to be reviewed in light of the market ambition expressed in response to the ScotWind leasing round and the associated economic, social, net zero and energy security benefits which could be delivered for Scotland.

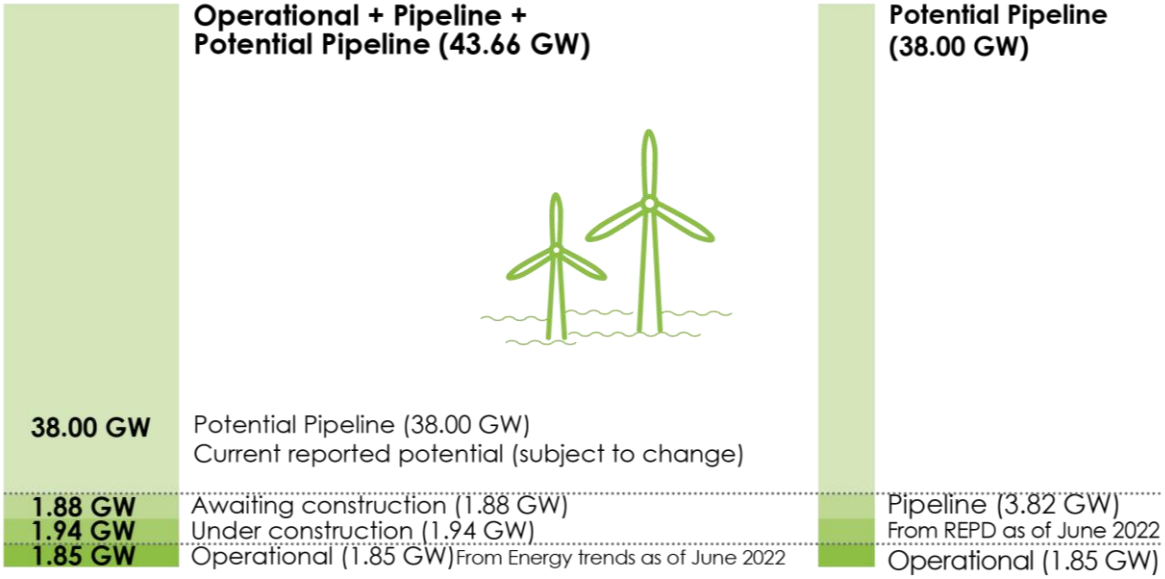
As of June 2022, Scotland has 1.9 GW of operational offshore wind. In the pipeline there is 3.8 GW of projects consented or under construction[47], and 4.2 GW of projects with lease options[48] ahead of the ScotWind leasing round results. Furthermore, the upcoming Innovation and Targeted Oil and Gas Decarbonisation (INTOG) leasing round will enable up to 5.7 GW of new

[46] https://www.gov.scot/publications/green-datacentres-and-digital-connectivity-vision-and-action-plan-for-scotland
[47] Scottish Energy Statistics Hub - Pipeline renewable capacity by planning stage Scotland, 2022 Q2 - Scottish Energy Statistics Hub (shinyapps.io)
[48] Marine Scotland – Marine Projects | Marine Scotland Information

offshore wind projects targeting oil and gas decarbonisation[49], and up to 0.5 GW of innovation projects[50]. Figure 15 shows Scotland's offshore wind capacity (operational, pipeline and potential pipeline).

The results of the ScotWind leasing round, published by Crown Estate Scotland in January last year, reflect market ambitions which exceed our current planning assumptions - with lease options signed by developers for a combined total of 27.6 GW.

Figure 15: Scotland's offshore wind capacity (operational, pipeline and potential pipeline)



Source: REPD and Energy Trends June 2022[51]

The UK Government has also set a target to reach 50 GW of offshore wind by 2030[52], including 5 GW of floating offshore wind. This is part of a further UK Government target to generate 95% of all electricity from low-carbon sources and the Climate Change Committee has projected that significantly more offshore wind will be required to achieve net zero across the UK by 2050[53]. Wind energy is now one of the cheapest forms of energy, and Scotland's offshore wind sector has the opportunity to be at the heart of the UK's energy transition.
However, as part of our just transition to a net zero energy system, the Scottish Government recognises that the major expansion in offshore wind projects

[49] Crown Estate Scotland, "INTOG Offshore Market Review" https://www.crownestatescotland.com/resources/documents/intog-offshore-market-review
[50] Crown Estate Scotland, "ScotWind Awards with Project Partners November 2022" https://www.crownestatescotland.com/resources/documents/scotwind-awards-with-project-partners-november-2022
[51] This is 38 GW of potential pipeline (27.6 GW coming from ScotWind, 4.2 GW with lease options and 6.2 GW from INTOG) plus 3.8 GW that is in the pipeline recorded in the Renewable Energy Power Database (REPD)
[52] British Energy Security Strategy - GOV.UK (www.gov.uk)
[53] Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

required to achieve our net zero and energy security goals will have impacts on marine biodiversity and other users of the sea. The volume of development that can be consented will depend on what is feasible within the bounds of environmental protection regulation, as well as other factors, such as what is technologically achievable within the natural geography of Scotland's seas.

These aspects, together with the need to fully consider the views of stakeholders about impact, mean that at present, whilst that work is underway, it is not possible to know now exactly what scale of development from offshore wind projects will ultimately be permitted or desirable. In addition, other factors which may shape the pace and scale of development include the time required for developments to be connected to the National Grid and the capacity of the supply chain to service a major step change in construction. However, there is no doubt that there is significant potential for the generation of electricity surplus to our domestic needs.

The current seabed leasing allocations are considered sufficient to meet our short-term ambitions, though we remain open to reviewing scope for future leasing opportunities should evidence become available which suggests this is necessary to support the sustainable growth of the Scottish offshore wind sector.

The Iterative Plan Review (IPR) process of the Sectoral Marine Plan for Offshore Wind Energy will take place in 2023. We will have a clearer picture once this review has concluded of the scale of offshore wind development which on current evidence will likely be permitted.

We are pressing the UK Government's Department for Business, Energy and Industrial Strategy (BEIS) and the Department for Environment, Food and Rural Affairs (DEFRA), for reforms to the habitats regulatory regime, through the UK Energy Bill, which will work for Scotland. These reforms are needed to enable a strategic approach to addressing the impact on marine habitats which will deliver gains to biodiversity and help facilitate the expansion of offshore wind in Scottish waters. This is vital to ensure that there is a streamlined and coherent regime in place that can secure sufficient environmental compensation to make projects consentable.

Maximising benefits to our economy, businesses and workers

ScotWind will deliver over £750 million in revenues for these initial awards alone. Once operational, the projects will raise billions more in annual rental revenues, which will be invested back into Scotland, benefitting our communities and our economy.

We welcome the commitments from developers to invest an average of £1.4 billion in the Scottish supply chain across the 20 ScotWind projects. This equates to £28 billion of potential Scottish economic activity, and around £1 billion of investment for every gigawatt of capacity built.

Independent research carried out for the Scottish Trades Union Congress (STUC) shows that Scotwind could add between 2,500-14,400 full time equivalent (FTE) employment[54]. There are also significant opportunities for the Scottish supply chain from our offshore wind potential. Our Sectoral Marine Plan will set the course for this delivery, maximising deployment in Scottish waters whilst protecting marine users and our environment.

In 2021, the Scottish Offshore Wind Energy Council (SOWEC), published its Strategic Infrastructure Assessment (SIA) for Offshore Wind. As the SIA made clear, the sector must now come together and work collaboratively, both to help focus activity and investment in Scottish ports, and to facilitate more meaningful engagement between Scottish suppliers and tier one manufacturers and installers.

SOWEC has developed a Collaborative Framework Charter which encourages developers, the public sector and the supply chain to work together to maximise deployment of offshore wind projects and supply chain opportunities. The Collaborative Framework Charter was launched by the First Minister in May 2022 and has been signed by 24 offshore wind developers. In committing to the Collaborative Framework, developers, while noting the need to make bilateral arrangements with suppliers on a project specific basis, recognise that there is also a role for coordinated, collaborative, strategic investment.

The Scottish Government has been engaging with SOWEC's Collaborative Framework Working Group - alongside all active offshore wind developers in Scotland, enterprise agencies and ORE Catapult - to develop a Strategic

[54] The ScotWind lease round: Analysis of ownership and potential job creation in offshore wind – Transition Economics

Investment Model to facilitate timely, strategic investment through the pooling/sharing and coordination of public and private sector funds.

The Strategic Investment Model is expected to be announced in early 2023.

The DeepWind Cluster, coordinated by Highlands and Islands Enterprise, brings together partners from industry, academia and the public sector, and aims to deliver new offshore wind supply chain opportunities to the north of Scotland. DeepWind will focus on deep water fixed bottom offshore wind technologies and will also act as the lead cluster for floating offshore wind in the UK.

Maximising benefits to communities and regions

Offshore wind is one of the lowest cost forms of electricity, representing good value for money for consumers[55].

We are currently updating our Good Practice Principles for Community Benefit from Offshore Renewable Energy Developments, and will consult on new draft guidance in 2023. We will also use the consultation to build on our evidence base and explore the potential for shared ownership of offshore renewable energy.

Maximising benefits to climate and the environment

We recognise the potential impacts on marine biodiversity arising from the major expansion in offshore wind required to achieve our common net zero goals. We commit to working together in a way that recognises this reality and ensures appropriate protection of our natural environment, as part of our joined up approach to tackling the climate and nature crises.

We will revise Scotland's National Marine Plan (2015) following the outcome of the earlier (2021) review. This new NMP will update our planning framework and help to facilitate sustainable delivery of offshore renewable energy.We will use the SMP (Sectoral Marine Plan) Iterative Plan Review to consider and assess new information relating to ScotWind and Innovation and Targeted Oil and Gas Decarbonisation (INTOG), providing an up-to-date evidence base to assist consenting and future planning.

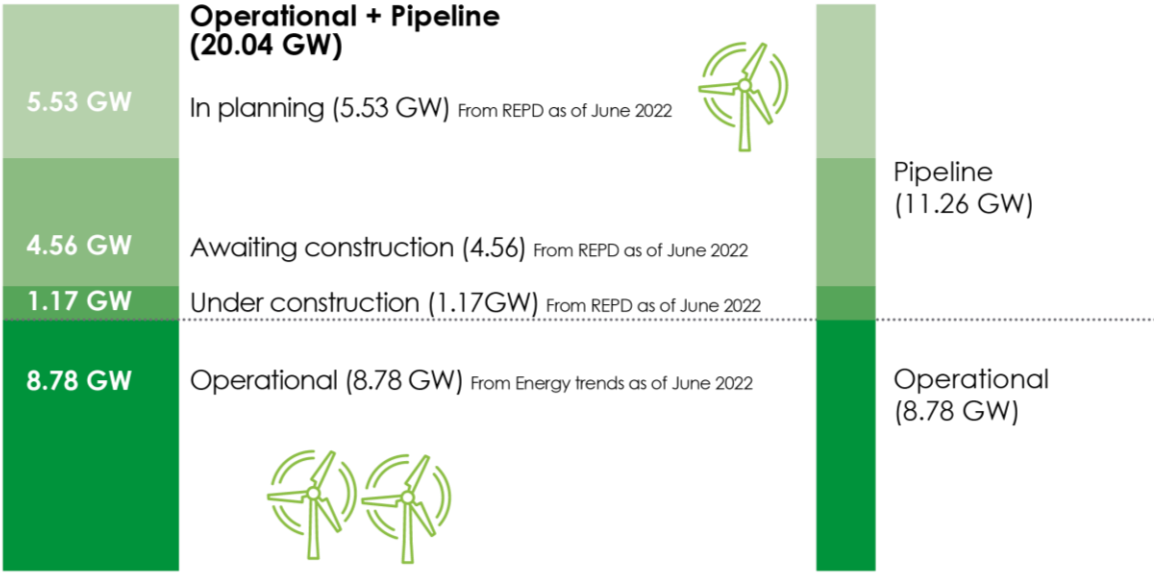
[55] have significantly decreased since the introduction of the first CfD in 2015. Since then, costs have fallen by 70% (from £114/MWh to £37/MWh)

We will deliver up-to-date critical research through the Scottish Marine Energy Research (ScotMER) programme to address key consenting and planning risks with increased funding for projects over the next five years. In line with our vision for a Blue Economy approach in Scotland, we are committed to ensuring that we balance our decision making around offshore wind development by considering the sustainability of delivering what is required to achieve our common net zero goals. The second National Marine Plan will be the statutory platform for achieving the desired outcomes.

3.1.2 - Onshore wind

Scotland is leading the way on onshore wind deployment and support at a UK level. We have set an ambition for an additional 12 GW of onshore wind, a **total of 20 GW of installed onshore wind by 2030**, more than doubling our existing capacity. Figure 16 shows Scotland's current onshore wind capacity (operational and pipeline).

Figure 16: Scotland's onshore wind capacity (operational and pipeline)



Source: REPD and Energy Trends June 2022

Our recently published Onshore Wind Policy Statement sets out detailed actions to deliver that ambition, including the commitment to a sector deal in 2023 which will seek to maximise supply chain and community benefit opportunities.

Scotland will embrace the opportunity to increase onshore wind capacity through turbine improvements. Taller and more efficient turbines can be deployed at both new developments and when considering the repowering of existing sites, providing significantly increased capacity, often without

increasing the footprint of an existing site. There are also substantial opportunities associated with repowering onshore wind farms as they come to the end of their lives.

Maximising benefits to our economy, businesses and workers

We will work with industry to deliver an Onshore Wind Sector Deal in 2023, to ensure we maximise deployment and the economic opportunities that flow from it. We continue to support the Scottish supply chain and recognise the particular opportunities in the onshore market, for example in operation and maintenance and decommissioning of sites.

Maximising benefits to communities and regions

Our Onshore Wind Policy Statement restates our clear position on community engagement, community benefit and shared ownership, including consideration of how communities might benefit from repowering opportunities. We will ensure that the community energy sector is represented on the forthcoming Onshore Wind Strategic Leadership Group.

Maximising benefits to climate and the environment

We are clear on the need to focus on planning and environmental assessment, and to work with developers and consultees to address the nature crisis as we deploy greater volumes of onshore wind.
We recognise, however, that the peatland impacts of onshore wind farms can be significant and we must balance the benefits from onshore wind deployment and the impacts on our carbon rich habitats. This includes being aware that there is potential for development in an area of deep peat to have a net negative carbon impact. We therefore commit to the following actions:

- We will convene an expert group, including representatives from industry, agencies and academia. This will provide advice to the Scottish Government on how guidance could be developed to support both our peatland and onshore wind aims.
- Work is underway to assess the operation of, and if necessary update or replace, the carbon calculator. The Scottish Government will ensure that adequate tools and guidance are available to inform the assessment of net carbon impacts of development proposals on peatlands and other carbon-rich soils.

Adopting a circular economy approach to sourcing materials for renewable energy developments both safeguards against potential future resource shortages and reduces the greenhouse gas emissions involved in manufacturing and transportation. We support the use of recycled and refurbished turbines, recognising the enormous potential to strengthen the Scottish supply chain, reduce waste, utilise more of our local skills and capabilities and improve costs for the onshore wind sector.

3.1.3 - Marine energy (wave and tidal)

Wave and tidal stream energy are two distinct but related technologies which, as part of a diverse renewable energy mix, can support Scotland's transition to a net zero emissions economy. Figures from BEIS show that there is 22 MW of shoreline wave and tidal electricity generation operational in Scotland. Of this, there are four main live tidal projects with a combined capacity of around 10 MW. New developments have the potential to quadruple this installed capacity to around 40 MW in Scottish waters by 2027. Figure 17 shows Scotland's shoreline wave/tidal capacity (operational and pipeline).

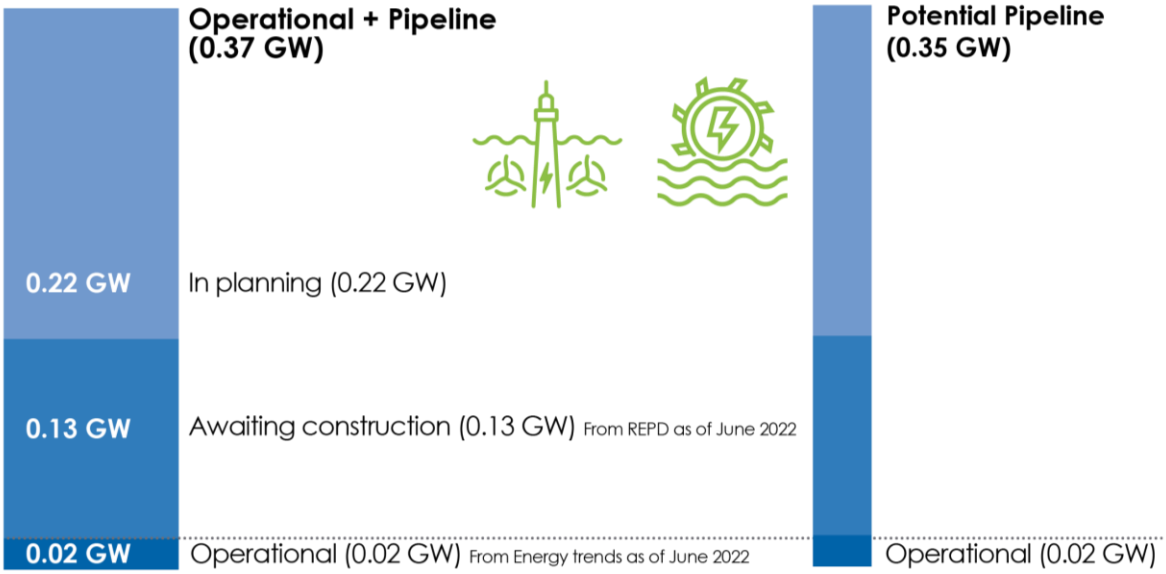
Tidal energy is highly predictable and can complement intermittent sources of energy, smoothing the overall power supply from renewables. The generation profile of wave energy is out of phase with other renewable sources such as offshore wind, giving it the ability to provide a grid balancing function.

A draft vision for marine energy is presented in Annex G, and views are being sought as part of this consultation. The marine energy vision statement will be published as part of the final Energy Strategy and Just Transition Plan in 2023.

Draft vision for marine energy

Wave and tidal energy has the potential to support the delivery of a secure and low carbon energy system while providing a new industrial opportunity and being part of Scotland's response to the global climate emergency. The predictability and availability of the marine energy resource off Scotland's coastline, together with Scotland's early lead in the technology, provides an opportunity to build on Scotland's maritime heritage and to secure a substantial share of the emerging global market for marine energy.

Figure 17 : Scotland's shoreline wave /tidal capacity (operational and pipeline)



Source: REPD and Energy Trends 2022

Maximising benefits to our economy, businesses and workers

Scotland is a pioneer in both tidal and wave energy, being home to some of the world's first, largest and most advanced tidal stream deployments, as well as our internationally-renowned Wave Energy Scotland programme. Scottish firms have already exported their technology and expertise, with projects in Japan and Canada.

A recent independent report by the Scottish Marine Energy Industry Working Group highlights the scale of the opportunity from wave and tidal energy supply chains in Europe and the UK, the latter totalling between £4.9 billion and £8.9 billion GVA by 2050.

Scotland's early lead can give it a first-mover advantage, particularly as Scotland has significant transferrable expertise and facilities from industries such as fisheries, offshore wind, oil and gas, shipbuilding and ports and harbours.

The Offshore Renewable Energy Catapult (ORE Catapult) has estimated that the tidal stream industry has the potential to support almost 4,000 jobs in the UK by 2030, while wave energy could support more than 8,000 jobs in the UK by 2040.

Marine

Tidal stream potential **4,000 jobs in the UK by 2030.**

Wave energy could support **8,000 jobs by 2040.**

Organisations such as the International Renewable Energy Agency (IRENA) have identified the enormous global potential of marine energy. This includes opportunities for island nations and remote coastal areas due to factors such as land restrictions, the availability of natural resources, the need to transition away from imported oil or diesel for power production, and the requirement for desalination plants. Industry analysis, published in Ocean Energy Europe's 2030 Ocean Energy Vision report, states that 1.3 GW to 2.4 GW of installed capacity from tidal energy could be deployed worldwide by 2030 and potentially more than 100 GW by 2050.

We will continue to support the delivery of the current five year business plan for Wave Energy Scotland and work with stakeholders to explore the longer-term needs of the wave energy sector.

Case study: European Marine Energy Centre (EMEC)

EMEC Caldale Substation and Hydrogen Plant
Photo credit: Orkney Sky Cam, courtesy of EMEC

EMEC is an innovation catalyst pioneering the transition to a low carbon future. Celebrating its 20th anniversary in 2023, EMEC is the world's leading centre for demonstrating wave and tidal energy converters in the sea. EMEC has been a catalyst for economic development, creating jobs and a world leading supply chain now exporting skills and knowledge around the globe. EMEC analysis reports this added £306 million GVA to the UK economy between 2003 and 2019.

Maximising benefits to climate and the environment

We recognise the potential impacts on marine biodiversity arising from the major expansion in offshore renewables required to achieve our common net zero goals. We commit to working together in a way that recognises this reality and ensures appropriate protection of our natural environment, as part of our joined up approach to tackling the climate and nature crises.

3.1.4 - Solar energy

Solar has an important role to play in decarbonising our energy system, particularly when combined with other renewables. Our aim is to maximise the contribution solar can make to a just, inclusive, transition to net zero. We will support the sector to minimise barriers to deployment wherever possible and continue to provide support through our renewable support schemes.

Solar is a long established, commercially viable renewable technology that has been at the forefront of decarbonisation efforts. It has seen great success in Scotland and we wish to provide clarity as to the important role it will play in meeting net zero, which is why we are consulting on a draft vision as part of this ESJTP consultation and seeking evidence from a wide range of stakeholders in order to finalise the vision in 2023.

We continue to make considerable progress in lowering barriers that are within Scottish Government competence, to facilitate greater deployment of solar. We will continue to work closely with industry to enable solutions for the sector.

Picture: Eigg Solar Array
Credit: Eigg Electric

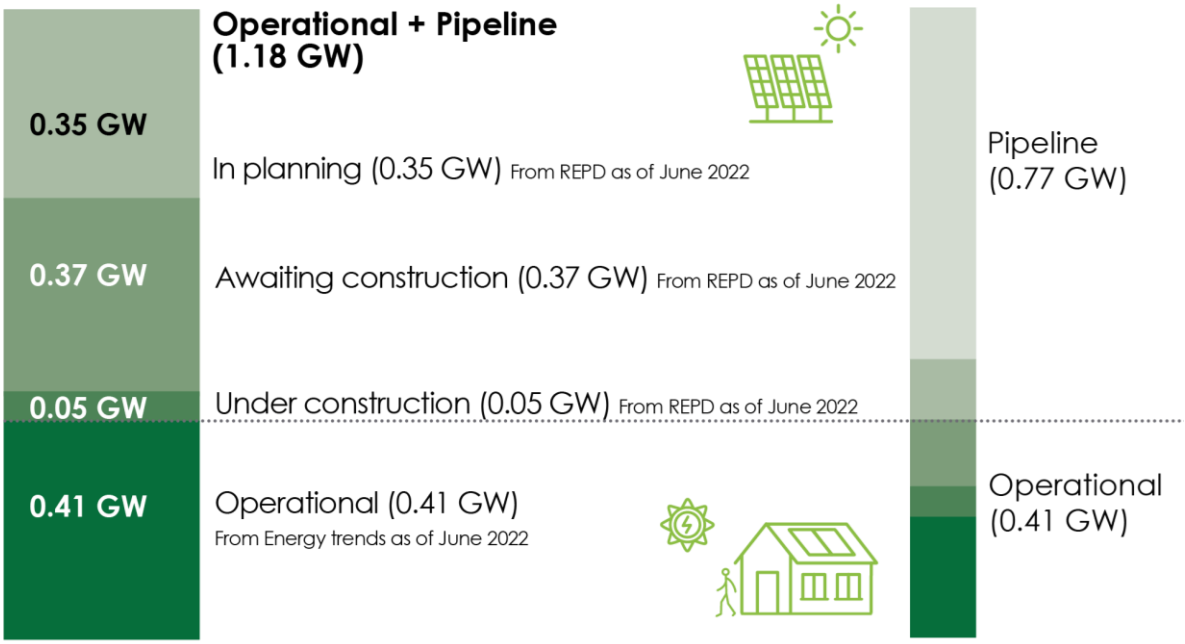
We see a strong role for solar thermal, as well as domestic and commercial solar PV combined with battery storage systems, which have the potential to help reduce consumer bills.

Scotland has 411 MW of operational solar capacity, with a further 767 MW of estimated pipeline capacity[56]. This pipeline of projects, which increases the current capacity by over 150%, shows the significant appetite for greater solar deployment in Scotland. Figure 18 shows Scotland's Solar PV capacity (operational and pipeline).

Independent evidence suggests that costs for solar have reduced by 60% since 2010 [57]with support also provided through UK Government schemes. Scottish Government funding is therefore focused on domestic and non-domestic projects, through a comprehensive range of support schemes for renewable and energy efficiency technologies (See Annex F).

A draft vision for solar energy in Scotland is presented in Annex G. The draft vision sets out the actions we will take to further deployment of solar, and views are being sought as part of this consultation. We are considering the evidence for setting a solar deployment ambition and are consulting on it through this draft vision. We will provide an updated position in our final solar vision in 2023.

Figure 18 – Scotland's Solar Photovoltaic (PV) capacity (operational and pipeline)



Source: REPD and Energy Trends 2022

[56] Scottish Energy Statistics Hub (shinyapps.io
[57]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1001896/uk-rooftop-solar-panel-behavioural-research.pdf

Maximising benefits to our economy, businesses and workers

On 1 April 2022, we expanded eligibility for the Business Growth Accelerator relief to include solar panels as a qualifying improvement eligible for relief for 12 months after installation.

We provide up to 100% Non-Domestic Rates relief to renewable energy generators, including solar, who provide community benefit. We are keen to see the number of solar installations offering community benefits increase and continue to encourage the sector to consider what packages of community benefit it can offer.

We will introduce a non-domestic rates exemption for plant and machinery used in onsite renewable energy generation and storage, including solar, from 1 April 2023.

We are aware there are pockets of skills gaps across some parts of Scotland for installation and maintenance of solar PV, and we will explore this further with industry. Our Climate Emergency Skills Action Plan provides the framework for creating and supporting the workforce in the transition to net zero and will reflect sector specific skills such as these when it is updated in 2023.

Maximising benefits to climate and the environment

We are engaging with stakeholders on the case that future rural support payments might be eligible on land used for solar installations that is also explicitly being used to deliver our Vision for Scottish Agriculture. In the present Common Agricultural Policy model, support cannot be claimed for this type of dual use. Notwithstanding the outcome of this, we will seek to encourage high biodiversity standards on solar farms.

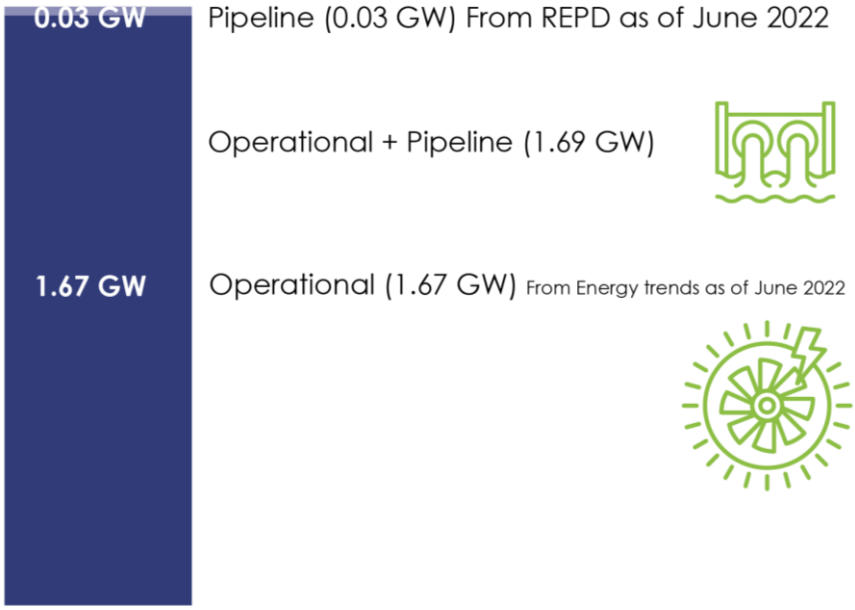
3.1.5 - Hydro power

Scotland has a proud history of hydro power and currently has 1.7 GW operational[58], which accounts for 88% of total UK hydro power capacity. There is an additional pipeline totalling 26 MW (excluding pumped hydro storage). Projects vary significantly in size, power output and geography. Figure 19 shows Scotland's hydro capacity (operational and pipeline).

Hydro power has the potential to play a significantly greater role in the energy transition – both at small-scale in co-operation with local communities as part of a diverse resilient energy supply in remote parts of Scotland, and at larger scale, providing flexibility services to the grid and helping to ensure a continued resilient and secure electricity supply.

However, whilst hydro power is a reliable source of renewable electricity, there are a number of challenges in developing new hydro power projects in Scotland. We urge the UK Government to provide appropriate market mechanisms for hydro power to ensure the full potential of this sector is realised. See Chapter 5 for more detail on the crucial role of pumped hydro in system level storage and security.

Figure 19: Scotland's small and large hydro capacity (operational and pipeline)



Source: REPD and Energy Trends 2022

[58] Scottish Energy Statistics Hub (shinyapps.io)

Case study: Community hydro power as part of a diverse energy mix in off-electricity grid areas

Knoydart Community Hydro Project
Photo Credit: Knoydart Renewables

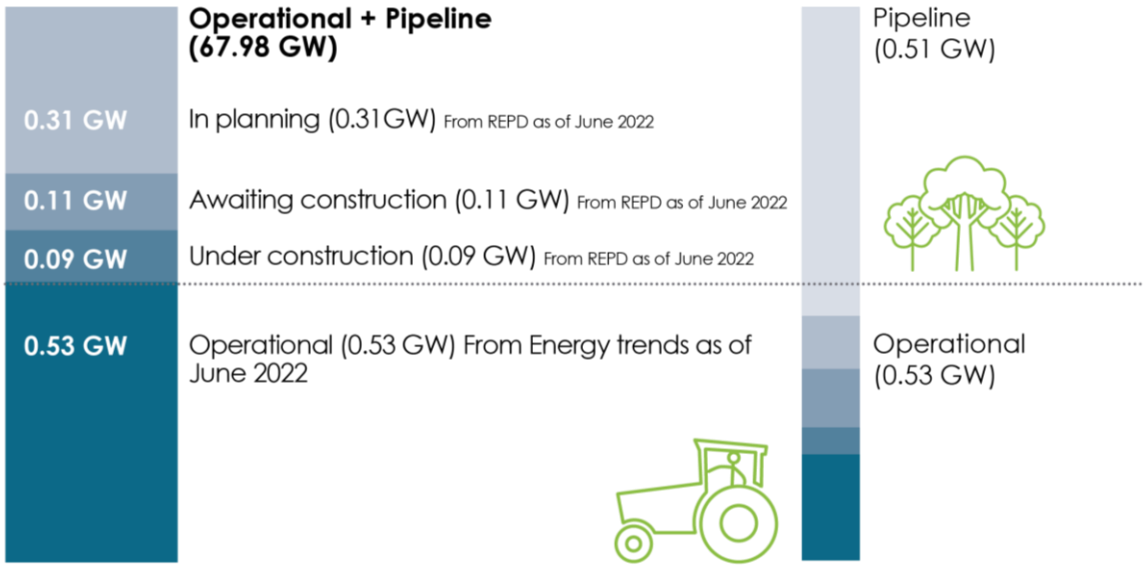
In 1999 the Knoydart Foundation bought 17,500 acres of the remote off-grid Knoydart Peninsula on behalf of the community. Over the last two decades, the community, supported by the Scottish Government (CARES), HIE, SSE and the Foundation, have refurbished the turbine, repaired the leaking dam, replaced a corroded penstock, generator, transformers, governor, control panels and begun to underground vulnerable overhead power lines. This valuable investment has helped enable the community to transition from a system that regularly needed to use back up diesel generation to a reliable system fit to supply zero-carbon electricity to the Knoydart Community until nearly the end of the century.

3.1.6 - Bioenergy

1 TWh | **almost 42,000 Football pitches of bioenergy crops**

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. Decisions over use of bioenergy should also align with and support Scotland's goals for protecting and restoring nature. Figure 20 shows Scotland's bioenergy and waste capacity (operational and pipeline).

Figure 20: Scotland's bioenergy and waste capacity (operational and pipeline)



Source: REPD and Energy Trends 2022

We have put in place an internal Scottish Government Bioenergy Policy Working Group, which is looking at the overall goals and priorities for bioenergy use in the short, medium and long term. The availability of land and competing priorities, such as woodland creation, peatland restoration, biodiversity regeneration, food and fodder production is a key consideration in the future of bioenergy production.

The work of the Bioenergy Policy Working Group will inform the development of a strategic framework for the most appropriate use of finite bio-resources, which will be published in a draft Bioenergy Action Plan for consultation.

