CLEAN ENERGY FOR EU ISLANDS

MULL & IONA COMMUNITY TRUST
EST. 1997

CLEAN ENERGY TRANSITION AGENDA

Mull Archipelago, Scotland

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NESOI
EU ISLANDS FACILITY

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Preface

This section introduces the Clean Energy Transition Agenda (CETA) conducted for the Mull Archipelago, Scotland, including the background of the islands, the objectives of this study and an introduction to key project partners.

The Mull Archipelago

The Mull Archipelago is located off the west coast of Scotland and consists of five inhabited islands – Mull, Iona, Ulva, Gometra, and Erraid – and many more uninhabited islands. These islands total approximately 90,000 hectares in land area and have seen significant population decline since the 1800s, reducing from 10,600 people in 1820 to approximately 3,100 residents (Marsh, 2017). However, population is forecast to grow by 2% in the short term, this means an increase of 62 people year on year. (National Records of Scotland , 2022).

The islands are connected to each other and the mainland by regular ferry services. The most heavily used of these is the Oban – Craignure ferry crossing, forming the main link to the mainland, with the Tobermory – Kilchoan and Fishnish – Lochaline crossings providing additional main land connections. The Fionnphort – Iona crossing links the islands of Mull and Iona, and Ulva is serviced by Ulva Ferry Community Transport.

The main industries currently on the archipelago are tourism and fishing, with approximately 480,000 visitors in 2019. This figure fell by two thirds in 2020 because of the COVID-19 pandemic causing a significant impact on local businesses.

The Project

Under the Climate Change Act, the Scottish Government has made a legislative commitment to reach net zero by 2045. This includes an interim target of a 75% reduction in emissions from 1990 levels by 2030. This interim target translates to an almost halving from current-day emissions by 2030. This is clearly an ambitious target, requiring progress and actions at a local level, as well as by the Scottish and UK governments (Scottish Government, 2020).

The ongoing climate crisis is making it clear that communities need to take action to reduce the potential for further harm. This Clean Energy Transition Agenda (CETA) therefore focuses on identifying and planning steps to mitigate and adapt to the negative effects of climate change. It forms part of the AMAZE project (The Archipelago of Mull Actions for Zero Emissions) which is a partnership project between the NESOI consortium, MICT and the AMAZE volunteer Steering Group. The Transition Team is led by the AMAZE steering group. This CETA sets out ambitious targets and principles to guide sustainable and low carbon development on Mull and across the wider archipelago.

To achieve these aims and targets, energy and carbon sources are assessed across several sectors, including:

- Domestic and non-domestic consumption of electricity and gas, as well as other sectors of energy consumption such as aquaculture, farming, and industry;
- Private and public transport, including the development of existing low carbon transport plans and the investigation of new options such as electric vehicles and bicycles;
- Infrastructural energy, including water, waste, heat, and electricity supply, such as the assessment of low carbon electricity generation options on the islands and the implementation of renewable heat supply;

- Land use, land-use change, and forestry (LULUCF), as well as the emissions from livestock and air pollution;

Using this information, this CETA report seeks to provide a clear and achievable roadmap to reducing carbon emissions and achieving net zero emissions by 2045, in line with Scottish Government objectives. Specifically, the CETA provides:

- An understanding the current energy and carbon situation, using this understanding to project future energy scenarios for the archipelago;
- A proposed carbon emissions target or ceiling, and setting out principles for low carbon development on the islands;
- Energy and carbon modelling of key decarbonisation targets for domestic and non-domestic buildings;
- Assessment of low carbon transport opportunities, including low carbon ferries, electric vehicles, shared transport solutions, and active travel;
- Assessment of low carbon generation options on the islands, including electricity and heat generation and supply options, energy storage, and associated energy network management solutions.
- Assessment of current land use and potential low carbon land use strategies, including both terrestrial and marine development plans.

New Energy Solutions Optimised for Islands (NESOI)

In 2021, the Mull archipelago received funding from the EU-funded NESOI project to develop a clean energy transition agenda (CETA). NESOI was set up to provide training, technical support, cooperation, and funding opportunities for islands. NESOI provides technical assistance to local authorities and communities to obtain funding and develop competencies to deploy investments required to realise an islands' energy transitions plans. The programme aims to mobilise more than EUR100 million of investments in sustainable energy by 2023, leading to an expected 440 GWh/year in energy savings and the avoidance of 160~~,000~~ $ktCO_2$.

NESOI proposes concrete support to the energy transition process at both the European level and in the implementation of interventions for the around 54 NESOI projects supporting 64 islands that they work with, including the Mull Archipelago.

Clean Energy Transition Agenda (CETA)

The CETA is a strategic roadmap for the transition process towards clean energy. It is designed by the local community, for the local community. CETA's are intended to direct support to the transition process and development increases islands' visibility and networks. Being part of an EU-wide CETA network will raise awareness of your island's activities and enable you to share your transition experiences with other islanders in order to help each other move forward effectively.

More information about CETA's and the development process can be found at: https://euislands.eu/energy-transition-agenda

Part I: Island Dynamics

Part I of the Clean Energy Transition Agenda aims at providing a picture of the status of the islands. This includes a description of the geographical, economic, and political situation on the islands, but also an analysis of the Energy System and of the Stakeholders that are important for the Clean Energy Transition.

1. Geography, Economy & Population

Geographic Situation

The Isle of Mull is the second largest island located within the Inner Hebrides of Scotland and by far the largest of the islands examined here. The Mull archipelago lies west of mainland Scotland, covering approximately 90,000 hectares. The islands are separated from mainland Scotland and one another by narrow straits requiring short ferry rides to cross.

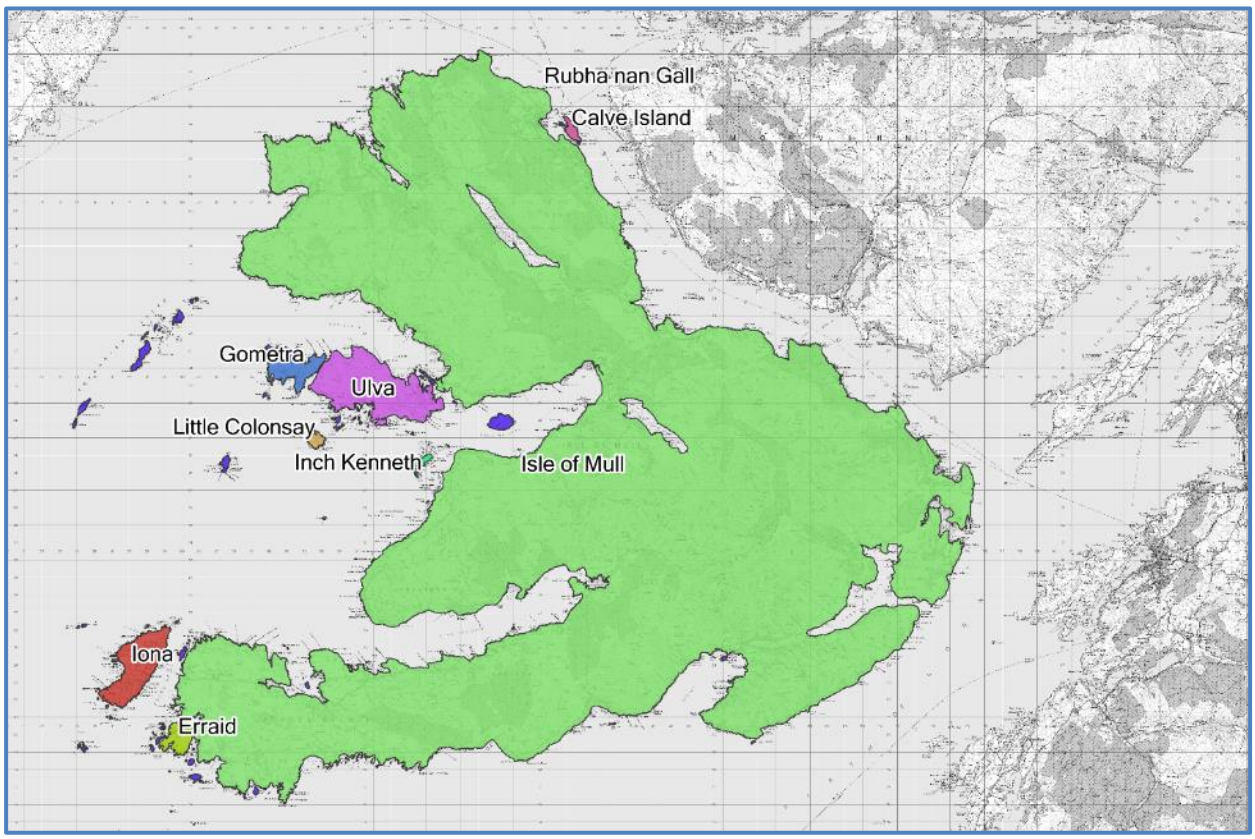

Figure 1 – The Mull Archipelago, including the inhabited islands of Mull, Ulva, Gometra, Erraid, Iona and Inch Kenneth.

The archipelago was volcanically active around 60 million years ago and has rocky and jagged coastlines with beaches along the coasts (Stephenson, 2011). The interior of the islands with the archipelago are predominantly mountainous, moorland, grassland, and native woodland, with settlements situated along the coast. Tobermory (900 residents) is the largest settlement on Mull, with smaller settlements at Dervaig, Salen, Craignure, Bunessan, and Fionnphort. The smaller islands within the archipelago have much smaller populations with large fluctuations between seasons. This includes Iona (177 residents), Ulva (11 residents), Erraid (6 residents), and Gometra (2 residents).

Mull is a place of high cultural sensitivity, with evidence of inhabitation from 8,000 - 10,000 years ago, following the last ice age (Ross of Mull Historical Centre , 2018). In particular, Iona is a globally important religious site, described as the birthplace of Christianity in Scotland and one of the most influential monastic sites in the British Isles.

The Mull Archipelago is also environmentally sensitive, with many key designations which may be constraining factors for low carbon development:

- The *Loch Na Keal* National Scenic Area (NSA), covering western Mull, Ulva and Gometra.
- Special Protected Areas (SPAs), including *Cnuic Agus Cladach Mhuile* covering the south coast and central Mull, including Ben More.
- *The Inner Hebrides and the Minches* Special Marine Areas of Conservation (SMAC), surrounding the archipelago.
- Sites of Special Scientific Interest (SSSI), including *Ardnameanach* and *Ben More* in central Mull and various sites across the south, west and north of the island.

Figure 2 provides an overview of key environmental designations and Figure 3 provides an overview of cultural designations across the archipelago.