3.1.7 - Hydrogen

As set out in our Hydrogen Action Plan,[59] our vision is for Scotland to become a leading Hydrogen Nation with an ambition to produce 5 GW of renewable and low carbon hydrogen by 2030, and 25 GW by 2045. A thriving hydrogen economy in Scotland will support domestic decarbonisation goals, our domestic supply chain capability and secure and create new jobs as part of the just transition. It will also help support the decarbonisation of other nations through the export from Scotland of renewable hydrogen, skills and expertise.

[59] Hydrogen Action Plan

The European Commission's REPowerEU Plan sets a target of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of renewable hydrogen imports by 2030. Scotland is well-placed to service future export markets for hydrogen and hydrogen derivatives at scale, by producing hydrogen powered by renewable electricity.

Hydrogen and hydrogen derivatives will help decarbonise sectors which are difficult to electrify and will create further economic opportunities for communities across Scotland. Hydrogen could also play a useful role in delivering large-scale and long-term energy storage in an integrated energy system and has the potential to replace or augment the critical balancing and resilience services that natural gas storage provides to the energy system today. See Chapter 5 for more on energy security.

Our plans to accelerate the hydrogen economy in Scotland will require the Scottish Government and its agencies, working with industry and with the UK Government, to apply both devolved and reserved powers in alignment.

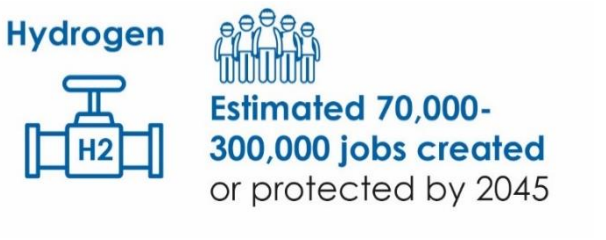
Maximising benefits to our economy, businesses and workers

The growth of the hydrogen economy is dependent on supply and demand developing in concert, as well as the enabling infrastructure required to produce, store and distribute the hydrogen products. Key to this are supportive policies and the establishment of investment and incentives to enable the growth of supply, demand and infrastructure, including the £100 million in capital funding for renewable hydrogen projects from our Emerging Energy Technologies Fund, which will complement UK Government funding and regulatory and market frameworks.

As is outlined in our Hydrogen Action Plan, we will work with key partners to provide targeted support to develop hydrogen production and supply chain capability, and the skills programmes to help individuals, companies and communities to connect to the opportunities created by the growing hydrogen economy.

Economic impact estimates based on scenarios developed for the Scottish Government indicate the development of a hydrogen economy in Scotland could mean between 70,000 and over 300,000 jobs could be protected or created with potential GVA (Gross Value Added) impacts of

between £5 billion and £25 billion a year by 2045 depending on the scale of production and the extent of exports.[60]

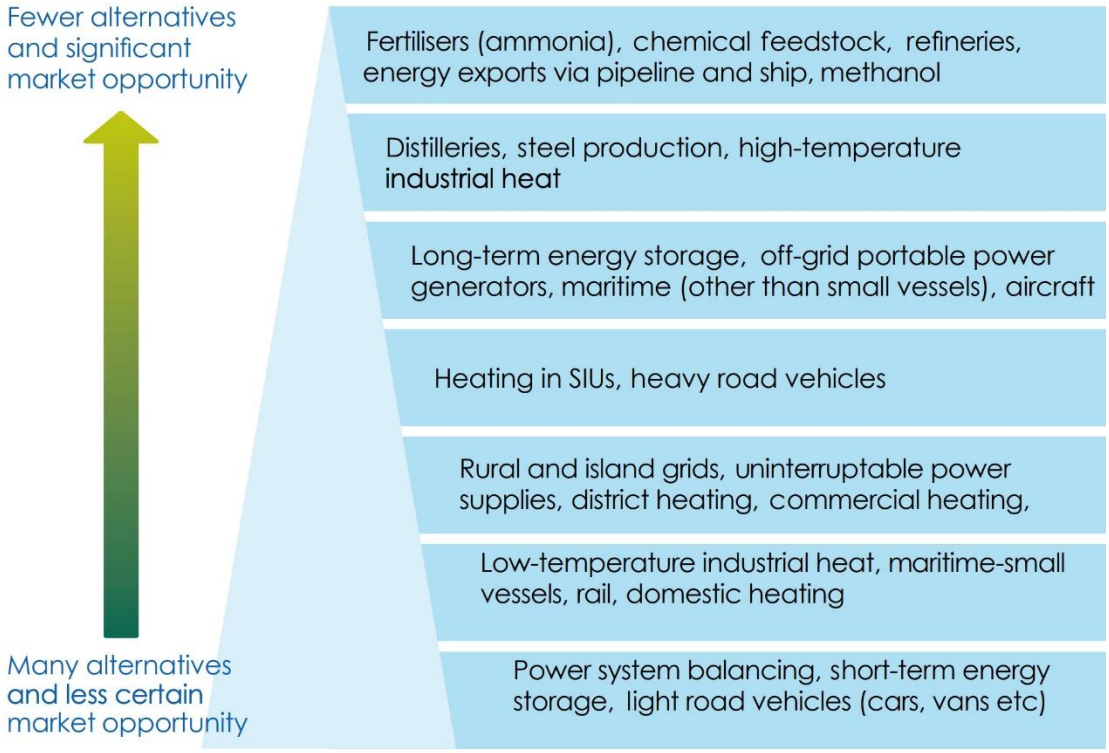


While the nature of hydrogen as an energy vector means that it can theoretically be used across many sectors of the economy, some sectors are more likely than others to adopt hydrogen as an optimal solution. The likeliness of hydrogen being adopted will depend on technical parameters such as efficiency, availability of alternatives. Other regional factors such as resource availability or available infrastructure will be of importance on a case-by-case basis. The potential uses of hydrogen are explored in greater detail in the Hydrogen Action Plan.

A hierarchy of uses is presented below [Figure 21]. This is based on our current understanding of the sector and provides our view of some of the hydrogen uses that are more or less likely to develop, based on current alternatives and available opportunities. This has been produced by considering a range of influencing factors such as economic, technical and logistical issues and will be taken into account as part of our considerations as we design support for the transition to a net zero economy.

[60] Scottish Government – Scottish hydrogen: assessment report (2020) Scottish hydrogen: assessment report - gov.scot (www.gov.scot)

Figure 21 : Hydrogen hierarchy



Source: Hydrogen Action Plan (2022)

The UK Government must accelerate decisions affecting the growth of the hydrogen economy including: the introduction of hydrogen business models to support production, hydrogen certification and standards, and the regulatory and market support mechanisms required to enable infrastructure development for the offshore transportation of renewable hydrogen from Scotland's ports and harbours. It is important that the supporting market and regulatory frameworks and strategic planning to guide the rollout of hydrogen transport and storage infrastructure is introduced quickly and considers both the onshore and offshore transportation of hydrogen in parallel.

Hydrogen will provide a decarbonisation solution for some parts of the transport sector and for energy-intensive industry, switching to renewable and low-carbon hydrogen is considered one of the few viable options for significant decarbonisation in the next decade. Low-carbon hydrogen production should also achieve the highest technically possible emissions capture rates. See Chapter 4 for more details, and for detail on the role of hydrogen for heat in buildings.

The Hydrogen Action Plan sets out our support for the development of both renewable and low-carbon hydrogen with an ambition of 5 GW of renewable and low-carbon hydrogen production by 2030 and 25 GW by 2045. We expect the majority of our 5 GW ambition by 2030 to come from renewables.

We wish to see as much renewable hydrogen in our energy system as quickly as possible. In addition to renewable and low-carbon hydrogen production and use, we also support the development of biomass gasification with carbon capture and storage for the production of negative emissions hydrogen.

The Scottish Government does not support new hydrogen production where CO_2 is unabated. We encourage industry to transition as quickly as possible away from production and use of unabated hydrogen and achieve the lowest possible emissions rates as part of their decarbonisation planning. We will not support via Scottish Government funding the development of new, industrial development where carbon emissions are unabated. Such development will require to demonstrate the implementation of a decarbonisation strategy at point of operation. This could include fuel switching, carbon capture, and energy efficiency and must be in line with our statutory climate change targets.

Maximising benefits to communities and regions

The growth of a strong hydrogen sector offers significant opportunities for regional and local economic benefit, creating new high-quality green jobs in our rural communities, islands and cities, and new opportunities for those currently working in high carbon sectors.

We are actively supporting the creation of Regional Hydrogen Energy Hubs that are host to the entire value chain from production, storage and distribution to end use. The Hubs include multiple end-users with applications covering more than one sector.

Hydrogen will play a key role in decarbonising our industrial clusters, supporting the just transition of the workforce in high carbon sectors in the North East of Scotland, and provide opportunities for our islands and rural communities to maximise the benefit of their vast access to renewable resources. Some Hubs are already producing renewable hydrogen and supporting demand for hydrogen fuels, e.g. Aberdeen and Orkney, while others are in development. The Aberdeen Hydrogen Hub is being taken forward as a joint venture between Aberdeen City Council and BP with £15 million of support from the Scottish Government.

3.2 - Reducing our reliance on other energy sources

We want to ensure the fastest possible just transition from dependence on a fossil fuel energy system to one that maximises the value we obtain from Scotland's rich and varied renewable energy resource. We are clear that unlimited extraction of fossil fuels is not compatible with our climate ambitions and will not resolve the challenges of energy cost or energy security.

We will continue to decarbonise Scotland's power sector. Electricity generation in Scotland is transitioning away from large, centralised fossil fuel power stations to more widely dispersed, smaller renewable generators. However, emissions still remain in combined cycle gas turbine generation, diesel back-up stations in islands locations, North Sea exploration and extraction, and refinement of oil and gas. We will continue to make progress in removing these emissions.

We are opposed to the continued use of unabated fossil fuels to generate electricity. The deployment of CCUS for the Scottish Cluster must demonstrate decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero.

In alignment with NPF4, we encourage, promote and facilitate all forms of renewable energy development onshore and offshore. This includes energy generation, storage, new and replacement transmission and distribution infrastructure and emerging low-carbon and zero emissions technologies, including hydrogen and carbon capture utilisation and storage (CCUS).

Some Islands communities rely on carbon intensive diesel generation as a backup in the event of an extended cable fault. These arrangements for securing supplies are not compatible with the transition to net zero, as diesel generation is carbon intensive, costly to operate and sometimes needs to operate for long periods while islands are disconnected from the mainland. In situations such as these, local renewables may need to be turned off to ensure the network operates within safety parameters. There is an opportunity to explore solutions for these situations and we will work to understand more about this ahead of the final Strategy and Plan.

3.2.1 - Onshore conventional oil and gas

In line with statutory requirements, the Scottish Government is developing a policy position for onshore conventional oil and gas. On 21 June 2022, we published a call for evidence seeking views on the future of onshore conventional oil and gas in Scotland; the responses to this call for evidence have been independently analysed and considered by Ministers alongside wider policy on energy and climate targets. This has allowed Ministers to

confirm a **preferred policy position of no support** for the exploration or development of onshore conventional oil and gas in Scotland.

3.2.2 - Onshore unconventional oil and gas

In October 2019, Scottish Ministers announced their finalised position of **no support for unconventional oil and gas**. Following a comprehensive evidence-gathering and public consultation exercise and the required statutory and other assessments, Scottish Ministers concluded that the development of onshore unconventional oil and gas is incompatible with our policies on climate change, energy transition and the decarbonisation of our economy.

3.2.3 - Coal extraction

In line with statutory requirements, the Scottish Government is developing a policy position for coal extraction in Scotland. On 21 June 2022, we published a call for evidence seeking views on this matter; the responses to this call for evidence have been independently analysed and considered by Ministers alongside wider policy on energy and climate targets. This has allowed Ministers to confirm a preferred policy position of **no support for coal extraction in Scotland.** Impact assessments for this policy will follow a similar approach as outlined above for conventional oil and gas; the finalised policy position will be confirmed on conclusion of this process.

3.2.4 - Nuclear

The Scottish Government's position on traditional nuclear energy has not changed. **We do not support the building of new nuclear power plants under current technologies**. Existing nuclear is expensive: under the current contract awarded by the UK Government to Hinkley Point C, the electricity that will be generated will be priced at £92.50 per megawatt hour, whereas the electricity being generated from offshore wind is currently priced at £37.65[61] per megawatt hour. In addition, the UK Government recently announced plans to take forward a £700 million stake in the new reactor of Sizewell C. That investment of £700 million could insulate and significantly improve the energy efficiency of approximately 200,000 homes[62]. The construction of new nuclear plant will do nothing to alleviate the current energy price crisis, as nuclear power stations take years, if not decades to build. Indeed, support for nuclear risks pushing bills even higher in the near- to medium-term.

[61] Contract for Difference – Allocation Round 4 – link to be inserted to reference this
[62] Based on an average cost of £3,500 per house spent on energy efficiency measures – Source: Climate Change Committee

Whilst there is increasing interest in the development of small modular reactors, or SMRs, these use the same nuclear fission technology as the power generating process found in larger traditional nuclear power plants and carry the same environmental concerns.

We are also aware of increasing interest in the development of fusion energy – which is different from traditional nuclear fission energy. However, we are clear that there is a long way to go in terms of fully understanding both the risks and opportunities that fusion energy technology presents. Any request to build a fusion energy plant in Scotland will require the consent of Scottish Ministers and will be assessed on safety, environmental concerns, cost and the contribution to Scotland's low carbon energy future.

3.2.5 - North Sea oil and gas

Scotland's North Sea Oil and Gas sector has provided highly skilled and valuable employment, income and supply chain activity, since the 1970s. The revenues generated by North Sea Oil and Gas have made a significant contribution to UK finances for more than 50 years.

This draft Strategy provides focus on energy usage and supply up to 2030 and how the transformation of our energy system will help to decarbonise our economy and society, and meet Scotland's net zero targets in 2045. In considering the role of oil and gas within this strategy, we must consider not just our climate obligations, but also the challenge presented by the maturity of the North Sea basin and the natural trajectory of production that comes with that maturity.

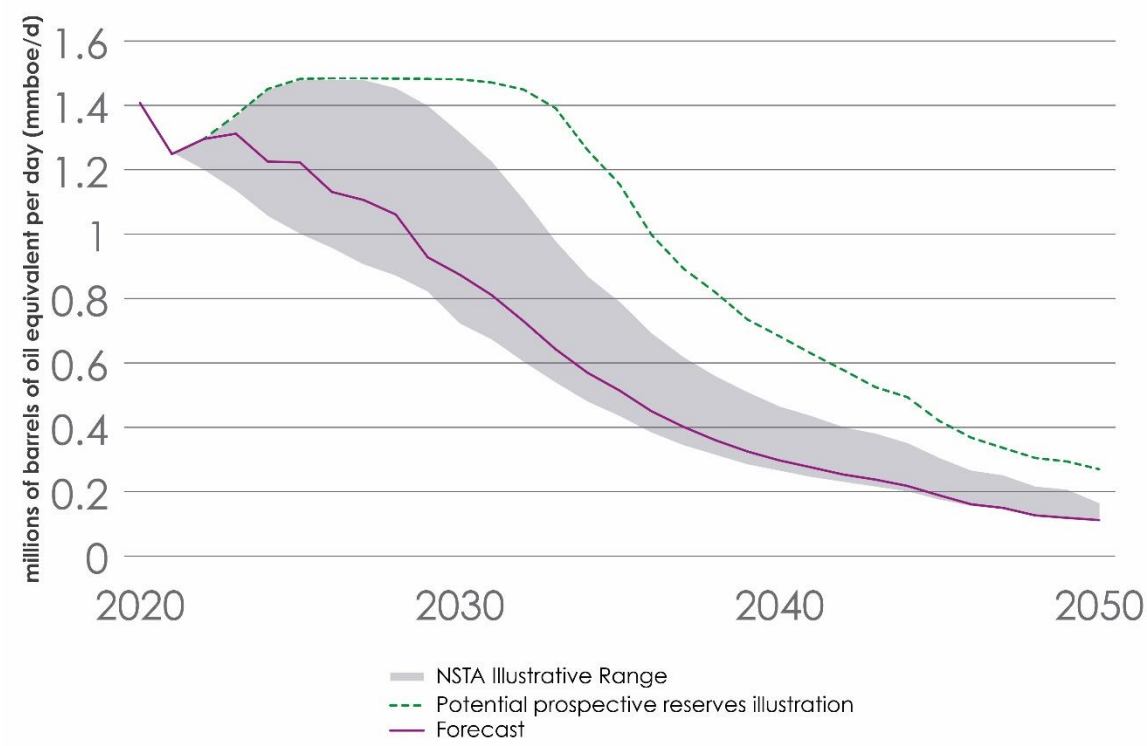
The oil and gas industry had a transformational impact on Scotland and the UK, but now as a result of the extraction of oil and gas over decades and the geology of the North Sea, the reality is that the oil and gas available for extraction from the waters off the coast of Scotland is a declining resource.

While higher prices or tax incentives could make it economic to extract more marginal reserves from the North Sea, they cannot change the overall trend that comes from being an older and more expensive basin for extracting oil and gas.

Production will decline, even with the UK Government's position on new exploration[63]. Figure 22 illustrates the projected future total oil and gas production and reserves.

[63] Source: EY, NSTA. The chart includes estimates that illustrate how cumulative NSTA reserves could apply as a production trajectory. These have been developed to provide comparable production pathways that align with the EY forecast.

Figure 22 : Projected total oil and gas production and reserves illustration

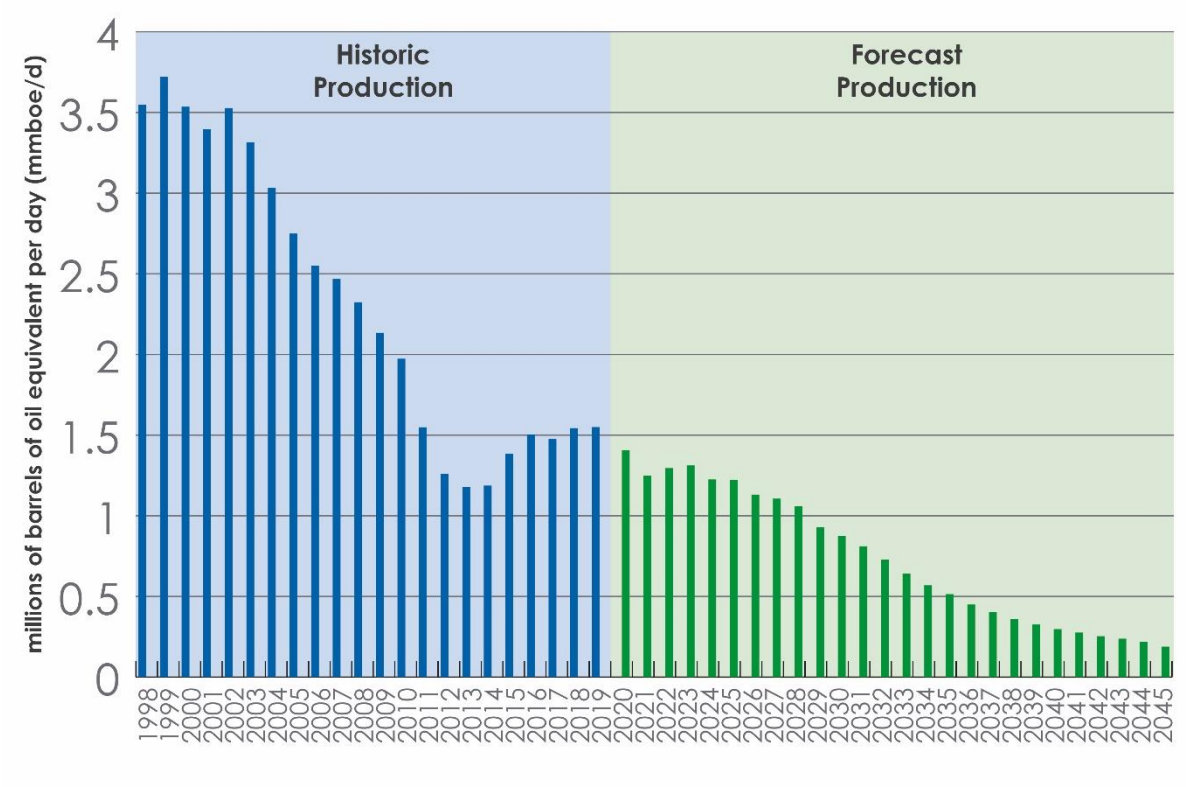


Source: Ernst and Young analysis, North Sea Transition Authority. The chart includes estimates that illustrate the how cumulative NSTA reserves could apply as a production trajectory.

Ernst and Young analysis suggests that over 80% of future production is expected to arise from existing sanctioned fields, with the remainder of forecasts coming from new developments. The waters off the coast of Scotland have been well explored and, as a mature basin, there are unlikely to be large fields which have not been exploited. Further production levels will be dependent on a number of factors including price and technical and economic limitation. It is unlikely that all potential reserves will ultimately be exploited. The opening of the 33rd licensing round by the UK Government is only likely to have an incremental, not a transformative, effect on production forecasts. Figure 23 shows that production in Scotland is expected to be around a third of 2019 levels by 2035 and minimal (less than 3% of the 1999 peak) by 2050[64].

[64] Ernst and Young analysis, North Sea Transition Authority. The chart includes estimates that illustrate the how cumulative NSTA reserves could apply as a production trajectory

Figure 23 : Hydrocarbon Production in Scotland 1998 – 2045



Source: Scottish Government, EY[65]

This means that, irrespective of the climate imperative, as an already established mature basin in gradual decline, planning for a just transition to our net zero energy system and securing alternative employment and economic opportunities for workers is essential if Scotland is to avoid repeating the damage done by the deindustrialisation of central belt communities in the 1980s, and to capitalise on our potential as a location for low carbon and renewable energy expertise.

Scotland's energy transformation is therefore urgent and inevitable.

Fortunately, the skills, drive and innovation of workers in the sector, the communities in which it is based and the companies that enabled Scotland to become a global source of energy expertise are already supporting a new energy revolution, repositioning Scotland as a centre of green energy excellence.

[65] While efforts have been made to align the historical and forecast data, there remains a slight degree of inconsistency because of differing measurement methodologies. These are minor, however, and do not affect the overall trends.

Bute House Agreement

As part of the Bute House Agreement between the Scottish Government and the Scottish Green Party, the Scottish Government committed to undertake a detailed analysis to better understand the future prospects for the North Sea including the pathway of oil and gas production projected for the basin, Scotland's energy requirements, how our energy activity aligns with our climate change commitments and the just transition impacts of a declining north sea basin at the same time as a rise in employment in low carbon and renewable energy industries.

This work was conducted independently and overseen by an independent expert panel. It has provided an analytical evidence base that has been used to underpin the relevant parts of this draft Strategy and Plan, including the evidence presented in this section. The independent report, once completed and reviewed by the independent panel, will be published during the consultation period for the Strategy and Plan.

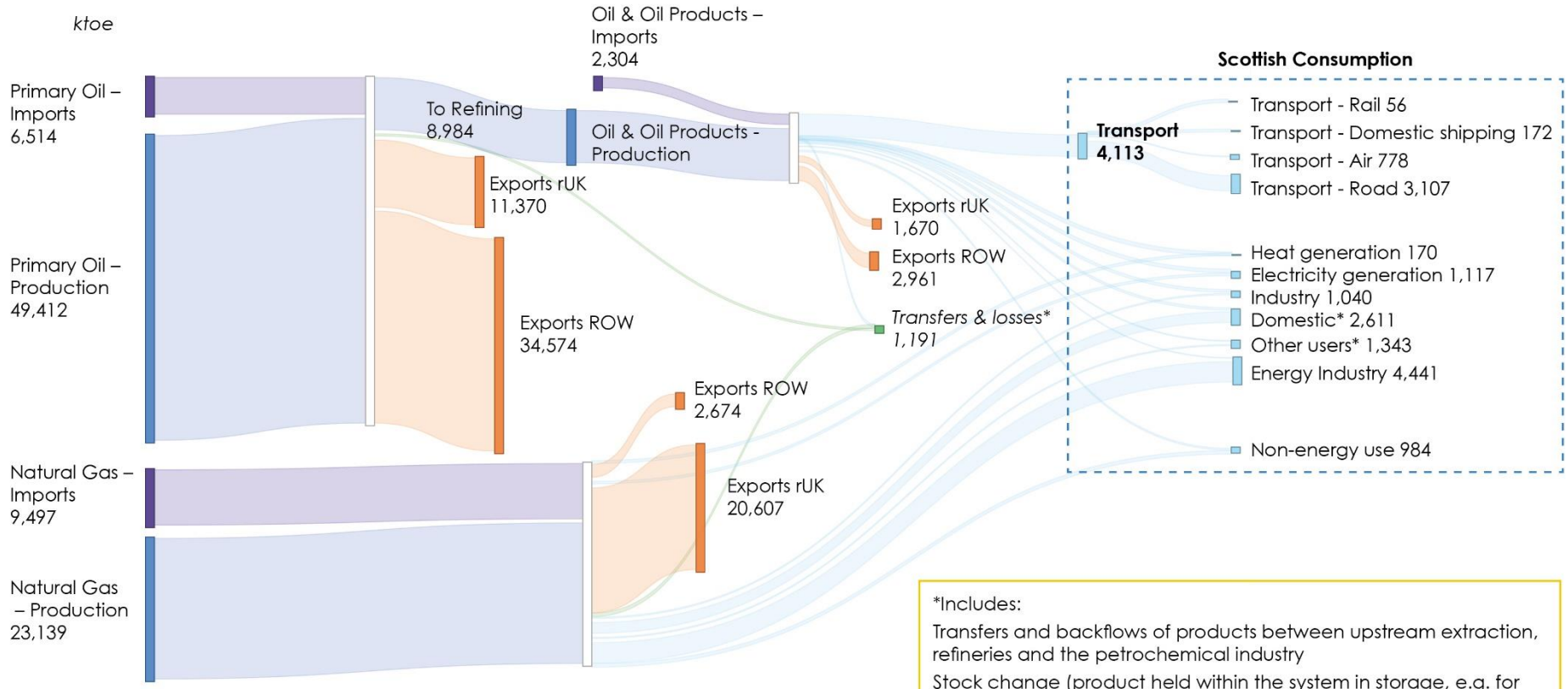
Global export and domestic usage

The oil and gas produced from the waters off the coast of Scotland[66] are global commodities, traded on international markets. In 2019, only a small proportion (about 16%) of the oil and gas coming in to Scotland (including imports from Norway and beyond), is consumed in Scotland. 81% of this oil and gas is exported, with oil exports primarily[67] going to the rest of the world and gas exports largely entering the UK gas grid for use throughout the UK, contributing to the UK's energy security. Figure 24 shows oil and gas flows through Scotland.

However, the decline in the basin has already meant a resultant decline in our export of oil; in 2019 we exported 49% less oil to the rest of the world than we did in 1999. Of the oil and gas consumed in Scotland, the biggest users are the energy industry itself, transport and heating. Oil and petroleum make up 42.0% of all Scottish consumption and gas makes up a third (35.6%).

[66] Scottish North Sea as defined per The Scottish Adjacent Waters Boundaries Order (1999).
[67] Of the total 81% exported, 75% of oil is sent to the rest of the world and 89% of gas is sent to the rest of the UK.

Figure 24 : Oil and gas flows through Scotland



Key:

Imports | Exports | Scottish production | Scottish Consumption | Other transfers and losses

Source: SG - Physical commodity balances of oil, gas and petroleum products
Digest of UK Energy Statistics (DUKES) 2021 - GOV.UK (www.gov.uk) (commodity balances)

*Includes:

Transfers and backflows of products between upstream extraction, refineries and the petrochemical industry

Stock change (product held within the system in storage, e.g. for use in emergencies. There is no storage of natural gas in Scotland)

Marine bunkers refers to the fuel products which leave Scotland as fuel for ships carrying exports.

Use in electricity and heat generation

Losses from the National Grid, including leaks and theft

Impact of Scotland's fossil fuel production on affordability of energy bills

Scotland's status as a fossil fuel producer has not insulated Scotland from the associated cost of living crisis because as a globally traded commodity, prices are set by international markets and Scotland's offshore gas reserves are too small to meaningfully change global gas prices. Scotland produced just 1% of global oil and gas production in 2019.

Oil and gas prices have surged since countries started to recover from the Covid pandemic and Russia invaded Ukraine. In 2022, wholesale natural gas prices increased more than 6-fold from their long-term average, resulting in upward pressure on household energy bills.

The importance of a just transition for the oil and gas sector

The maturity of the North Sea basin means a managed and just transition is essential in order to ensure that the move to renewable and low carbon sources of energy supports the oil and gas workforce, the communities in which they live and work, and the regional economies that have greatly benefited from oil and gas activities and have much to gain from the transition to net zero.

In 2019, 57,000 people had jobs that were directly or indirectly, through the supply chain, dependent on the offshore oil and gas sector[68]. Jobs in the industry are well paid - the average salary for those working in extraction was £88k, while for those working in the supply chain it was £51k, compared with an average salary in Scotland of £29k.

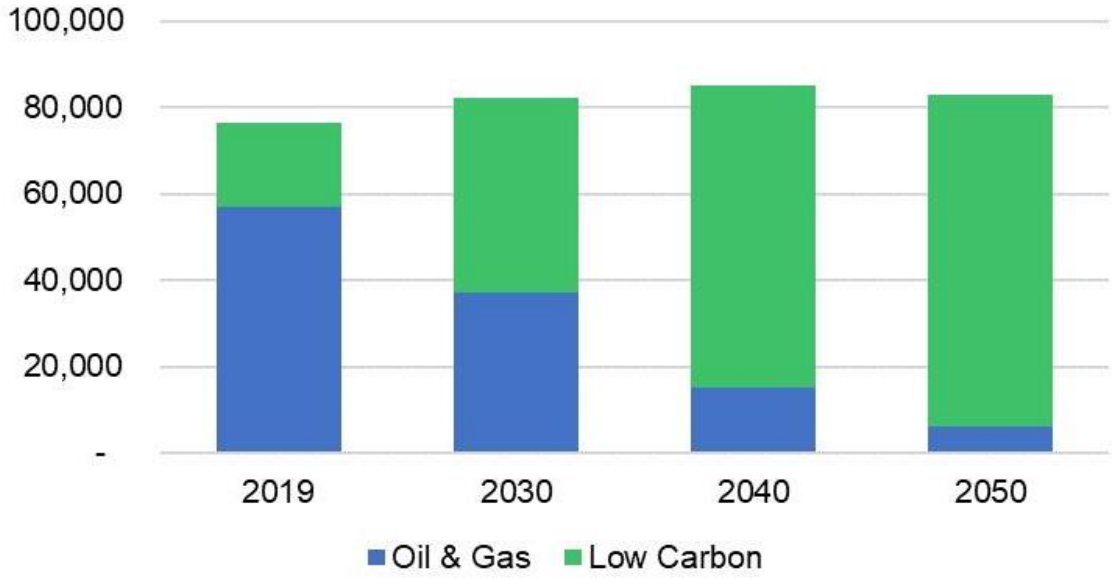
Jobs in oil and gas production, and the associated supply chain, are expected to decrease over the coming decades, as production from the North Sea basin declines. However, accelerated diversification of traditional oil and gas businesses and significant growth – as set out in this Strategy – in renewable electricity, hydrogen, heat and transport decarbonisation, and more will mean that low carbon jobs increase in number, with the total number of jobs in the energy sector expected to remain fairly constant. Energy production sector jobs are expected to hit 82,000 in 2030 as onshore wind development rapidly expands. Most new roles in the sector will build on existing skills sets from oil and gas, industrial research, manufacturing, and civil engineering, providing employment over the long term for those already

[68] 89,000 if "induced" jobs i.e. those created as a result of those working directly in the industry spending their income on goods and services is included. We are using direct + indirect as easier to compare technologies.

working in the energy production sector and exciting opportunities for individuals beginning or switching to an energy-based career.

The pace and extent of replacement will be determined by wider energy policy decisions. For example, we continue to call on the UK Government to support the Scottish CCUS cluster. Modelling suggests that with the right support there could be a net increase in energy sector jobs from as early as the mid-2020s. Figure 25 shows direct and indirect employment by sector.

Figure 25: Direct and indirect employment by sector



Source: EY analysis, Scottish Government.