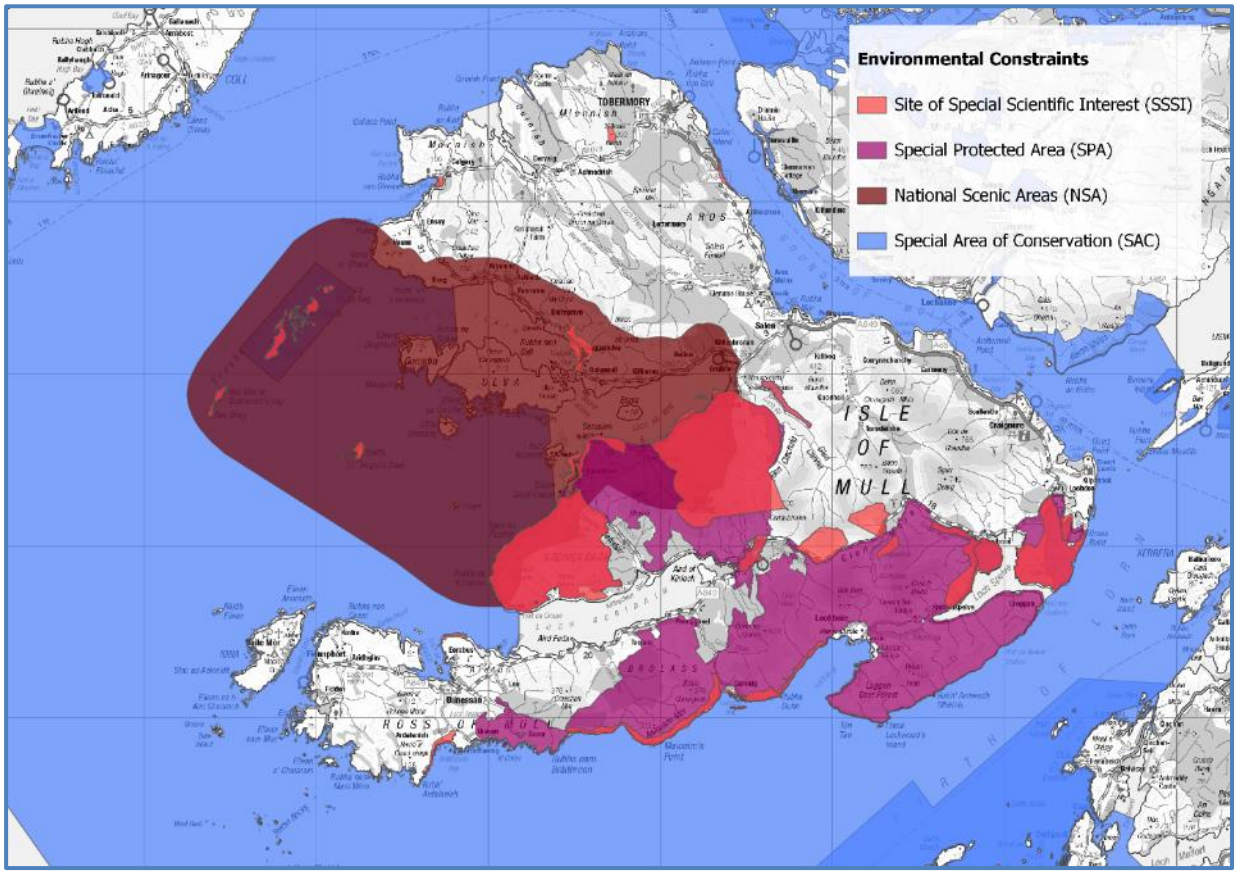

Figure 2 – Environmentally sensitive and protected areas on the Mull Archipelago.

There are approximately 85 listed buildings on the Mull archipelago, including a number of Grade A listed buildings: Iona Abbey, Iona; Macquarie's Mausoleum, Gruline; Torosay Castle and Duart Castle, Craignure. These sites are particularly sensitive and may form a constraint to some forms of energy and low carbon development. Conversely, decarbonisation of such high-profile sites should be seen as an opportunity and may be worth considering as demonstrator or lighthouse projects within The Archipelago.

Further to these listed properties, there are conservation area designations covering Tobermory, Dervaig, and the main settlement on Iona. Conservation areas limit development of visible interventions particularly, including solar panels, external heat pumps, and external energy efficiency works (e.g., double glazing, external wall insulation). There are 94 scheduled monuments across a range of archaeologically important sites on Mull and the wider Archipelago that should be considered in any low carbon or energy development planning.

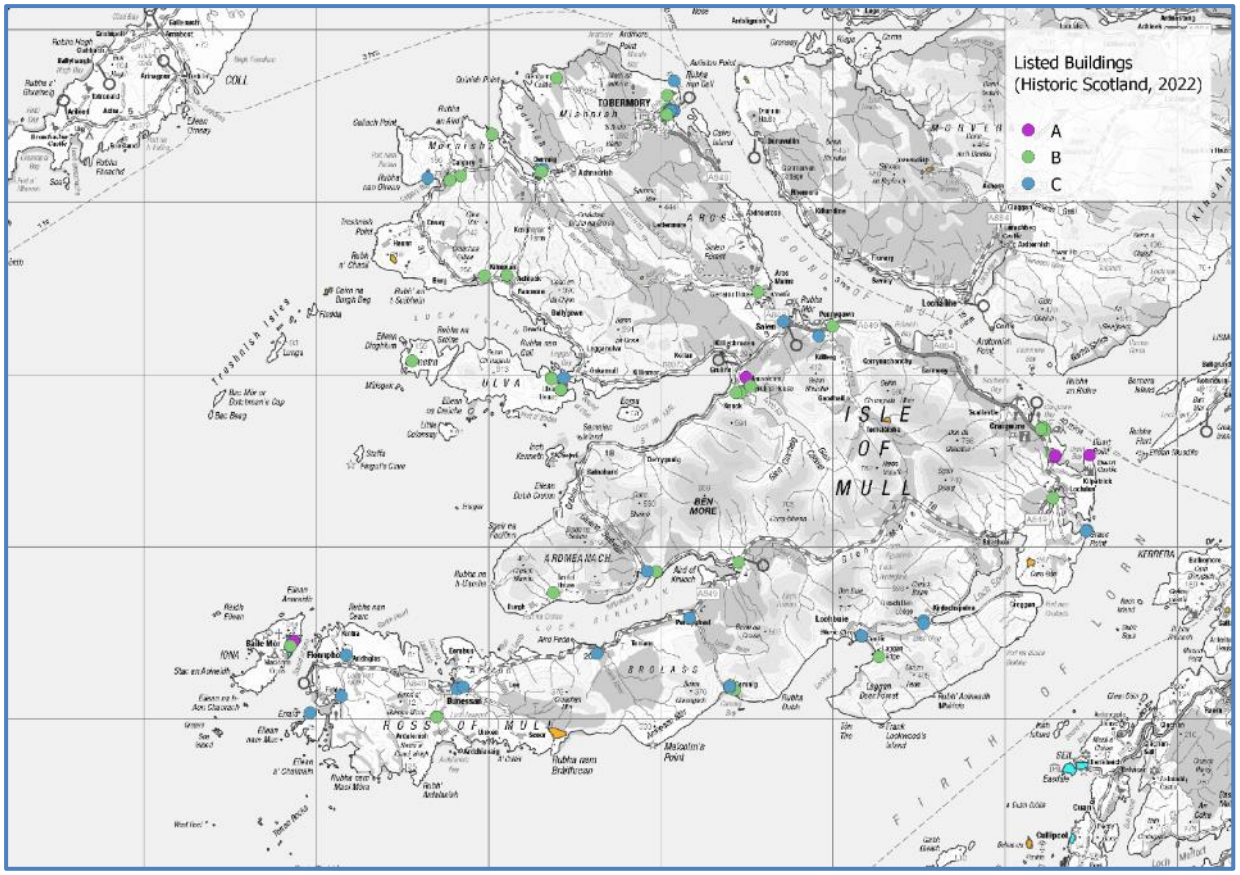

Figure 3: Culturally sensitive and protected locations on the Mull Archipelago.

Demographic Situation

The archipelago has been continuously inhabited for over 8,000 years. However, having hosted over 10,600 inhabitants across the Islands at its peak in the mid-19th century, the islands have since suffered a significant population decline. As of 2021, the population has stabilised at approximately 3,100 people, substantially higher than the lowest number of inhabitants recorded on the islands in 1971, when there were roughly 2,000 inhabitants (The Gazetteer for Scotland, 2022). With the archipelago population anticipated to grow by 2% a year, (~62 people), the demography is expected to change over the short to medium term. The average age for the archipelago is 40, two years younger than the Scottish average.

Based on CalMac carrying statistics, we estimate that there were 480,000 tourist visits to the islands in 2019, with overnight stays contributing to over 600,000 total "tourist days" on the islands (CalMac, 2023). There was a significant drop in tourist numbers in 2020 and 2021 due to the Covid-19 pandemic. Total passenger numbers on the four CalMac archipelago ferries fell by 64% from 2019 to 2020. Higher numbers of tourists were seen during 2022, with the expectation that tourist numbers will continue to rebound into 2023.

Local Government

A report from Strathclyde university consulted local communities to identify the challenges and strengths of living in the Mull area. They found a strong sense of community, heritage, and culture with untapped potential. Although, issues and challenges were found relating to transport, fuel poverty and security of fuel supply, stopping population decline and economic development. (Univeristy of Strathclyde , 2019)

The local government for the Mull Archipelago is Argyll and Bute Council (A&BC), based in Lochgilphead on mainland Scotland. A&BC has a service point in Tobermory, Mull, providing a location for customers to engage with local service provision, tax, and planning processes. A&BC is the local planning authority and is therefore the deciding body for most planning applications, in line with the Local Development Plan. Further relevant parties in relation to low carbon development on the islands are the Scottish Government, in relation to low carbon and energy policy, and NatureScot / Historic Scotland, in relation to planning and permitting of low carbon developments.

Local governance is supported by community organisations across the archipelago, including Mull Community Council (MCC), Iona Community Council (ICC), the Mull & Iona Community Trust (MICT), South West Mull and Iona Development (SWMID) (which owns Tiroran forest that has potential for 2 hydro-electric sites identified in 2012 by Mott MacDonald), and North West Mull Community Woodland Company (NWMCWC) – which owns and manages the island of Ulva – and other local organisations, companies, and bodies.

Economic Activities

Tourism has represented the primary economic activity on Mull for the past few decades. Based on ferry usage between mainland Scotland and Mull, it is estimated that the island received an estimated 480,000 visitors in 2019. The onset of the COVID-19 pandemic and related lockdown and travel restrictions in the spring of 2020 onwards reduced tourism by at least two thirds in 2020. The tourism industry is a key employer on the islands, with the tertiary (services) sector accounting for over 60% of all businesses or organisations on the islands.

In addition to tourism, forestry, small-scale agriculture, and a well-developed aquaculture sector form a large part of the islands' economy. The Tobermory distillery, a large four-still whisky distillery, is one of the largest commercial operations on the islands and is the largest single energy user on the island of Mull and the archipelago.

The primary sector also makes up 10% of businesses on the islands, this includes farming, fishing, and forestry sectors which make up a large part of the local economy. Secondary (manufacturing, construction) and quaternary (information technologies, consultancy, research) sectors make up 13% and 10% of organisations respectively (Companies House, 2023).

In order to decarbonise economic activity, it is important to first map the energy use and emissions from commercial operations, both direct and indirect. This includes a Greenhouse Gas Inventory, with sub-sectoral analysis, which contributes to an island low carbon transition pathway. Decarbonisation is an opportunity for businesses on the archipelago to do more than just reduce environmental impacts; it can reduce ongoing costs (e.g., energy bills), lead to improvements in operational efficiency, open up new markets (e.g., ecotourism), and support wider decarbonisation of transport, domestic energy, and land use.

Connection to the mainland

The islands are connected to each other and the mainland by ferry services operated by Caledonian MacBrayne (CalMac). The most heavily used of these is the Oban - Craignure ferry crossing which transported 650,000 (one-way) passengers in 2019. The Tobermory - Kilchoan and Fishnish - Lochaline crossings provide additional connections to the mainland. The Fionnphort - Iona crossing links Mull, Iona, and Ulva is serviced by a private ferry between Ulva Ferry and the island. The main Oban to Mull service is occasionally impacted by poor weather and fleet maintenance issues at CalMac, reducing frequency and availability of ferries and affecting deliveries to and from Mull. Similarly, the smaller ferries and inter-island ferries are affected by poor weather and are frequently unable to run, particularly in winter months.

Collectively, these four ferry crossings carried over a million passengers, 240,000 car, 10,000 commercial vehicles, and 2,500 coaches in 2019. Passenger journeys fell by two thirds in 2020, during the Covid-19 pandemic, with 2021 journeys also down by one third.