A just transition for energy jobs

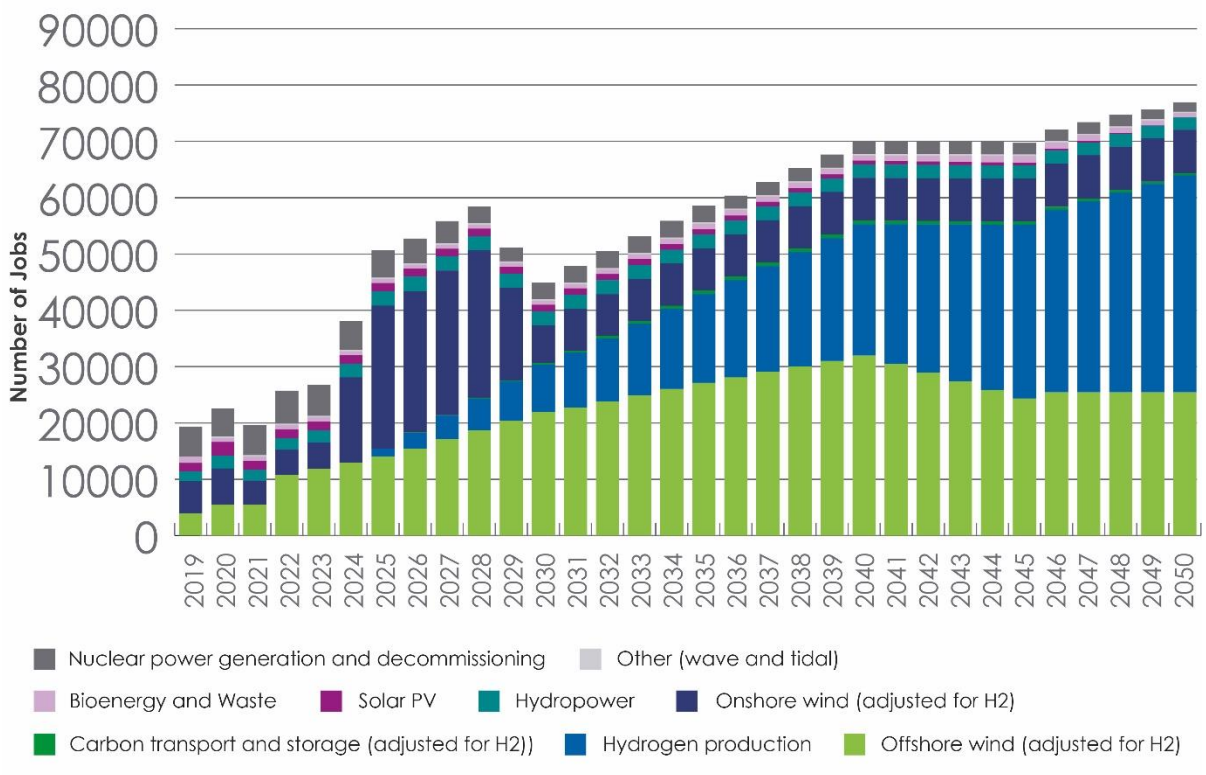
The projected employment shown in the graph below (figure 26) is direct and indirect employment by sector and is taken from two data sets – the assumed decline of production in the North Sea basin, which helps inform the calculation of future oil and gas jobs, and the 'Balanced options' (BOP) scenario in the Energy Systems Catapult (ESC) Scenarios, which establishes a trajectory for low carbon energy. The Energy and Just Transition analysis work then calculates low carbon jobs based on the amount of energy generated i.e. the more energy generated, the higher the number of jobs. The graph demonstrates that following the BOP scenario results in 83,000 jobs in the overall energy production sector by 2050, from a baseline of 76,000 in 2019.

This increase of 7,000 jobs in the energy sector is of course positive, but it is also only part of the just transition picture. In 2019, there were just over 19,000 estimated jobs in the low carbon energy sector, but with around 6,000 jobs remaining in oil and gas sector by 2050 the number of low carbon jobs will rise from 19,000 to 77,000 – a 58,000 increase in low carbon

jobs in energy production created by 2050 as the result of a just energy transition.

The nature and the pace of our transition to net zero will impact the overall number of jobs created and different pathways for the decline of the oil and gas sector can further impact the number of jobs supported.

Figure 26 : Low Carbon Energy Production Sector Jobs (Direct + Indirect)

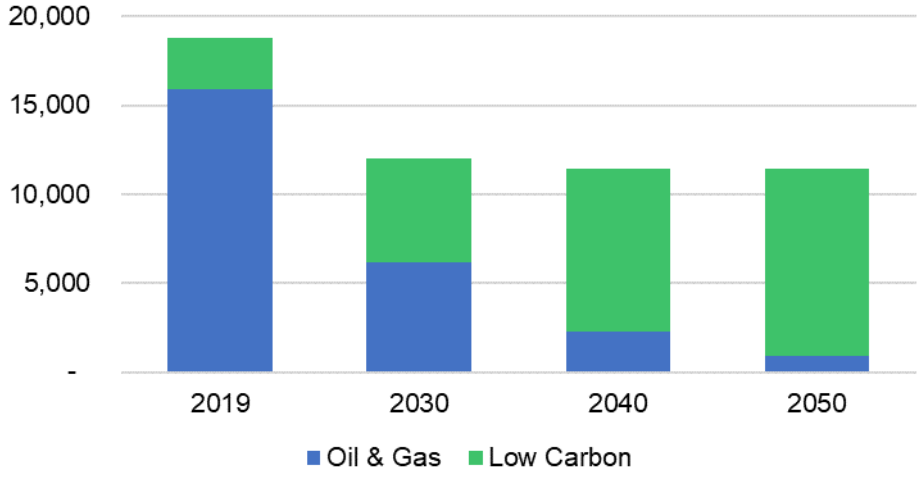


Source: EY analysis using Energy Systems Catapult Balanced Options Scenario

The GVA per job of the oil and gas extraction sector is £ 1.1 million, 15 times higher than the average for the Scottish economy. A significant proportion is paid to the UK Government through taxation and dividends are paid to shareholders, but the industry has made a very significant, if declining, contribution to Scotland's economy. While the number of workers employed, and economic value created by the oil and gas sector are expected to continue to decline as fossil fuel production in the basin declines, low carbon-based activity is expected to increase with the expansion of renewables. Importantly, although not projected to fully offset the decline in GVA from the oil and gas sector, the expansion of renewable energy production / generation will make a very significant contribution, and will substantially narrow the gap that would otherwise emerge. See figure 27.

These estimates do not include the GVA potential of exports of Scotland's renewable or low carbon energy – such as the potential for Scotland to develop a hydrogen export economy, which we expect would further boost GVA from the low carbon and renewable energy sector as a whole and help to reduce the impact of a decline in the export driven oil and gas sector.

Figure 27 : Direct and Indirect GVA by sector (£m)



Source: EY analysis, Scottish Government.

The role of the North East

The North East of Scotland is a global centre for the energy industry. With more than 50 years of knowledge and experience in offshore energy exploration and production.

Of the 25,000 jobs directly dependent on offshore oil and gas production (2019 figures), 98% are located in Aberdeen and Aberdeenshire. The industry has brought prosperity to the region, transforming the North East into a global energy hub, with many of the sector's workforce enjoying international careers from a local base. The personal and economic impact of oil and gas on the region has been profound.

Estimates from Robert Gordon University suggest that realising our ambition to retain the region's role as a hub for continuing energy innovation may require 14,000 people in the region to move from oil and gas to renewables and up to 16,000 new people to join the industry between 2022 and 2030[69]. Over 90% of the North-East of Scotland's existing oil and gas workforce has medium or high skills transferability to renewable energy roles meaning a just transition can create a significant economic and employment opportunity[70].

[69] RGU Making the Switch: The Future Shape of the Offshore Energy Workforce in the North East of Scotland – May 2022 (link)
[70] PWC Green Jobs Barometer 2022

A just transition

The opportunity for a just transition is not just in the North East. All regions of Scotland will have a role to play in creating our future energy system, with the development of energy hubs with the potential to accelerate the industry to a net zero future, whilst continuing to support our energy ambitions. We are already seeing this in action through the Shetland Energy Hub which will accelerate the development of key technology to create an integrated energy future for Scotland and enable the region to transition to a hydrogen economy.

Grangemouth is ideally placed to produce future products in a net zero economy, and the region can also enable decarbonisation across other regions and sectors within Scotland. There is significant potential for carbon intensive industrial clusters, such as Grangemouth and Mossmorran, to unlock deeper decarbonisation across Scotland. In particular, Grangemouth's wealth of investment, infrastructure, skills, knowledge and productivity has strong potential for supporting a net zero economy.

Whilst the age profile of oil and gas workers means a significant proportion are expected to retire within this timeframe - a recent survey found 35% of oil and gas workers are over 50 - support will be needed for those who require retraining and to bring a new generation into the energy industry. Many young people are already choosing renewable or low carbon roles and the same survey found only 12% of the oil and gas workforce is under 30[71].

As the energy industry evolves, Scotland is well placed to harness and retain the existing skill set by securing new jobs and investment through the energy transition. To deliver a just transition for energy workers we must work with the energy sector to plan for a multi-skilled workforce, one that can benefit from opportunities across the energy system. This includes transitioning skilled offshore workers into jobs in CCUS and decommissioning or diversifying oil and gas business models into renewable energy portfolios, including offshore wind, CCUS and hydrogen sectors. Our oil and gas workers, and their vital skills, will be essential to the transition. Workers, and trade unions, will be at heart of everything we do as we work on our just transition plans.

[71] Ageing oil and gas workforce presents net zero challenge - ECITB

Energy Sector Workers Survey

We worked with trade unions and employers to survey energy sector workers' views on the net zero transition. Detailed analysis of c. 900 responses will be published in early 2023.

Just under half of all respondents worked in the oil and gas sector, with around a quarter in the nuclear industry. Almost half of all respondents lived in the North East of Scotland. The largest cohort, by age group, were aged 50-55. Less than a quarter of respondents were female.

Initial findings:
The majority were not aware of the term "just transition". Once explained, the majority supported the Scottish Government's definition and approach. However, respondents tended to express low confidence in a just transition for the sector.

The majority believed the transition would have a big impact on their jobs. Early analysis indicates that oil and gas workers tended to believe this impact would be negative, whilst those in renewables tended to believe it would be positive.

Most thought the transition could create new energy jobs and saw themselves transitioning to a green/low carbon job in the future (either immediately or over the long term).

Respondents identified several key barriers to moving to green/low carbon jobs. These included not wanting to leave their current job; not being able to find equivalent good pay and a lack of information around reskilling/retraining and job opportunities.

Some said that they could never see themselves moving into a green job and this was typically due to either a lack of equivalent pay, or retirement plans. Others indicated they would benefit from improved support such as: more information on job opportunities, clearer information on retraining pathways, help with mapping their skillset and financial help for retraining.

Our £500m **Just Transition Fund** is providing financial support to help address some of the concerns raised in the Workers Survey around the ability to reskill and find good jobs and to build confidence in the potential for a just transition. The following projects have already been allocated funding from the Just Transition Fund.

Project	Lead Organisation	Description	Funding Awarded
Skills Passport	OPITO	Development and deployment of an industry led digital offshore energy skills passport to support the transition of skills and jobs across the rapidly changing industry.	£4,986,000
Advanced Manufacturing Skills Hub	ETZ and North East Scotland College	Creation of the Skills Hub in Altens as a focal point of the Energy Transition Zone Skills Campus.	£4,500,000
Pilot Energy Transition Skills	National Energy Skills Accelerator (NESA)	Pilot scheme to determine the skills required to reach an energy transition.	£1,000,000
Net Zero Bottlenecks in Moray	UHI Moray	Feasibility study to identify the current skill gaps in Moray and what is holding it back in transitioning to net zero	£210,000

Recognising that depletion of the North Sea basin means that the era of oil and gas production will inevitably come to an end, the Scottish Government is determined to ensure we protect opportunities for workers and bolster our regional and national economies. Further, we believe the energy transition presents considerable economic opportunity, if we act early and with ambition. The Scottish Government, through our £75 million Energy Transition Fund (ETF), is supporting the energy sector to diversify and innovate and attract private sector investment into the region.

The Energy Transition Zone in Aberdeen will receive £26 million from the Scottish Government to become a focal point and catalyst for high-value manufacturing, research, development, testing and deployment with significant opportunities in offshore wind, hydrogen, and carbon capture and storage.

In delivering a just transition, and in giving workers and communities confidence in a just transition, it is essential that all parts of the current oil and gas industry and the communities connected to it, embrace the opportunities. This will mean working collaboratively with existing oil and gas businesses, low carbon and renewable energy businesses, across further and higher education and with local authorities, public agencies, trade unions and enterprise bodies to maximise the potential of the energy industry and areas such as the North East and Shetland. We already have successful partnerships with Opportunity North East, the Net Zero Technology Centre, Global Underwater Hub and Aberdeen City Council.

Decommissioning opportunities

As a mature basin, North Sea oil and gas infrastructure is coming to the end of its use for oil and gas production and decommissioning presents new opportunities.

The global decommissioning market is expected to be worth around £67 billion over the next 10 years[72] and offers significant opportunities for Scottish companies. As one of the first oil and gas sectors globally to require decommissioning on a significant scale, Scotland is already a centre of decommissioning excellence, and we want to ensure that the world class Scottish supply chain continues to develop competitive capabilities and can export its expertise. We urge the UK Government to provide more support directly to the decommissioning sector to ensure as much of this growing area of work as possible is carried out in Scotland, creating and protecting jobs and economic opportunities.

Much of the supply chain, skills and expertise in the industry currently are transferable to offshore decommissioning. The NSTD Integrated People and Skills Strategy[73] noted that 38% of current oil and gas workers saw working on decommissioning as their preferred destination as part of an orderly energy transition.

We have announced our intention to invest £9 million in the development of an ultra-deep-water port at Dales Voe, Shetland through the Islands Growth Deal to further increase the competitiveness of the decommissioning sector in Scotland.

Benefits of decommissioning to the climate and the environment

We are committed to ensuring that decommissioning is carried out to the highest safety and environmental standards, minimising the risk to the environment and other users of the sea. Decommissioning at Scottish ports should be undertaken in line with the principles of a circular economy and promote the reuse of materials over recycling and disposal. A circular approach has the potential to reduce the energy intensity and emissions from decommissioning structures, create new jobs and business opportunities, and provide cost savings for manufacturing processes that use decommissioned material.

[72] OEUK Decommissioning Insights 2019
[73] https://www.offshoreenergypeopleandskills.co.uk/

Exploration and new production

Oil and gas exploration and production, including licensing, remains reserved to the UK Government. In 2014, Scotland's Independent Expert Commission on Oil and Gas recommended a policy approach based on Maximum Economic Recovery (MER), to maximise the total value added to Scotland from the oil and gas resources in the waters off Scotland. This position was reflected in our 2017 Energy Strategy: Future for Energy in Scotland.

In response to growing global understanding of the scale and implications of climate change, 192 countries and the EU joined the UN Paris Agreement. In 2019 the Scottish Government was one of the first in the world to declare a global climate emergency, making a commitment that Scotland's contribution to global emissions would end definitively within a generation.

Emissions impacts of oil and gas activity, and existing action in the sector on climate and the environment

Around 20% of the emissions associated with North Sea production are from the extraction and production process. Of this, more than 2/3 is a result of using natural gas or diesel in the energy intensive production process. Just over a fifth relates to flaring with less than 3% due to venting.

The North Sea Transition Deal[74] commits the sector to reduce emissions associated with oil and gas production by 50% by 2030. Key actions to reduce emissions include powering equipment by electricity instead of gas, and reducing flaring and venting. Total UK offshore flared volumes fell by 20% and venting by 22% in 2021. The OEUK Methane Action Plan also identifies a 50% reduction in total methane emissions by 2025.

The Scottish Government is committed to ensuring secure, reliable and affordable energy supplies and supporting the long-term decarbonisation of our energy generation in Scotland. Through the INTOG leasing round we are helping offshore oil and gas platforms to reduce their emissions by using electricity generated directly from local wind turbines to meet the targets in the North Sea Transition Deal.

The remaining 80% of emissions created from oil and gas is associated with end use of the products. 16% of this is in Scotland and the remaining will be attributed to the emissions of the countries where the products are

[74] The North Sea Transition Deal is a sector deal between the UK Government and the offshore oil and gas industry. The deal included a voluntary commitment to achieve 50% UK content across the lifecycle of all related energy transition projects by 2030, as well as in oil and gas decommissioning.

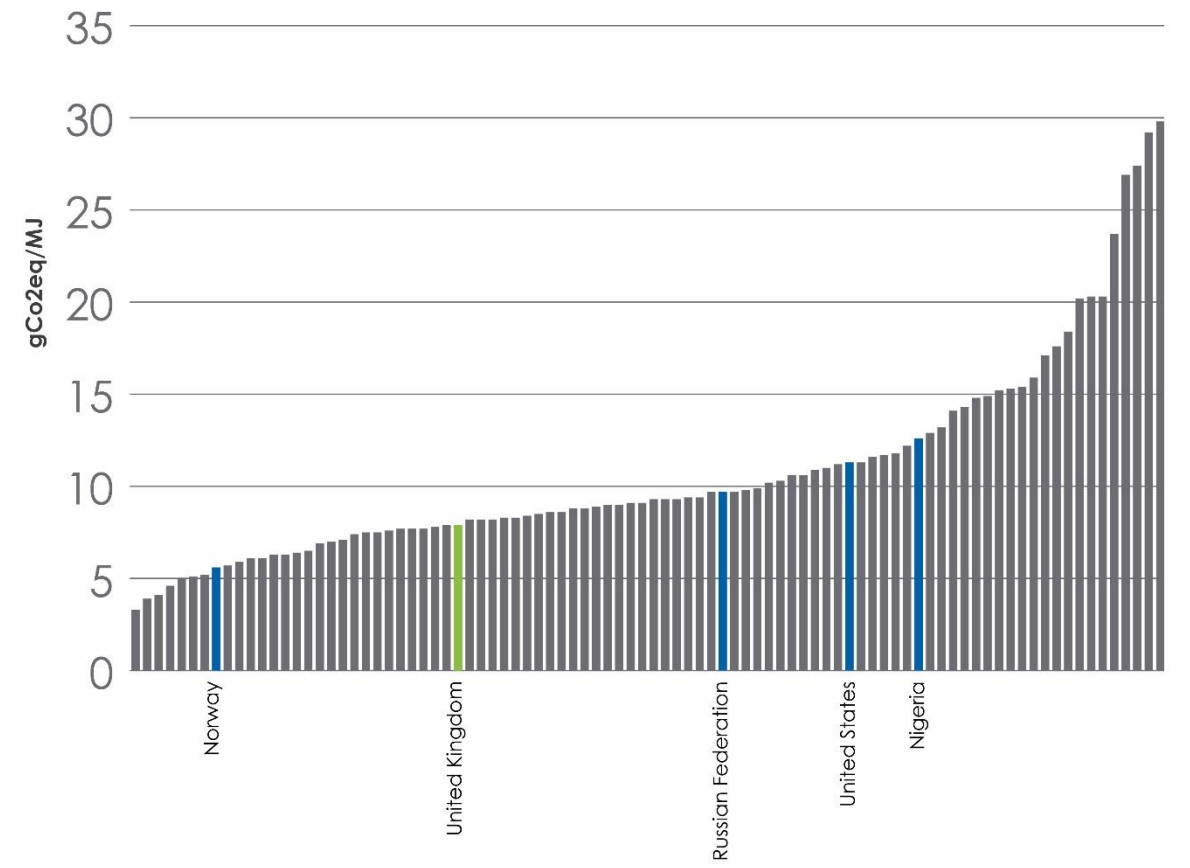
ultimately used. See Chapter 4 for information on how we are reducing reliance on fossil fuels across our demand sectors.

In 2021 the International Energy Agency advised that no new oil and gas fields beyond those already approved for development as of 2021 should proceed if the global climate goal of net zero emissions by 2050 is to be met.

In 2021, taking account of these developments, the Scottish Government set out that Maximum Economic Recovery was incompatible with our climate obligations and no longer government policy.

In their letter of February 2022, to the UK Department for Business, Energy and Industrial Strategy, the UK's independent advisors on climate change, the Climate Change Committee, noted that whereas the evidence against any new consents for coal exploration or production is overwhelming, the evidence on new UK oil and gas production is not clear-cut.

Figure 28 : Estimated global upstream crude oil carbon intensity (2015)



Source: EY analysis, Stanford University [75]

[75] Source: Stanford University Paper. Author. Masnadi, Mohammad S, El-Houjieri, Hassan M, Schunack, Dominik, Li, Yunpo, Englander, Jacob G, Badahdah, Alhassan et all. Global Carbon intensity of crude oil production. United States. 2018.

While there remains demand for oil and gas as an energy source through the transition, it is difficult to establish the net impact on global emissions of new UK oil and gas production as UK extraction carries a relatively low carbon footprint compared to other producers[76] (figure 28). However, the availability of production from the UK supports a larger global market than if there were less production overall.

Despite these difficulties, the Climate Change Committee concluded that it would support a tighter limit on production, with stringent tests and a presumption against exploration, observing that an end to UK exploration would send a clear signal of commitment to net zero to investors and consumers. This could have an important impact while businesses and individuals make decisions regarding how and when to adapt to net zero. The Climate Change Committee noted that there are additional important considerations, such as UK energy security, that extend beyond its statutory remit.

The Scottish Government is clear that **unlimited extraction of fossil fuels is not consistent with our climate obligations.** It is also clear that unlimited extraction, even if the North Sea was not a declining resource as outlined above, is **not the right solution to the energy price crisis** that people across Scotland are facing or to meeting our energy security needs.

As a country with a rich oil and gas heritage, and in a time of geopolitical crisis, we have a responsibility to balance energy security and national economic and social benefit with our international climate commitments.

As a result, in establishing a renewed policy position on oil and gas, whilst licensing is reserved to the UK Government, the Scottish Government is consulting on whether, in order to support the fastest possible and most effective just transition, **there should be a presumption against new exploration for oil and gas.**

Climate Compatibility Checkpoint

In September 2022, the UK government introduced a climate compatibility checkpoint for all new licensing rounds as part of the 33rd licensing round. Whilst in the absence of a presumption against exploration, we welcome this in principle, **we believe that the assessment criteria are not rigorous enough to align with climate commitments under the Paris Agreement and should be strengthened.**

[76] EY data shows that the largest share of Scotland's crude oil imports come from Nigeria, USA and Norway, with Nigeria and the USA having a higher carbon intensity than the UK and Norway a lower emissions intensity.

In particular, any credible and effective package of climate compatibility tests must reflect the full global emissions impacts of oil and gas activity – in particular considering the emissions associated with the use of oil and gas (regardless of whether this occurs domestically or internationally), as well as its production.

While international bodies such as the International Energy Agency have developed global reduction pathways for fossil fuels (including oil and gas) production consistent with the Paris Agreement, there is no agreed method to allocate a production share to individual countries. However, the Paris Agreement more widely states that "The Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances." As part of the Bute House Agreement, analysis is underway to provide an evidence base to support efforts to ensure Scotland's energy activity is consistent with the Paris Agreement.

In this draft Strategy and Plan, as well as consulting on whether there should be a presumption against new exploration, we are also consulting on what factors should be considered in assessing the impact of new oil and gas production (i.e. from fields that are already consented but not yet in production) in the context of the global goals of the Paris Agreement.
We are consulting on whether the following principles should be considered in the development of a more rigorous package of tests:

- The impact of any new oil and gas production on global greenhouse gas emissions in the context of meeting the Paris Agreement goals, particularly in efforts to limit warming to 1.5°.
- Whether any new production of North Sea oil and gas is needed to improve national energy security and whether it will help reduce costs of overall energy to consumers.
- Benchmarking of global emissions from new oil and gas production against the most likely alternative energy supply.
- How the application will contribute to efforts by the oil and gas sector to reduce the emissions associated with extracting oil and gas.

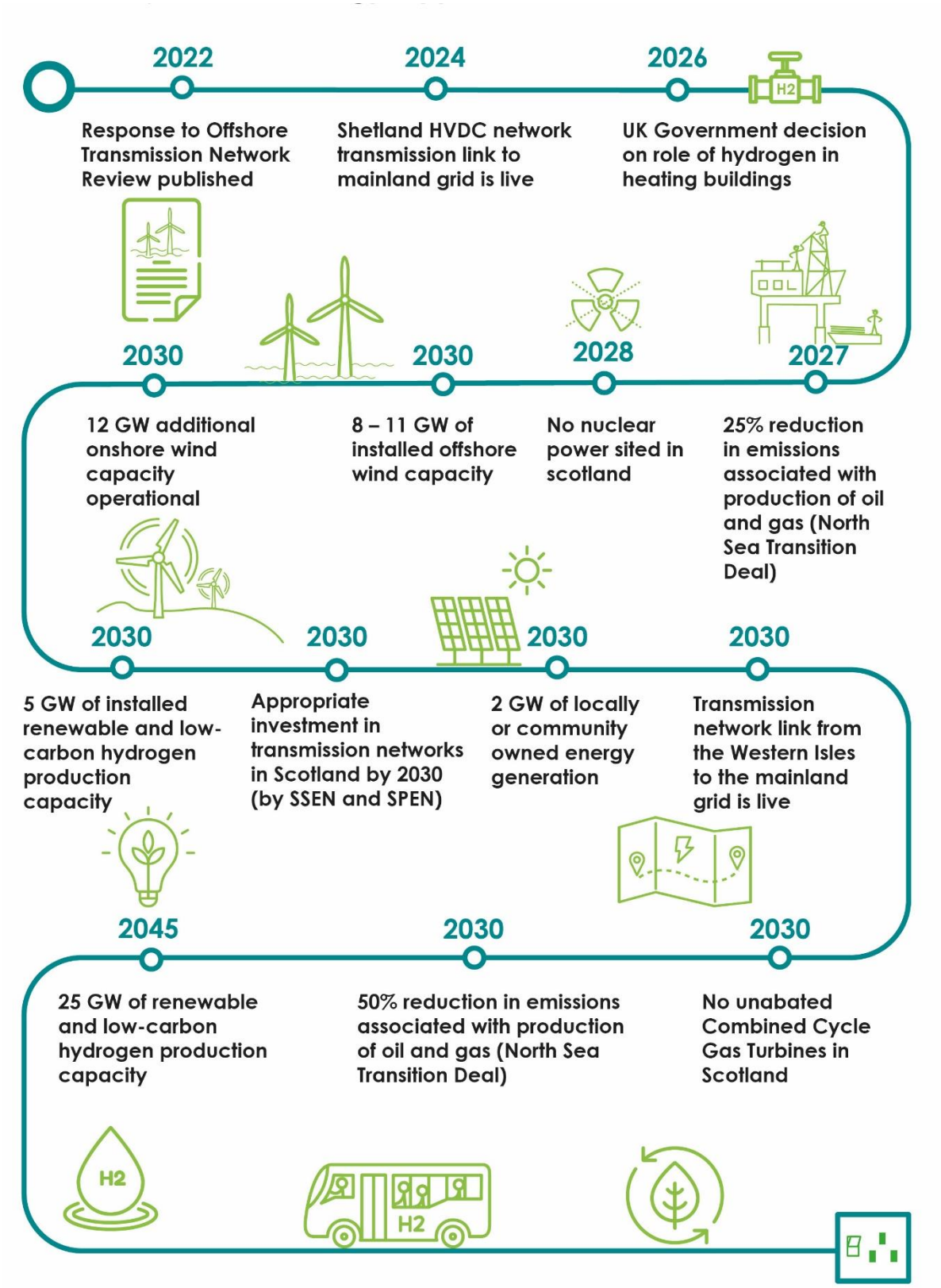
After consulting on whether there should be a presumption against new exploration and on the principles governing an enhanced climate compatibility checkpoint for new production (from fields already consented but not yet in production), a confirmed policy position will be published in the final ESJTP.

While we consult, we are calling on the UK Government to immediately strengthen their current climate compatibility tests in line with the principles set out above.

We also call on the UK Government, particularly as the recipient of oil and gas revenues for 50 years, to step up their support to ensure a just transition for the energy sector and to commit to working with the Scottish Government to deliver key energy transition projects.

There is a **bright future for the energy sector in Scotland** and the skills and design ingenuity of our oil and gas workforce will be central to achieving success. The Scottish Government will continue to support individuals, communities and businesses to accelerate a just and sustainable transition.

Figure 29: Route map to 2045 – Energy supplies



Chapter 4: Energy demand

Our future energy use will be climate friendly

By 2030, Scotland's main energy using sectors - heat in buildings, transport, industry and agriculture - will be using energy more efficiently. The energy they do use will be largely decarbonised, helping to deliver against our economy-wide statutory climate change targets. We will see significantly reduced demand for energy overall and at least 1 million homes decarbonised. Car kilometres will have reduced by 20% and Carbon Capture Utilisation and Storage will be on its way to being an established technology in Scotland. At least the equivalent of 50% of our energy across heat, transport and electricity demand will come from renewable sources. By 2032, industrial emissions will have decreased 43% from 2018 levels, with industry remaining globally competitive.

This chapter sets out the transformation needed in how we use energy to deliver against our net zero, affordability and economic objectives, and details the actions we will take to change the way we use energy in our homes, in our transport systems, in industry and in agriculture. We will take action to reduce demand overall.

Meeting our targets will also depend on the reduction of fossil fuel energy use across industry, including the deployment of carbon capture, utilisation and storage (CCUS). To achieve this, we will continue to support the low carbon transition of industry in Scotland, call on the UK Government to accelerate the Scottish Cluster to full Track-1 status without delay and continue to implement the Emissions Trading Scheme.

Reducing demand and decarbonising our energy use across heat and transport sectors	
Heating and cooling our buildings	We have set an ambition to decarbonise **1 million homes by 2030, and to reduce emissions from our non-domestic buildings.**
	We will consult during 2023 on a **Heat in Buildings Bill** and outline proposals for regulating energy efficiency and zero direct emission heat in Scotland's homes and buildings.
	We will deliver support for the transformational change needed for heat in buildings through **our National Energy Agency – Heat and Energy Efficiency Scotland.**
	We are **investing over £1.8 billion** in decarbonising homes and buildings, through **Heat and Energy Efficiency Scotland**, over the course of this parliament.

	We have introduced a Home Energy Scotland Grant scheme in 2022/2023 including enhanced support for **rural off gas households.**
	We will publish a **Public Engagement Strategy for Heat in Buildings and the report from the Green Heat Finance Task Force** in 2023.
	We have set an ambition for **2.6 TWh of thermal energy to be supplied by heat networks by 2027** and 6 TWh by 2030, and will set a new target for 2035.
	We will **establish a new regulatory regime for heat networks in Scotland** and appropriate financial mechanisms.
	We will publish an **updated target for renewable heat** in 2023.
	We will support local authorities to produce their **Local Heat and Energy Efficiency Strategies** (LHEES) and Delivery Plans by providing capacity support training in partnership with Zero Waste Scotland.
Energy for Transport	We have committed to **reduce car kilometres by 20% by 2030**, and are investing **£500 million in active travel**.
	We are **investing £500 million** in bus priority measures and investing over **£5 billion** in maintaining, improving and decarbonising Scotland's rail network.
	We are **helping more people on lower incomes and remote/island communities** to switch to zero emission vehicles with a further **£30 million** of loans and grants **through our domestic and business EV funds.**
	We are developing a **Just Transition Plan for Transport** which will help create an energy system that delivers for people, places and communities in Scotland.
	We are supporting innovation and **attracting inward investment in zero emission mobility,** including through the Michelin Scotland Innovation Park and the National Manufacturing Institute Scotland.
	We will **make up to £58 million available** for zero emission buses and charging infrastructure.
	We will **accelerate the transition away from fossil fuels** by supporting households and businesses to make the switch to low/zero emission vehicles, including: o **expanding electric vehicle infrastructure** with **£60 million** of public and private investment. o **legislating to require new homes and non-residential buildings to include EV charging points**. o helping to facilitate the development and rollout of the **infrastructure needed for hydrogen vehicles** to operate in Scotland. o delivering the **rail decarbonisation plan**.

	o working towards **decarbonisation of ferry services**. o working to **decarbonise scheduled passenger flights** within Scotland by 2040.

Supporting industry to reduce demand and decarbonise energy use	
Energy for Industry	We will continue to offer **match-funding support for industrial energy efficiency or decarbonisation** via the Scottish Industrial Energy Transformation Fund (SIETF) with £34 million available to fund projects until 2026.
	We call on the UK Government to work with us on **getting consumers, or other buyers, to choose low carbon products**.
	We will work with the UK Government to **plan and secure the delivery of the substantial infrastructure**, as well as new energy generation and conversion assets, that need to be developed before industrial fuel switching (to renewable or low – carbon hydrogen and/or to electrification) and CCUS can be deployed on a large scale.
	We are supporting innovative proposals to reduce the carbon footprint of manufacturing through the **Low Carbon Manufacturing Challenge Fund** with £3 million in 2022 and a total of £26 million over 5 years.
Carbon Capture Usage and Storage	We will continue to work with the North East CCUS industry led alliance to **support the delivery of the CCUS industry in Scotland**.
	We will continue to engage with the Scottish Cluster and have offered **£80 million from our Emerging Energy Technologies Fund** until 2026 to support the deployment of the Scottish Cluster. Due to delays with the UK Government announcing the Scottish Cluster, we have re-profiled our offer of financial support into subsequent years.
	We will support the development and demonstration of technologies that utilise carbon dioxide and create value in CO_2 through our £5 million CO_2 utilisation Challenge Fund
	We will **continue to provide funding and policy support to industry group NECCUS in financial year 2022/23**, including on the development of Scottish Net Zero Road Map (SZNR) [77]which is scheduled to be completed in early 2023.
	We will continue to **build the evidence base for CCUS in Scotland**, including exploration of non-pipeline transport solutions, such as CO_2 shipping and the unique opportunities these provide to Scotland (initial outputs delivered in early 2023) and the CCUS regulatory landscape in Scotland.

[77] The Project – Scottish net zero roadmap (snzr.co.uk)

	We will work constructively with the UK Government on the **development of CCUS in the UK** and will continue to input into the Track-2 sequencing process to ensure it does not unfairly disadvantage Scotland.
	We continue to call on the UK Government to **reverse its CCUS cluster sequencing decision** and to accelerate the Scottish Cluster to full Track-1 status without delay.
	We also urge the UK Government to provide **urgent clarity** on the timelines and processes of the next stages (Track-2) of the cluster sequencing process.
Energy in Agriculture	We are providing **advice and support to help farmers and crofters reduce energy demand and decarbonise energy** use though a suite of advice programmes.
	We are building our evidence base through research on opportunities to **reduce demand and decarbonise energy usage across the agricultural sector**.
Emissions Trading	We are currently developing the UK ETS to align it with our net zero targets. We consulted on proposals with the UK Government, Welsh Government and Northern Ireland Executive in March-June 2022 and will **bring forward legislation in response to these proposals in 2023**.
	We will continue to work with industry to support them to make the **decarbonisation investments** needed in the context of the price signal from the ETS.

Reducing demand and decarbonising our energy use

As the energy transition progresses, we will all see changes in our day-to-day consumption habits. This will include increased use of public transport or active travel, and reduced heat demand by improving the energy efficiency of our homes and non-domestic buildings.

Changes to the way we use energy (or 'demand-side measures') can deliver significant co-benefits for people and society, including improvements in health and wellbeing, contributing positively to a just transition. Reducing energy demand has the double benefit of saving emissions and lowering energy and infrastructure costs. By using less energy overall through energy efficiency, we can reduce the negative impact of fluctuating energy prices.

Feedback from engagement

Stakeholders called for improved incentives to encourage the switch to cleaner energy and reduction of energy use for consumers and businesses alike. This includes investment in public transport, supporting costs of energy efficiency measures and enhancing the coordination of retrofit schemes.

4.1 - Energy for heat in buildings

Heating Scotland's building stock accounted for 51% of our energy consumption and is a significant source of emissions[78]. As set out in our Heat in Buildings Strategy[79] (HiBS) we need to transform the way we heat our homes, workplaces, communities and other public buildings. This will involve using less energy by improving energy efficiency, and moving to zero emissions heating systems.

Use of hydrogen for heating

We do not consider that hydrogen will play a central role in the overall decarbonisation of domestic heat and therefore we cannot afford to delay action to decarbonise homes this decade through other available technologies.

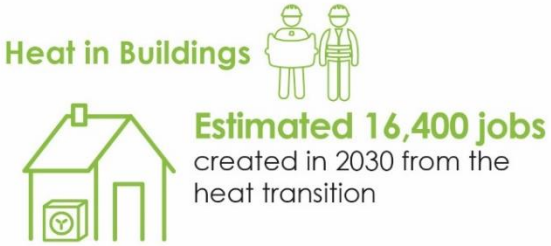
The potential for hydrogen to play a role in heating buildings depends upon strategic decisions by the UK Government that will be made over the coming years. The Scottish Government will continue to urge the UK Government to accelerate decision-making on the role of hydrogen in the gas grid.

The gas industry is testing options for blending hydrogen into the gas network up to the limit that can be safely used in existing appliances. Using a blend of hydrogen up to 20% by volume has the potential to reduce carbon emissions from gas use by up to only 6-7% on current GB grid gas consumption. There is also potential for some parts of the gas grid in Scotland to be converted to 100% hydrogen in the 2030s and beyond, in specific circumstances such as rural island areas, Statutory Independent Undertakings (SIUs)[80] or areas of potentially high levels of hydrogen use.

[78] Scottish Energy Statistics Hub (shinyapps.io)
[79] Heat in Buildings Strategy - achieving net zero emissions in Scotland's buildings - gov.scot (www.gov.scot)
[80] The Statutory Independent Undertakings (SIUs) are 5 remote independent gas networks; four in the mainland (Wick, Thurso, Oban and Campbeltown) and one on the Isle of Lewis (Stornoway)

The Scottish Government is seeking to commission independent laboratory testing of hydrogen boilers to determine what – if any – greenhouse gas emissions are produced from the combustion of 100% pure hydrogen (under normal operating conditions). Once the testing has concluded, in early 2023, we will set out our position on the use of 100% hydrogen for space and hot water heating in new buildings.

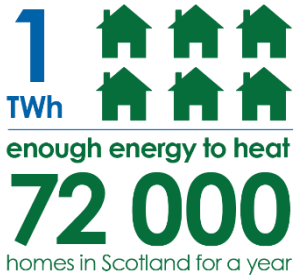
It will take an unprecedented level of leadership and co-ordination to ensure everyone, from industry to individual households, is aware of, and understands, the changes required to deliver this green heat transformation. A key factor will be to ensure everyone can access the right support, at the right time, to meet their needs as they move through this transition. That is why we made a commitment to establish a dedicated National Public Energy Agency by 2025.



However, in recognition of the urgency to act now, we launched a virtual Agency in October 2022 – Heat and Energy Efficiency Scotland. The agency's initial focus will be to build public understanding of the changes needed in how people heat and use energy in their properties, act as a centre of expertise for green heat projects and co-ordinate investment. We have committed £1.8bn over the course of this parliament, to support the work of Heat and Energy Efficiency Scotland.

We have already expanded the capacity of our Home Energy Scotland (HES) advice service and have introduced a new HES grant scheme for households during 2022/23, including enhanced support for rural off-gas households. Businesses can access free energy advice via Business Energy Scotland, and drive change within the SME sector through financial support via the SME Loan and Cashback scheme.

We will consult during 2023 on a Heat in Buildings Bill and outline proposals for regulating energy efficiency and zero direct emission heat in Scotland's homes and buildings. We will also publish a Public Engagement Strategy and the report from the Green Heat Finance Taskforce in 2023. This will focus on raising awareness and understanding about why we need to change the way we heat our homes and buildings, the benefits this can deliver, the changes people will need to make and the support and advice that will be available to help achieve this.



Heat networks will also have a big part to play in providing clean heat across Scotland. We are supporting these through our £300 million Heat Network Fund, available over the next parliamentary session. We have set an ambition for 2.6 TWh of thermal energy to be supplied by heat networks by 2027 and 6 TWh by 2030, and will set a new target for 2035. We continue to support the deployment of heat networks in Scotland through the Heat Networks (Scotland) Act[81], which will be implemented by 2024 to establish a new regulatory regime for heat networks in Scotland.

In order to comply with existing statutory requirements, our Heat in Buildings Strategy set out a new provisional target (22%) for the proportion of non-electrical heat demand in buildings supplied by renewable sources (either directly, or via a heat network). The Renewable Heat Target (RHT), as currently defined, is an important factor in monitoring Scotland's wider 2030 renewable ambitions. However, we believe that the current RHT alone is insufficient to measure progress towards our Heat in Buildings ambitions. These are to displace Direct Emissions Heating with Zero Direct Emissions Heating, which could include, but not be restricted to, non-renewable sources. We will be considering alternative approaches and metrics against which to measure our progress over the coming year, and will engage with stakeholders as part of this process.

Climate resilience

Some buildings also require energy for cooling. At present, this is more relevant for non-domestic properties, such as hospitals, larger open plan offices, hotels and retail units. As our climate changes, we are likely to experience increased temperatures, with warmer winters and hotter summers becoming more common. As a result, we are likely to see an increased demand for cooling in the future. Some of this will be met through changes to building design and the deployment of natural solutions. However, we recognise that it will be important to understand the need for, and role of, zero emission technologies that can also provide cooling, such as reversible heat pumps.

[81] Heat Networks (Scotland) Act 2021 (legislation.gov.uk)

Benefits to climate and the environment

The Heat in Buildings Strategy sets out a pathway for the way in which zero emissions heating systems, accompanied by measures to reduce the amount of energy that we use, will keep us on course to achieve our binding emission reduction targets. It includes a series of actions for the near term and beyond, including the principles we will apply to ensure that those actions, and our accompanying programmes of support, are consistent with our fuel poverty objectives and commitments, and with a just transition.

Maximising benefits to our economy, businesses and workers

The recent 'Decarbonising Heating – Economic Impact'[82] report estimated almost 16,400 additional jobs could be created in 2030 across the Scottish economy from the heat transition, with further jobs supported through the roll out of energy efficiency.

We are focused on the opportunities to develop new supply chains and jobs that the heat in buildings transformation can provide, including through our work on a Supply Chain Development Programme for Heat Pumps, and our Heat in Buildings Supply Chain Delivery Plan, which was published in November 2022. This has been developed with input from across the Scottish public sector and is designed to strengthen the supply chains that will manufacture and install the new heating systems and energy efficiency measures we need.

Benefits to our communities and regions

There is strong evidence that home energy efficiency improvements can have positive impacts on health and well-being, particularly when targeted at vulnerable groups[83]. These include reduced symptoms of respiratory problems, cardiovascular conditions, arthritis and allergies, as well as improved mental health outcomes.

Our Community and Renewable Energy Scheme, CARES, has an enhanced focus on heat decarbonisation of community buildings, reaching urban and rural communities across Scotland to make buildings warmer, greener

[82] Decarbonising heating - economic impact: report
[83] Heat in buildings strategy: equality impact assessment

and cheaper to run. It also enables them to continue delivering essential local services and acting as exemplars so people can experience low carbon technologies in their community.

Local Heat and Energy Efficiency Strategies (LHEES) are the principal mechanism for locally-led heat planning in Scotland. LHEES will support local planning, coordination and delivery of the heat transition and provide an area-based 'blueprint' for decarbonising buildings. All local authorities must produce LHEES Strategies and Delivery Plans by the end of 2023 and update them every five years. A multi-year funding package is now in place to ensure that local authorities are properly resourced to develop their LHEES, and many are well on their way to publishing strategies. We will support local authorities to produce their LHEES Strategies and Delivery Plans by providing capacity support training in partnership with Zero Waste Scotland.

We are also collaborating with international governments, for example through our Memorandum of Understanding with Denmark, and examining international delivery mechanisms that could be applied to the Scottish energy sector – where competent to do so – such as municipally owned energy service companies.

4.2 - Energy for transport

Our ambition for Scotland, as set out in the National Transport Strategy[84], is to have a sustainable, inclusive, safe and accessible transport system helping deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors.

Transport is currently a significant user of fossil fuels, accounting for 25% of Scotland's energy consumption in 2019[85]. Decarbonising the sector creates multiple opportunities for transport to play a different role in the energy system. Renewable electricity and hydrogen will meet the vast majority of future transport energy needs, and the transport sector will also play a greater role in providing energy storage and flexibility through vehicle to grid and reuse of batteries. See more details in Chapter 5. Greater integration of the transport and energy systems can help us create a fairer, wealthier and greener Scotland: a Scotland where low and zero emission transport is affordable and reliable.

[84] https://www.transport.gov.scot/our-approach/national-transport-strategy/
[85] Scottish Energy Statistics Hub (shinyapps.io)

Our national demand forecasts[86] indicate that meeting our emission reduction targets through reducing car use and switching to electricity and hydrogen will result in a gradual increase in demand for renewables through the 2020s. A significant acceleration in demand would follow by 2030, implying that we need to start rolling out the supply and infrastructure for transport decarbonisation during this decade.

Hydrogen use in the transport system

Hydrogen and hydrogen-based fuels could decarbonise parts of the transport sector where full electrification is challenging, such as the aviation and maritime sectors.

The Enviro400 FCEV – a Hydrogen Fuel Cell Bus Photo Phote credit: Alexander Dennis.

Our forecasts indicate that demand for hydrogen in the transport sector has the potential to increase to around 6 TWh a year by 2035.[87] This is equivalent to around 80% of the diesel used by Heavy Goods Vehicles (HGVs) on Scotland's roads in 2019. By 2045, this could be as high as 14.9 TWh.

We have supported hydrogen demonstration projects in the transport sector, including the development of Scotland's first hydrogen powered

[86] Zero Emission Energy for Transport Forecasts: National | Transport Scotland
[87] Zero Emission Energy for Transport Forecasts: National | Transport Scotland

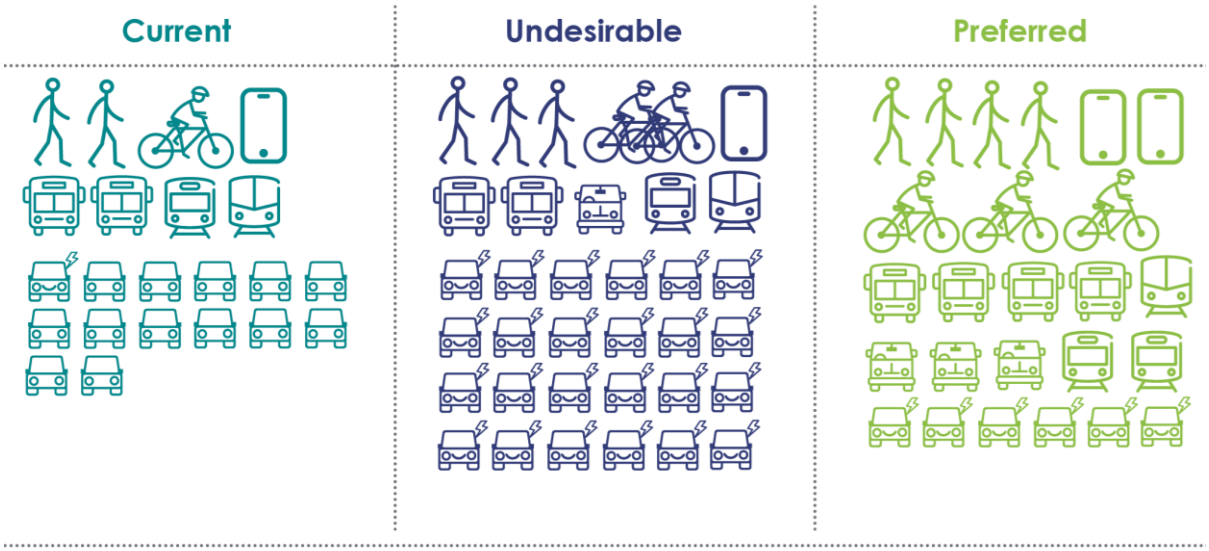
train and LOCATE, a drivetrain testing facility supporting the development of hydrogen niche and heavy-duty vehicles.

The Hydrogen Action Plan sets out how we will facilitate the use of hydrogen vehicles.

We aim to reduce the need to travel by car and increase the proportion of journeys by active travel or public transport. We do not expect car use to reduce equally for all – for example rural communities will continue to have a higher reliance on private vehicles – but we want to encourage and support those who are able to change their travel behaviour to do so.

We want to transition all vehicles to run on zero emission energy, including cars, buses, HGVs, ferries, and planes, wherever possible. Our aim is for most modes of transport to transition directly to zero-emission fuels and to avoid low-emission fuels as an interim stage wherever technically possible. Any support for low-emission fuels would be dependent on evidence that use of low-emission technology would not lead to a delay in achieving fully zero-emission transport. Overall, we want transport to use less energy in the future, and for the energy used to be affordable and reliable as shown in the transport hierarchy below.

Figure 30: The Transport Hierarchy



Source: NTS 2 – National Transport Strategy

Benefits to communities and regions

The importance of affordable energy has been shown by the impact that increased fuel prices have had on people who cannot easily switch to other modes of transport. For example, people living in rural areas, or blue badge holders, who are reliant on their car.

The current approach to motoring taxation is a significant barrier to the decarbonisation of the transport sector, particularly here in Scotland. We will continue to press the UK Government to implement reforms. Longer term, we want those least able to pay to benefit most from the switch to cleaner vehicles, reducing their cost of travelling as well as being more environmentally friendly.

In addition to our targeted support for rural and island areas (See Annex I), to support the people of Scotland through this period, we have put in place measures to help make public transport more affordable. This includes freezing all ScotRail fares until March 2023 and the Network Support Grant to support bus services in keeping fares more affordable and networks more extensive. Additionally, we are undertaking the Fair Fares Review to consider the range of discounts and concessionary schemes available on all modes of transport to ensure a sustainable and integrated approach to public transport fares. This includes a review of ferry fares policy for the Clyde and Hebrides Ferry Services (CHFS) and Northern Isles Ferry Services (NIFS) networks.

Benefits to climate and the environment

Low Emission Zones have been introduced in Aberdeen, Dundee, Edinburgh and Glasgow to help to improve air quality. Poor air quality has a negative impact on everyone's health, especially the very young, the elderly and those with pre-existing health conditions. The Low Emission Zone Support Fund aims to help those who would have the most difficulty adapting to the introduction of Low Emission Zones. This includes support to convert vehicles to LPG and we have been working with local councils and the private sector to help improve the availability of LPG.

Maximising benefits to our economy, businesses and workers

The transition from a fossil fuel-powered transport system to a low/zero emission system presents economic opportunities for Scotland. It is estimated that globally around 10 million jobs [88] could be created as a result of the transition to low/zero emission mobility. With Scotland's strengths in big data, sensors and digital technologies – all of which are important for efficient route planning, smart charging[89] and vehicle to grid technology – there is the opportunity for a number of these jobs to be in Scotland.

Scotland also has expertise in power system and grid integration for electrification, advanced manufacturing and integration of renewables. This expertise can help Scotland gain a share of the expanding market for refuelling and recharging infrastructure, as well as energy storage. See Chapter 5 for more details on flexibility.

By population, Scotland has the most public electric vehicle charging points outside of London, and the most rapid charge points anywhere in the UK. Through the PACE project[90] we supported new approaches to planning and installation of public charging points, demonstrating that making effective use of the existing electricity network can potentially achieve average cost savings of between £30,000 and £60,000 on average per location.

Scotland has the UK's first fleet of double deck hydrogen buses, and three of Scotland's seven cities are already connected by a modern electrified rail network. Glasgow's Smart Street[91] shows what is possible if all parts of the energy system work together. For example, the street will have street lighting which integrates the electric vehicle-charging point into the lighting column. The lighting column transmits and receives data so that vehicles are charged at the best times and the street lights are only on when needed.

[88] Informal document 08 Study on green and healthy jobs in transport.pdf (unece.org)
[89] Smart charging is when the charger communicates with your car/other vehicle and the grid to work out when is the best time to charge. This can put less pressure on the grid and reduce the cost
[90] Case study - Project PACE drives electric vehicle charge point growth and efficiencies | Transport Scotland
[91] RUGGEDISED - Smart city lighthouse project | GLASGOW

4.3 - Energy for agriculture

We have an ambition to reduce energy use in agriculture and to maximise opportunities for land managers for generating zero carbon energy. Agricultural energy use accounts for 0.8 $MtCO_2e$, 2 % of Scotland's total emissions and includes energy used for agricultural vehicles and processes. Approximately 300 million litres of (red) diesel (equivalent to 3 TWh) is consumed each year by the agriculture sector in Scotland. This is over 10% of Scotland's total estimated diesel consumption[92].

Energy demand on farms and crofts can be high for numerous reasons, including heating animal sheds, drying grain and powering heavy machinery. These processes currently tend to rely on fossil fuels. Through Farming for a Better Climate, Scotland's Farm Advisory Service, the Knowledge Transfer and Innovation Fund and Business Energy Scotland, we provide advice and support to help farmers and crofters cut energy use and carbon emissions, thereby reducing costs and supporting our vision for agriculture. We also provide advice and support on the opportunities available to produce renewable energy, offering a diversified income stream.

To inform how we decarbonise tractors and machinery, we are undertaking analysis on the 'Decarbonisation of mobile agricultural machinery in Scotland'. This will shape the policies we develop as part of the upcoming Climate Change Plan.

We will take forward an Agricultural Bill to deliver the powers that will enable the realisation of our Vision for Agriculture. This Vision aims to ensure Scotland will be recognised as a leader in regenerative and sustainable farming.
We will build our evidence base through a range of research including:

1. The opportunities and risks of developing a Scottish anaerobic digestion market from agricultural wastes to produce biomethane, CO_2 and digestate.
2. Private sector drivers for climate change action in Scottish agriculture.
3. Increasing low-carbon energy production and use in Scottish agriculture through a whole systems approach.
4. Decarbonisation of mobile agricultural machinery in Scotland.

[92] Scottish Greenhouse Gas Statistics 2020 - Scottish Greenhouse Gas Statistics 2020 - gov.scot (www.gov.scot)

Case Study: Woodend Farming Partnership, Scottish Borders

Woodend Farm, Photo credit: John Seed

The Woodend Farming Partnership focuses on free range egg production and arable cropping. To make the business more resilient, a 950kW biomass boiler was installed in 2013 to dry grain and provide heat to the egg pack house and properties on the farm via a district heating system.

The farm has 125kW of solar panels and a 75kW wind turbine to provide nearly all the power needed to run the grain dryer and farm.

There are plans to install electric vehicle chargers and battery storage at every house on the farm as Woodend moves towards having 100% electric vehicles. Through investing in energy production and adopting low-carbon, energy-efficient production systems, the farm will maintain and even improve its resilience and profitability. To read the full case study visit: www.farmingforabetterclimate.org

4.4 - Energy for industry

The energy intensive sectors of oil and gas refining, cement, pulp and paper, food and drink, iron and steel, chemicals, glass and ceramics, together account for around 15% of Scotland's greenhouse gas emissions[93]. We have an ambition to achieve a 43% reduction in industrial emissions by 2032, but we recognise that industry is likely to be a source of residual emissions in 2045. This emphasises the need for technologies that can remove and lock away carbon i.e. negative emissions technologies (NETs) and carbon capture, utilisation and storage (CCUS). Industrial decarbonisation will require systemic change involving energy efficiency, electrification, CCUS and fuel-switching, in particular to hydrogen.

[93] Deep decarbonisation pathways for Scottish industries: research report - gov.scot (www.gov.scot)

As we work to support the efficient decarbonisation of industry, incentives must focus on increasing energy efficiency. This will not only reduce emissions, but will protect industry from future energy price volatility. During the current energy crisis, we must also ensure that policy is responding to commercial cases of energy intensive industries.

We will continue to offer match-funding support for industrial energy-efficiency or decarbonisation via the Scottish Industrial Energy Transformation Fund (SIETF). £34 million is available to fund projects until 2026. To date, over £12 million has been offered in grants to around 20 industrial sites with more to follow.

We call on the UK Government to work with us on getting consumers, or other buyers, to choose low carbon products; and ensure these choices influence the long-term investment decisions on energy consumed during production by manufacturing industries. We also want to work with the UK Government to plan and secure the delivery of the substantial infrastructure, as well as new energy generation and conversion assets, that need to be developed before industrial fuel switching (to renewable hydrogen and/or to electrification) and CCUS can be deployed on a large scale.

Low carbon manufacturing

We recognise the need to support manufacturers to reduce their carbon emissions. The Low Carbon Manufacturing Challenge Fund (LCMCF) was announced by the First Minister in early 2022 as part of a wider £60 million investment in industrial decarbonisation. Innovative proposals to reduce the carbon footprint of manufacturing will be supported with £3 million funding in 2022 and a total of £26 million over five years. It is designed to build on Scotland's existing expertise, encouraging partnerships to come forward with bids that will support the adoption or development of low carbon technologies or processes.

Maximising benefits to our economy, businesses and workers

Grangemouth area view
Photo credit: INEOS

We want to encourage innovation in reducing emissions. The National Manufacturing Institute Scotland (NMIS) is a cutting-edge facility which represents a £75 million investment in the future of the sector. Through helping manufacturers to be more efficient, productive and cost-effective, many aspects of its mission overlap with our desire to promote the reduction of carbon emissions in the manufacturing process.

We have learnt that many businesses struggle to understand the carbon impact of their operations. For this reason, we launched a CivTech Challenge in 2021 to explore how technology can help manufacturing businesses decarbonise while building resilience and strengthening competitive advantage. We are now working with a Scottish start-up – iSumio – who plan to be in a position to launch a beta product by the end of 2022. To date, this work represents the largest value of any CivTech pre-commercialisation contract.

Grangemouth is home to the largest base of industrial manufacturing in Scotland. This industrial cluster plays an important part in Scotland's current energy system. However, the area is also responsible for 8% of Scotland's carbon emissions. Given the critical role of Grangemouth, both for our economy and our climate change targets, it is our ambition to see the site remain not only a key

manufacturing base for the future, but also one that is significantly decarbonised, supporting further carbon reduction across Scotland.

Grangemouth already presents a clear opportunity to achieve this through an extensive range of knowledge, skills and experience. For example, the production and handling of hydrogen requires a depth of chemicals expertise that is highly compatible with bio-based manufacturing. This existing knowledge base has the potential to attract new and innovative industries via co-location to become an anchor point for low-carbon supply chains. This is an opportunity that could further Grangemouth's status as an exemplar low-carbon cluster, whilst maintaining, re-purposing and growing skills and training for jobs that will be necessary in a net zero economy.

Grangemouth is ideally placed to produce future products in a net zero economy, and the region can also enable decarbonisation across other regions and sectors within Scotland. There is significant potential for carbon intensive industrial clusters, such as Grangemouth and Mossmorran, to unlock deeper decarbonisation across Scotland. In particular, Grangemouth's wealth of investment, infrastructure, skills, knowledge and productivity has strong potential for supporting a net zero economy.

Benefits to our communities and regions

The transition for Grangemouth must be a just one that shares the costs and benefits fairly across the broader region. In support of this, the Scottish Government, with partners across the Grangemouth Future Industry Board, is working to deliver a Just Transition Plan for the Grangemouth Industrial Cluster. The plan will outline a shared vision for future operations in a net zero world, identifying actions to help achieve this.

Case study: National Manufacturing Institute Scotland

Automotive manufacturers are looking to find more efficient manufacturing process routes to reduce emissions and input material weight. Alloy wheels, traditionally manufactured through casting or multi-stage forging and flow forming, can be energy intensive and time-consuming to produce, with significant heat and machining required.

The Advanced Forming Research Centre (AFRC), a part of the NMIS Group, demonstrated the potential of hybrid split forming and flow forming to produce a lower carbon footprint alloy wheel for the automotive industry.

The alloy wheel component was formed in a cycle time of three minutes, compared to 10-30 minutes for the conventional process. No heating was required, which could yield significant energy savings, whilst eliminating joining methods substantially reduces machining requirements. The AFRC is now engaging in dialogue with leading automotive manufacturers interested in embracing split and flow forming within their operations. Source: www.nmis.scot

4.5 - Carbon Capture, Utilisation and Storage (CCUS)

Carbon capture, utilisation and storage will be essential for capturing residual emissions in our energy system[94]. CCUS will play a role in reducing emissions in hard to decarbonise industrial sectors that cannot electrify their industrial processes[95]. It is also a key enabler for negative emissions technologies (NETs), which are critical for reaching net zero.

Scotland has vast potential for CO_2 storage in the North Sea, estimated to be up to 46 Gt of CO_2 storage in Scottish waters.[96] This is estimated to be over half of the UK's total CO_2 storage capacity, providing a route for much of the UK's emissions to be safely stored.

The Scottish Government remains supportive of these technologies as part of the energy transition and in particular it remains committed to supporting the delivery of the Scottish Cluster (known as the Acorn project). **However, we agree that any strategy for deployment of these technologies must enable decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero.**

While the probability of CO_2 leaks from a regional CCS industry has been shown to be low and if leaks do occur the spatial scale of impact is likely to be small and the potential environmental impacts minimal[97], robust monitoring is important. Also important is the setting of high performance standards for CCUS facilities. The UK Government has set minimum CO_2 capture rates as part of a number of performance conditions in its cluster

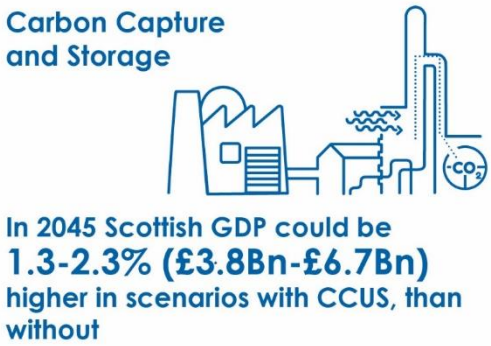
[94] IEA - Transforming Industry through CCUS
[95] This view is supported by the IEA which recognises that CCUS is one of the most cost-effective solutions available for large scale emissions reductions.
[96] Opportunities for CO2 Storage around Scotland —an integrated strategic research study / Progressing Scotland's CO2 Storage Opportunities
[97] Frontiers | A Review of National Monitoring Requirements to Support Offshore Carbon Capture and Storage (frontiersin.org)

sequencing process[98] and in the business models that are currently being developed e.g. for industrial carbon capture[99] and power CCUS[100].

Case study: The Scottish Cluster (Acorn)

The Scottish Cluster, led by the Acorn Project at St Fergus, is critical to delivering on Scotland's potential to develop a viable CCUS industry[101]. The Acorn Project has potential to store up to 5 million tonnes of CO_2 per annum by 2030. Its access to Peterhead Port gives the project potential to become a European hub for a whole new CO_2 shipping economy and attract significant inward investment.

CCUS has now been deployed worldwide, but it does not have an established market in the UK and requires revenue and capital support. The UK Government's decision to not award the Scottish Cluster Track-1 status in their CCUS cluster sequencing process has generated significant uncertainty on the timely deployment of CCUS in Scotland and, therefore, our ability to achieve our emissions reduction targets and economic ambitions as part of a just transition.



Although the Cluster has been granted "reserve status", this does not provide any guarantee of support and no projects linked to the Scottish Cluster have been progressed in Phase-2 of Track-1. Delays in the deployment of CCS infrastructure in Scotland will require contingency planning to identify the additional emissions reduction effort that may be needed from other sectors to meet Scotland's 2030 target. This will be explored in the 2023 Climate Change Plan.

We therefore continue to call on the UK Government to reverse its CCUS cluster sequencing decision and to accelerate the Scottish Cluster to full Track-1 status without delay. We also urge the UK Government to provide urgent clarity on the timelines and processes of the next stages (Track-2) of the cluster sequencing process. We are also working constructively with the UK Government on the development of CCUS in the UK and will continue to

[98] Cluster Sequencing for Carbon Capture Usage and Storage Deployment: Phase-2: guidance and comments for submissions (publishing.service.gov.uk)
[99] Industrial Carbon Capture Business Model April 2022 (publishing.service.gov.uk)
[100] Dispatchable Power Agreement Business Model Summary (publishing.service.gov.uk)
[101] SCCS - Opportunities for CO2 Storage around Scotland —an integrated strategic research study

input into the Track-2 sequencing process to ensure it does not unfairly disadvantage Scotland.

Maximising benefits to our economy, businesses and workers

Scotland's industrial clusters in the North East and in Grangemouth are linked by a network of pipelines to oil and gas fields in the North Sea. This offers rare access to existing legacy infrastructure for carbon storage and provides Scotland with a competitive advantage in CCUS. Peterhead Port provides opportunities to commence CO_2 shipping, unlocking potential for Scotland to be the centre of a European hub for the importation and storage of CO_2 from Europe. Our experience in oil and gas also means we have much of the expertise and transferable skills to kick-start what could become a whole new on and offshore industry for Scotland.

By deploying CCUS, low-carbon hydrogen and direct air capture technologies in Scotland, the Scottish Cluster (led by the Acorn CCUS Project at St Fergus) could support an average of 15,100 jobs between 2022-2050, with a peak of 20,600 jobs in 2031[102].

Scottish Government economic scenario analysis shows CCUS would have a positive impact on the Scottish economy. In 2045 Scottish GDP could be 1.3-2.3% (£3.8 bn-£6.7 bn) higher in scenarios with CCUS, than without.[103]

We are continuing to engage with the Scottish Cluster and have offered £80 million from our Emerging Energy Technologies Fund until 2026 to support the deployment of the Scottish Cluster. Due to delays with the UK Government announcing the Scottish Cluster, we have re-profiled our offer of financial support into subsequent years. We will continue to explore how this funding can best be utilised to operationalise CCUS in Scotland. We also continue to build the evidence base for CCUS in Scotland, including exploration of non-pipeline transport solutions such as CO_2 shipping and the CCUS regulatory landscape in Scotland.

In addition to the Scottish Cluster, we benefit from the presence of significant industry and academic expertise that is committed to operationalising CCUS in Scotland. Launched in November 2019, North East CCUS (NECCUS) is an industry-led alliance drawn from industry, academia, membership

[102] https://storegga.earth/news/2021/news/scottish-cluster-expected-to-deliver-20-600-jobs-in-the-next-decade
[103] Element Energy, CCUS economics impacts study – delivering a route map for growth and emissions reductions in Scotland

organisations and private sector bodies to promote CCUS in Scotland. It currently has over 50 members comprising the majority of Scottish industrial emissions, and is leading on critical projects such as the development of the Scottish Net Zero Route map (SNZR). We will continue to work with these experts in delivering a viable CCUS industry in Scotland.