Energy Infrastructure

The Mull archipelago is particularly suitable for many forms of renewable energy, including small-scale hydroelectric potential, high and consistent wind resources, and solar potential. The energy audit detailed in chapter 2 highlights that there is already some locally owned, renewable energy on the islands in the form of hydroelectric (2,450kW), wind (313kW) and solar PV (115kW) installations. The islands already self-produces around 38% of their total electricity consumption, and this may need to increase to match increased electricity usage. However, the electricity network on Mull is highly constrained due to ageing and unsuitable grid supply infrastructure and distribution networks, as well as low levels of investment in network management and upgrade. Beyond use of electricity, the area is heavily reliant on fossil fuels for domestic and non-domestic heating and transport (including public and private road transport, as well as ferries).

The Mull electricity distribution network is connected to the mainland via three 33kV subsea cables. Iona and Ulva are both connected to Mull via domestic scale 11kVcables. The energy network on Mull and the wider archipelago is highly constrained. With a growing drive to decarbonise via the electrification of heating and transport, these capacity restrictions may place a significant limitation for the realisation of the archipelago's ambitions for island development. Several of the islands' primary substations are listed as constrained or partially constrained by the network operator, SSEN. Local distribution networks are undergoing major maintenance with 15km of 33kV upgrades planned for the Ross of Mull in 2024. The major constraint which limits new generation connections is imposed by the constrained Grid Supply Point (GSP) at Taynuilt on the mainland transmission network, which is not expected to be resolved until 2034.

In the UK there are ongoing discussions and emerging policy seeking to better enable local energy development. This is an important step in areas constrained by poor electricity distribution networks and includes options such as local balancing and demand side response, active network management, and local energy tariffing. For example, The Local Electricity Bill, supported by Power for People, recently passed the initial round of the House of Lords voting in July 2021. This will enable electricity generators to become local electricity suppliers. (Authority of the House of Commons , 2021)

2. Energy System Description

The energy system description of the Mull Archipelago can be split into several separate relevant energy sectors:

- Electricity consumption
- Electricity generation
- Heating
- Transport on the islands
- Transport to and from the islands
- Industries
- Other

Each sector has been analysed using available data from a range of sources, or otherwise suitable statistical calculations where direct data is not available. The data sources and methods used to calculate emissions are included for each sectoral analysis. The information provided is used to highlight the greatest contributors to greenhouse gas emissions from the archipelago, therefore enabling the development of a decarbonisation pathway and resulting allocation of focus, research, and resources.

Stationary energy usage (electricity and heating) and transportation are the main two emissions categories, both associated with a similar scale of emissions (14,700 and 12,200 tCO_2e respectively). Within this, the largest emission sectors are ferry transportation (6,900 tCO_2e), industry energy usage (4,700 tCO_2e) electricity (5,800 tCO_2e, much of which is used for heating), non-electric heating (4,300 tCO_2e) and passenger vehicles (3,500 tCO_2e).

Total carbon emissions across all sectors (electricity consumption, heating, transport, industry, waste, land use and livestock) amount to 35,800 tonnes CO_2e (tCO_2e), with approximately 102,000 MWh of energy used in 2019. This equates to 11.8 tCO_2e per resident which for context is 2.9 tonnes higher per person than the Scottish average.

Total emissions in 2018 were 2.3% higher than 2019, due to the ongoing reductions in the carbon intensity of the electricity grid. Hence, 2019 is used as the most representative baseline year for future comparisons within this study, with 2020/21 affected by the pandemic and only incomplete data available for 2022. The gathered data on all energy sectors associated with the Mull Archipelago are summarised in Table 1, with total emissions presented in the figure below.

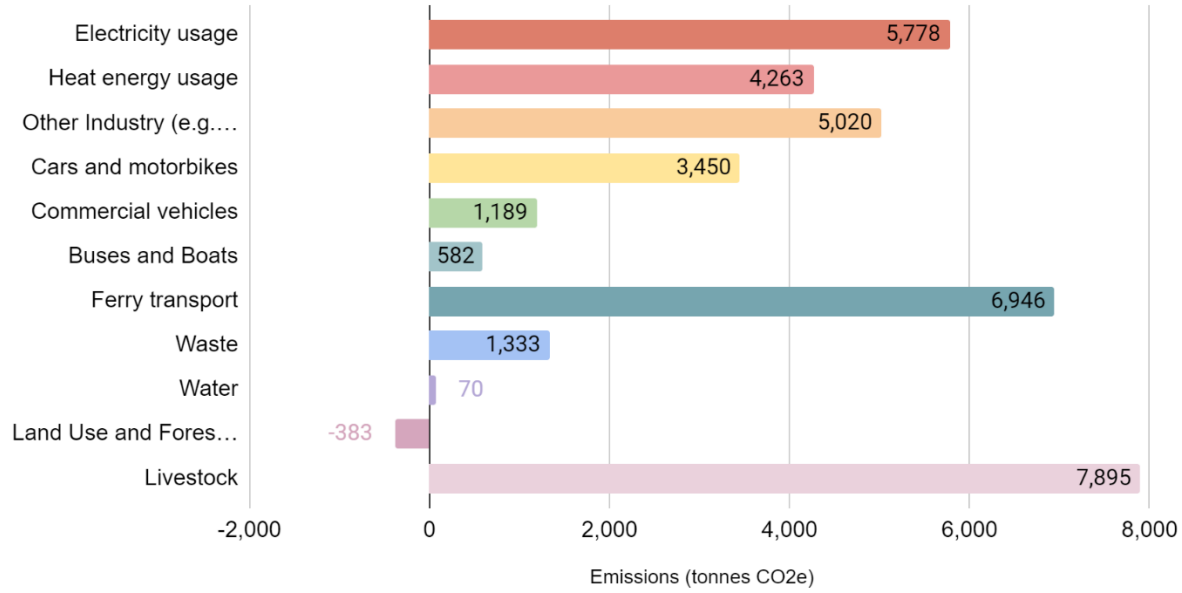

Figure 4: Breakdown of Total Carbon Emissions by sub-sector (tonnes CO2e. 2019)

Addressable Emissions

The Mull Archipelago is demographically very different from Scotland as a whole, and the emissions discrepancy is largely driven by factors particular to the archipelago. The High emissions from heating are due to the islands not being connected to the UK gas grid as well as energy inefficient housing stock. Tourism accounts for an estimated 17% of archipelago emissions.

This CETA provides a roadmap to net zero carbon emissions within the control of island-led transition actions, therefore some significant emissions sources may be outside of local control. Ferry emissions, of which 54% are attributable to tourists, are hard to abate without significant national investment in low carbon efficiency and fuelling upgrades. Livestock emissions are better viewed through a national lens, as they are skewed by the archipelago's small population and large land area. Farming is an essential part of islands life. Hence, removing these emissions categories, total "addressable emissions" are 21,300 tCO_2e, 7.1 tCO_2e per resident.

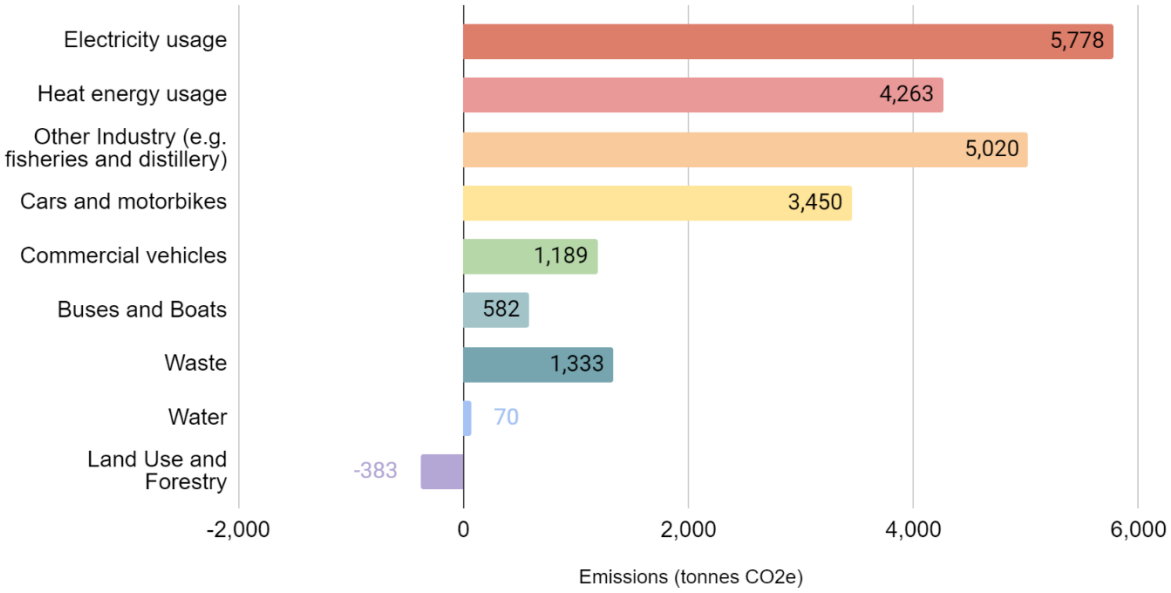

Figure 5: Breakdown of "Addressable" Carbon Emissions by sub-sector (tonnes CO2e. 2019)

Table 1: Summary of the total energy consumption on the islands.

2019 Data	Final [1] energy consumption [MWh]	CO_2e emissions [tonne]
Electricity consumption		
Residential	15,287	3,907
Primary sector	1,117	286
Secondary sector	1,991	509
Tertiary sector	2,453	627
Quaternary sector	1,756	449
Transport on the islands		
Cars and Motorbikes	13,497	3,450
Commercial Vehicles	4,446	1,189
Public Buses	1,356	325
Coach and Boat Tours	1,102	257
Ferry Transport to/from the islands		
Fionnphort - Iona	1,639	418
Fishnish - Lochaline	2,081	531
Oban - Craignure	20,660	5,266
Tobermory - Kilchoan	2,870	732
Heating (residential and non-domestic)		
Oil boilers	10,917	2,694
Solid fuel (wood or coal)	4,460	804
Multiple heating mix	1,711	352
LPG	1,927	414
Electric Heating*	11,610*	2,967*
Other Energy Usage by fisheries and industry	13,059	5,020

[1] All consumption figures are final totals. Using PE conversion factors, estimated total primary energy consumption is 123,000 MWh (BRE, 2019). (Electricity – 34,000 MWh. Transport – 22,000 MWh. Ferries – 30,000 MWh. Heating and Industry – 37,000 MWh). Carbon emissions in all cases refer to scope 1 and 2 emissions.

2019 Data	Final [1] energy consumption [MWh]	CO_2e emissions [tonne]
Other		
Waste and Water		1,403
Land Use and Forestry		-383
Livestock		7,895
TOTAL	**102,329**	**36,142**
Attributable to Tourists		6,224
Total Addressable Emissions**		**21,301**
Attributable to Tourists		*2,477*

** Note: Electric heating is also included as part of electricity consumption, so is not double counted in the final total tally.*
***Addressable Emissions exclude the emissions from ferries and livestock.*

Energy System

The Mull electricity distribution network is connected to the mainland via a 33kV subsea cable connecting the east of Mull (at Fishnish) to Lochaline, and two 33kV subsea cables connecting south-east Mull (at Gorten) to the mainland via the isle of Kerrera. Iona and Ulva are both connected to Mull via domestic scale 11kV cables.

The islands are not connected to the national natural gas grid, with no metered gas supply for heating. Residents and businesses therefore rely mainly on oil-fed boilers and electric heating, with a smaller role also for wood fuel stoves (often using locally sourced wood), coal and Liquid Petroleum Gas (LPG). The electricity network operator is SSEN (Scottish and Southern Electricity Networks).

Electricity Consumption:

The electricity consumption of the islands has been divided into residential, primary sector (e.g., farming / fishing), secondary sector (e.g., manufacturing), tertiary sector (e.g., hospitality) and quaternary sector (e.g., public sector and schools). Electricity usage data is sourced from National Statistics (BEIS, 2023).

Residential Demand

In 2019 there were 1,568 occupied dwellings across the islands, which used a total of 15,287 MWh electricity for domestic purposes. This is substantially higher than the Scotland average due to the greater use of electricity for heating purposes, amounting to 51% of total electricity usage. Although Tobermory has the highest prevalence of electric heating (57%), the Mull Central, South, and East geographic area has the highest household electricity usage at 10.5 MWh per occupied dwelling. This is most likely due to the area having the largest proportion of detached larger homes.

Total carbon emissions from residential electricity consumption were 3907 tCO_2e in 2019, which is slightly less than emissions from car transportation. The carbon emissions per kWh of electricity used will continue to decline year-by-year due to the ongoing decarbonisation of energy

generation infrastructure in the UK. Although more efficient use of electricity would reduce overall emissions, ongoing electrification – including for heating and transport – is expected to increase overall consumption. Higher electricity consumption is a net positive for overall emissions if it is displacing high emission energy sources (e.g., fossil fuels).

Non-domestic Demand

Non-domestic electricity consumption accounts for 7,341 MWh electricity usage, less than half that of domestic consumption. Similar to domestic usage, around half of this is used for heating purposes. Non-domestic electricity consumption emits 1,870 tCO_2e annually. Non-domestic electricity usage declined by 14% in the pandemic-affected 2020.

Tobermory is the area with the highest non-domestic electricity consumption (2,659 MWh) due to its high proportion of the islands' secondary and tertiary businesses. In contrast, Iona's small non-domestic consumption of 134 MWh originates from its few hospitality businesses.

The total non-domestic electricity consumption is divided by sector, using typical energy usage weightings per sector and a count of all archipelago organisations, as set out below.

Primary Sector

10-15% of organisations on the islands are in the primary sector, dominated by farming and aquaculture industries. The main emissions associated with these industries are not electrical in origin but are based on fuel usage (for boats or equipment), land usage emissions, and direct emissions from livestock. These are covered in the industry and other sections below.

Secondary Sector

The Secondary sector is the second largest source of electricity demand on the islands, using an estimated 27% of the total. 15% of organisations on the islands are in the secondary sector, some of which are associated with high electricity load. The Tobermory distillery uses 400 MWh electricity per annum, with the Mull Cheese Factory and Mull Bakery using 588 MWh (Scottish Islands Federation, n.d.).

Tertiary Sector

The tertiary sector is the largest source of electricity demand, accounting for a third of the total. Almost half of this tertiary demand originates from Tobermory. Over 60% of organisations on the islands are classified as in the tertiary sector, with hospitality a leading industry in the islands. Yet the typical tertiary property has fairly low energy demand, with reduced hours or closure in the winter months.

Quaternary Sector

In this initial overview we estimate that the quaternary sector uses 24% of total archipelago electricity usage, with Tobermory High School, Salen Primary School, and the Progressive Care centre the larger energy users. The quaternary sector includes a number of schools, and public and community buildings. A more detailed assessment of the energy demand of community owned properties will follow in phase 2.

Heat

Without metered gas central heating, the archipelagos residents rely on imported fuel for heating, with electric heating also playing a significant role. Direct non-gas heating data is not available and so the data presented in table 2 are best estimates based on Argyll and Bute heating data (BEIS, 2023), non-gas map data (non-gas map, 2023), reports on Scottish island

energy usage, and census-based data on property types.. The average domestic heat demand across Argyll and Bute in 2019 was 15,772 kWh annually.

Total domestic heating demand across the Mull archipelago totals 21,000 MWh, with 39% of this coming from heating oil and 37% from electric heating. Electric heating refers to the total electricity demand used for heating; electric heating uses lower energy inputs for the same heat energy output thanks to its high efficiency of close to 100% in the case of electric heaters and Coefficient of Performance (COP) of around 3~~00%~~ for heat pumps. Heating oil is associated with 49% more carbon emissions than electric heaters per kWh of heat produced (in Mull in 2019), and this discrepancy is only going to grow as UK electricity supply becomes lower carbon. Heating oil is also a higher carbon emission fuel than natural gas (or LPG) and thus shifting homes from this fuel to electricity is a decarbonisation priority. The two thirds of islands homes that use non-electric heating sources produce more carbon emissions than all car transportation by islands residents.

The few properties on the islands which use coal for heating are associated with the highest emissions, which are 58% greater than heating oil homes. Unfortunately, the best available data does not split coal-fired homes from wood-fired homes and therefore the data in table 2 combines both into a solid fuel (coal and wood) emissions estimate. In principle - when sustainably sourced and felled trees are replaced with trees with similar carbon sequestering properties - wood-fired homes are associated with the lowest system-wide carbon emissions of all heating types. However, the burning of wood pellets or unsustainably sourced wood fuel does produce a very high direct carbon emission, and the true sustainability of biomass as a fuel is an ongoing debate. Further, the burning of wood is associated with high levels of air pollution, with DEFRA data suggesting that wood-burners in the UK produce more particulate pollution than all road traffic.

Non-domestic heat demand totalled 9,461 MWh, with our best estimate being that this is powered 40% by electric heating, 29% by heating oil. Businesses with higher level heating needs typically use LPG or similar liquid fuels. Similar to the geographical split seen in the electricity consumption section, Tobermory is the area with the highest heat demand, with Mull North-West having a small heat requirement. The quaternary sector has a high heating demand due to the energy required to heat large spaces in the winter. Most schools have electric heating systems, and the Progressive Care Centre uses biomass.

Table 2: Heating fuel type and usage estimates across domestic and non-domestic properties.

Fuel Type	Total Domestic Heat Demand (MWh)	CO_2e Emissions (tonnes)
Oil boilers	8,152	2,012
Solid fuel (Wood or Coal)	2,998	540
Multiple heating mix	1,712	352
LPG	453	97
Electric Heating	7,850	2,006
	21,165 MWh	**5,007 tCO_2e**

Fuel Type	Total non-domestic Heat Demand (MWh)	CO_2e Emissions (tonnes)
Oil boilers	2,764	682
Solid fuel (Wood or Coal)	1,462	263
LPG	1,474	317
Electric Heating	3,760	961
Total	**9,461 MWh**	**2,223 tCO_2e**
Combined Total Heat Demand		
Total	**30,626 MWh**	**7,230 tCO_2e**
excluding electricity	**19,015 MWh**	**4,263 tCO_2e**

Combined heat demand totals over 30,000 MWh per year, with this split between oil boilers and electric heating. The below figure displays the energy usage for each main heating type, across both domestic and non-domestic properties.

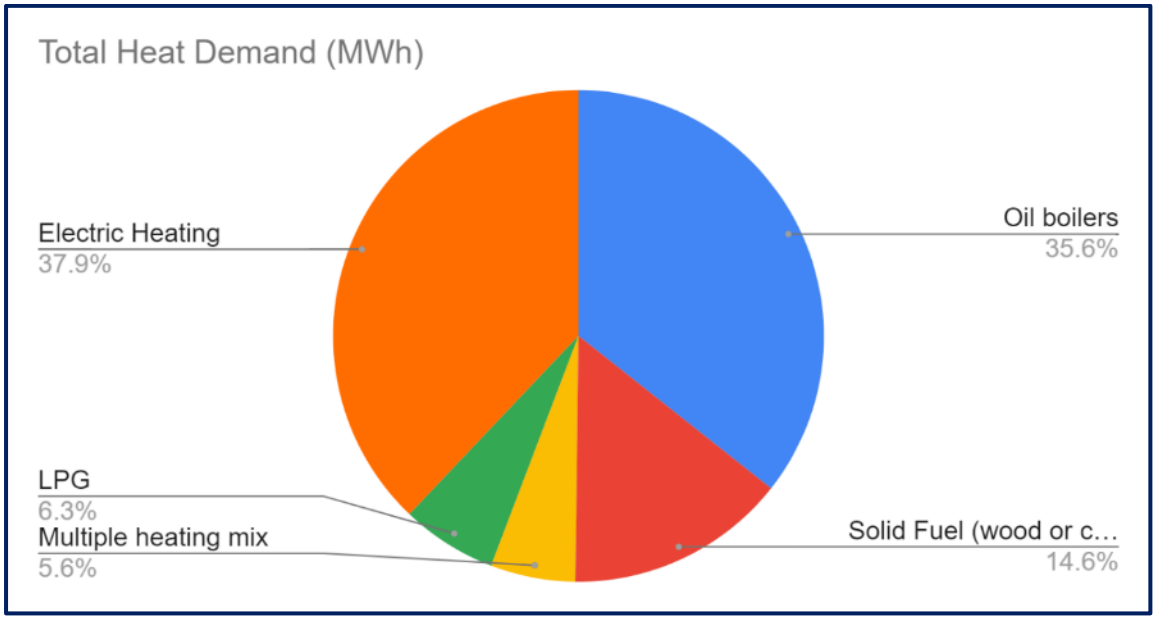

Figure 6: Total Heat Demand, MWh (domestic and non-domestic)

Electricity Generation

The Mull Archipelago has several renewable energy generators, with a combined **total installed operational grid-connected capacity of 2.85MW, which is estimated to produce 8,577 MWh in a typical year**. The largest generators are the Derryguaig (900kW), Ben More (550kW) and 400kW Garmony Hydro sites, which, along with six other hydro sites produce an estimated 7500MWh per year, 87% of total production. The other hydro sites are Tobermory (280kW),

Sgriob Ruadh (180kW), Ardnacross (100kW), Alt a'Mhuilnn (88kW), West Ardhu (80kW) and Torloisk (50kW). This is based on Local Energy Scotland (2022) and Argyll and Bute (2022) data.[2]There are 10 grid-connected small-scale wind turbines, led by the Glengorm Landfill Site (90kW), the Scottish Water Treatment facility (60kW) and Sgriob Ruadh (50kW). There is also 22kW in off-grid wind. Islands' generation figures are based on (Local Energy Scotland, 2023) (Argyll and Bute Council, 2023)) and local Mull Wind power servicing data.

Based on the Mull and Iona energy audits undertaken by the Scottish Islands Federation (Alderd, 2016) there are at least 36 small-scale solar sites across Mull and Iona which we estimate produced 110 MWh in a typical year. There is also a solar installation in Ulva capable of producing 21 MWh which is currently non-operational as of 2022, due to a lack of demand at the unoccupied supply properties and technical problems with the array.

The Mull Archipelago therefore produces around 38% of the electricity it consumes, relying on imports from the mainland for the other 62%. With the growing electrification of demand, particularly for heating and transport, this may need to increase to enable suitable local capacity. Mull is connected to the mainland by three subsea 33kV cables, which is one more than nearby Arran despite the smaller population size. However, several of the island's substations are listed as constrained or partially constrained by the network operator, SSEN.

The National Grid carbon intensity of electricity in 2019 was 0.26 kg CO_2e/kWh and this has been used to calculate the emissions associated with electricity usage. However, it is reasonable to assume that in reality the actual emissions associated with electricity usage is lower than this thanks to 38% of islands' electricity demand being self-produced with renewable energy. This electricity production is unlikely exported beyond the local distribution network. Yet, distribution network losses are high in the Archipelago due to the long 33kV and 11kV distribution radials. Overall, grid carbon intensity declines year-by-year. From 2019 to 2021, grid carbon intensity declined by 17%, and National Grid forecasts carbon intensity to decline to between 0.04 to 0.1 kg CO_2e/kWh by 2030 in their four alternative scenarios (National Grid, 2022).

Table 3: Total electricity produced across the Mull Archipelago.

Data for year 2021	Estimated yearly energy production [MWh]	Total installed capacity [kW]
Wind (14 sites inc. Glengorm)	***1034***	*313*
Hydro (7 Sites inc. Garmony)	***7,506***	*2,448*
Solar (at least 36 sites)	***110***	*115*
TOTAL	***8,649***	*2,876*

A map of renewable hydroelectric, wind and renewable heat sites on the archipelago can be seen in Figure 7. The blue drop pins indicate the hydro energy sites, the yellow drop pin is the Glengorm wind turbine site, and the red drop pins represent the solar sites. There are at least 36 solar sites on the archipelago, although these sites are small scale. New generation is a challenge on the archipelago due to network constraints. Smart metering is not available

on most of the islands, and it is reported that SSEN consider grid connections for generators that can offer "flexible services." Therefore, energy storage, active network management or innovative capacity trading are crucial considerations for new developments.