At present, there are no plans by industry to develop Bioenergy Carbon Capture and Storage (BECCS) technology at scale in Scotland. In order to enable the delivery of BECCS for power generation and biomass gasification at scale, a sustainable biomass supply chain, CCUS technology and infrastructure, and a route to market will be required. The scenarios we commissioned to inform this draft Strategy suggest the main role of BECCS in the long term would be to support hydrogen production and industrial processes. See Chapter 3 for more details on the Bioenergy Action Plan.

4.6 - Emissions trading

While we must decarbonise our industrial and power sectors at an ambitious pace, we must also work with Scottish industry to manage the transition to net zero and ensure it can continue to compete in global markets. The UK Emissions Trading Scheme (UK ETS) establishes a market price for carbon and incentivises business investment in least cost decarbonisation. The UK ETS sets a cap on emissions from the traded sector (power, heavy industry, manufacturing, refining and aviation) and enables the trade of emission allowances. The UK ETS allocates a number of free allowances to those industries most vulnerable to the risks of carbon leakage (where activity moves to a region with a lower carbon price resulting in higher emissions) in order to enable a more level playing field.

As part of the UK ETS Authority (alongside the UK Government, Welsh Government and Northern Ireland Executive), we are developing proposals to align the UK ETS cap with our ambitious net zero targets. We consulted on proposals to reduce the overall cap in Spring 2022 and will propose legislative amendments to the cap in 2023. As we align the ETS cap with our net zero targets, we will also continue to work with industry to support a managed and just transition, including how risks of carbon leakage are mitigated through the ETS. This will be complemented by other policies outlined in this document, such as energy efficiency support and carbon capture and storage that support industry to decarbonise and remain competitive in a net zero economy.

Maximising benefits to our economy, businesses and workers

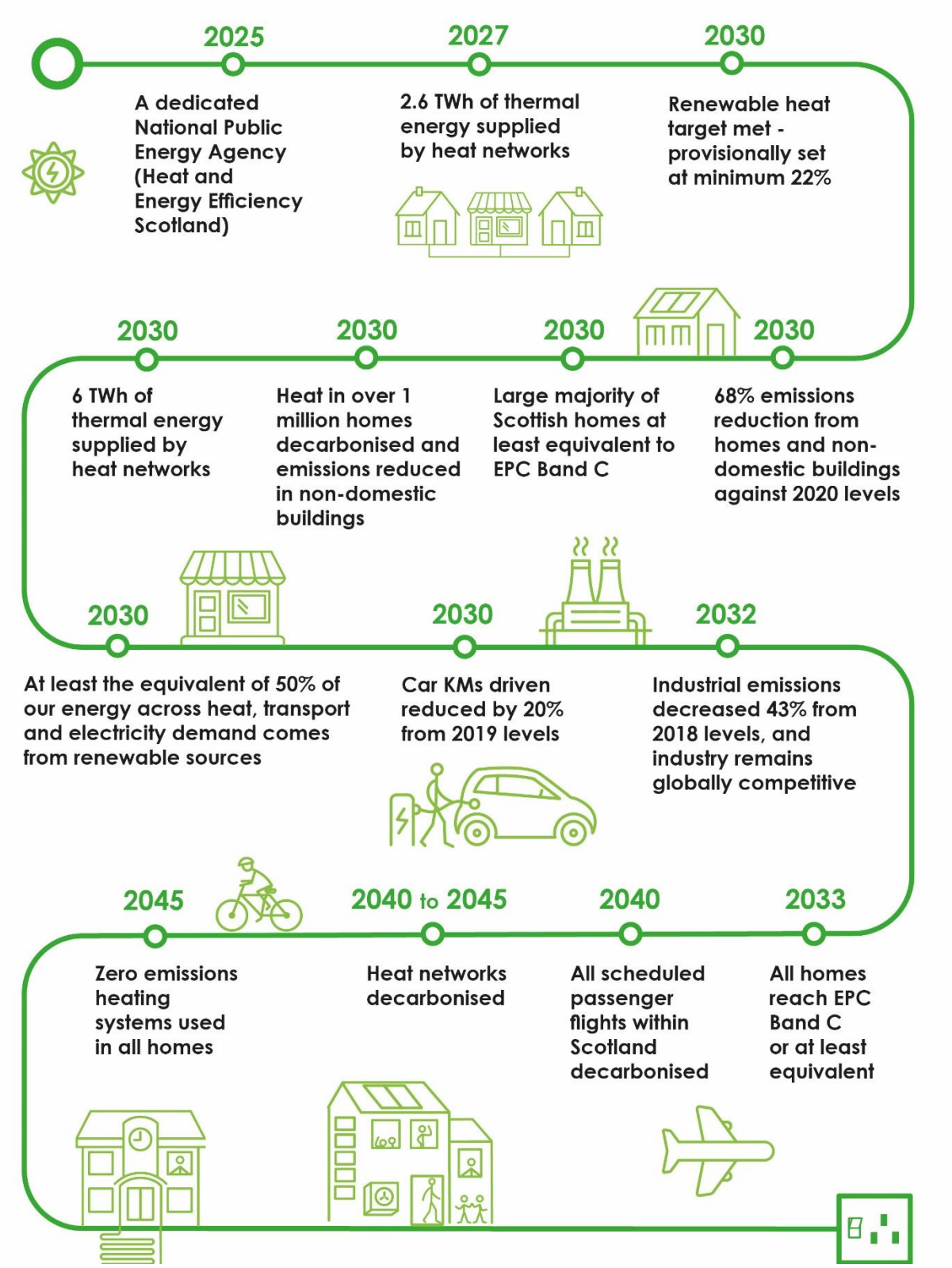
Industries can play their part to decarbonise the economy in many ways. For example, investing in production that demands less energy (or emits less carbon) per unit, can lead to cost savings as well as competitive market benefits for progressive products. The Scottish Government has published research on how to capture these benefits.

Investment in a world-scale low-carbon hydrogen plant is at the heart of the Ineos Grangemouth Net Zero route map that commits to deliver emissions savings of more than 60% across the site by 2030.

In addition to reducing emissions, investing in locally produced hydrogen will benefit other assets at the Grangemouth site, fuelling the existing Combined Heat and Power Plant, the KG Ethylene Plant and assets in the Petroineos Refinery. The scope of design is also planned to provide capability to link the low-carbon hydrogen production to third parties in the local area to support development of a local hydrogen hub.

We are currently developing the UK ETS to align it with our net zero targets. We consulted on proposals with the UK Government, Welsh Government and Northern Ireland Executive in March-June 2022 and will bring forward legislation in response to these proposals in 2023. We will continue to work with industry to support them to make the decarbonisation investments needed in the context of the price signal from the ETS.

Figure 31: Route map to 2045 – Energy Demand



Chapter 5: Creating the conditions for a net zero energy system

Creating the conditions for a net zero energy system – By 2030, Scotland's energy supplies will be secure, reliable and affordable for people and businesses across the country. The total electricity produced in Scotland will contribute to increasing energy security and limit the impacts of global energy shocks.

As we transition to a net zero energy system, renewables and other zero-carbon technologies, including pumped hydro storage, will need to provide all the services required to ensure a secure energy system.

Along with ensuring that investment in our infrastructure is sufficient to allow us to maximise the benefits of increasing renewable electricity and hydrogen supplies we need to integrate the demands of heat, industry and transport to ensure that we take a whole systems approach to our future net zero energy system.

This chapter sets out actions to ensure that we have a resilient, affordable and secure future energy system. Many of the areas covered in this chapter sit across the reserved powers of the UK Government, and we therefore outline how we will work together to achieve the necessary policy, regulation and investment changes require to deliver benefits for net zero and our economy.

We will:

Ensuring energy security and resilience	
Energy Security	We will work with key industry stakeholders and partner countries to explore the goal of a **fully interconnected North Sea grid,** opening up further opportunities for export of Scottish renewable energy to assist others in meeting their decarbonisation goals.
Electricity System Operability and Restoration	We will continue to press UK Government to **update technical requirements** for black start services.
Pumped Hydro Storage	We call on the UK Government to support the development of pumped hydro storage through an appropriate **market mechanism.**
Flexibility	We urge the UK Government to make the **ancillary service markets** more accessible for Battery Energy

	Storage Systems (BESS) and other low carbon technologies ahead of fossil fuel powered alternatives.
	We commit to taking forward research to explore the opportunities available to Scotland through **Vehicle to Grid technology** as part of our net zero energy system.
	We will explore the role of **EV battery recycling** as a circular economy opportunity for Scotland.
Energy Network Resilience	We will continue to seek to influence UK Government decision-making to ensure **Scottish interests and all risks are fully taken account of**.
Climate Impacts	We will develop the next statutory **Climate Change Adaptation Programme for publication in 2024**, in response to the full set of 61 risks and opportunities identified in the 2021 UK Climate Change Risk Assessment.
	We will **improve our response to climate related events** by facilitating the local authority roll out of the Persons At Risk Distribution (PARD) system.

Energy markets and network regulation	
Electricity Market Arrangements	We are engaging with the UK Government to ensure that any reform of the wholesale market supports **continued deployment of renewable generation and adequate protection to consumers.**
	We will continue to call on the UK Government to reform the GB wholesale market to enable consumers, communities and businesses in Scotland to **share the benefits of low-cost renewable power**.
	We will continue to call on the UK Government to reform the market to **break the link between the price of electricity and the cost of gas**.
Network Investment	We are working closely with the network companies to support **timely delivery of required electricity network infrastructure.**
	We are engaging with Ofgem and the network operators to provide **clear and transparent information** on the impact of SG policies and targets on network infrastructure.
	We are influencing policy and regulatory reform at a UK level – for example through the **Offshore Transmission Network Review (OTNR).**
Grid charging methodologies	We will continue to press for **reforms to the transmission charging arrangements** through

	Ofgem's transmission charging task force and National Grid modifications.
Constraint Costs	We will continue to work with National Grid ESO, transmission owners and Ofgem to **explore opportunities to accelerate planned network investment** to relieve constraints.
	We will continue to work with National Grid ESO to explore opportunities to **use the value of constraints as a means of incentivising demand,** such as heat and hydrogen.
	We are engaging with the UK Government to ensure that any reform of the wholesale market supports **continued deployment of renewable generation and adequate protection to consumers**.

5.1 - Ensuring energy security and resilience

Energy security is a matter reserved to the UK Government (See Annex E). Scottish Ministers have responsibilities in responding to and managing civil contingencies, including large scale loss of electricity supply.

Security of electricity supplies

Excluding intermittent renewable generators such as wind and solar, Scotland had a maximum supply capacity of 10 GW available in 2020/21. This breaks down as 5.6 GW of non-intermittent generation in Scotland and 4.5 GW of import capability. Scotland's peak demand in winter 2020/21 was 5 GW, comfortably within maximum supply capacity of 10.0 GW.[104]

Scotland's electricity system is part of the broader GB system, providing a form of resilience as the GB system can provide both a source of import and export. While Scotland's electricity has historically been provided by nuclear power stations, large fossil fuel power stations, pumped storage and hydro, National Grid Electricity System Operator (National Grid ESO) has confirmed that Scotland's demand can be met even in the event of earlier than expected closure of existing nuclear facilities. Increasing our levels of renewables capacity (as set out in Chapter 3) will also boost the available energy for our growing net zero energy system.

Cross border transfers of electricity and the use of interconnection with the diversity of technologies on the continent helps to maintain resilience in the wider system against individual shocks and to make the most efficient use of the resources at our disposal. Collaboration through interconnection with other countries will become increasingly important as offshore wind becomes

[104] Scottish Energy Statistics Hub (shinyapps.io)

a bigger proportion of our energy generation, and it will be vital to bring these projects forward in an efficient way that helps future-proof our energy system.

The North Sea has the potential to be 'the battery for Europe' – we will be looking to work with others on how we realise this potential, and how best to create shared and mutually reinforcing systems and infrastructure. A fully interconnected 'North Sea Grid' will ensure greater security and stability than what we would see with segregated systems.

Maximising benefits to our economy, businesses and workers

A fully integrated North Sea Grid would open up opportunities for the large-scale export of Scottish renewable energy to the rest of Europe, also realising Scotland as a world-leading destination for the import and storage of CO_2. We will work with key industry stakeholders and partner countries towards the goal of a fully interconnected North Sea grid, opening up further opportunities for export of Scottish renewable energy to assist others in meeting their decarbonisation goals.

Building in flexibility to respond to changing levels of supply and demand in our electricity system

Maintaining energy security includes responding to seasonal variations in supply and demand. Seasonal variations in the demand for electricity are much smaller than they are for gas[105]. This pattern will change as heat, transport and industry decarbonise and demand larger amounts of electricity than today. Efficiently matching energy supply and demand for power, heat, transport and industry will allow us to make the best use of our flexibility tools, such as energy storage (including pumped hydro storage as well as grid scale batteries) and demand-side response.

There are several technologies that can increase flexibility in our electricity system and provide wider benefits for consumers and society. This includes grid scale battery storage, as well as pumped hydro storage. Scotland has approximately 864 MW of electricity storage capacity[106], and 2.2 GW of battery storage that has been approved planning permission. We need to significantly increase this capacity.

In its role balancing supply and demand across the electricity system, National Grid ESO must keep the system within defined operating limits. Traditionally, these services were often provided by thermal generators such

[105] Scottish Energy Statistics Hub (shinyapps.io)
[106] Scottish Energy Statistics Hub (shinyapps.io)

as gas-fired power stations. As we transition to a net zero energy system and reduce our dependence on fossil fuel generation, renewables and other zero-carbon technologies, including pumped hydro storage, will need to provide all the services needed to ensure a secure electricity system.

System level storage (sometimes knowns as Long Duration Energy Storage – LDES) plays an important role in Scotland's energy system. Several recent studies have highlighted the benefits of deploying long-duration storage technologies such as pumped storage in the UK. For example, Aurora Energy Research recently found that 24 GW of long-duration electricity storage (LDES), equivalent to eight times the current installed capacity, would be needed in Great Britain to meet the government's commitment to decarbonise the power sector by 2035[107]. Such levels of LDES would not only reduce overall system costs by £1.13 billion per annum. (2.5%) benefiting bill payers, but also drastically cut our reliance on imported gas.

Pumped hydro storage (PHS)

PHS is a flexible technology that can ramp up to respond to periods of low output (for example days with low wind). Depending on the size of the body of water and number of turbines, it can produce relatively small amounts of electricity or provide a substantial amount to the grid. When there is more power on the system than demand, a pump hydro storage will take power from the system to push water back up hill ready to be used again.

In recent years the removal of the UK Government's Feed in Tariff (FiT) and Renewables Obligation (RO) mechanisms has made the installation of new conventional hydro power schemes challenging. However, Scotland remains the UK's hydro capital, with over 88% of the total UK hydro capacity.[108] PHS also continues to play a pivotal role in Scotland's energy system providing long-term storage and reserve for the electricity networks. PHS accounts for 740 MW of Scotland's 864 MW of energy storage[109].

There are currently 1.5 GW of pumped hydro storage projects awaiting construction in Scotland that could deliver vital flexibility for the grid and balance out the intermittent nature of renewables. However, the lack of a dedicated support mechanism means these projects do not have sufficient certainty to proceed. We have repeatedly called on the UK Government to support the development of pumped hydro storage. Recent events have fully demonstrated that reliance on gas balancing is no longer tenable from

[107] Aurora Energy Research: Long Duration Electricity Storage in GB
[108] Including hydro flow and pumped storage
[109] Source:https://scotland.shinyapps.io/Energy/?Section=SystemSecurity&Chart=ElecStorage

a price or environmental perspective. Given this, it is now imperative that the UK Government provides the right framework for investment to enable pumped hydro storage projects and similar technologies to proceed.

Maximising benefits to our economy, businesses and workers

Pumped hydro storage projects have the potential to create a large number of jobs and benefit the local economy, as well as providing much needed resilience in the system.

At up to 1.5 GW of capacity and 30 GWh of storage, SSE Renewables' Coire Glas pumped hydro storage project will more than double the UK's electricity storage capacity. That is equivalent to enough power for 3 million homes for up to 24 hours non-stop. While pumped storage is a well-established and proven technology, it will be the first project to be developed in the UK for over 30 years.

Coire Glas represents over £1 billion in investment for SSE Renewables, and another significant investment in the Great Glen, and Highland Region, with further community investment funds in addition to more than 500 jobs during construction.

Batteries

Batteries can be combined to provide energy storage: In a domestic setting supporting the energy efficiency of individual homes; In communities and neighbourhoods, supporting the energy efficiency of the local low energy network; In strategic locations and through aggregating a large number of fixed and vehicle batteries to support regional energy and grid balancing a high energy network.

Utility scale battery storage offers fast responding, dispatchable power when required. As of September 2021, only 124 MW of the total 864 MW [110]of energy storage was provided by Battery Energy Storage Systems (BESS) capacity installed in Scotland. However, there is a further 2.1 GW that has secured planning permission. Typically, these systems use lithium-ion technology, and only contain energy to dispatch full power continuously for a short number of hours. They also provide a number of ancillary services required to maintain stability within the electricity networks. We urge the UK Government to make these markets more accessible for BESS and other low carbon technologies ahead of fossil fuel powered alternatives. Our Revised

[110] Scottish Energy Statistics Hub (shinyapps.io)

Draft NPF4 supports development proposals for all forms of renewable, low-carbon and zero emissions technologies including energy storage, such as battery storage and pumped hydro storage.

Vehicle-to-grid (V2G)

V2G technology allows electricity stored in the battery of an electric vehicle to be supplied back into the network through a two-way V2G enabled charger. It enables electric vehicles to be used to store energy when generation exceeds demand and supply it back to the network during periods of peak demand when vehicles are less likely to be in use. This means there is potential for the transport system to support the grid in integrating high levels of variable renewable energy sources and consequently reduce the need to call on gas-powered stations to meet high energy demand.

It also presents an economic opportunity for electric vehicle owners and operators to sell electricity stored in their vehicles batteries back to the grid when it is most expensive, then charge during cheaper periods. Although there will be economic benefits for individuals who install V2G chargers, the largest benefits would likely be for organisations who own large fleets.

Traditionally these fleets only generate revenue whilst operational, however V2G means they could also provide revenue in their downtime. Research suggests V2G could be close to mass market rollout. V2G technology was demonstrated in Britain for the first time in August 2022, showing the potential direct role consumers could play in balancing the grid. We will take forward research to explore the opportunities for Scotland in this area.

Maximising benefits to our economy, businesses and workers

Research suggests that over 14,000 tonnes of energy storage and electric vehicle (EV) batteries will be placed on the market in Scotland on an annual basis by 2050. It is estimated that the total capacity of the EV batteries reaching end-of life in 2050 will be between 4.8 and 7.7 GWh.[111]

End of life waste may create significant circular economy opportunities for businesses in Scotland:

- Repair: Triage battery cells to fix faulty/damage elements.
- Refurbish: The battery is disassembled, and cathode material is restored for a new battery or partially reused for manufacturing of a new battery.

[111] Battery use in Scotland now and in the future

- Remanufacture: The battery is disassembled, and intact parts are reused whilst defective parts are restored to a like-new capability.
- Recycle: Extracting and processing the batteries raw materials through pyro, hydro, or direct recycling processes. These are then put back into the supply chain for reuse or other uses.
- Reduction: Reducing hazardous waste.

A number of businesses have already begun to operate in this market, with 436 registered industrial battery producers in the UK as of May 2022. Of these, 10 were companies registered with facilities in Scotland.

Commercial-scale recycling for EV batteries is expected to become sustainable in the next 5-8 years, with further potential opportunities for Scotland in addition to the reuse of batteries for energy storage.

There are currently gaps in data on battery composition, use and disposal.[112] Improving current policy and regulation is likely to help support the development of a more **circular economy** for batteries, reducing waste and maximising the value of batteries, and the rare earth elements they contain, for Scotland's economy. We will further explore this opportunity in 2023.

Hydrogen could also play a useful role in delivering large-scale and long-term energy storage in an integrated energy system and has the potential to replace or augment the critical balancing and resilience services that natural gas storage provides to the energy system today. It can help address intermittency of renewables through its production by electrolysis at times of excess green electricity supply. Hydrogen electrolysers co-located with renewables or deployed at scale in strategic locations will enable this.

Electricity System Restoration

The Scottish Government welcomes the Electricity System Restoration Standard proposed by BEIS in April 2021. This requires that at least 60% of demand can be restored in each region of GB (including Scotland) within 24 hours of a GB wide blackout, and that all demand can be restored within 5 days.

During events like this, the electricity system is traditionally restarted using thermal generation. However, there is a growing level of expertise in Scotland in using renewable generation to provide system restoration services. This innovative approach could mean that ultimately renewables could provide a cost-effective restart service for the electricity system.

[112] Due to the limited nature of the information gathered under the 2006 EU Batteries Directive and current Waste Batteries and Accumulators Regulations, which pre-date the growth in the battery market in recent years.

Although the technology exists, to encourage this approach requires National Grid ESO to develop market mechanisms tailored for renewable generation to participate effectively. National Grid ESO has existing markets for black start services, but the technical requirements are based on those of thermal power plants. The Scottish Government will continue to press the UK Government to update these requirements, taking into account lessons learned from the Scottish Government supported Dersalloch trial.[113]

As thermal generation looks to retire, National Grid ESO has been working with key stakeholders to establish alternative avenues to restore power in the event of a national power outage. In March 2022 they tested the feasibility of using Drax Power Station and Cruachan pumped hydro power station to restart part of the GB transmission network. This test was a success and demonstrated the ability to reconnect the North of England and Scotland from two existing Restoration Service Providers.

Resilience

A resilient energy system is one which can allow continued generation, transmission and consumption of energy, without having an impact on other parts of the system. Short-term and prolonged outages of parts of the energy system (caused by technical issues, rare or adverse weather) can have a significant impact on people and businesses.

The Scottish Government takes an 'All Risks' approach to Critical Infrastructure Resilience (CIR) through the Scottish Government's Strategic Framework 2020-2023 outlined in Keeping Scotland Running | Ready Scotland. [114]

Responsibility for the security and resilience of infrastructure lies solely with UK Government. The Scottish Government seeks to influence UK Government decision-making to ensure Scottish interests and all risks are fully taken account of. To this end, Scottish Government sits on energy sector security and resilience forums at a UK level.

Increased use of digital technologies will support this transition. However, we must be aware of the increased cyber security risk. It is paramount that we have the capabilities and capacity to withstand, adapt to and rapidly recover from cyber incidents and attacks, while preserving the continuity of these critical infrastructure operations.

It is vital that the whole energy system is resilient to the impacts of climate change and other local and global phenomena which can impact our energy system. The Climate Change Committee (CCC), set out eight highest

[113] Global first for ScottishPower as COP countdown starts - ScottishPower Renewables
[114] Keeping Scotland Running | Ready Scotland

priority climate risk areas for urgent action to enhance resilience in June 2021 as part of its advice to governments across the four UK nations. 'Risks to people and the economy from the climate-related failure of the power system' is one such priority risk area, due primarily to projections indicating that both dependence on electricity is likely to increase through the net zero transition, alongside an increase in intensity and variability of extreme weather events.

The locked-in impacts of climate change, such as the increasing frequency of severe storms and flooding, can have major effects on the ability of network and other key infrastructure to remain operational. While storms in recent years have led to severe damage to networks infrastructure, we must be prepared for such weather to become more common and it is vital that the networks look to increase, where possible, practical and efficient, the resilience of the network to minimise the impact of such events on homes and other energy users.

Some climate impacts vary substantially across Scotland. For example, extreme winter rainfall is increasingly affecting the west of the country more heavily, whereas summer droughts typically affect the east. Small low-lying islands are also under particular threat from climate change and predicted sea-level rise. Analysis by the CCC shows that it is often more remote parts of the country that are most vulnerable to these impacts and where it takes longer for power to be restored. Disruption to energy supply also tends to affect those who are already more vulnerable; e.g. Storm Arwen left 80,000 homes in Scotland without power and Ofgem's review into the networks' response recommended that all networks develop robust winter preparedness plans as an important part of ensuring that all customers, including those in vulnerable situations, are effectively supported[115].

In October 2022, the Scottish Government published the third and final report in the response to Storm Arwen [116]. It details the coordination of a Winter Preparedness Programme, improved public communications, and welfare checks as part of a wide range of 'care for people' in the event of a power outage caused by a major storm event. We will improve our response to climate related events by facilitating the local authority roll out of the Persons at Risk Distribution (PARD) system across Scotland, which helps local authorities and the NHS to identify vulnerable individuals during an emergency.

The Scottish Government is currently developing the next statutory Climate Change Adaptation Programme for publication in 2024, in response to the full set of 61 risks and opportunities identified in the 2022 UK Climate Change Risk

[115] https://www.ofgem.gov.uk/publications/storm-arwen-report
[116] https://www.gov.scot/publications/storm-arwen-review-recommendations-update-october-2022/pages/recommendations/

Assessment (which in turn is informed by the CCC's independent evidence base as noted above).

5.2 - Energy markets and network regulation

Electricity market arrangements

The UK Government's Review of Electricity Market Arrangements (REMA) seeks views on a wide range of options to address the combined challenges of responding to higher global energy costs, the need to further boost energy security and move the UK to a cleaner energy system. The Scottish Government responded to the first phase consultation on 10 October 2022.

Changes being consulted on include:

- de-coupling costly global fossil fuel prices from electricity produced by cheaper renewables, a step to help ensure consumers are seeing cheaper prices as a result of lower-cost clean energy sources.
- introducing incentives for consumers to draw energy from the grid at cheaper rates when demand is low or it's particularly sunny and windy, saving households money with cheaper rates.
- reforming the capacity market so that it increases the participation of low carbon flexibility technologies, such as electricity storage, that enable a cleaner, lower cost system.

Benefits to our communities and regions

We continue to call on the UK Government to reform the GB wholesale market to enable consumers, communities and businesses in Scotland to share the benefits of low-cost renewable power. The UK Government must design and implement recently announced changes to the wholesale market for renewable and nuclear generators in a way that maximises the benefit to consumers and does not disadvantage generators who are not making excessive profits.

Longer-term, the Scottish Government is urging the UK Government to reform the market to permanently break the link between the price of electricity and the cost of gas. Scotland is part of the GB system and GB gets around 35% of its electricity demand from gas-fired power stations. The cost of gas therefore has a strong impact on the cost of electricity in the GB market. Gas generation is approximately 9 times more expensive than renewables. Even if we assume the highest cost estimates for grid integration of intermittent renewables (£30/MWh), gas generation is still almost 6 times more expensive than renewables.

Energy networks

Significant infrastructure investment in Scotland's transmission system is needed to ameliorate constraints and enable more renewable power to flow to centres of demand. National Grid ESO has identified the requirement for over £21 billion of investment in GB electricity transmission infrastructure to meet 2030 targets. Over half of this investment will involve Scottish Transmission owners SPEN and SSEN. The most recent Network Options Assessment from the ESO also includes two major subsea links to England from Peterhead.

The Scottish Government is working closely with network companies to support timely delivery of this infrastructure. Our Major Electricity [Networks] Project Group brings together representatives from industry and across Government to monitor progress, identify barriers and mitigations.

Our Energy Networks Vision to 2030[117], published in 2019, describes our vision for Scotland's networks: placing Scotland's consumers, economy and society at the heart of our energy system as we transition to net zero.

In the years that have followed, significant progress has been made:

- Both transmission and distribution businesses have published ambitious business plans to reflect the scale and pace of delivery required to meet Scottish Government ambitions.
- National Grid ESO has progressed a coordinated approach to network design, supporting delivery of Scotland's offshore wind ambitions.
- Project PACE and the Electricity A9, developed through the Scottish Government's EV Strategic Partnership have clearly demonstrated the value of collaboration between DNO's and Local Authorities, ensuring that the network acts as an enabler for net zero change.
- Our gas networks are continuing to explore and expand on the opportunities that will come through the hydrogen economy by testing and demonstrating blended and 100% hydrogen distribution through the gas network infrastructure.

There is the potential to repurpose and redesign some parts of Scotland's gas networks in order to carry low carbon gases, including biomethane and hydrogen. There is also the potential to repurpose some parts of the gas network to transport CO_2 associated with Carbon Capture and Storage.

[117] https://www.gov.scot/publications/vision-scotlands-electricity-gas-networks-2030/

While policy and regulation in respect of energy networks is reserved to the UK Government, the Scottish Government has an important role to play. We are engaging with Ofgem and the network operators to provide clear and transparent information on the impact of SG policies and targets on network infrastructure.

We are also influencing policy and regulatory reform at a UK level to ensure that it supports the delivery of Scottish Government policies and targets – for example working with BEIS, Ofgem and National Grid ESO through the Offshore Transmission Network Review (OTNR). Relevant areas of devolved policy and decision making are regularly reviewed to ensure they continue to support timely delivery of network infrastructure.

Maximising benefits to our economy, businesses and workers

New subsea connections will strengthen our ability to export renewable power while new 'first of a kind' coordinated connections will minimise the overall cost of offshore connections sharing infrastructure between offshore developers, Offshore Electricity Transmission (OFTOs) and onshore transmission owners. For example, Ofgem has approved the need for a 1.8 GW transmission link from the Western Isles to the mainland National Grid. This will not only enable onshore wind projects on the Western Isles to export to the grid, but also offshore ScotWind projects, and will provide a more cost effective solution than individual radial connections.[118]

Constraint costs

When the electricity transmission system is unable to transmit power being generated to the location of demand, due to congestion at one or more parts of the transmission network, constraint management is needed.

As deployment of renewable generation has increased, the volume of generation managed under the current 'connect and manage' regime has grown. This has meant that the cost of constraint management is now expected to reach close to £2 bn/year by late 2020s[119]. Constraint payments are paid by users of the network, including consumers.

The Scottish Government is clear that this expected increase in cost means that the threshold for significant new infrastructure is met and the UK Government must enable investment to be taken forward at the earliest opportunity to relieve constraints. We continue to work with National Grid

[118] Ofgem approval
[119] download (nationalgrideso.com)

ESO, transmission owners and Ofgem to explore opportunities to accelerate planned network investment.

We will also continue to work with National Grid ESO to explore opportunities to use the value of constraints as a means of incentivising demand – such as heat and hydrogen.

The rising cost of constraints has also been cited as a strong indicator for reform of the GB wholesale market under the UK Government's Review of Electricity Market Arrangements. The Scottish Government is engaging with the UK Government to ensure that any future arrangements support continued deployment of renewable generation and adequate protection to consumers.

Grid charging methodologies

Just Transition Commission recommendation

The current transmission charging scheme militates against investment in Scottish solutions and inflates costs for Scottish communities. It needs urgent reform. The Scottish Government should bring the full weight of its influence to bear on this matter, which remains reserved to Westminster.

The Scottish Government has long called for the GB regulator to reform the charging arrangements used to recover the cost of our transmission grid infrastructure.

With more forms of zero carbon generation and demand seeking to make use of a net zero electricity system, it is increasingly important that these arrangements are reformed in the right way, where those who drive costs on the system are paying their share.

Despite our extensive renewable capability, renewable generation in Scotland is subject to higher transmission charges. In a net zero world it is counterproductive to care more about where generation is situated than what type of generation it is, and a new, sustainable long-term approach is needed to support an energy transition that is just and fair for everyone.

We must also consider the potential for charging arrangements to lead to unintended consequences in other parts of the energy system. For example, high transmission costs and volatile pricing forecasts placed on generators in Scotland can increase investor risk and drive-up Contract for Difference (CfD) prices for generators across Great Britain.

Further, the UK Government must take a carefully considered approach to determining how locational signals are used, and take full account of the risks of placing those costs on customers as a barrier to net zero investment.

The Scottish Government will continue to press for similar reforms to the transmission charging arrangements through Ofgem's transmission charging task force. Scotland's Energy Task Force identified transmission charges as one of the key barriers to net zero as part of the Joint Business Plan for Unlocking Investment in Scotland's Energy Sector.[5]

In today's market, TNUoS (Transmission Network Use of System charging) is the only form of locational signal applied to generation. However, for many forms of generation like wind and solar it is not the main factor to inform siting decisions.

Ofgem has acknowledged the potential for network charges to act as an unnecessary barrier to net zero. In its Access SCR decision, Ofgem removed the contribution to reinforcement for demand connections. This recognised that impact on network costs will be outweighed by the broader benefits of supporting the transition to net zero[120]

This is a welcome intervention that will ensure customers looking to adopt heat pumps or EVs are paying for the network on a level playing field. We would urge similar pragmatism to be applied to assessment of transmission charges.