Figure 7: Renewables Mapping for the Mull Archipelago (Blue: Hydro, Red: Wind)

Transport on the Islands

On archipelago transportation used 20,900 MWh fuel in 2019, which is associated with 5,200 tonnes CO_2e emissions. This includes all vehicle types for private transportation, as well as public buses, coach tours and boat tours around the islands (but not ferry transport). The breakdown of results is displayed in table 4. Vehicle emissions are estimated using the induced activity method, based on the number of licensed vehicles by type in the study area and vehicle traffic miles (DfT, 2023). This is amended to include the transportation of tourists, as determined by CalMac vehicle carrying statistics (CalMac, 2023).

Petrol and Diesel cars are the leading energy users, collectively accounting for over 64% of fuel litres and 66% of emissions of all transportation on the islands. A portion of these emissions are attributable to tourists, whose driving, coach, and bus journeys emit an estimated 1,265 tCO_2e, 24% of the archipelago on islands transport total. The drop-off in tourism alongside lockdown measures reduced total on-islands transportation emissions by 21% in 2020. Indeed, the private land emissions attributable to residents' transportation is not large compared to Argyll and Bute, standing at 1.2 tonnes per resident compared to 2.5 tonnes. According to the

Scottish Islands Federation audit, the average yearly car mileage by Mull residents is around 9,100km, or 110 miles per week (Alderd, 2016). Based on statistical adaptation to Census data, there are an estimated baseline of 2041 vehicles owned by residents of the islands, including 822 petrol cars, 687 diesel cars, and 393 vans.

The average diesel car is associated with lower emissions per km than petrol cars (0.173 vs. 0.181 $kgCO_2e$/km), although they contribute greater volumes of nitrous oxide emissions, worsening air pollution. Commercial (mainly Light Good Vehicles) produce a disproportionate share of private transportation emissions due to the combination of higher emissions per km (LGVs produce around twice those of cars) and greater annual mileage.

Every kilometre travelled via walking, cycling, EV or public transport produces a significant reduction in emissions if it is displacing combustion vehicle transportation. For example, a 2km displacement per day - such as from walking rather than driving a petrol car to local shops or schools - results in an estimated 132 $kgCO_2e$ reduction over the year. Taking a journey by the average local bus rather than a petrol car reduces carbon emissions by 0.07 $kgCO_2e$ per kilometre per passenger. As an illustration, replacing a once per week 34 km petrol car round trip (such as from Craignure to Tobermory) with bus journeys would reduce annual emissions by 270 kg CO_2e. However, taken on an individual-by-individual basis, the savings are greater than this as the bus service is typically going to run whether someone decides to make a journey by bus or not – higher average bus occupancy results in lower emissions per passenger.

Public transportation on the archipelago comprises a fairly small share of total on-islands transportation usage, with the public buses producing just 6.2% the emissions (325 tCO_2e) and 6.5% the energy usage (1,356 MWh). This is calculated using the timetable of the 3 local bus routes (494, 95/495, 96/496) as well as an estimation of usage from Ulva Community Transport's electric car, hybrid bus and tourer[3]. The two Craignure buses (the 95/495 to Tobermory, 43km, and the 96/496 to Fionnphort, 56km) produce the highest emissions due to the larger distances travelled and, in the case of the 95/495, double frequency at weekends. The electrification of, for example, the 95/495 bus (Craignure to Tobermory, 21km) which produces an estimated yearly 138 tCO_2e, would have a similar effect to the electrification of 60 cars.

Coach and boat tours of the islands collectively emit an estimated 260 tCO_2e from their over 100,000 litres fuel usage, as based on vehicle/vessel type, routes, and timetabling over the year. West Coast Tours appear the largest operator due to the frequency and range of trips, with 119 tCO_2e in coach emissions and 58 tCO_2e in boat emissions estimated.

The fuel costs of all on-islands transportation amounts to £3m annually, with almost £2m for cars only. Despite using more fuel than the coach and bus tours, local buses have a lower fuel cost (estimated at almost £100,000 in 2019) thanks to the 80% fuel duty rebate.

Table 4: Estimated fuel consumption, cost, and emissions, used for transportation on the islands in 2019.

Vehicle	Fuel Type	Average cost of fuel (£)	Litres of fuel total	Annual CO2e total (tonnes)	Annual MWh of final energy total
Petrol Cars	Petrol	£983,900	787,900	1,891	7001
Diesel Cars	Diesel	£844,400	642,201	1,541	6429

[3] The public bus fleet consists of Irizar i4 Integra (55 seats), Scania Irizar i6 (43 seats) and Optare Solo (~30 seats) (West Coast Motors, 2023)

Vehicle	Fuel Type	Average cost of fuel (£)	Litres of fuel total	Annual CO2e total (tonnes)	Annual MWh of final energy total
Hybrid Cars	Petrol/(E)	£2,450	1,960	5	17
Motorbikes	Petrol	£19,500	15,603	13	50
Commercial	Diesel	£585,500	445,320	1067	4446
Other	Diesel	£66,000	50,234	121	503
Public Bus	Diesel	£95,500	135,450	325	1356
Coach tours	Diesel	£94,500	71,841	172	719
Boat tours	Marine fuel	£28,500	35,148	84	383
TOTAL		**£2,720,236**	**2,175,683**	**5,206**	**20,904**
Attributable to Tourism				**1,265**	**24%**

The distribution of carbon emissions across on-island transportation methods is displayed in the below figure.

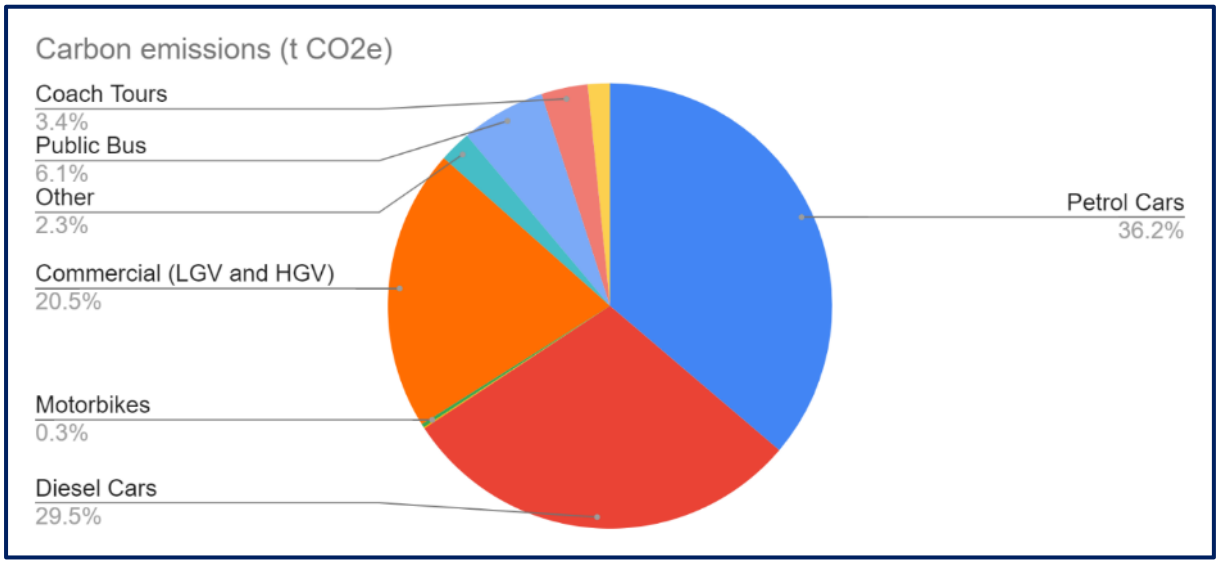

Figure 8: On-island transportation emissions (t CO2e)

Transport to and from the Islands

Transportation to and from the islands is a large energy use, with associated emissions and energy usage (6,950 tCO_2e, 27,000 MWh) surpassing all on-islands transportation.

There are 4 private ferry services, operated by Caledonian MacBrayne (CalMac). The largest of these is the 15km Oban – Craignure crossing, with the regular "Isle of Mull" vessel using 1,900,000 litres of fuel and emitting 5,300 tCO_2e in 2019. This vessel represents 76% of the emissions of all four ferry services. The two other crossings to the mainland (Fishnish – Lochaline and Tobermory – Kilchoan) contribute 18% of the total. The Fishnish-Lochaline Lochinvar vessel is diesel-electric hybrid and has been in operation since 2013. This is associated with a 20%

reduction in fuel usage and thus also emissions. The inter-islands Fionnphort - Iona crossing is the smallest in terms of emissions thanks to the very short (1km) distance of the crossing.

There is also a small local passenger ferry between Mull and Ulva which is community operated, predominantly used for foot passengers and bicycles. During the summer months the ferry is available for tourists when required; however, during the winter months until April, the ferry is operated between 9.15am to 3.30pm to carry school children across to school on Mull. Annual fuel consumption is an estimated 2,500 litres which is equivalent to 0.6 tonnes CO_2e.

Around 54% of ferry energy usage is attributable to tourism. There were 1,070,000 passenger crossings in 2019 and 240,000 crossings by cars. Despite the very large portion of these journeys which are attributable to tourists, the heavier weight of commercial vehicles skews upwards the share of ferry emissions attributable to activity by residents. Fuel usage data below was provided by CalMac.

Table 5: Fuel consumption and emissions, used for transportation to and from the islands in 2019.

CalMac ferry journeys (2019)	Litres of fuel total	Annual CO2e total (tonnes)	Annual MWh of energy total
Fionnphort - Iona **(Regular vessel: Loch Buie)** **(Other vessels: Loch Linnhe, Loch Tarbert)**	150,500	418	1,639
Fishnish - Lochaline **(Regular vessel: Lochinvar)** **(Other vessels: Hallaig, Loch Tarbert**	191,120	531	2,081
Oban - Craignure **(Regular vessel: Isle of Mull)**	1,897,316	5,266	20,660
Tobermory - Kilchoan **(Loch Linnhe and Tarbert vessels)**	263,594	732	2,870
TOTAL	**2,502,530**	**6,946**	**27,250**
Attributable to Tourism	**53.9%**	**3747**	**53.9%**

Industries

Industrial energy usage amounts to an estimated 13,000 MWh, producing 4,700 tCO_2e – this is the non-electrical and non-heating energy usage. These emissions are similar in scale to all on-islands transportation or all electricity usage. The main contributors are the larger manufacturing businesses (the largest being the Tobermory Distillery) and the sizable aquaculture industry. Other smaller inclusions are from farming equipment and construction. Of note here is the new development planned for 90 new homes, a care home, nursery, and

shop in Craignure. Most of the data provided below is sourced from the Scottish Islands Federation energy audit (Alderd, 2016).

On-islands industry

The Tobermory distillery is a large four-still distillery which was founded in 1798 and now owned by multinational Distel. Since a four-still upgrade it is capable of producing up to 1,000,000 bottles per year. It uses 8,000 MWh of fuel oil in the high-energy heating processes, which is associated with 2,100 tCO_2e. The whisky industry in Scotland accounts for around 10% of total Scottish energy consumption. (Früh, Hillis, Gataora, & Maskell, 2021) but it is a hard industry to decarbonise due to the high heat and steam requirements. The most energy-intensive aspects of the distillery process are the heating of the wort (72°C) for fermentation and the distillation phases (92°C). Potential decarbonisation options include using biomass, anaerobic digesters, or the more immature technologies (on this scale) of heat pumps or hydrogen boilers.

The Isle of Mull Cheese factory and Mull Bakery use around 400 MWh in red diesel and 1,300 MWh in wood according to the Scottish Islands federations (2015) audit.

Aquaculture

The islands have a large aquaculture industry with 30 licensed sites (19 shellfish, 11 finfish), operated by 13 companies. This is associated with almost 2,000 tCO_2e from fuel usage by red diesel (2,000 MWh), marine diesel (750 MWh), and petrol (250 MWh). This includes several salmon sites. Fishing by non-local boats has not been included here, and there is sizable activity around the Mull archipelago.

Shellfish capture plays a large role in the islands' aquaculture and is associated with lower emissions than other fisheries due to the lower fuel usage and distances travelled. In fact, shellfish farming can bring eco-system benefits through its negative eutrophication potential, actively cleaning the water. Also of note is Aird Fada Seaweed Farm, a 6-hectare seaweed owned by SWMID in the waters of Loch Scridain, south west Mull. The seaweed harvest is sold for uses such as foodstuff, sustainable packaging, livestock feed, soil regeneration and cosmetics.

The Sound of Mull Spatial Plan (2010) set out policy guidelines and information for achieving sustainability in the marine environment (Scottish Sustainable Marine Environment Initiative, 2010). It is important to balance the two policy priorities of encouraging developments that further the needs of the community, whilst also safeguarding local 'features of importance.' Sound of Mull vessel numbers have remained fairly stable amid a turbulent time for the industry and fish stocks due to the majority of local boats being small (<10m). The 2010 development plan highlights the importance of the industry to Mull, its excellent clean waters and ideal fishing grounds.

Other Emission sources

Waste and Water

Waste may be a small contributor to local emissions (at 3.9% of the total), but at around 1,300 tCO_2e this is similar in scope to non-domestic heat consumption. These emissions do not include the embedded emissions from the initial production of materials, but include the emissions from collection, transportation, and disposal of waste, "gate to grave." This predominantly comprises emissions from anaerobic decomposition of the waste in landfill, a process which releases greenhouse gases including methane. Methane is 25 times more

potent than CO_2 in its global warming potential (GWP). Households account for 34% of the waste emissions, with the rest produced by non-domestic organisations.

Emissions from waste in Mull are more than twice the Scottish per person average due to high landfill rates, with almost half the tonnage of waste being disposed in landfill in 2019, rather than recycled, composted, or incinerated. Argyll and Bute council landfill rates ranked 4th highest out of the 32 Scottish local authorities in 2019. The last Argyll and Bute waste strategy identified the Glengorm landfill site in Mull as near capacity, and it is to be extended beyond the limits of the 2021 Scottish Government ban on biodegradable municipal waste in landfills. Recycled materials are transported and sorted on the mainland.

Sending paper or cardboard waste to landfill rather than recycling contributes an additional tCO_2e per tonne of waste. These materials only make up 0.8% of Scottish landfill but produces 1.6% of the landfill emissions. Composting food or garden waste (rather than landfill) saves 0.6 tCO_2 per tonne of waste.

Water-related emissions are reported according to the national level reported by Scottish Water, at 70 tCO_2e for treatment and processing for the 305 million litres used by islands residents in 2019.

Land Use, Land Use Change and Forestry (LULUCF)

Land use emissions in the area reduce total emissions by almost 400 tCO2e / year. Scotland as a whole also typically has neutral or negative LULUCF emissions thanks to large areas of forestry, woodland and peatland that act as a carbon sink. In the case of Mull, the carbon sink of forestry sequesters over 1000 tCO_2e / year. In scale, this negates the emissions from, for example, both the Fishnish - Lochaline and Tobermory - Kilchoan ferries. Opposing these carbon negative land uses are the carbon emissions resulting from croplands, grasslands, wetlands, and settlements. The highest emitting aspect of cropland is from the management of soils. Nitrous oxide, which has 298 times the global warming potential of CO_2, is released with the application of fertilisers to soils. The largest emitting aspect of grassland management comes from the drainage of mineral soils.

Protecting (and extending) the forestry and woodland of Mull is a decarbonisation priority. The Mull and Iona Community Trust bought the 200ha of the Ardura forest in 2019, which is planned to be used both for the protection of biodiversity but also to strengthen the financial position of the community via 110ha of commercial timber crop. SWMID have owned the Tioran Community Forest since 2015 and manage it for the benefit of the local community. Similar care should be taken that timber is sustainably harvested, and indeed SWMID have also purchased a sawmill. The Tireragan Trust works to protect 625 hectares of conservation importance in the south west tip of the Ross of Mull (Tireragan Trust, 2023). The North Mull Land Management plan is currently being renewed, with the over 3000ha of land that covers Aros, Ardmore and Quinish forests, similarly balancing protection, and biodiversity with timber production. In the east of Mull, the Torosay hills restoration project, spanning a 3000ha area, aims for the restoration of the woodland and peatland environment, coupled with reduced sheep and deer grazing.

There are several heritage conservation areas in the Mull archipelago, including in Dervaig, Iona and Tobermory. As described in section 2, the Mull Archipelago is environmentally sensitive, with the National Scenic Area (NSA) covering western Mull and nearby Isle of Ulva, designated ancient woodland areas, a special area of marine conservation (SAMC) to the

South and West of the island, Special Protected Area (SPAs), Sites of Special Scientific Interest (SSSI), and Special areas of Conservation (SAC).

Livestock

The emissions from livestock farming includes enteric fermentation and manure management. An estimate of these emissions is included here for informational purposes for a complete carbon audit of the archipelago. However, farming is an integral and highly valued part of island life. Any community climate action proposed in this report is centred on encouraging local consumption and resource use.

Livestock emissions are estimated to contribute 7,900 tCO_2e, with 80% of these emissions originating from enteric fermentation (methane) and 20% from manure management (methane and nitrous oxide). Cattle make up 81% of total emissions, 14% are from sheep. Caution is required when comparing agricultural emissions to other emissions on the archipelago due to the large discrepancy between the land area (910 km^2) and small population, which has a smaller associated energy and transport footprint. We estimate that livestock emissions are five times less than the Scottish average on a per km basis. For context, according to the latest statistical release the agricultural sector as a whole constitutes 17% of Scotland's total emissions (Scottish Government, 2023).

These figures were calculated using archipelago livestock numbers based on the agricultural census and DEFRA livestock demographic heat maps and is therefore sensitive to the assumed livestock numbers stated below (Animal & Plant Health Agency, 2022). Livestock emission factors are from the UK Greenhouse Gas Inventory which assume average management measures and feedstock (DEFRA, 2003). Whilst some farming methods on the archipelago may not reflect these "average" emissions factors, it is beyond the scope of this high-level audit to produce more detailed analysis, which would require a further study.

Methane and nitrous oxide have particularly damaging global warming potential (GWP), with methane 30 times the GWP of CO_2, and Nitrous Oxide 298 times the GWP of CO_2. The manure management system, livestock species, feedstock, and rearing measures effect emissions. Collective livestock and manure emissions account for 5.8% of all global carbon emissions (Ritchie, Roser, & Rosado, 2020). Methane released via enteric fermentation, a by-product of digestion, is particularly voluminous in cattle. Dairy herds emit more than twice as much as beef herds, and beef herds roughly eight times that of sheep, on a per animal per year basis. Pigs have low enteric fermentation and poultry do not produce enteric methane by-products. To place enteric fermentation in context, in 2019 the emissions from one average beef cow was the same as that of the average petrol car in Mull. Abatement of a portion of these enteric fermentation emissions is possible by raising cattle with probiotics, selecting for low methane production, and altering the configuration of diet for adults.

Emissions from manure management are estimated to contribute 1,500 tCO_2e to the above total, with emissions dominated by cattle who make up 86% of the emissions from manure. Nitrous oxide and methane are released when manure decomposes, particularly when under low oxygen conditions in confined areas where manure is stored in piles. Emissions depend on the manure management system in place.

Table 6: Livestock Emissions

Livestock	Livestock Population	Enteric Fermentation Methane Emissions (tonnes CH_4)	Manure Management emissions		Total Carbon Dioxide Equivalent (CO_2e)
			Methane (tonnes CH_4)	Nitrous Oxide (tonnes N_2O-N)	
Cattle	3.5 / km²	206	18	2.6	**6,389**
Sheep and Lamb	5 / km²	34	1	0.7	**1,072**
Other[4]		13	2	0.2	**434**
Total		254	21	3.5	**7,895**

Future Energy Use

This section provides an overview of future energy uses, projections and energy systems for the Mull Archipelago.

Future Electricity Demand

It is important to forecast energy scenarios to understand how electricity demand and generation may increase in the future. This informs the strategy for how best to decarbonise and provides contextualisation for the roll-out of low carbon technologies such as Electric Vehicles (EVs) and heat pumps. The Distribution Network Operator (DNO) for Mull – Scottish & Southern Electricity Networks (SSEN) – has formed projections for growth in renewable generation and demand technologies according to four scenarios: Steady Progress, Consumer Transformation, System Transformation and Leading the Way (SSEN, 2022). All apart from Steady Progress achieve the Scottish government target of net zero emissions by 2045. Table 7 and 8 translate these regional projections to the Mull Archipelago based on the required growth rate in renewable generation (table 7) or proportionate share based on total households and vehicles in the archipelago (table 8). These are presented as indicative growth forecasts to be used only as a transformation benchmark for Mull. In practice, achieving transformation – both in on-islands electricity demand and generation – requires substantial upgrades to the currently constrained Mull distribution network.

Only the Steady Progression and Consumer Transformation scenarios have been reported in the table, for the most direct representation of the impact of community action.

- Under Steady Progress, the net zero target is not hit, and any decarbonisation progress is slower to be rolled out.
- Under the Consumer Transformation scenarios, communities and individuals have a leading decarbonisation role (rather than relying on system-level transformation).

The Consumer Transformation scenario may act as a guiding aim for the Mull archipelago communities and give a sense of the scale of transformation of energy infrastructure required.

Table 7 outlines how SSEN's forecast for growth in renewable generation translates to the archipelago under the two scenarios. Under the Steady Progress scenario, total renewables

[4] Goats 0.01 / km², Pigs 0.25 / km², Horses 0.43 / km².
Wild deer are not included in total livestock emissions, but assuming a population of 9.35 / km² are responsible for around 1,660 tonnes CO_2e.

capacity only increases 44% by 2045 on the islands, in a slow manner. In comparison, under the Consumer Transformation scenario, local generation doubles by 2045. Current archipelago electricity demand is only able to be met by archipelago generation in the Consumer Transformation 2045 scenario, but of course, by 2045 total electricity demand may have doubled.

Table 8 starkly lays out the huge increases in electricity load required for a net zero transformation, assuming a steady 1% increase in population and tourism. As seen in table 7, even this moderate 1% assumption leads to substantial demand increases over time. Under the Consumer Transformation scenario total electricity usage increases 49% by 2030, with this driven by a fairly even split in EVs, heat pumps, and population-led growth. At this stage about a quarter of the islands' cars are electric, and one fifth of the homes have heat pumps. However, by 2045 the rollout accelerates to incorporate all vehicles and homes, contributing to a more than doubling in total electricity demand. Heat pumps typically have ~~around~~a coefficient of performance of around 3 ~~300% efficiency, as~~ the heat energy is transferred from the initial heat source rather than generated via fuel. This means that the roll-out of heat pumps leads to less total heat energy input required, with 8,200 MWh estimated to be required for heat pumps in 2045.

Table 7: Future electricity generation under different SSEN future energy scenarios, 2030 and 2045

Renewable Generation (MW)	Baseline 2019	2030		2045	
		Steady Progress	Consumer Transformation	Steady Progress	Consumer Transformation
Estimated total (MW)	2.88	3.4	4.2	3.7	5.7

Table 8: Future electricity demand under different SSEN future energy scenarios, 2030 and 2045. Increases compared to 2019 baseline.