[120] Access and Forward-Looking Charges Significant Code Review: Decision and Direction | Ofgem

Chapter 6: Route maps to 2045

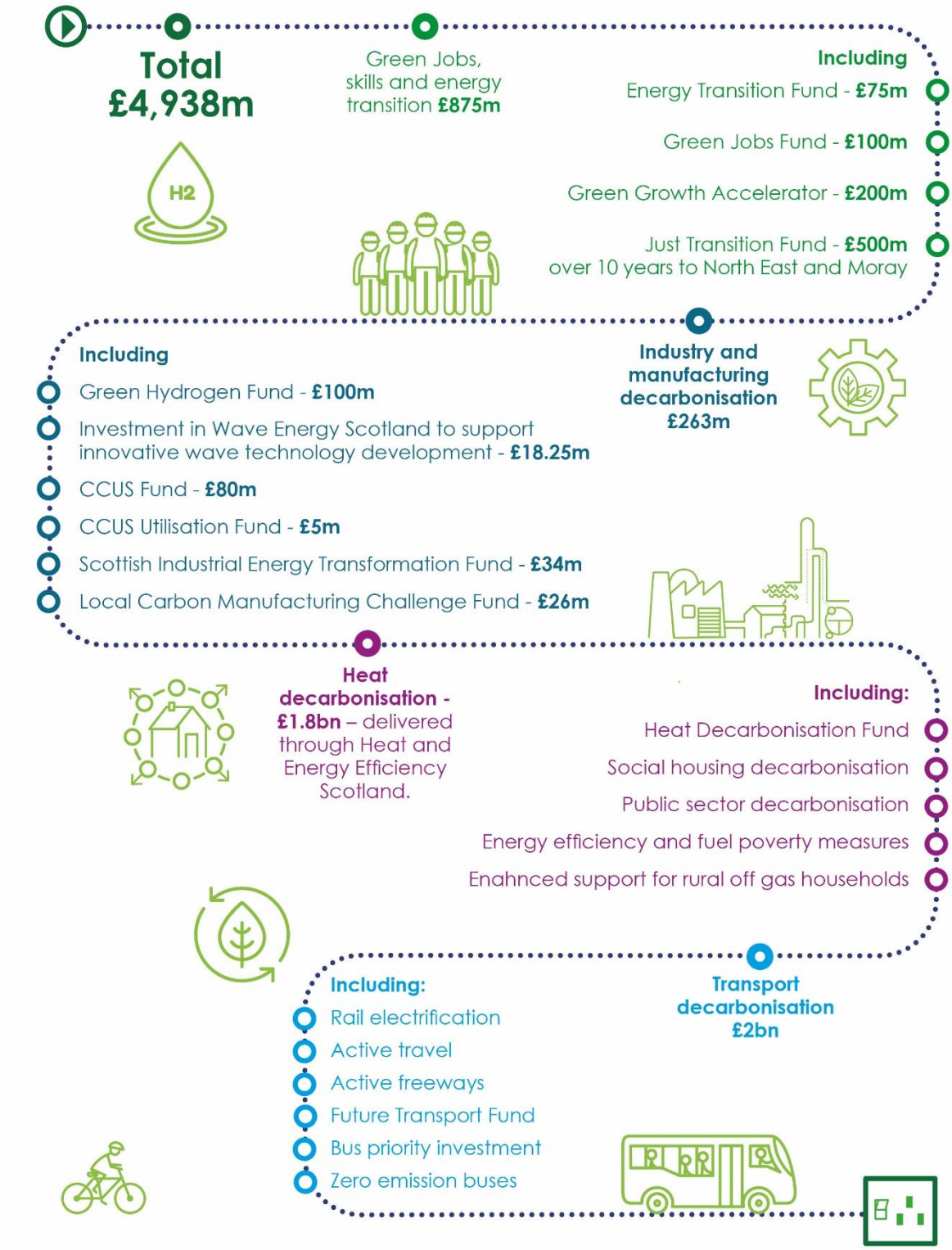
The following section details our route map to 2045, focusing on the actions needed over this decisive decade out to 2030. This section sets out:

6.1 - Our investment plan over this parliament
6.2 - Route map for policy and legislation
6.3 - Energy supplies route map
6.4 - Energy demand route map

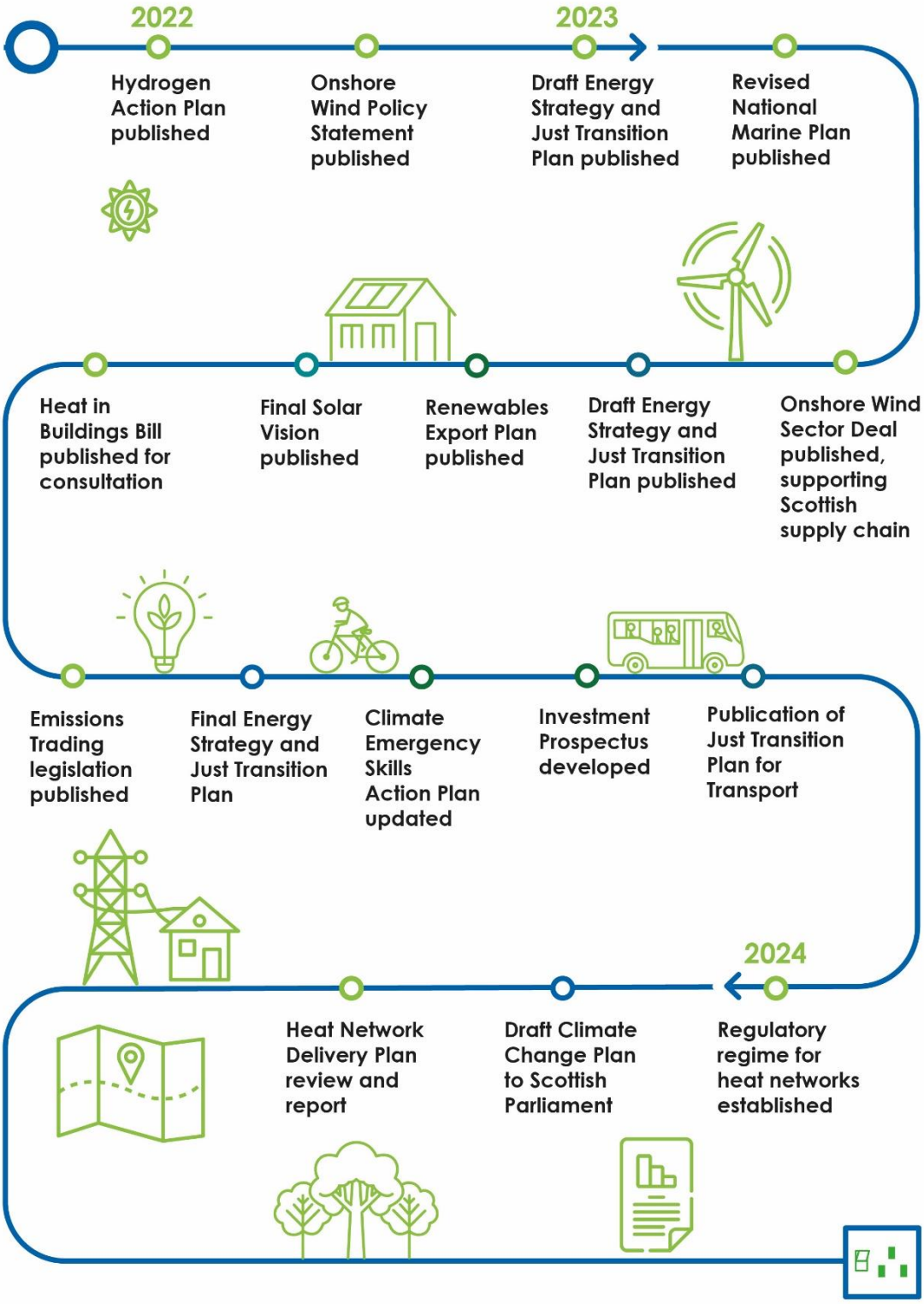
Just Transition Commission recommendation

An energy route map to net zero, with an associated Investment Plan, should be embedded within the Energy Strategy and Just Transition Plan to enable workforce planning, supply chain investment and diversification, infrastructure planning and planning at the regional level.

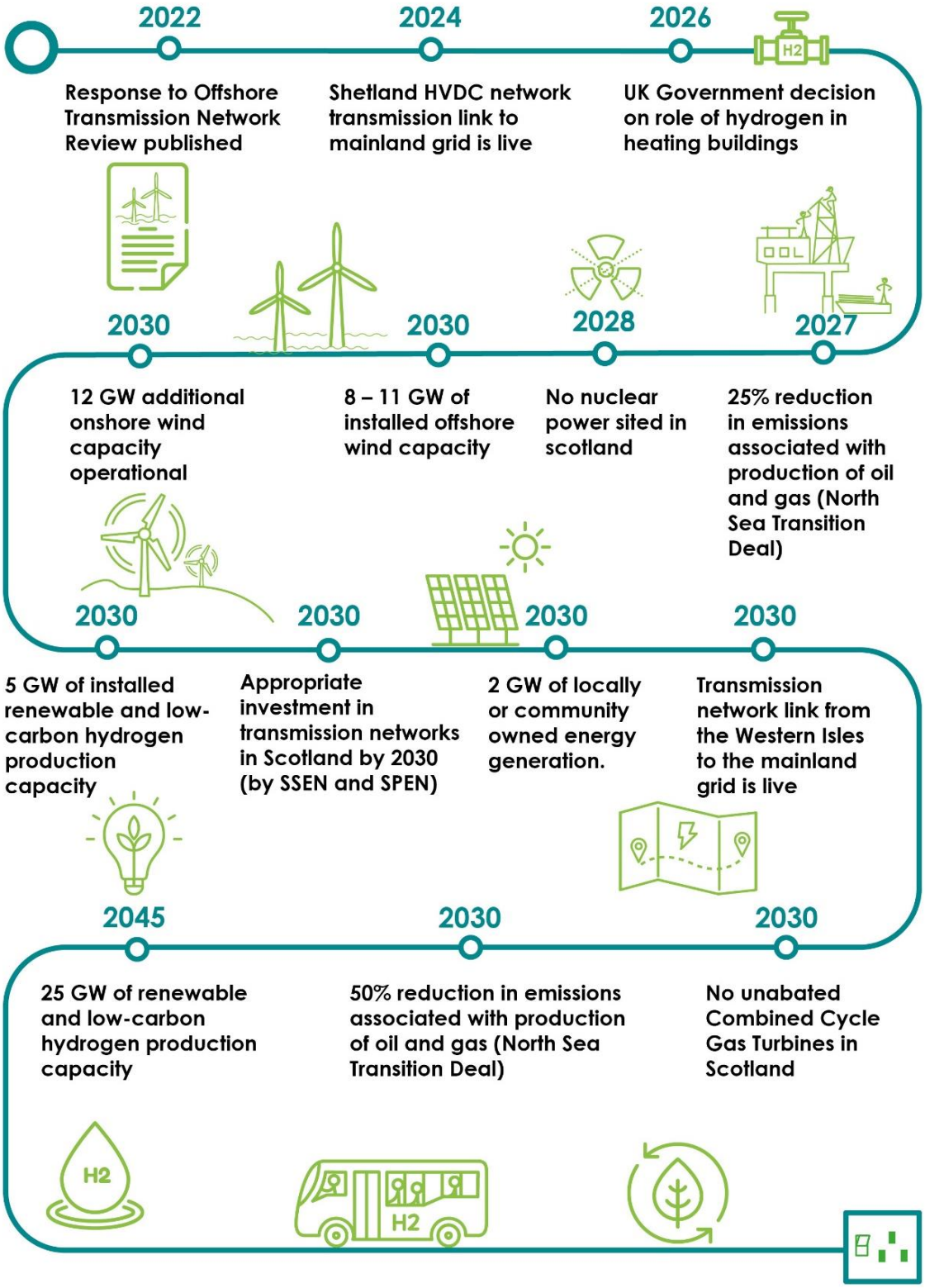
6.1 – Scottish Government investment over this parliament – we are investing almost £5 billion in the sector's net zero energy transformation



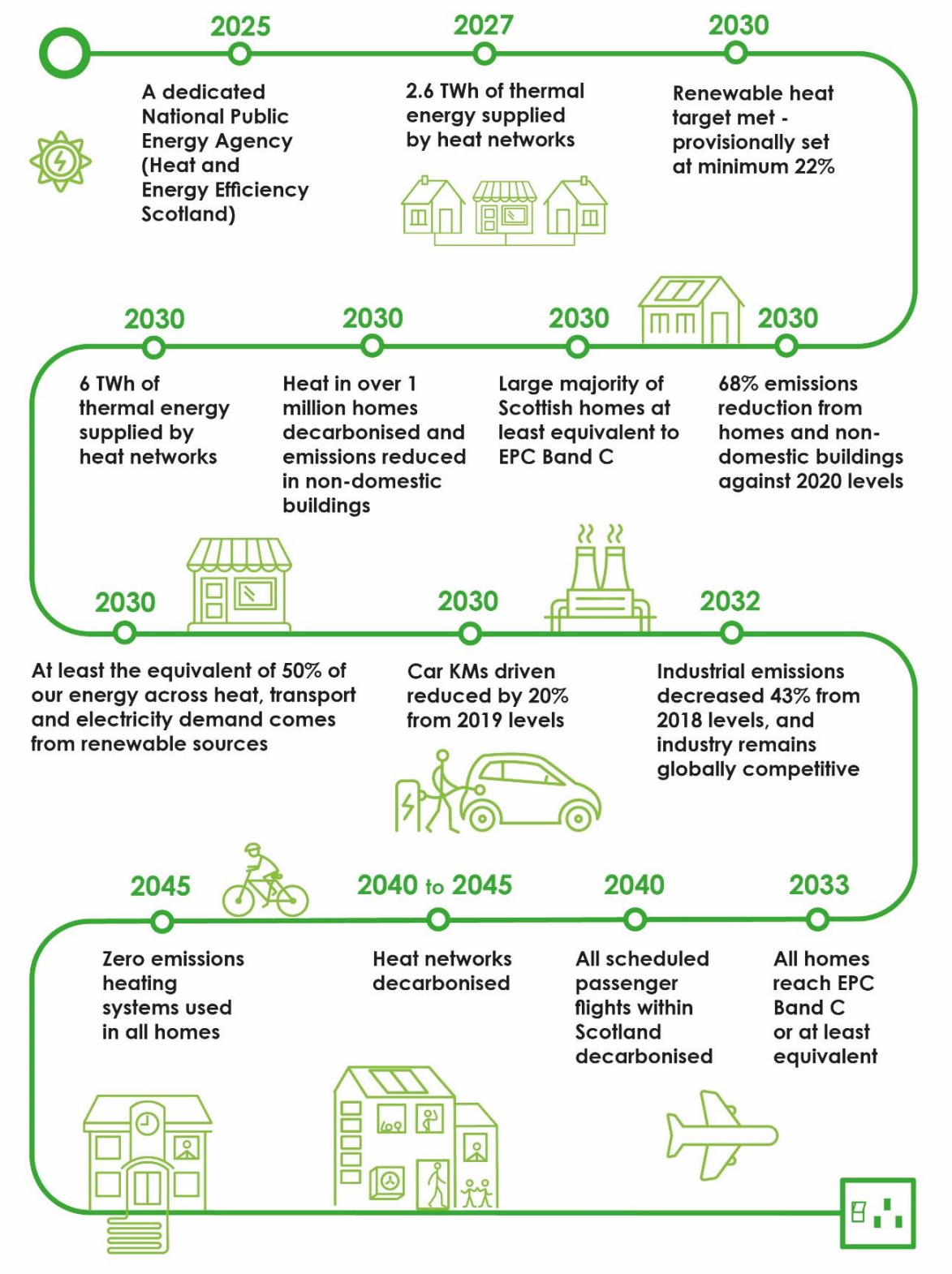
6.2 Policy and legislation over this parliament to enable a net zero energy system



6.3 Route map to 2045 – Energy supplies



6.4 Route map to 2045 – Energy Demand



Chapter 7: Action the UK Government must take

Many areas of energy policy are reserved to the UK Government. This means that we need to work with the UK Government to deliver the ambition outlined in this Strategy. The key areas where the UK Government needs to take action to support delivery of this strategy are listed below.

UK Government action to support delivery of the ESJTP	
Preparing for a Just Energy Transition	
Affordable energy	• We continue to call on the UK Government to take stronger and more targeted action to support households and businesses: o A windfall tax should apply fairly to all companies benefiting from significantly higher profits. o We have highlighted repeatedly the need for extra support for vulnerable energy consumers who are already struggling to pay their bills and heat their homes. o More needs to be done to support households across Scotland who rely on alternative fuels to heat their homes. • The UK Government should also accelerate the recently announced review of support for domestic and non-domestic consumers after March 2023 – it is essential that those households and businesses which are not classified as fuel poor or vulnerable, but for whom soaring costs remain a huge concern, continue to receive some support.
Community energy	• We call on the UK Government to consider mechanisms for maximising community benefit from renewable energy developments and offers of shared ownership. These could potentially include powers to make such benefits (and offers of shared ownership) mandatory, subject to full consultation. • We welcome UK Government proposals to consider how local communities can benefit from electricity infrastructure. We will work closely with the UK Government to ensure this policy reflects the diverse needs of industry and community stakeholders across Scotland.
International Opportunities: Trade and Inward Investment	• We urge the UK Government to create a frictionless trading environment for renewable energy, goods and services by using trade agreements and policies to address tariff and non-tariff barriers to trade.

	• The UK Government must take the action necessary at a UK-level to facilitate the smooth international trade of hydrogen, in line with Scottish export ambitions. • We continue to push the UK Government and European Union, through the Specialised Energy Committee, to deliver more efficient electricity trading. • The UK Government must enable international trade of CO_2 with bilateral agreements under the London Protocol. They should collaborate with the Scottish Government to ensure such agreements align with project-to-project agreements with the Scottish cluster. • The UK Government must ensure that barriers within the European Union and UK ETS and the European Union CCS Directive and reciprocal UK legislation are addressed to enable international trade of CO_2 for storage in Scotland.
Energy Supplies	
Oil and gas-North Sea extraction and exploration	• We call on the UK Government to assess all new exploration and approved offshore oil and gas licenses where drilling has not yet commenced against our climate commitments. The climate compatibility checkpoint tests announced by the UK Government must be strengthened if they are to act as a credible test. • We urge the UK Government to provide more support directly to the decommissioning sector to ensure as much of this growing area of work as possible is carried out in Scotland, creating and protecting jobs and economic opportunities.
Wind – offshore	• The scale and potential of Scottish offshore wind projects is such that they are set to make a major contribution to Scotland and the UK reaching net zero. Scottish Ministers firmly believe it is to the benefit of both the Scottish and UK Governments to establish a streamlined and coherent licensing and consenting system that allows projects to be approved at pace in Scottish waters and have asked the UK Government to ensure this can be delivered. • Scottish Ministers are concerned that the UK Government's proposed approach for reforming existing environmental assessment and habitats regulations assessment (HRA) processes should not add complexity and a lack of clarity for industry, potentially slowing down planning and consenting in Scotland. To ensure these reforms are effective we continue to call upon the UK Government to respect Scottish Ministers' devolved and executively devolved roles and responsibilities in consenting as a minimum, and we believe that a fit for purpose licensing and consenting regime for offshore wind is most simply achieved through full legislative devolution.

Marine Energy	• The ringfencing of support for tidal stream in Contracts for Difference Allocation Round 4 represents an overdue but welcome step in the journey towards the commercialisation of tidal stream energy. To fully unlock its potential, the sector needs certainty about the support that will be available in future allocation rounds.
Hydrogen	• We urge the UK Government to expedite progress on amending regulations and legislation to support hydrogen blending, accelerate decisions on the role of 100% hydrogen in the gas grid and to enable our ambition to maximise volumes of renewable hydrogen in our energy system as quickly as possible. • We urge the UK Government to include the supporting infrastructure development for the offshore transportation of green hydrogen from Scotland's ports and harbours in energy infrastructure considerations.
Energy Demand	
Heat in Buildings	• We call on the UK Government to: 1. implement its proposed new market mechanisms to drive investment in, and uptake, of zero emission heat systems 2. accelerate decisions on the role of hydrogen and provide clarity on the future of the gas network 3. rebalance energy bills in a way that supports the transition away from fossil fuels and delivers a fairer outcome for consumers 4. review energy prices to reduce the difference in unit costs between gas and electricity, helping support the transition away from fossil fuels.
Transport	• We continue to press the UK Government to reform motoring taxes to remove barriers to decarbonisation of road transport.
Carbon Capture and Storage	• We continue to call on the UK Government to reverse its CCUS cluster sequencing decision and to accelerate the Scottish Cluster to full Track-1 status without delay. • We also press the UK Government to provide **urgent clarity** on the timelines and processes of the next stages (Track-2) of the cluster sequencing process. • We are working constructively with the UK Government on the development of CCUS in the UK and will continue to input into the Track-2 sequencing process to ensure it does not unfairly disadvantage Scotland and takes into account Scottish statutory emissions reduction targets. • We urge the UK Government to seek the development of a common international standard on CO_2 storage that focuses on storing emissions from essential industries. • We also support calls (including by the UK CCUS trade association, the Carbon Capture and Storage Association) on the UK Government to make progress on a number of key areas, including passing legislative proposals in the Energy Bill as soon as possible, providing

	clarity on the future of, and support for, non-pipeline transport and the future process for more dispersed emitters and taking forward necessary actions (particularly on the EU ETS and the London Protocol) to enable cross-border CO_2 storage.
Industrial decarbonisation	• We ask the UK Government to work with us to incentivise consumers, or other buyers, to choose low carbon products; and ensure these choices influence the long-term investment decisions on energy consumed during production by manufacturing industries. • We will work with the UK Government to plan and secure the delivery of the substantial infrastructure, as well as new energy generation and conversion assets, that need to be developed before industrial fuel switching (to green hydrogen and/or to electrification) and CCUS can be deployed on a large scale.
Creating the conditions for a net zero energy system	
Wholesale Market	• We continue to call for reform of the GB wholesale market to enable consumers, communities and businesses in Scotland to share the benefits of low cost renewable power. • The UK Government must design and implement recently announced changes to the wholesale market for renewable and nuclear generators in a way that maximises the benefit to consumers and does not disadvantage generators who are not making excessive profits. Longer-term, the GB wholesale market must be reformed to break the link between electricity prices and the cost of gas.
System restoration	• Although National Grid Energy System Operator (ESO) have existing markets for black start services, the technical requirements are based on the thermal power plants. We continue to press the UK Government to update these requirements, taking into account lessons learned from the Dersalloch trial.
Energy system flexibility	• We call on the UK Government to support the development of pumped hydro storage through a market mechanism for pumped storage.
	• We urge the UK Government to make ancillary markets more accessible for Battery Energy Storage Systems (BESS) and other low carbon technologies ahead of fossil fuel powered alternatives.
Electricity Networks	• We urge Ofgem to ensure its ongoing review of charging arrangements delivers a fairer solution that considers the type of generation we connect to the system as much as where that generation is situated. We will also continue to work with the UK Government to ensure that costs are fairly distributed. • We urge the UK Government and Ofgem to ensure that investment in our grid infrastructure happens at the pace and scale required to deliver a just energy

	transition in line with statutory climate targets, including those set by the Scottish Parliament. • We urge the UK Government to take steps to facilitate necessary reforms to Scotland's onshore grid consenting regime.

-END-

Annex A - Responding to this consultation

We are inviting responses to this consultation by 5pm on Tuesday 4 April 2023.

Please respond to this consultation using the Scottish Government's consultation platform, Citizen Space. You can view and respond to this consultation online.

You can save and return to your responses while the consultation is still open. Please ensure that consultation responses are submitted before the closing date of 4 April 2023.

If you are unable to respond online, return your response, including the Respondent Information Form (see 'Handling your Response' below) to:

Onshore Electricity, Strategic Coordination and Energy Consents Division
Scottish Government
5 Atlantic Quay
Glasgow
G2 8LU

It would be helpful to have your response by email or using the electronic response form. The electronic response form can be accessed at the following website address: https://consult.gov.scot/energy-and-climate-change-directorate/energy-strategy-and-just-transition-plan/

You can also email your response to energystrategy@gov.scot

Handling your response
If you respond using Citizen Space you will be directed to the Respondent Information Form. Please indicate how you wish your response to be handled and, in particular, whether you are happy for your response to published.

If you are unable to respond via Citizen Space, please complete and return the Respondent Information Form included in this document. If you ask for your response not to be published, we will regard it as confidential, and we will treat it accordingly.

All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under the Act for information relating to responses made to this consultation exercise.

Next steps in the process
Where respondents have given permission for their response to be made public, and after we have checked that they contain no potentially defamatory material, responses will be made available to the public on the Citizen Space website.

If you use Citizen Space to respond, you will receive a copy of your response via email. Following the closing date, all responses will be analysed and considered along with any other available evidence to help us. Responses will be published where we have been given permission to do so.

Comments and complaints
If you have any comments about how this consultation exercise has been conducted, please send them to: energystrategy@gov.scot

Scottish Government consultation process
Consultation is an essential part of the policy-making process. It gives us the opportunity to consider your opinion and expertise on a proposed area of work.

You can find all our consultations online: http://consult.scotland.gov.uk

Each consultation details the issues under consideration, as well as a way for you to give us your views, either online, by email or by post.

Responses will be analysed and used as part of the decision-making process, along with a range of other available information and evidence. We will publish a report of this analysis for every consultation. Depending on the nature of the consultation exercise the responses received may:

- indicate the need for policy development or review;
- inform the development of a particular policy;
- help decisions to be made between alternative policy proposals; and
- be used to finalise legislation before it is implemented.

While details of particular circumstances described in a response to a consultation exercise may usefully inform the policy process, consultation exercises cannot address individual concerns and comments, which should be directed to the relevant public body.

Next steps
The Scottish Government will review responses to the consultation and the issues raised during engagement with stakeholders to inform development of the final version of the Energy Strategy and Just Transition Plan.

Annex B - Consultation questions

Chapter 1 – Introduction and Vision

1. What are your views on the vision set out for 2030 and 2045? Are there any changes you think should be made?

Chapter 2 – Preparing for a Just Energy Transition

2. What more can be done to deliver benefits from the transition to net zero for households and businesses across Scotland?
3. How can we ensure our approach to supporting community energy is inclusive and that the benefits flow to communities across Scotland?
4. What barriers, if any, do you/your organisation experience in accessing finance to deliver net zero compatible investments?
5. What barriers, if any, can you foresee that would prevent you/your business/organisation from making the changes set out in this Strategy?
6. Where do you see the greatest market and supply chain opportunities from the energy transition, both domestically and on an international scale, and how can the Scottish Government best support these?
7. What more can be done to support the development of sustainable, high quality and local jobs opportunities across the breadth of Scotland as part of the energy transition?
8. What further advice or support is required to help individuals of all ages and, in particular, individuals who are currently under-represented in the industry enter into or progress in green energy jobs?

Chapter 3 – Energy supply

Scaling up renewable energy

9. Should the Scottish Government set an increased ambition for offshore wind deployment in Scotland by 2030? If so, what level should the ambition be set at? Please explain your views.
10. Should the Scottish Government set an ambition for offshore wind deployment in Scotland by 2045? If so, what level should the ambition be set at? Please explain your views.
11. Should the Scottish Government set an ambition for marine energy and, if so, what would be an appropriate ambition? Please explain your views.
12. What should be the priority actions for the Scottish Government and its agencies to build on the achievements to date of Scotland's wave and tidal energy sector?
13. Do you agree the Scottish Government should set an ambition for solar deployment in Scotland? If so, what form should the ambition take, and what level should it be set at? Please explain your views.

14. In line with the growth ambitions set out in this Strategy, how can all the renewable energy sectors above maximise the economic and social benefits flowing to local communities?
15. Our ambition for at least 5 GW of hydrogen production by 2030 and 25 GW by 2045 in Scotland demonstrates the potential for this market. Given the rapid evolution of this sector, what steps should be taken to maximise delivery of this ambition?
16. What further government action is needed to drive the pace of renewable hydrogen development in Scotland?
17. Do you think there are any actions required from Scottish Government to support or steer the appropriate development of bioenergy?
18. What are the key areas for consideration that the Scottish Government should take into account in the development of a Bioenergy Action Plan?
19. How can we identify and sustainably secure the materials required to build the necessary infrastructure to deliver the energy strategy?

North Sea Oil and Gas

20. Should a rigorous Climate Compatibility Checkpoint (CCC) test be used as part of the process to determine whether or not to allow new oil and gas production?
21. If you do think a CCC test should be applied to new production, should that test be applied both to exploration and to fields already consented but not yet in production, as proposed in the strategy?
22. If you do not think a CCC test should be applied to new production, is this because your view is that:
    - Further production should be allowed without any restrictions from a CCC test;
    - No further production should be allowed [please set out why];
    - Other reasons [please provide views].
23. If there is to be a rigorous CCC test, what criteria would you use within such a test? In particular [but please also write in any further proposed criteria or wider considerations]
    - In the context of understanding the impact of oil and gas production in the *Scottish North Sea* specifically on the *global* goals of the Paris Agreement, should a CCC test reflect –

      A)the emissions impact from the production side of oil and gas activity only;

      B) the emissions impact associated with both the production and consumption aspects of oil and gas activity (i.e. also cover the global emissions associated with the use of oil and gas, even if the fossil fuel is produced in the Scottish North Sea but exported so that use occurs in another country) – as proposed in the Strategy;

      C) some other position [please describe].
    - Should a CCC test take account of energy security of the rest of the UK or European partners as well as Scotland? If so, what factors

would you include in the assessment, for example should this include the cost of alternative energy supplies?
- Should a CCC test assess the proposed project's innovation and decarbonisation plans to encourage a reduction in emissions from the extraction and production of oil and gas?
- In carrying out a CCC test , should oil be assessed separately to gas?

24. As part of decisions on any new production, do you think that an assessment should be made on whether a project demonstrates clear economic and social benefit to Scotland? If so, how should economic and social benefit be determined?
25. Should there be a presumption against new exploration for oil and gas?
26. If you do think there should be a presumption against new exploration, are there any exceptional circumstances under which you consider that exploration could be permitted?

Chapter 4 Energy demand

Heat in Buildings

27. What further government action is needed to drive energy efficiency and zero emissions heat deployment across Scotland?

Energy for transport

28. What changes to the energy system, if any, will be required to decarbonise transport?
29. If further investment in the energy system is required to make the changes needed to support decarbonising the transport system in Scotland, how should this be paid for?
30. What can the Scottish Government do to increase the sustainable domestic production and use of low carbon fuels across all modes of transport?
31. What changes, if any, do you think should be made to the current regulations and processes to help make it easier for organisations to install charging Infrastructure and hydrogen/low carbon fuel refuelling infrastructure?
32. What action can the Scottish Government take to ensure that the transition to a net zero transport system supports those least able to pay?
33. What role, if any, is there for communities and community energy in contributing to the delivery of the transport transition to net zero and, what action can the Scottish Government take to support this activity?
34. Electric vehicle batteries typically still have around 80% of their capacity when they need replacing and can be used for other applications, for example they can be used as a clean alternative to diesel generators. What, if anything, could be done to increase the reuse of these batteries in the energy system?

Energy for agriculture

35. What are the key actions you would like to see the Scottish Government take in the next 5 years to support the agricultural sector to decarbonise energy use?

Energy for Industry

36. What are the key actions you would like to see the Scottish Government take in the next 5 years to support the development of CCUS in Scotland?
37. How can the Scottish Government and industry best work together to remove emissions from industry in Scotland?
38. What are the opportunities and challenges to CCUS deployment in Scotland?
39. Given Scotland's key CCUS resources, Scotland has the potential to work towards being at the centre of a European hub for the importation and storage of CO_2 from Europe. What are your views on this?

Chapter 5: Creating the conditions for a net zero energy system

40. What additional action could the Scottish Government or UK Government take to support security of supply in a net zero energy system?
41. What other actions should the Scottish Government (or others) undertake to ensure our energy system is resilient to the impacts of climate change?

Chapter 6: Route map to 2045

42. Are there any changes you would make to the approach set out in this route map?
43. What, if any, additional action could be taken to deliver the vision and ensure Scotland captures maximum social, economic and environmental benefits from the transition?

Impact assessment questions

44. Could any of the proposals set out in this strategy unfairly discriminate against any person in Scotland who shares a protected characteristic? These include: age, disability, sex, gender reassignment, pregnancy and maternity, race, sexual orientation, religion or belief.
45. Could any of the proposals set out in this strategy have an adverse impact on children's rights and wellbeing?
46. Is there any further action that we, or other organisations (please specify), can take to protect those on lower incomes or at risk of fuel poverty from any negative cost impact as a result of the net zero transition?
47. Is there further action we can take to ensure the strategy best supports the development of more opportunities for young people?

Just Transition energy outcomes

48. What are your views on the approach we have set out to monitor and evaluate the Strategy and Plan?
49. What are your views on the draft Just Transition outcomes for the Energy Strategy and Just Transition Plan?
50. Do you have any views on appropriate indicators and relevant data sources to measure progress towards, and success of, these outcomes?

Annex C - Engagement

The vision and actions set out in this draft ESJTP will impact everyone in Scotland, and for us to succeed in delivering on our net zero ambitions we need to ensure that these plans are shaped and driven by the people, communities and businesses that they impact most.

Our approach is guided by our Just Transition Planning Framework. The plan will continue to be developed through additional co-design with stakeholders and the public to ensure it is an iterative, ongoing process.