Electricity demand increase (MWh)	2030		2045	
	Steady Progress	Consumer Transformation	Steady Progress	Consumer Transformation
Electric Vehicles	520	1,200	3,600	3,500
Heat pumps	1,060	3,360	3,480	8,200
Population and Tourist growth (1% yearly)	3,100	3,650	12,700	14,200
Estimated increase (MWh)	**4,680**	**8,180**	**19,800**	**25,870**
Total (MWh) (2019 = 23,600 MWh)	**28,300**	**31,800**	**43,400**	**49,500**
% Increase to 2019 baseline	**20%**	**35%**	**84%**	**110%**

The shape of the net zero trajectory appears different under alternative scenarios. Under the SSEN "System Transformation" scenario net zero progress is driven by system-level change - here the growth in electric vehicles is 35% lower by 2030 than under the Consumer Transformation scenario due to lack of consumer confidence and an assumed delay of the 2030 ban. However, EV growth is 34% higher in the "Leading the Way" scenario, which is characterised by a Consumer Transformation level of societal change turbocharged by system-level support. Heat pump take-up under the System Transformation scenario is lower than under Steady Progress due to the envisaged future role for a hydrogen network. Heat pump take-up under Leading the Way is 16% higher than Consumer Transformation by 2030 but drops back by 2045 due to the assumed role for hydrogen. Under the System Transformation scenario, growth in onshore wind is 25% lower than in the Consumer Transformation scenario and driven by larger scale development. Growth in large-scale solar in both scenarios is similar, although small-scale solar is substantially reduced in the System Transformation scenario (32% lower).

3. Stakeholder mapping

The stakeholder mapping provides a plan for stakeholder engagement to support the progression of low carbon opportunities for the Clean Energy Transition Agenda (CETA) and community-led renewable energy hub and EV scheme on Mull and the wider Mull Archipelago. Scene will deliver the described engagement in close coordination with the climate action steering group from the Mull & Iona Community Trust (MICT) as part of the AMAZE project – The Archipelago of Mull Actions for Zero Emissions.

The engagement methods described have been designed to ensure that the main organisations around which the CETA is focused on are full stakeholders in the process, to secure their support and participation. A wider objective is to engage with residents and relevant wider stakeholders to make them aware of the project and offer the opportunity to input into the development process.

The purpose of this stakeholder engagement plan is to:

- Identify the key stakeholder types and key contacts (*who* to engage with), and the level of their involvement/interest and influence in relation to the proposals and to define a communications hierarchy (Stakeholder Mapping);
- Develop the aims and objectives for the engagement, relative to the stakeholder types, to define *how* we will engage, and *what* the message is; and
- Assess the capacity for involvement, to understand how much involvement the different stakeholder types want or expect, to define timelines for the planned engagement activities.

The Plan comprises two parts, which are intended to be used dynamically throughout the development stages. This report, which provides the methodology for how to develop and deliver the plan; and a spreadsheet, which provides the structure for populating, and recording, the stakeholders, the communications strategy, and the action plan.

Civil society organisations

Mull and Iona Community Trust (MICT)

Mull and Iona Community Trust (MICT) is a local trust that works to engage and improve the communities of Mull, Iona, and associated islands. The organisation's mission is to enable thriving and socially connected communities through high-quality local services, housing, and amenities, making use of natural and human assets to sustain its economic, cultural, and natural environment. As a community partner in the ACCESS project (Assisting Communities to Connect to Electric Sustainable Sources) (Local Energy Scotland, 2023), they have assisted communities to connect to sustainable electrical sources, such as the trialling of the Garmony Hydro project.

Perspective on the transition: As a community-led organisation, MICT has a strong perspective on the transition to a low carbon economy on the Mull Archipelago. The organisation recognises the unique challenges and opportunities presented by the islands' isolated location and the need to reduce reliance on fossil fuels. MICT is aware of the impacts of climate change on the archipelago and the need for urgent action to reduce

carbon emissions and protect the local environment. They ensure high quality local services, housing, and amenities, making use of natural and human assets to sustain its economic, cultural, and natural environment.

Engagement in the transition: MICT is actively engaged in the transition to a low carbon economy on the Mull Archipelago. The organisation has implemented and supported a number of initiatives to promote sustainability and reduce carbon emissions, including the funding of highly efficient 'passive houses' and the development of sustainable transportation options such as securing funding for a ferry pontoon.[5] MICT also works with a range of partners, including local authorities and other community organisations, to support the transition to a low carbon economy on the islands. Through its efforts, MICT is helping to drive the transition to a low carbon economy on the Mull Archipelago and to support the long-term sustainability and well-being of the island communities.

MICT leads the project and works closely with Scene and NESOI to develop it. They also provide ongoing engagement through meetings, workshops, and communication with local councils. The MICT Climate Action Steering Group plays a key role in this process and are the main decision makers.

Contact person: Sandy Brunton, MIC Convenor - enquiries@mict.co.uk

Community Council & Wider Community Organisations

Community Councils and community-run organisations support the well-being and development of their local communities. On the Mull Archipelago, this includes the North West Mull Community Woodland Company (NWMCWC), Iona Community Council, Mull Community Council, and South West Mull & Iona Development (SWMID). These organisations and councils are dedicated to the sustainable management and development of their respective regions, providing a variety of services and resources to community members, and are run by volunteers.

Perspective on the transition: As community-based organisations, these organisations want to support their respective communities in the transition to low-carbon economies, from both economic and environmental perspectives. They are aware of the significance of climate change on the archipelago as well as the issues related to energy, such as the cost of living and fuel price crises.

Engagement in the transition: These organisations have implemented several initiatives to promote sustainability and reduce carbon emissions, such as planting native species in the community woodlands and promoting sustainable transportation options. For example, SWMID has commissioned reports on sustainable tourism and long-term forestry plans, ensuring a transition to more sustainable practices in the industries. SWMID also sponsored a renewable energy mapping for the island. Community Energy Scotland, an energy charity based in Inverness, provided project management to ACCESS projects, also acting as advisors for community energy matters. These organisations also work with a range of partners, including local authorities and other community organisations to support the transition to a low-carbon economy on the islands. Through their efforts, these organisations

[5] https://www.mict.co.uk/projects-services/pontoon-development/

are helping to drive the transition to a low-carbon economy on the Mull Archipelago and to support the long-term sustainability and well-being of the island communities.

Other organisations such as Argyll and Bute Council also play a role in supporting the transition to a low-carbon economy on the Mull Archipelago by working closely with the North West Mull Community Woodland Company, Iona Community Council, Mull Community Council, and other stakeholders to develop and implement initiatives that promote sustainability and reduce carbon emissions in the region. ALIenergy (Argyll, Lomand & the Islands Energy Agency) promote sustainable energy usage and generation with the aim of reducing fuel poverty and carbon emissions in the region.

Mull and Iona Village Halls

There are many village halls in Scotland owned and managed by local communities or organisations, typically used for a variety of purposes, including social events, meetings, activities, and classes. Many village halls in Scotland are run by volunteers and are an important hub for community members.

There are a number of village halls across the Mull Archipelago including, Dervaig Village Hall, Aros Hall, An Roth Community Enterprise Centre, Craignure Village Hall, Pennyghael Community Hall, Bunessan Hall, Salen Church Hall, Iona Village Hall and Creich Hall. These halls play an integral role within the community through support and a connection hub.

Perspective on the transition: A village hall owner or manager may have a variety of goals and objectives depending on the needs and priorities of the local community. However, most village halls are committed to supporting the well-being and development of their local community and may strive to be environmentally sustainable in their operations.

Engagement in the transition: A village hall may engage in a range of activities to support the transition to a low carbon economy and to reduce its environmental impact. This could include implementing energy-saving measures, such as upgrading insulation or installing energy-efficient lighting and appliances. The village hall may also seek to generate its own renewable energy, such as through the installation of solar panels or a small-scale wind turbine. These may be financial or environmental decisions. In addition, a village hall may engage with the local community to promote sustainable practices and behaviours, such as recycling and reducing energy use. Through its efforts, village halls can contribute to the transition to a low carbon economy and support the well-being and development of its local community.

General Public

The general public on the Mull Archipelago, comprising individuals who live and work on the islands, are a crucial stakeholder in the transition to a low carbon economy. The transition, which aims to reduce carbon emissions and address the negative impacts of climate change, requires the participation and support of people from all sectors of the island communities.

Perspective on the transition: The perspective of the general public on the Mull Archipelago on the transition to a low carbon economy may vary, as people have different beliefs,

values, and priorities. However, many members of the public on the archipelago are likely to be aware of the unique challenges and opportunities presented by the island's isolated location and the need to reduce reliance on fossil fuels. They may also be aware of the impacts of climate change on the islands and the need for urgent action to reduce carbon emissions and protect the local environment.

Engagement in the transition: Members of the general public on the Mull Archipelago can engage in the transition to a low carbon economy in a number of ways. This could include making personal lifestyle choices that are more environmentally friendly, such as using public transportation or reducing energy consumption in the home. The general public on the archipelago can also support organisations and businesses that are committed to sustainability and the transition to a low carbon economy, for example by choosing to buy products or services from these companies. In addition, members of the public can advocate for policies and initiatives that support the transition to a low carbon economy on the islands, for example by contacting their elected representatives or participating in local environmental groups. Through their actions and choices, members of the public on the Mull Archipelago can play a vital role in the transition to a low carbon economy and in the protection of the islands' unique natural and cultural heritage.

European Small Island Federation (ESIN)

Perspective on the transition: ESIN is a not-for-profit organisation based in Sweden, acting to represent the voices of over 350,000 small islanders across Europe. ESIN's objective is to support the sustainable development of small European island communities through strengthening their cultural identity, facilitating knowledge sharing, and advocating for EU policy.

Engagement in the transition: For this study, ESIN is acting as the Energy Working Group, community engagement specialists, and Project Coordinator. ESIN has secured an EU grant through the NESOI project, intending to mobilise sustainability research and development across small island communities which also include Nagu (Finland), Fur (Denmark), and Veno (Denmark). ESIN have developed the Clean Energy Transition Agenda (CETA) framework, providing a strategic roadmap to articulate and plan the clean energy transition vision and process for these islands.

Scottish Island Federation (SIF)

Perspective on Transition: SIF is a network of island communities working together to ensure a stronger voice on common challenges for island communities in Scotland. They share ideas and innovate to accelerate positive change. The overarching aim is to promote, publicise, and advance the interests of Scotland's islands.

Perspective on the Transition: SIF understand the how climate change can negatively impact the islands they work to protect. Their members, as part of these island communities want to work to ensure the sustainability of their inhabitants.

Engagement in the Transition: To realise their ambitions, SIF has worked on the Clean Energy EU Islands to facilitate the energy transition on all EU islands. This project provides a pathway for islands to transition to clean energy. Ensuring they are protected against the negative impacts of climate change and have robust and sustainable energy systems to support islands.

Other Organisations

There are many more important actors regarding the clean energy transition of the Mull archipelago such as, Samsø Energy Academy, Mull Theatre and An Tobar Arts Centre, Ross of Mull Historical Centre, Visit Scotland, and voluntary sector organisations including Tobermory Harbour Association. These organisations will understand the importance of having sustainable islands to persevere its heritage and protect its communities.

Businesses

Charge Place Scotland

ChargePlace Scotland is a network of electric vehicle (EV) charging stations in Scotland that is funded and managed by Transport Scotland. The network provides EV drivers with access to a range of charging options, including fast and rapid chargers, at locations throughout Scotland.

Perspective on the transition: ChargePlace Scotland is a key part of Scotland's transition to a low carbon transportation system. By providing access to reliable and convenient charging options, ChargePlace Scotland aims to make it easier for people to switch to electric vehicles and to reduce the carbon emissions associated with transportation in Scotland.