We are grateful to the following organisations who have been involved in engagement events to support development of the draft strategy and plan:

Scottish Youth Parliament
Committee on Climate Change
Enterprise agencies
Moray Chambers of Commerce
Aberdeen and Grampian Chambers of Commerce
Just Transition Commission
Trade unions
Universities
Port owners
Net Zero Technology Centre
Offshore wind developers
Oil and gas industry
Onshore wind developers
North Sea Transition Authority
Offshore Energy UK
Aerospace Technology Institute
Scottish Council for Development and Industry
Scottish Gas Networks
Ofgem
Prioritising Female Voices
Scottish Offshore Wind Energy Council
Crown Estate Scotland
Environmental Non-Governmental Organisations
Energy Task Force
Industry Liaison Group Co-Chairs
Strategic Liaison Group Co-chairs
Public bodies
Networks Strategic Liaison Group
Local authorities
Fishing associations
Community groups

Friends of the Earth Scotland
WWF

Over summer 2022, we engaged across 57 events, involving participants from the energy sector, environmental organisations, young people, equalities and community groups. This included:

- **Meetings with experts across the energy sector** to gain their input on complex and technical issues.
- Discussions with the **Scottish Energy Advisory Board**, related **Strategic Leadership Groups, eNGOs and public organisations**.
- **Information sharing activities** through in-person and virtual events, including surveys and the use of online platforms. These were aimed at the general public.
- **In-depth sessions on maximising opportunities and managing risks**. These were aimed at specific groups likely to be most impacted by the transition and at key stakeholders and stakeholder representatives.
- Two packages of engagement, delivered by external facilitators: (1) a series of "sprints" – consecutive, linked events, bringing together multiple stakeholders, cross-sectoral voices and system-wide, national issues; and (2) Place-based "participatory futures and community workshops". Further details on these can be found on our website.
- **A dedicated session on the future of energy and transport**, involving representatives from the transport, energy and finance sectors.

In total, there were over 20 in-person sessions across Scotland, stretching from Dumfries to Thurso. These were bolstered by online events and input from various digital platforms, including a workers survey. We engaged with around 1,500 people from a range of backgrounds, including workers, community groups, businesses, young people and civil society organisations.

How engagement has informed the draft ESJTP

The engagement on the draft ESJTP has enabled us to identify the priority issues for those most affected by the energy transition. The engagement events generated a large number of outline proposals and recommendations that the participants felt should be considered to help deliver the energy transition. All the proposals were collated and analysed, after which they were grouped in order to identify key themes and common issues.

These proposals were considered in the context of existing Scottish Government policy positions, devolved powers and their direct relevance to the scope of the Energy Strategy and Just Transition Plan.

The information gathered has enabled us to develop our vision for the just transition of our energy economy.

Key Themes

There were several key themes which emerged through the stakeholder engagement:

1 - The Role of Communities

Stakeholders emphasised that communities must be empowered by, and supported through, the energy transition. This includes exploring models of shared ownership, mandating a level of local content in every major energy project, delivering community-owned energy generation through local authorities and establishing a community benefit framework with clear criteria to make sure the right benefits reach the right communities.

2 - Affordability and Access to Cleaner Energy

Stakeholders highlighted the importance of ensuring that every household can get the energy they need at an equitable rate. It was also highlighted that support should be provided for those on lower incomes and those in, or at risk of, fuel poverty.

Stakeholders called for improved incentives to encourage the switch to cleaner energy and reduction of energy use for consumers and businesses alike. This includes investment in public transport, supporting costs of energy efficiency measures and enhancing the coordination of retrofit schemes.

3 - Supply Chains and Exports

Many voices called for the Scottish Government to help provide the correct market signals and to propose a timetable for when critical components of the energy system are needed. This would ensure that home industries can scale up and invest to deliver transformation of the energy system, as well as harness the opportunities to export products and expertise around the globe.

4 - Jobs and Skills

Stakeholders raised the need for a clear plan, direction of travel and timetable for when the correct skills and jobs are required to deliver the energy transition at both a local and national level. This requires sustained and sufficient alignment between professional bodies, industry and bespoke training providers to deliver the workforce of the future.

The majority of respondents to the survey of workers were not aware of the term "just transition", though most supported the Scottish Government's definition and approach, when it was explained. Respondents tended to express low confidence in a just transition for the sector.

The majority believed the transition would have a big impact on their jobs. Early analysis indicates that oil and gas workers tended to believe this impact would be negative, whilst those in renewables tended to believe it would be positive.

Most thought the transition could create new energy jobs and saw themselves transitioning to a green/low carbon job in the future (either immediately or over the long term). However, they identified a number of key barriers to moving to green/low carbon jobs. These included not wanting to leave the current job; not being able to find equivalent good pay and a lack of information around reskilling/retraining and job opportunities.

Stakeholders felt that our energy system transition needed to have a strong focus on future proofing and planning. A priority for many stakeholders was for the Scottish Government to work within the bounds of a UK-wide energy system to bring about the systematic change needed within the energy sector, including changes to unlock local supply, greater coordination between government and regulators and a more rigorous regime of obligations and penalties for non-compliance, as well as embedding decarbonisation and adaptation as core components of all development.

Next Steps

We will build on the engagement carried out so far, beginning with the consultation on the draft ESJTP. A cycle of engagement, policy design and testing and refinement will continue alongside progress of the finalisation of the Energy Strategy and Just Transition Plan, as well as on other just transition plans throughout 2023. We will continue to engage the Just Transition Commission to enable their advice and scrutiny of our Just Transition Plans.

A key reflection from the engagement and initial stages of co-design on the ESJTP is that an outline plan and indicative policies will support more detailed co-design for subsequent sector plans. That has informed the process underway for those plans. The next phase of co-design and consultation will allow us to build out the actions needed from industry, communities and individuals to set out a shared action plan. This draft Energy Strategy and Just Transition Plan will form the basis of the next phase of the consultation process, during which we will focus on the issues raised by stakeholders that this plan does not address.

Annex D - Research and analysis

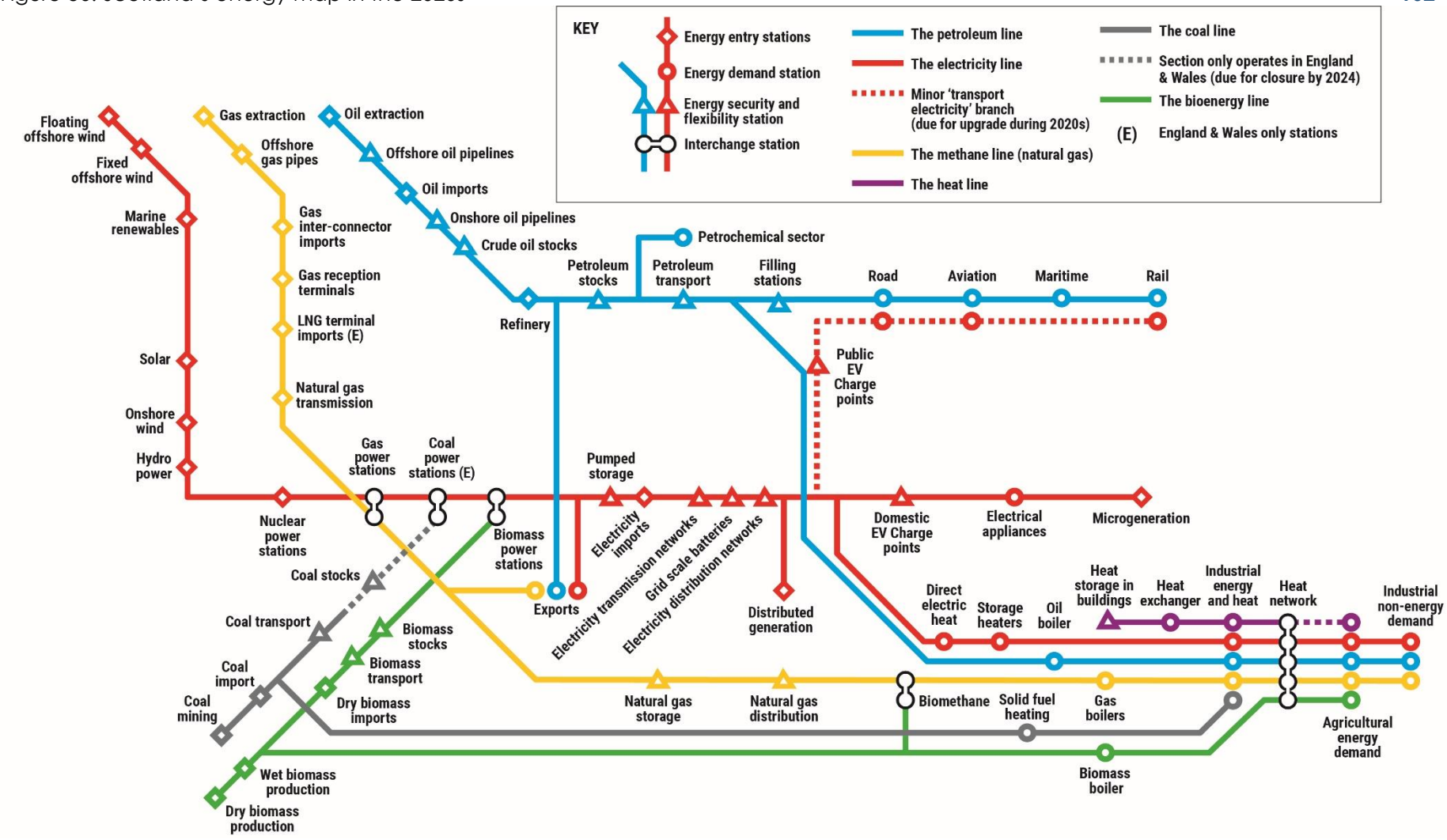
This draft strategy considers not only the components of the energy system – energy generation, transmission, and demand – but how they fit together and interact with one another. Decisions taken in one part of the energy system will influence other parts. There are trade-offs involved in many of the decisions we face about our future energy system. Critically, Scotland's energy system is an intrinsic part of, and connected in complex ways, to the wider economy, society and environment within Scotland, as well as being interdependent with wider GB, UK, EU and global systems. We are therefore taking a whole system approach.

A whole systems approach can help to identify key systemic barriers and means to overcome them. For example, ensuring our supply chain is ready to deliver the economic and social opportunities of the transition. It can also help improve decision making across government to deliver truly joined up policy that meets multiple objectives, mitigating unintended consequences from isolated decision making and ensuring that we achieve efficiencies through analysing synergies, common goals and system optimisation.

To help understand the complexity and interlinkages of Scotland's energy system we have produced a series of visual 'maps'. The examples below shows how energy supply, physical networks, and society's demand relate and interact with each other, and how a future energy system is likely to have more vectors and more interdependencies. See figures 36 and 37 overleaf.

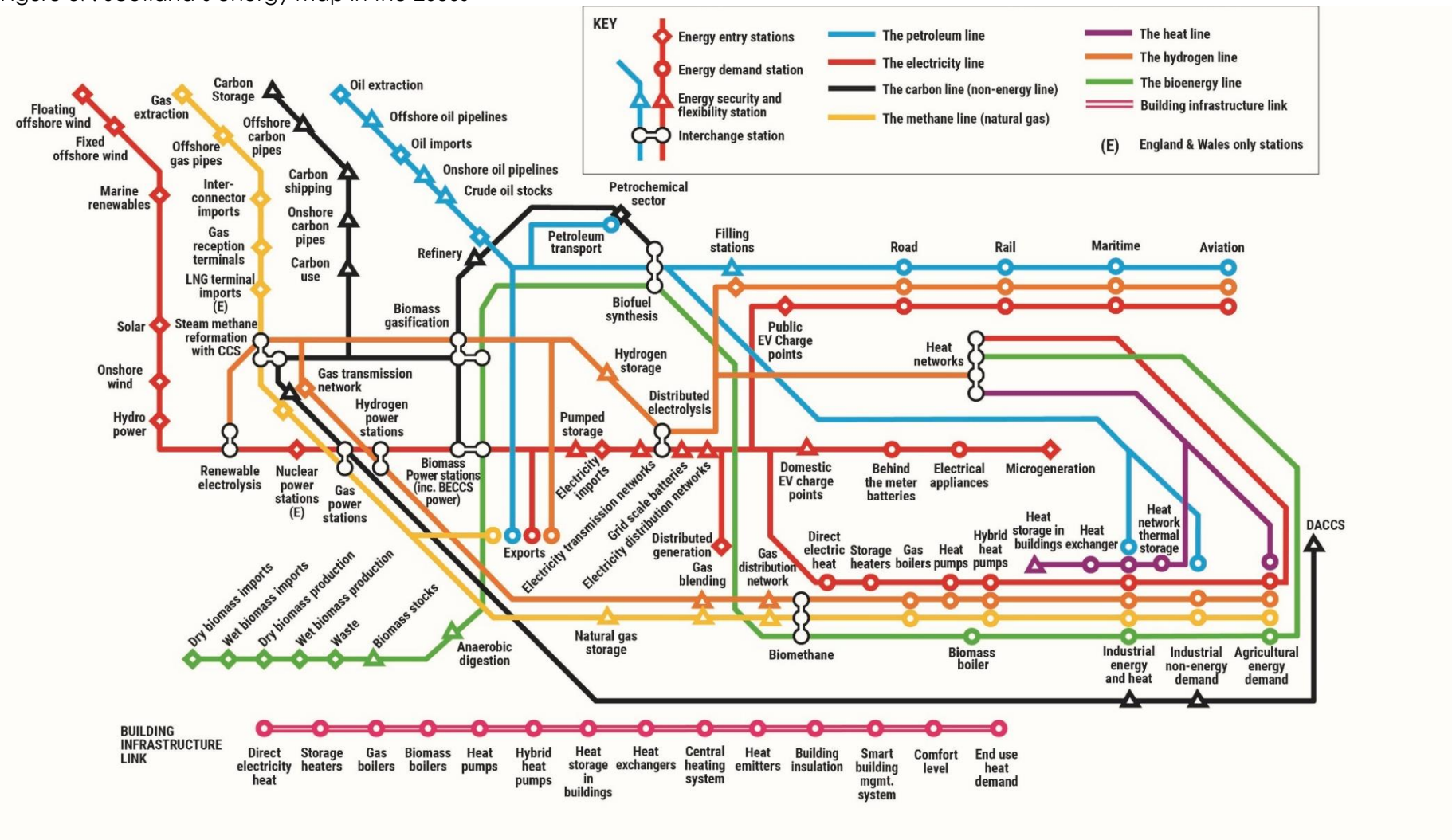
The draft Strategy and Plan is informed by a suite of whole systems analysis and evidence. Although all of the studies cited contribute analytical evidence to the ESJTP and the core messages, they need in most cases to be viewed as discrete pieces of work. Results will not necessarily be directly comparable between the different studies since they may have been derived using different methods and different sets of assumptions. Data sourced in this draft Strategy and Just Transition Plan is correct as of 21st December 2022.

Figure 36: Scotland's energy map in the 2020s



Source: Scottish Government

Figure 37: Scotland's energy map in the 2030s



Source: Scottish Government

Key sources of information and evidence include:

Research	Link/Description
Energy Systems Catapult – Scottish Whole Energy System Scenarios – and Context Document.	The three scenarios met Scotland's annual, interim (2030) and net zero (2045) greenhouse gas (GHG) targets over the modelled period 2020-2050, through different combinations of technology innovation and societal change https://www.climatexchange.org.uk/media/5419/cxc-scottish-whole-energy-system-scenarios-may-2022.pdf https://www.gov.scot/publications/scottish-whole-energy-system-scenarios-context-document/
Oil and Gas Transition Analysis	As outlined in the Bute House Agreement. This is an extensive analysis of the oil and gas sector to inform future Scottish Government policy, including in areas where we lack devolved competence at present. The ESJTP draws on the programme of work and analysis that we are undertaking to better understand our energy requirements as we transition to net zero.
Scottish Hydrogen Assessment Report	Scottish hydrogen: assessment report - gov.scot (www.gov.scot)
Scottish Hydrogen Action Plan (2022)	Hydrogen action plan - gov.scot (www.gov.scot)
Zero Emissions Energy for Transport	Zero Emission Energy for Transport Forecasts: National | Transport Scotland
Marine Scotland study	Frontiers | A Review of National Monitoring Requirements to Support Offshore Carbon Capture and Storage (frontiersin.org)
Scottish Scientific Advisory Council Report on Opportunities and challenges associated with hydrogen's role in the future energy system	An assessment of public and key stakeholder views of the hydrogen sector in Scotland, and perception of the challenges, risks and opportunities which exist within the sector. SSAC Hydrogen Technical Briefing Note.pdf (scottishscience.org.uk)
REGEN – Community Energy State of the Sector	Community Energy State of the Sector Reports 2021 - Regen

We are also undertaking further research that can help inform the final Strategy and Plan.

Further Research to be Undertaken / Underway
Preparing Scotland for a Just Energy Transition
Monitoring and evaluation of a just transition
Carbon Neutral Islands 2040 Sector Readiness and Skills Assessment
Understanding the environmental, social and economic benefits of sustainable travel to local highstreets and town centres: A literature and policy review
Leveraging community and local energy for a just transition: opportunities for Scotland
Understanding the potential impacts of a shift towards climate friendly diets in Scotland: An evidence review
Maximising Economic Benefits of Surplus Low Carbon Energy and Infrastructure in Scotland
Scottish Futures Trust – Investment opportunities and challenges for the Future energy system in Scotland - An independent report in to the opportunities, challenges and synergies for financing the various components of the whole energy system required to make a net zero transition
Energy supplies
Scottish anaerobic digestion market based on agricultural waste
Mapping the current and forecasted hydrogen skills landscape
The whole system interactions and impacts of high volume deployment of domestic and commercial solar PV on the electricity distribution system
Cost reduction pathways of renewable hydrogen production in Scotland – total costs and international comparisons
The Whole System implications and economics of Hydrogen locations and production methods
Energy demand
Low carbon transport fuels - evidence assessment
Zero emissions heating in new buildings across Scottish Islands
Decarbonisation of agricultural machinery in Scotland
Increasing low-carbon energy production and use in Scottish agriculture through a whole systems approach
Encouraging sustainable travel behaviour in children young people and their families: A literature and policy review
The future second hand bus market in Scotland: Impact of the move to battery electric buses by major operators
Scoping the development of whole building assessment for energy efficiency and zero direct emissions heat in multi-owner and mixed use buildings
Communicating effectively on the heat transition
Maximum flow temperatures in domestic heating

The experiences of early adopters of zero direct emissions heating system and energy efficiency retrofit in Scotland: domestic owner-occupiers
Methodology for apportioning measured emissions in non-domestic buildings
The environmental, social and economic benefits of sustainable travel to local highstreets and town centres: A literature and policy review
Multi-Modal Hydrogen Refuelling Infrastructure in Scotland
Heat in Buildings Public Engagement: exploring attitudes, barriers and capacity of different groups to adopt zero emissions heating systems and energy efficiency measures, in line with proposed regulations
Creating the conditions for a net zero energy system
TIMES model industry sector update
Electricity system stability and security of supply in Scotland
Research on opportunities for Vehicle to Grid in Scotland
Electricity network investment required to deliver on Scotland's heat decarbonisation targets

Annex E - UK Government powers

Energy policy crosses a large number of areas that are reserved to the UK Government. This means that we need to work with the UK Government to enable a number of the changes outlined in this Strategy. The UK Government has many additional powers not listed here.

PREPARING FOR A JUST TRANSITION	
Consumer protection and regulation	• Consumer protection is one of the core remits of Ofgem, the national energy regulator.
Community benefits from renewables	• The ability to mandate community benefits and offers of shared ownership through energy regulation is reserved to UKG.
ENERGY SUPPLIES	
Electricity	• Our energy supplies are governed by UK Government through the UK Electricity Act under the legislation of the Electricity Act 1989 vi, the Pipelines Act 1962 vii and the Gas Act 1986 viii, which govern the generation, transmission, distribution and supply of electricity. This also covers renewable electricity generation from marine, solar, hydro and wind.
Hydrogen	• Hydrogen subsidy / revenue support and the regulation of piped gas supply and gas networks are reserved to the UK Government.
Bioenergy	• Market support and incentives to deploy BECCS, the regulation of the gas and electricity grids, and future access to biomass imports through trade agreements are reserved to the UK Government.
Coal	• Powers over coal exploitation are reserved to the UK Government, and the Coal Authority is responsible for licensing coal mining activity in Scotland.
North Sea Oil and Gas	• The UK Government is responsible for the fiscal regime and regulation of the oil and gas industry. • The North Sea Transition Authority (previously Oil and Gas Authority) acts as the oil and gas sector's independent regulator. Its role is to regulate, influence and promote the oil and gas industry, in order to maximise the economic recovery of the UK's oil and gas resources. The NSTA regulates the licensing of exploration and development of the UK's offshore and onshore oil and gas resources, gas storage and unloading activities. • The Petroleum Act 1998 confers all rights to the UK's petroleum resources to the Crown, but the NSTA can grant licences that

	confer exclusive rights to search and bore for and get petroleum, over a limited area for a limited time.
ENERGY DEMAND	
Heat in Buildings	• There are several areas reserved to the UK Government, including market mechanisms to drive investment in and uptake of zero emission heat systems, and the decision on the role of hydrogen in the gas grid and the future of the gas network.
Transport	• Examples of reserved issues include Fuel duty, Renewable Fuel Transport Obligation (RTFO), UK Emissions trading scheme - only aviation but covers other demand sectors (joint with other Devolved Administrations), Sustainable aviation fuels mandate.
Carbon Capture and Storage	• Access to BEIS business revenue support and underwriting of liabilities as well as an economic licence from the proposed UK-wide new economic regulator are essential to accelerate CCUS in Scotland.
CREATING THE CONDITIONS FOR A FUTURE NET ZERO ENERGY SYSTEM	
Security of supply and resilience	• Security of electricity and gas supply is a reserved area of policy. The UK Government sets the long-term policy direction, whilst Ofgem, as energy regulator, ensures markets work properly and that there are no barriers to licensed businesses meeting their obligations. • National Grid ESO is responsible for the operation of the electricity system, moving electricity around the country, looking at the whole GB system second by second to ensure that the right amount of electricity is where it is needed when it is needed. • The overall responsibility to deliver secure gas supplies in GB is shared between gas shippers (including energy suppliers), and the National Grid, and the powers are reserved to the UK Government.
Energy storage and flexibility	• Market support (and incentives to deploy pumped hydro storage) are reserved.
Planning and consenting	• The framework under which certain consenting decisions are made is reserved to the UK Government. Planning is a devolved competency.

Electricity networks policy and regulation	• The UK Government is responsible for energy network policy and regulation. • The role of the UK energy regulator, Office of Gas and Electricity Markets (Ofgem) is defined in UK Parliamentary legislation and includes the regulation of gas and electricity networks, and determination of the regulated network companies' allowed revenues.

Annex F - Monitoring and evaluation

Monitoring and evaluation of the Energy Strategy and Just Transition Plan will align with the principles and outcomes of our National Performance Framework. During the development of the final Strategy and Plan we will develop a monitoring framework which takes into account our National Performance Framework, outputs from our impact assessments, the wider just transition monitoring framework, activities of our Energy Transition Taskforce and the Climate Change Plan Monitoring and Evaluation Framework.

Climate Change Plan monitoring and evaluation framework

This draft Strategy and Plan has been developed with consideration to the next economy-wide Climate Change Plan, a draft of which will be laid in Parliament in late 2023. The next Climate Change Plan will include assessments of costs and benefits of policies, and be accompanied by a thorough monitoring and evaluation framework, which will support the monitoring and evaluation of the final Strategy and Plan policies.

Impact assessment

In line with the principles of the Just Transition, assessment of the impact of this strategy is an important part of its development. Alongside consultation, and in response to our statutory obligations, we are working with key stakeholders to develop a series of impact assessments. These are evidence–based assessments of the economic, social and environmental effects of policy. These will be reflected in the actions that we take and include:

- Equalities Impact Assessment (EQIA)
- Island Communities impact assessment (ICIA)
- Fairer Scotland Duty (FSD)
- Child Rights and Wellbeing Impact Assessment (CRWIA)
- Business and Regulatory Assessment (BRIA)
- Strategic Environmental Assessment (SEA) - findings and consultation responses received will inform the finalised Strategy and Plan

The Scottish Government is required to undertake relevant statutory and other impact assessments, including a Strategic Environmental Assessment (SEA) and Business and Regulatory Impact Assessment (BRIA), prior to policy finalisation. The preferred policy position on onshore conventional oil and gas is being included in the impact assessments of the wider Energy Strategy and Just Transition Plan, and the finalised policy position will be confirmed on conclusion of this process.

Monitoring and reporting of Just Transition Plans

Through ClimateXChange, we have research to inform a monitoring and evaluation framework for a just transition in Scotland, incorporating an evidence assessment of just transition monitoring internationally. In light of the Just Transition Commission's remit to advise on monitoring and evaluation progress towards achieving a just transition in Scotland, the Commission has been involved in this research from the beginning and will incorporate its advice at key moments. We will engage with stakeholders to build on the findings of this research in early 2023 and develop a framework that reflects the Just Transition Commission's recommendations around effective engagement on monitoring progress. The overarching Just Transition Monitoring and Evaluation Framework will inform further development of the Draft Monitoring and Evaluation Plan for this Strategy and Plan.

Draft Just Transition Outcomes for the Energy Sector

The following table sets out the draft outcomes for the Strategy and Plan under the vision. We have distilled these into four broad themes: Jobs, Skills and Economic Opportunities; Communities, People and Equity; and Adaptation, Biodiversity and the Environment. We are inviting views on these outcomes through this consultation.

	Draft Outcomes
Jobs, Skills and Economic Opportunities	**More jobs** – The transition to net zero has resulted in net positive employment in the energy economy.
	Better jobs – The jobs created in the net zero energy economy are good, meaningful, high value and sustainable jobs, underpinned by a commitment to collective bargaining and ensuring workers have the ability to shape their place of work.
	Access to jobs – People have the skills to make meaningful choices about jobs in the energy sector and employers have access to a skilled workforce. These jobs further the diversification of the workforce and young people of all backgrounds aspire to them. People can access jobs in their area and communities.
	Renewables are a critical part of Scotland's economy – The renewable energy sector is a valuable and growing part of Scotland's wider economy in terms of gross value added (GVA), trade, supply chains, investment and prosperous businesses. Fossil fuel companies' operations in Scotland have successfully diversified and transitioned to compete and grow the net zero economy.
	A continuously innovative and competitive energy sector – The net zero energy economy is innovative and competitive in domestic and international markets, and has capitalised on the opportunities of growing and creating markets to develop intellectual property, supply chains, and exports.

Communities and Places	**Maximised energy production and community ownership** – Communities have been supported to maximise their energy production potential, which will vary by geography, including increasing the number of community owned energy assets, supporting their energy security and energy affordability.
	Community empowerment – Communities have been empowered to shape their energy use, the infrastructure they host and to maximise the benefit they receive from that.
	Local content and job creation – Local content, local job creation and wider community benefit has been increased in major energy infrastructure projects, such as Scotwind and the development of larger wind and hydrogen projects.
	Supporting regions and communities most at risk – Recognising that the energy transition will not impact all communities equally, particular support and provision, such as the North East and Moray Just Transition Fund and the Energy Transition Fund, has supported the transition of those regions and communities most at risk.

People and Equity	**Affordable energy that reduces poverty and furthers equity** – People have access to energy efficient housing, and affordable clean energy without sacrificing other basic needs (such as food). Actions to reduce fuel poverty and child poverty were aligned to ensure both statutory targets were met. People with additional energy needs, such as those experiencing disability, have been supported with energy costs.
	Access to transport – People and places have access to the energy needed for transport regardless of location and socioeconomic background
	Fair distribution of costs – The costs of the energy transition have not disproportionally been borne by vulnerable households.
	Improved health outcomes – The energy transition has improved health outcomes, including indoor and outdoor air quality.

Adaptation, Biodiversity and Environment	**Adaptation and resilience** – Power assets and the power system have reduced vulnerability to the impacts of climate change, including storminess, higher temperatures and flooding, and the most vulnerable people are identified and supported during and after instances of power failure to ensure a reliable and affordable power supply for all in a net zero economy.
	Environmental protection and restoration – The energy transition supports Scotland's ambitions for restoring nature and biodiversity - including by carefully managing and avoiding potential negative impacts in Scotland and overseas - as part of our joined up approach to tackling the climate and nature crises.
	Natural capital – Our net zero energy system helps to restore and rebuild Scotland's natural capital.
	Access to the natural environment – People are consulted and can influence decisions around energy and their natural environment and have access to nature.

Annex G - Draft marine and solar visions for Scotland

Draft marine energy vision for Scotland

Wave and tidal energy has the potential to support the delivery of a secure and low carbon energy system while providing a new industrial opportunity and being part of Scotland's response to the global climate emergency. The predictability and availability of the marine energy resource off Scotland's coastline, together with Scotland's early lead in the technology, provides an opportunity to build on Scotland's maritime heritage and to secure a substantial share of the emerging global market for marine energy.

Scotland's marine energy achievements to date

Scotland is the most advanced hub in Europe for the development and deployment of marine energy technologies. Scottish tidal stream energy developers including Simec Atlantis Energy, Orbital Marine Power and Nova Innovation have delivered pioneering projects in Scotland which showcase Scotland's innovation strength and supply chain capabilities while demonstrating the reliability of tidal energy and taking this proven technology to the cusp of commercialisation. The outcome of the most recent allocation round under the Contracts for Difference offers the potential for a substantial increase in the installed capacity from tidal stream energy in Scotland over the next five years.

Wave Energy Scotland (WES), established by the Scottish Government in 2014, is the largest dedicated wave energy research and development programme in the world. It is driving innovation in the key systems and sub-systems of wave energy, which is at an earlier stage of technology and commercial development than tidal stream energy. The recent real-sea testing in Orkney of scaled wave energy convertors developed by two Scottish developers under the WES programme, AWS Ocean Energy and Mocean Energy respectively, represents a significant milestone for the sector. Together with the Basque Energy Agency, WES is co-leading EuropeWave, a pan-European programme which mirrors and builds on the WES pre-commercial procurement model to support the further development of the most promising wave energy concepts.

The achievements of Scotland's marine energy sector to date have been underpinned by the European Marine Energy Centre (EMEC) in Orkney, at which more wave and tidal energy devices have been tested than at any single site in the world. With 20 years' experience as a hub for technical innovation and international collaboration, EMEC has a level of expertise in marine energy which is unsurpassed anywhere in the world.

Potential benefits of marine energy

Wave and tidal stream energy are two distinct renewable energy technologies which, as part of a diverse energy mix, can support Scotland's transition to net zero. Tidal energy is highly predictable and can complement intermittent sources of energy, smoothing the overall power supply from renewables. The generation profile of wave energy is out of phase with other renewable sources such as offshore wind, giving it the ability to provide a grid balancing function.

Marine energy technologies have minimal visual impact and are scaleable, with the potential to be integrated with other energy technologies in order to maximise energy output and contribute to net zero ambitions. Scotland also has significant transferrable expertise and facilities from industries such as fisheries, offshore wind, oil and gas, shipbuilding and ports and harbours. This provides an opportunity to support a just transition to a low carbon economy, as well as a home-grown industrial capability to help scale the marine energy sector.

Supply chain analysis by the Scottish Marine Energy Industry Working Group has identified that Gross Value Added (GVA) from UK wave and tidal deployments could range from £4.9 billion - £8.9 billion from domestic deployments by 2050. The Offshore Renewable Energy Catapult has estimated that the tidal stream industry has the potential to support almost 4000 jobs in the UK by 2030.

Projections for global deployment of marine energy technology, from the International Energy Agency (IEA) TIMES model, are for around 180 GW of capacity by 2050. Scotland's early lead could give it a first-mover advantage in this emerging market, with tidal stream technology developed in Scotland having already been exported to countries including Japan and Canada.

Actions to enable further deployment of marine energy in Scotland

The Scottish Government established the Scottish Marine Energy Industry Working Group in 2021 as a forum for the sector to speak with one voice about its priorities and the steps needed to maintain and build on Scotland's competitive advantage.

The industry view is that a strong domestic market for marine renewables is critical for maintaining the current high level of local content and enabling the Scottish sector to play a substantial role in the future global market. It is proposed that further and larger scale tidal stream deployments over the next five years are essential to enable tidal energy to continue along the cost reduction pathway and to embed the necessary skills and expertise in Scotland.

The industry group recommends the introduction of marine energy deployment targets, including at least 40 MW of installed capacity from tidal stream energy by 2027.

The industry group also recommends the provision of continued innovation funding and other financial mechanisms to support further deployment of tidal technology and ensure it is in a position to compete in potential future CfD allocation rounds as it continues the journey towards commercialisation.

The group recommends the continuation of Scottish Government support for Wave Energy Scotland, and suggests that an appropriate target for wave energy could be the testing of up to four wave energy convertors (250 kW each) at EMEC by 2027.

The industry supports, and will actively engage in, the continued development of the consenting, licensing, and connection process, facilitated through Crown Estate Scotland, Marine Scotland, the DNOs, and National Grid.

The industry has also called for a strategic review of existing infrastructure and future requirements for marine renewables. The Strategic Investment Model (SIM) for offshore wind provides an opportunity for marine renewables to strategically develop their supply chain asks alongside those of offshore wind. Activity in this area will help to ensure delivery of a commitment in the Bute House Agreement of August 2021 relating to the development of ports and manufacturing infrastructure needed by the offshore renewables sector.

Next steps

We will continue to engage with industry and other stakeholders to understand the barriers to and opportunities from the further development of wave energy and the commercialisation of tidal stream energy. This engagement, including responses to the consultation questions below, will inform the development of the final version of the marine energy vision statement, to be published as part of the Energy Strategy and Just Transition Plan in 2023.

Draft solar vision for Scotland

Solar has an important role to play, as part of a diverse energy mix, in Scotland's decarbonisation journey. Our aim is to maximise the contribution solar can make to a just, inclusive, transition to net zero. We will support the sector to minimise barriers to deployment wherever possible, and will continue to provide support through our schemes such as Community and Renewable Energy Scheme and Home Energy Scotland.

Solar capacity in Scotland

Currently, Scotland has **411 MW** of operational solar capacity, with a further **767 MW of estimated pipeline capacity**.[121] This pipeline of projects, which will increase the current capacity by over 150%, shows the significant appetite for greater solar deployment in Scotland, and shows Scotland is a great place for solar. Our ambition is for solar deployment to go further, faster. Below we have set out the actions we are taking to support this.

Benefits of greater solar deployment in Scotland

We recognise solar has an important role to play in decarbonising our energy system, particularly when combined with other renewables. We see a strong role for solar thermal, as well as domestic and commercial solar PV combined with battery storage systems - which have the potential to help reduce consumer bills.[122]

Current support for solar in Scotland

Scottish Government Funding - Costs for solar have reduced by 60% since 2010 with support also provided through UK Government schemes.[123] Scottish Government funding is therefore focused on domestic and non-domestic projects, through a comprehensive range of support schemes for renewable and energy efficiency technologies. Further information on these funding schemes can be found in Annex I.

Non-Domestic Rates (NDR)[124] – We provide generous NDR relief for renewable generators, including an exemption for solar PV with a capacity of up to 50kW.[125] On 1 April 2022, we expanded eligibility for the Business Growth

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[121] Scottish energy statistics hub index - gov.scot (www.gov.scot)
[122] Building-level energy storage: reducing consumer bills to deliver zero-emissions heat: Changeworks, January 2022
[123] Through the Contracts for Difference Scheme (installations >5MW) and the Smart Energy Guarantee (installations up to 5MW).
[124] Non-domestic rates (also known as business rates) are taxes paid on non-domestic properties to help pay for local council services. Non-domestic rates are based on the rateable value of a property, which is determined by the independent Scottish Assessors.
[125] Relief to renewable generators is estimated by the Scottish Fiscal Commission to be worth over £50 million to renewable energy operators between 1 April 2022 and 31 March 2028.

Accelerator relief to include solar panels as a qualifying improvement eligible for relief for 12 months after installation.

Community Benefits[126] - We provide up to 100% NDR relief to renewable energy generators (including solar), who provide community benefit.[127] We are keen to see the number of solar installations offering community benefits increase and continue to encourage the sector to consider what packages of community benefit it can offer communities local to developments, in line with our Good Practice Principles.[128]

Actions to enable greater deployment of solar in Scotland

We continue to make considerable progress in lowering barriers that are within Scottish Government competence, to facilitate greater deployment of solar. We will continue to work closely with industry to enable solutions for the sector. Below, we have set out the ongoing commitments we will take to further deliver this:

Solar Deployment Ambition - We are considering the evidence for setting a solar deployment ambition and are consulting on it through this draft vision (see consultation questions in Annex B). We will provide an updated position in our final solar vision in 2023.

Public Sector Buildings – We will encourage solar on public sector buildings through our Green Public Sector Estate Decarbonisation Fund, which provides a number of funding routes for the public sector to install solar energy.[129] When consulting on regulations for heat and energy efficiency of existing non-domestic buildings, we will highlight our solar vision that additionally signals our strong support for rooftop solar deployment on commercial and public buildings.

Skills - We are aware there are pockets of skills gaps across some parts of Scotland for installation and maintenance of solar PV, and we will explore this further with industry. Our Climate Emergency Skills Action Plan is the framework for creating and supporting the workforce in the transition to net zero and will reflect sector specific skills like these, in the update due by the end of 2023.

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[126] Community benefits are voluntary arrangements between renewable energy businesses and communities near to their renewable energy development.
[127] Up to 100% relief is available for renewable generators where the scheme provides community benefit - giving at least 15% of annual profit to a community organisation or so much of the annual profit as is attributable to at least 0.5 megawatt of the total installed capacity of the project. The percentage of relief is lower where the rateable value is greater than £145,000.
[128] Community benefits from onshore renewable energy developments - gov.scot (www.gov.scot)
[129] Public sector decarbonisation - Energy efficiency - gov.scot (www.gov.scot)

Permitted Development Rights (PDR)[130] - We will bring forward our consideration of new and extended PDR for non-domestic solar equipment from Phase 4 to Phase 3 of our PDR review programme. We intend to consult on Phase 3 proposals early in 2023.

National Planning Framework 4 (NPF4)[131] – The Revised Draft National Planning Framework 4 signals a turning point for planning, placing climate and nature at the centre of our planning system and making clear our support for all forms of renewable, low-carbon and zero emission technologies, such as solar, and including transmission and distribution infrastructure. The Revised Draft NPF4 was laid in the Scottish Parliament on 8 November 2022. Should Parliament approve NPF4, Scottish Ministers would move swiftly to adoption to allow us to progress onto implementation and delivery.

Scottish Government Research - We have commissioned research on the whole system interactions and impacts on the electricity distribution network of high-volume deployment of domestic and commercial solar PV. This will be completed in early 2023.

New Builds and Building Warrants[132] – Following the recent publication of the revised standards and guidance for Scottish building regulations we will continue to liaise with industry on the solar aspects. We will also engage with the sector to understand the extent of the current issues experienced with gaining permissions for building warrants.

Biodiversity - We are engaging with stakeholders on the case that future rural support payments might be eligible on land used for solar installations that is also explicitly being used to deliver our Vision for Scottish Agriculture. In the present Common Agricultural Policy model, support cannot be claimed for this type of dual use. Notwithstanding the outcome of this, we will seek to encourage high biodiversity standards on solar farms.

Non Domestic Rates(NDR) – In addition to our already generous NDR reliefs in relation to renewable energy generators, we will introduce a new exemption for plant and machinery used in onsite renewable energy generation and storage. This will be available from 1 April 2023 until 31 March 2035.

Next steps

We will continue to work with the solar sector, conducting wide stakeholder engagement in progressing these actions. Following consultation we will seek to finalise and update our Solar Vision. We expect to publish this in 2023.

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[130] PDR refers to forms of development that are granted planning permission through national legislation, meaning they can be carried out without a planning application having to be submitted to – and approved by – the relevant planning authority.

[131] The NPF4 is a new national spatial strategy that sets out how planning and development will help achieve a net zero, sustainable Scotland by 2045.

[132] Under building regulations, a building warrant must be applied for before installing a solar array, except for installations on one or two storey houses where structural assessment confirms suitability.

Annex H - Related policy documents

This draft Energy Strategy and Just Transition Plan complements wider Scottish Government policies on economic development, trade, communities, circular economy, environment and land use. Key policy documents that feed into this draft include:

Policy	Description
Bute House Agreement	The Bute House Agreement is the shared programme agreed to build a greener, fairer, independent Scotland.
National Performance Framework	The National Performance Framework (NPF) is Scotland's wellbeing framework. It sets out an overall vision for Scotland.
Preparing Scotland for a just energy transition	
Tackling Fuel Poverty in Scotland Strategy	The Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019 sets out ambitious targets that will be met nationally and in each local authority area. It includes actions to tackle each of the four drivers of fuel poverty: poor energy efficiency of the home; high energy prices; low household income; and how energy is used in the home.
Economic Transformation	The National Strategy for Economic Transformation (NSET) sets out the priorities for Scotland's economy, as well as the actions needed to maximise the opportunities of the next decade to achieve our vision of a wellbeing economy.
Islands	The National Plan for Scotland's Islands sets a direction of travel for the Scottish Government and provides a framework for action in order to meaningfully improve outcomes for island communities.
Local and Community Energy	The Local Energy Policy Statement sets out the key principles and associated outcomes that we wish to see adopted to ensure an inclusive energy transition with people at its centre.
Good practice principles for community benefit from onshore wind	The Community benefits from onshore renewable energy developments sets out guidance on good practice principles for communities, businesses, local authorities and others on onshore wind developments.
Good practice principles for community benefit from offshore wind	The Scottish Government good practice principles for community benefits from offshore renewable energy developments provides Guidance on good practice principles for communities, businesses, local authorities and others on offshore renewable developments.
Green Datacentres and Digital Connectivity	Green datacentres and digital connectivity: vision and action plan set out how, through co-ordinated action, we can position Scotland as a leading zero-carbon, cost competitive green data hosting location, contributing towards our ambition of achieving net zero emissions by 2045.

Environment	The Environment Strategy creates an overarching framework for Scotland's policies on the environment and climate change. It was placed on a statutory basis by the Continuity Act 2021. Is sets out Scotland's commitment to tackling the climate and nature crises. It recognises that this will rely on transformative economic and social change, but that this can transform Scotland for the better through wider benefits for jobs, businesses, equalities, health, wellbeing etc.
Trade	Scotland's export growth plan, A Trading Nation, (2019) set out our ambition to grow the proportion of exports in Scotland's GDP to 25% by 2029. ATN highlights the importance of the energy sector in doing this. We are developing both renewables and hydrogen sector export plans that identify the internationalisation opportunities being created by Scotland's transition to net zero.
Trade	In our Vision for Trade (January 2021), which describes the overarching approach to all of SG's trade policy, we set out net zero as one of the five principles governing our trade activities. We committed to ensuring that our trade and investment policies increase progress towards our net zero target. Among a comprehensive list of actions, we set out our commitment to end all Scottish Government overseas trade support and promotion activities solely focused on fossil fuel goods and services by COP26. This was a refocusing of our support, and not a reduction, designed to support businesses transitioning away from solely fossil fuel-related exports.
Inward Investment	Scotland's Inward Investment Plan (2020) sets out how we will attract investment that aligns with Scotland's values, giving inward investment a key role in the creation of a fair, sustainable, inclusive and low carbon future for Scotland. Our clear, evidence based approach mapped Scotland's strengths to global investment flows and identified nine opportunity areas for a new strategic focus, including two under the overarching theme of net zero – Energy Transition and Decarbonisation of Transport. A progress report which sets out what has been delivered since Plan publication, as well as our priorities for the next phase of Plan delivery was published in September 2022.
Blue Economy	A Blue Economy Vision for Scotland sets out our long-term ambition for Scotland's blue economy to 2045. It demonstrates how much we value our marine environment and its significance. This is captured in six outcomes sitting across a range of environmental, social and economic ambitions.
Investment	Investing with purpose articulates the important role private capital investment can play in driving an investment-led recovery in Scotland. Our commitment to net zero underpins this plan. Put simply, we should no longer direct public resource into originating, structuring and promoting investments in Scotland that do not support our transition to net zero. By focusing on our priority sectors and employing a net zero and place focus, we will be able to start to build markets instead of individual investment opportunities. Our priority will be to identify opportunities for Scotland to lead the global movement towards investment that is

	socially and environmentally responsible, identifying and targeting investors who share our values.
Infrastructure Investment	The Infrastructure Investment Plan supports the decarbonisation of industry by helping overcome private sector investment and transition challenges through our: · £180 million Emerging Technologies Fund to support carbon capture and storage, negative emissions technologies and hydrogen development. · £34 million Scottish Industrial Energy Transformation Fund for energy efficiency technologies and decarbonisation studies. · £60 million Energy Transition Fund, focused on the North East, to support businesses in the energy sectors as they grow and diversify, and help attract private sector investment.
Energy supplies	
Bioenergy	The Bioenergy Update considers the potential role for bioenergy to support our net zero greenhouse emissions targets and outlines how we intend to move forward in order to understand the most appropriate and sustainable use of bioenergy resources in Scotland.
Hydrogen	The Hydrogen Policy Statement published in 2020 set out the Scottish Government's vision for Scotland to become a leading nation in the production of reliable, competitive, sustainable hydrogen, securing Scotland's future as a centre of international excellence as we establish the innovation, skills and supply chain to underpin our energy transition.
Hydrogen	The Hydrogen Action Plan was published in December 2022 and sets out actions that will be taken over the next five years to support the development of a hydrogen economy to further our efforts to reduce greenhouse gas emissions from Scotland 's energy system while ensuring a just transition.
Onshore Wind	The Onshore Wind Policy Statement sets out our ambition to deploy 20 GW of onshore wind by 2030, as well as details on the formation of an onshore wind strategic leadership group, who will develop an onshore wind sector deal.
Offshore Wind	Offshore Wind Policy Statement was published in 2020, setting out Scottish Government's ambitions for the future of offshore wind in Scotland and outlining the context for Marine Scotland's Sectoral Marine Plan for Offshore Wind Energy.
Energy demand	
Heat Decarbonisation	The Heat in Buildings Strategy and the Heat in Networks Delivery Plan set out our vision for the future of heat in buildings, and the actions we are taking in the buildings sector to deliver our climate change commitments, maximise economic opportunities, and ensure a just transition, including helping address fuel poverty.
Transport	The National Transport Strategy (NTS) sets out the role of transport in delivering the priorities of reducing inequalities and taking climate action, while helping deliver inclusive economic growth and improving health and wellbeing.
Transport	A route map to achieve a 20 per cent reduction in car kilometres by 2030.

Agriculture	Our Vision for Agriculture was published in March 2022 and outlines our aim to transform how we support farming and food production in Scotland to become a global leader in sustainable and regenerative agriculture.
Creating the conditions for a net zero energy system	
Energy Networks	The Energy Networks Vision looks at the ways in which Scotland's electricity and gas network infrastructure will continue to support the energy transition.
Climate Resilience	Keep Scotland Running takes an 'all risks' approach to critical infrastructure resilience (CIR) through the Scottish Government's Strategic Framework 2020-2023.

Annex I - Scottish Government energy sector funding and finance

Funding source	Detail
Preparing Scotland for a Just Energy Transition	
Fuel Insecurity Fund	We have invested £10m through our Fuel Insecurity Fund and have committed to use the Emergency Budget Review to double it to £20 million this year.
CARES (Community and Renewable Energy Scheme)	CARES aims to accelerate progress towards the Scottish Government's ambition of 2 GW of community and locally owned energy by 2030. The goal of CARES is that communities across Scotland are engaging, participating and benefiting in the energy transition to net zero. This is achieved through funding and support for community groups to install renewable energy generation.
Green Jobs Fund	£100m Green Jobs Fund aims to support businesses to create and maintain jobs that improve the environment, and to support projects that align with Scottish Government net zero policies.
Just Transition Fund	The Just Transition Fund (JTF) is a £500 million ten-year commitment that supports projects in the North East and Moray which contribute towards the region's transition to net zero. This includes a commitment of £100,000 in grant funding to support just transition capacity within the trade union movement.
Climate Justice Fund	The world-first Climate Justice Fund has been trebled to £36 million over this parliamentary term and we are also providing the Women's Environment Development Organisation with £50,000 annually to support capacity building and training for women to engage in UNFCCC talks and integrate gender equality considerations into the outcomes.
City Region and Regional Growth Deals	City Region and Regional Growth Deals have now been announced for every part of Scotland, with Scottish Government investment totalling more than £1.9 billion. They are packages of funding and decision making powers agreed between the Scottish Government, UK Government and local partners. Across Scotland numerous energy projects are being supported.
Energy For Heat in Buildings	
Heat and Energy Efficiency Scotland	We are investing over £1.8 billion in decarbonising homes and buildings, through Scotland's Heat and Energy Efficiency Agency, over the course of this parliament.
Area based schemes	Our local authority led Area Based Schemes continue to provide grants for all of Scotland's local authorities to unlock investment in schemes targeting fuel poor areas (including hard to treat properties) and high levels of fuel poverty. A whole-house retrofit approach is prioritised. LAs can use part of the funding provided to pay for their own enabling costs.

Scotland's Heat Network Fund	Our £300 million Heat Network Fund provides grant funding to support the development and rollout of zero emission heat networks across Scotland.
Heat Network Support Unit	The Heat Network Support Unit aims to support the growth of heat networks by working with the public sector to address key challenges and build capacity through advice, expertise and financial support.
Social Housing Net Zero Heat Fund	Our £100 million Social Housing Net Zero Heat Fund provides a blend of capital grant and low interest finance for zero emission heat and energy efficiency retrofit in social rented properties.
Green Public Sector Estate Decarbonisation Scheme	Our £200 million Green Public Sector Estate Decarbonisation Scheme provides capital support to aid the decarbonisation of Scotland's Public Sector Estate.
Warmer Homes Scotland fuel poverty programme	The Scottish Government's Warmer Homes Scotland programme offers funding and support to households struggling to stay warm and manage energy bills. It is targeted at less energy efficient homes, as well as households with low incomes or those who are particularly vulnerable to the effects of cold (via a range of benefit proxies). Interest-free loans with significant cashback grants for energy efficiency and zero emissions heating are available to all homeowners (not limited by targeting like WHS and ABS).
Home Energy Scotland (HES) Grants and Loans	Funding for homeowners to install energy efficiency measures and zero direct emissions heating systems in their homes. A standalone grant has been introduced to replace the cashback element of HES Loans for domestic owner occupied properties. The new grant provides funding for heat pumps up to £7,500 and for energy efficiency improvements – up to 75% of the combined cost of the improvements and up to a maximum grant amount of £7,500. A rural uplift of £1,500 applies to both the heat pump and energy efficiency grants.
Business Energy Scotland SME Loans and Cashback	Funding for small and medium-sized enterprises to install energy efficiency measures and zero direct emissions heating systems in their premises
Affordable Housing Supply Programme	Through the Affordable Housing Supply Programme, we continue to support affordable housing providers who wish to install zero direct emissions heating in homes ahead of regulatory requirements in 2024.
Energy for transport	
Bus Partnership Fund	The Scottish Government is continuing its programme of investment for over £500 million in bus priority infrastructure. The Bus Partnership Fund will support local authorities, in partnership with bus operators, to tackle the negative impact of congestion on bus services so that bus journeys are quicker and more reliable – encouraging more people to travel by bus.

Domestic EV fund	Provides a £300 grant towards the cost of purchasing and installing a home chargepoint, this fund is targeted at people living in a category 5,6,7 or 8 or an island in Scotland where installation costs are higher due to their locations.
Business EV fund	Covers 50% of the cost of purchasing and installing an EV chargepoint for eligible small and medium-sized enterprises (SMEs) and again. It is targeted at those in category 5,6,7 or 8 or an island in Scotland. These chargepoints can be used for occupants, staff and visitors.
Low Carbon Transport Loan	Supports purchase of used EVs by offering interest free loans of up to £30,000 with a repayment term of up to 5 years. This supports low income households make the change to EVs and loan recipients can also access the Domestic EV fund regardless of where they stay.
Energy for industry	
Scottish Industrial Energy Transformation Fund (SIETF)	The SIETF will provide £34m grant funding to reduce energy costs and emissions through increased energy efficiency. Decisions on funding awards are weighted towards energy and/or carbon savings and it's primarily aimed at businesses with high energy use.
Low Carbon Manufacturing Challenge Fund	The Low Carbon Manufacturing Challenge Fund is administered by Scottish Enterprise and will run until 2025-26, providing more than £25 million to support eligible projects over the next four years. Research and development funding will support innovation in low carbon technology, processes and infrastructure within manufacturing.
National Manufacturing Institute Scotland Funding	The Scottish Government is investing £75 million in the National Manufacturing Institute Scotland (NMIS) to enable industry, academia and the public sector to work together on manufacturing research to transform productivity levels, increase competitiveness and boost the skills of our workforce.
Emerging Energy Technologies Fund	The £180 million Emerging Energy Technologies Fund (EETF) supports the development of the hydrogen sector and carbon capture and storage (CCS), including Negative Emissions Technologies (NETs) in Scotland. The EETF will provide capital support over five years (2022 – 2026) to accelerate low carbon infrastructure projects that will be essential to deliver net zero. £100 million is available to support renewable hydrogen projects and we have offered £80 million from the EETF to accelerate the deployment of the Scottish CCUS Cluster. Due to delays with the UK Government announcing the Scottish Cluster, we have re-profiled our offer of financial support into subsequent years.
CO_2 utilisation Challenge Fund	The £5 million CO_2 Utilisation Challenge Fund will help businesses and organisations develop and commercialise the technology, which involves harnessing and converting CO_2 – the biggest contributor to climate change emissions – and using it to produce valuable products, such as synthetic fuels and proteins for use in aquaculture.

Annex J - Support for the energy supply chain

Title	Short Description
Low Carbon Manufacturing Challenge Fund	The Low Carbon Manufacturing Challenge Fund is for any company with a manufacturing base in Scotland that wishes to pursue business growth by developing low carbon products, processes or services. This may be achieved through pure research and development (R&D), capital investment or environmental aid support.
SMART Grants	SMART:SCOTLAND is a research and development (R&D) grant for small and medium-sized businesses that aims to support high risk, highly ambitious projects. It covers conducting feasibility studies to show how ideas could work in the real world and supports activities that have a commercial endpoint.
Scottish Manufacturing Advisory Service	The Scottish Manufacturing Advisory Service (SMAS) helps businesses across the manufacturing supply chain become more productive, profitable, and competitive.
Hydrogen Supply Chain Support	As outlined in the Hydrogen Action Plan, together with our Enterprise Agencies, trade associations and other relevant stakeholders, we will explore the requirement for an online tool to ensure that companies have clear visibility and access to information about upcoming hydrogen projects in order to maximise the potential for Scottish content.
Scottish Hydrogen Innovation Network	Not yet in place but is trailed in the Hydrogen Action Plan. This project will provide an overarching framework for Scotland's growing portfolio of hydrogen innovation assets. It will enable collaboration between those assets and help to enhance Scotland's international hydrogen innovation reputation by showcasing all that we have to offer in one place. It will also provide additional personnel resource to boost industry engagement. This would enable inward investment into hydrogen technologies, innovative technologies and develop expertise in Scotland.
Mapping of hydrogen supply chain companies	Not yet in place but is trailed in Hydrogen Action Plan. Detailed supply chain database with clear taxonomy so that we are able to identify who to work with on what, share information on events, projects and offer other support.
Mapping of hydrogen companies/ brokerage events	Detailed supply chain database with clear taxonomy so that we are able to identify who to work with on what, share information on events, projects and offer other support. An example event can be found here.
Offshore Wind Expert Support	Offshore Wind Expert Support (OWES) helps businesses identify relevant opportunities in the offshore wind sector and develop a market entry strategy to target these opportunities.

DeepWind Offshore Wind Cluster	The main purpose of the DeepWind cluster is to help its members achieve greater benefits from the current and future development of offshore wind in the UK and internationally.
Forth & Tay Offshore Wind Cluster	Forth and Tay Offshore works on behalf of members to promote the capabilities of companies and organisations in the offshore wind sector and to assist them in accessing new opportunities.
Zero Emissions Mobility Innovation Fund - ZEMIF	Scottish Enterprise and Transport Scotland have developed ZEMIF to support Scottish based businesses to scale the manufacture of prototype zero emission niche and HDV components, systems and vehicles through research and development activities.
Green Heat Innovation Support Programme (GHISP)	GHISP offers a range of capital, research and development, European Union and targeted procurement. This £17.6 m programme, supported by Scottish Government, is designed to assist companies to expand, diversify or invest in Scotland.
Green Heat Hub Grand Challenge (GHHGC)	The GHHGC is an innovative approach to developing a new "Heat Hub" for Scotland, addressing industry requests in the SG Heat Pump Industry Expert Advisory Group. The aim being to develop Scotland as a key location for green heat manufacturing.
Green Heat Accelerator	The Green Heat Accelerator is an immersive three month intensive programme of support for a cohort of small or start-up companies developing new products and services for green heat.
HeatSource	HeatSource has been developed to bring the green heat supply chain together and support knowledge transfer, raise awareness of the market opportunities and signpost to support.
Offshore Wind Cluster Builder	The Offshore Wind Cluster Builder works with small and medium-sized enterprises (SMEs) in Scotland to promote opportunities and address challenges in the offshore wind sector.
Wave Energy Scotland (WES)	The WES technology programme has funded 120 contracts, committed £50 million and been involved with 300 organisations from across 18 different countries. These projects are developing wave devices, sub-systems and components, as well as leading the way in advanced control systems. A number of programmes are already complete, but quick connections and control systems programmes are in progress.
Clean Energy Transition Partnership	The Clean Energy Technology Partnership is a transformative research, development and innovation programme designed to accelerate clean energy transition through annual funding calls. It is an international collaboration involving 32 countries, over 50 agencies, and supported via the Horizon Europe Research and Innovation Programme. The Scottish consortium (SE, SOSE, HIE and SG) will allocate up to £6 million for offshore power breakthrough technologies, storage, heating and cooling, industrial energy systems and built environment.

Glossary

Term	Definition
Active travel	Walking, wheeling and cycling as an alternative to motorised transport.
Ancillary services	Services to balance demand and supply and to ensure the security of electricity supply across Britain's transmission system.
Biomass	Refers to any material of biological origin used as a feedstock or products (e.g. wood in construction to make chemicals and materials, like bio-based plastics), or as a fuel for bioenergy (heat, electricity and gaseous fuels such as biomethane and hydrogen) or biofuels (transport fuels).
Bioenergy Carbon Capture and Storage (BECCS)	BECCS is a negative emissions technology, and, if proven at scale, would help achieve Scotland's net zero targets, compensating for residual emissions in hard-to-decarbonise sectors.
Carbon Capture, Utilisation and Storage	Carbon capture utilisation and storage (CCUS) encompasses the methods and technologies required to capture carbon dioxide (CO_2) from large emitters, such as biomass or fossil fuel power plants and industrial processes, and either convert this into new commodities (utilisation) or transport it for safe and permanent storage deep underground in a geological formation.
Climate Compatibility Checks	Checkpoints being introduced by UK Government to ensure any future licensing of oil and gas extraction is compatible with the UK's climate objectives before a licensing round is offered.
Circular Economy	A circular economy is one that is designed to reduce the demand for raw material in products; to encourage reuse, repair and manufacture by designing products and materials to last as long as possible, in line with the waste hierarchy.
Co-design	Co-design relies on an inclusive and participative engagement process that empowers specific groups and people in society, to directly influence policy decisions and actions. The aim is to ensure that plans reflect their needs and circumstances, and the barriers they face.
CO_2 intensity of electricity	Carbon intensity of electricity measures the amount of greenhouse gases emitted per unit of electricity produced. Each kilowatt hour of electricity generated in Scotland in 2020 added an estimated 33.6 grams of carbon dioxide into the atmosphere (gCO2e/kWh), a sizeable drop from 389.8 gCO2e/kWh in 2010.
Direct Emissions	Emissions released on an organisation's site or from their vehicles or as a by-product or unintended consequence of operations. More accurately, they are greenhouse gas

	emissions that come from sources which are owned or controlled by an organisation. Direct emissions are also referred to as Scope 1 emissions.
Dispatchable Capacity	Energy generation which can be available on demand.
Energy Demand	Uses of electricity and other fuels including domestic uses, industrial usage, transport and agriculture.
Energy Generation	The production of electricity, heat, or usable fuel through conversion of renewable sources, extraction and processing of fossil fuels or conversion of other primary sources of energy.
Energy Networks	A system of connected cables or pipes for transporting electricity or gas from the points of generation to the points of demand.
Energy Security	Energy security can be defined as having sufficient energy generation to meet the volume and type of energy demand at any point, and having the means to get that energy to the point of use.
Gross final electricity consumption	Gross electricity consumption refers to total electricity generation minus net export.
GW /GWHr	See Watts and Watt – hours
Heat Networks	Heat networks distribute heat or cooling from a central source or sources and deliver it to a variety of different customers such as public buildings, shops, offices, hospitals, universities and homes. By supplying multiple buildings, they avoid the need for individual boilers or electric heaters in every building.
Indirect Emissions	Emissions produced by an organisation through consumption and purchasing decisions. Indirect emissions are classed as 'Scope 2' (generated electricity and heat) or 'Scope 3' (other goods and services).
INTOG	Innovation and Targeted Oil and Gas (INTOG) is a leasing round for offshore wind projects that will directly reduce emissions from oil and gas production and boost further innovation.
Intermittent Renewable Generators	Renewable sources of energy which cannot provide continuous, steady power.
Just Transition	Just transition is both the outcome and the process for a fairer, greener future for all, in partnership with those impacted by the transition to net zero.
Long Duration Energy Storage (LDES)	Technology which has the capacity to convert electricity to another form of energy and convert it back to electricity, supplying the grid with continuous power over a number of hours or longer.
Low Carbon / Blue Hydrogen	Hydrogen produced by reforming natural gas in conjunction with carbon capture and storage with high capture rates.
Low-emission Fuels	Forms of fuel that when burned produce low greenhouse gas emissions at the point of use - such as low-carbon hydrogen.

Maximum Economic Recovery	The continuous extraction of oil and gas from the North Sea, until the value of the energy extracted no longer exceeds the cost of extracting and producing it.
Mt Co_2e	$MtCO_2e$ means metric tons of carbon dioxide equivalent. This measure is used to compare emissions from different greenhouse gases based on their global warming potential (GWP).
Mmboe/d	Million barrels of oil equivalent per day
National Grid ESO	National Grid ESO are the Electricity System Operator for Great Britain, and are responsible for the safe, secure supply of electricity across the country.
Negative Emissions Technologies (NETs)	Negative Emissions Technologies (NETs) are an emerging field of technologies that remove greenhouse gases from the atmosphere and, utilising carbon capture and storage, sequester them permanently. NETs can include forms of Direct Air Capture with Carbon Storage (DACCS), Bioenergy with Carbon Capture and Storage (BECCS) or other more experimental means such as enhanced weathering or biochar. NETs can be considered one form of Greenhouse Gas Removals (GGRs), which also includes natural sequestration methods such as afforestation. It can also be used interchangeably with Carbon Dioxide Removal technologies (CDR).
Net Positive Employment	Refers to more jobs being created by the transition to net zero than have been displaced during the transition.
Net Zero	The balancing of greenhouse gas emissions against greenhouse gas removals with the net result being zero (see also carbon neutral).
Onshore conventional oil and gas	Petroleum, or crude oil, and raw natural gas extracted from the ground by conventional means and methods.
Operational	Electricity generation capacity which is currently operational.
Pipeline	Electricity generation capacity which is under construction, awaiting construction, or in planning.
Potential pipeline	Electricity generation capacity from offshore wind that is not yet in the official planning pipeline (in the Renewable Energy Planning Database), but where information is available through ScotWind and INTOG leasing rounds.
Primary electricity	Primary electricity refers to electricity generated from nuclear, wind, solar, and natural flow hydro.
Pumped Hydro Storage	A flexible technology that can ramp up to respond to periods of low output (for example, days with low wind). It works by moving water between two pools to generate electricity. When the water is released from the top it drives turbines which produces electricity. Depending on the size of the body of water and number of turbines, it can produce relatively small amounts of electricity or provide a substantial amount to the grid. When there is more power on the system than demand, a pump hydro

	storage will take power from the system to push water back up hill ready to be used again.
Renewable / Green Hydrogen	Hydrogen produced using electrolysis of water, powered by renewable electricity.
Supply Chain	A network between a company and its suppliers to produce and distribute a specific product to the final buyer. This network includes different activities, people, entities, information and resources. The supply chain also represents the steps it takes to get the product or service from its original state to the customer.
System restoration (or black start)	A system restoration or black start service is the process of restoring an electric power station or a part of an electricity grid to operation without relying on the external electric power transmission network in order to recover from major disruption to the transmission and distribution network. Power to restart the network may come from a nearby standby generator. Black start services are agreed by the National Grid Electricity System Operator with generators under contract.
Watts – including Mega, Giga and Terra Watts	Watts are a unit of power used to quantify the rate of energy transfer. A Kilowatt (KW) is equal to one thousand Watts. A Megawatt (MW) is equal to one million Watts. A Gigawatt is equal to one billion Watts. A Terawatt is equal to one trillion watts.
Watt hours – incl, Mega, Giga and Terawatt-hours	A Watt-hour is a unit of work or energy equivalent to the power of one watt operating for one hour. A kilowatt-hour is equal to one thousand watt-hours. A Megawatt-hour is equal to one million watt-hours. A Gigawatt-hour is equal to one billion watt-hours. A Terawatt-hour is equal to one trillion watt-hours.
Thermal Generation	Conventional power plants that use a form of fossil fuel to power a turbine to generate electricity.
Unconventional oil and gas	Includes any development connected to the onshore exploration, appraisal or production of coal bed methane or shale oil or shale gas using unconventional oil and gas extraction techniques, including hydraulic fracturing and dewatering for coal bed methane.
Vehicle to Grid	Two way electric vehicle charging that can either draw or supply power between the battery in an electric vehicle and the electricity grid system.
Zero Direct Emissions Heating (ZDEH)	Heating systems which have no direct emissions (see definition above) at the point of use.

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