Engagement in the transition: The ChargePlace Scotland network provides EV drivers with access to a range of charging options at locations throughout the country, making it easier for people to switch to electric vehicles and reducing the carbon emissions associated with transportation. ChargePlace Scotland also works with a range of partners, including local authorities, businesses, and EV manufacturers, to promote the use of electric vehicles and to support the development of the EV market in Scotland. Through its work, ChargePlace Scotland is helping to drive the transition to a low carbon transportation system in Scotland.

Caledonian MacBrayne (CalMac)

CalMac is the UK's largest ferry operator in terms of ships and destinations served. A multi-award-winning ferry operator, providing essential services and logistics to support islands in Scotland and remote communities. They are customer focussed and date their community role back more than 160 years and is a part of the DNA of the highlands and islands communities. They are a major employer with 1,700 people working for them. They have a

main port in Craignure, connecting the Isle of Mull to mainland Scotland, as well as ports in Fishnish, Fionnphort, Iona and Tobermory.

Perspective on the transition: CalMac are committed to the sustainability and economy of the communities they serve. They have recently published an environmental strategy for 2021-2023, outlining their ambitions to protect the climate. They understand the significant threat that climate change poses to the island communities they serve and their role in protecting these communities.

Engagement in the transition: They have set a target to reduce vessel fuel consumption by 2% year on year during the period of their environmental strategy (2021 – 2023). They have incorporated flexible working to reduce business mileage as well as adopting new low carbon technologies. They have already taken significant steps to review H2 fuel cells for their vessels to reduce the carbon emissions associated with them. They hope to reduce energy and carbon by way of business behaviour change, for example moving towards a paperless operation.

Scottish and Southern Electricity Networks (SSEN)

As a major energy provider and network operator in Scotland, SSEN has a significant role to play in the transition to a low carbon economy on the Mull Archipelago. The company operates electricity networks that serve homes and businesses on the islands, and therefore has the ability to shape energy usage patterns and promote the adoption of sustainable energy practices in the region.

Perspective on the transition: SSEN has a strong understanding of the challenges and opportunities presented by the transition to a low carbon economy on the Mull Archipelago, as the organisation operates within the energy sector and is therefore closely tied to issues of carbon emissions and sustainability in the region. The company recognizes the need to reduce its own carbon footprint on the islands and the importance of adopting renewable energy technologies and energy-efficient practices. SSEN is also proactive in seeking ways to adapt its operations and business model to meet the challenges and opportunities of the transition to a low carbon economy on the Mull Archipelago. SSEN are committed to a net-zero energy transition with a focus on community-led initiatives, to help combat climate change. However, their ability to support such initiatives will be highly conditional on certain technical requirements. Most relevant to this investigation on Mull will be the ability and capacity of SSEN's distribution network to accommodate changes and additions to generation, made by the installation of new renewables and other low carbon technologies, as well as new electrical demand, such as EV charging and heat pumps.

Engagement in the transition: SSEN is actively engaged in driving the transition to a low carbon economy on the Mull Archipelago, both in its own operations and in the wider energy sector in the region. This includes the adoption of renewable energy technologies, the implementation of energy-efficient practices, and the promotion of sustainable energy usage among its customers on the islands. SSEN works with a range of partners, including government bodies, industry organisations, and community groups on the Mull Archipelago, to support the transition to a low carbon economy and to promote sustainable energy practices in the region. Through its efforts, SSEN is helping to shape the transition to a low carbon economy on the Mull Archipelago and is playing a key role in the long-term

sustainability of the energy sector in the region. SSEN is already providing funding to support rural households in the north of Scotland to connect to its electricity network (SSEN, 2023). In the Mull archipelago context, SSEN are bound by the constraints of the mainland transmission network, particularly at Taynuilt.

Contact person: SSEN's Innovation Team is responsible for exploring solutions to distribution network constraints: commercial.contracts@sse.com

Iona Renewables

Iona Renewables is an organisation committed to advancing environmental protection and improvement, as well as community development, on the island of Iona. The main focus of Iona Renewables is to maximise renewable energy generation and storage on the island, by identifying opportunities for renewable energy use and securing funding for projects.

Perspective on the transition: Iona Renewables plays an important role in the transition to a low-carbon economy on the island of Iona. Through its focus on maximising renewable energy generation and storage, Iona Renewables aims to reduce the island's dependence on imported, high-carbon energy sources. Additionally, by promoting community ownership and benefit, Iona Renewables supports the social, economic, and environmental sustainability of the island. Through its activities, Iona Renewables aims to set an example for other communities on how to reduce their carbon footprint and generate more clean energy.

Engagement in the transition: Iona Renewables engages in community engagement and partnership working to ensure that its activities are aligned with the needs and priorities of the island's residents and visitors. The organisation also reinvests resources generated by its activities in support of social, economic, and environmental sustainability on the island. Additionally, Iona Renewables conducts feasibility studies and energy audits to identify opportunities for renewable energy generation and storage and to measure progress towards its goals. Furthermore, Iona Renewables offers tours and tastings to the public, which allows visitors to learn about the organization's practices and efforts to decrease the carbon footprint.

Iona renewables has developed a proposed heat network project for Iona, using borehole-based ground-source heating to supply island properties with heat and hot water. The project received significant funding but is currently on hold due to a lack of funding and the negative impacts on the COVID-19 pandemic on a previously secured funding package for the project.

Local Business Owners and Operators

Business owners and operators on Mull Archipelago are individuals or organisations that own and operate businesses on the Isle of Mull. These businesses could be in a variety of sectors and may range in size from small, locally owned enterprises to larger organisations with a regional or national presence. Some notable industries and businesses include, bike hire, bus companies, accommodation providers, construction industry services, commercial boat

businesses (including pleasure/leisure trip and dive boat operators), manufacturing and processing industries, farmers, and crofters.

Perspective on the transition: The perspective of business owners and operators on the Mull Archipelago, on the transition to a low carbon economy may vary depending on the specific goals and priorities of each business. However, many business owners and operators may recognize the importance of sustainability and may strive to reduce their environmental impact and support the transition to a low carbon economy through their operations.

Engagement in the transition: Business owners and operators on the archipelago may engage in a range of activities to support the transition to a low carbon economy. This could include implementing energy-efficient practices, using renewable energy sources, and reducing waste and resources. Business owners and operators may also engage with the local community and stakeholders to promote sustainable practices and behaviours. Through their efforts, business owners and operators on the Mull Archipelago can contribute to the transition to a low carbon economy and support the long-term sustainability and well-being of the local community.

Private Landlords

For both the tourism and residential sector, private landlords play a significant role in ensuring a sustainable transition. A large proportion of the population living on the archipelago are renters, with most tourists taking up short term rentals. This means moving towards sustainability within those properties falls to private landlords.

Perspective on the transition: There are many Scottish government grants available to support individual landlords to take up energy efficiency measures and renewable heat alternatives, with support along the way to guide them through the transition. For example, the Energy Saving Trust, or Business Energy Scotland can support landlords with The Boiler Upgrade Scheme, providing funding for renewable heat sources, or Residential landowners Electric Vehicle ChargePoint Scheme. Some important landowners of note would be Inch Kenneth owners and Ulva owners (NWMCWC) and the Van der Sluis family who own the island of Erraid with the Findhorn Foundation as their custodians.

Engagement in the transition: Landlords can change existing oil boilers to renewable heat alternatives such as ASHP or GSHP, using the Boiler Upgrade Scheme, getting funding to change to more sustainable heat that can also save them money. SME loan schemes can also be used by landlords who use their properties for business. The SME loan scheme can provide funding for energy efficiency measures such as improving insulation and opting for more efficient lighting.

Landlords have a vital role to play in the transition of the archipelago to a low carbon future and should be considered when planning for a clean energy transition.

Public Sector

Governmental Actors

Argyll & Bute Council

Argyll and Bute Council is the local government council that serves the Argyll and Bute council area in Scotland, which includes the Mull Archipelago. The council is responsible for a wide range of services, including education, social care, planning and development, waste management, transportation, and the transition to a sustainable future.

Perspective on the transition: Argyll and Bute Council is committed to supporting the transition to a low carbon economy in the council area. The council has set a target to reduce emissions by 75% by 2030, and net zero by 2045, in line with Scottish Government targets, and is working to reduce its energy consumption, increase the use of renewable energy sources, and promote sustainable practices and behaviours among its employees and the wider community. Responsible for reviewing and approving all planning applications across the Mull Archipelago, ABC has an interest in ensuring that local development plans on all islands in the archipelago.

Engagement in the transition: Argyll and Bute Council is actively engaged in the transition to a low carbon economy in the council area. The council has implemented a number of strategies to promote sustainability and initiatives to reduce its own carbon emissions, including the installation of renewable energy technologies, the implementation of energy-efficient practices, and the promotion of sustainable behaviours among its employees. The council also works with a range of partners, including local businesses, community organisations, and other public sector bodies, to promote sustainability and to support the transition to a low carbon economy in the council area. Through its efforts, Argyll and Bute Council is helping to drive the transition to a low carbon economy in the council area. A&BC is a critical stakeholder for improving and encouraging access to the Isle of Mull e.g., through the Mull Ferry port.[6]

Contact person:

Councillor David Kinniburgh, Policy Lead for Planning, Protective Services, and Licensing.

Councillor Robin Currie, Policy Lead for Housing, Roads, and Infrastructure Services.

planning.olandi@argyll-bute.gov.uk

NatureScot

Perspective on the transition: Originally known as 'Scottish Natural Heritage (SNH),' since 2020 NatureScot is the nature agency of Scotland, working to protect, improve, and promote Scotland's landscape and natural heritage, contributing to a cleaner environment as well as to human well-being. NatureScot is the leading public body responsible for advising the Scottish Government on all matters relating to natural heritage. It is funded mainly by the Environment and Forestry Directorate of the Scottish Government.

[6] https://www.argyll-bute.gov.uk/news/2020/jul/council-congratulates-mict-new-development-plans

Engagement in the transition: As the islands are of extremely rich cultural and natural heritage, it is a highly relevant location for preservation and protection by NatureScot. The island's community buy-out and ongoing development of Ulva has also been supported by the Scottish Government's Natural & Cultural Heritage Fund, which is one of the European Regional Development Fund's Strategic Interventions being led by NatureScot (the other is the Green infrastructure Fund).

Historic Environment Scotland (HES)

Historic Environment Scotland (HES) is a public body in Scotland that is responsible for the care, maintenance, and promotion of the country's historic environment. This includes a wide range of sites and properties, such as castles, palaces, abbeys, and ancient monuments, as well as museums, archives, and other cultural resources.

Perspective on the transition: As a public body, HES is committed to supporting the transition to a low carbon economy in Scotland. The organisation recognizes the importance of sustainability and is working to reduce its own carbon emissions and to promote sustainable practices and behaviours among its employees and the wider community. HES also recognizes the value of the country's historic environment as a resource for learning and enjoyment and is working to protect and preserve this heritage for future generations.

Engagement in the transition: HES is actively engaged in the transition to a low carbon economy in Scotland. The organisation has implemented a number of initiatives to reduce its own carbon emissions, including the installation of renewable energy technologies and the implementation of energy-efficient practices. HES also works with a range of partners, including local authorities, community organisations, and other public sector bodies, to promote sustainable practices and behaviours and to support the transition to a low carbon economy in Scotland. Through its efforts, HES is helping to protect and preserve the country's historic environment for future generations and to support the transition to a low carbon economy in Scotland.

New Energy Solutions Optimised for Island (NESOI)

Perspective on the transition: NESOI is a European facility that was founded with the goal of supporting the transition to renewable energy on EU islands. The organisation aims to promote investments in sustainable energy projects, facilitate the decentralisation of energy systems, and contribute to EU policy goals for energy transition. NESOI works to unlock the potential of EU islands to become leaders in the transition to renewable energy and to test innovative technologies and approaches in a cost-competitive way. They provide high-level funding and support for the Mull Archipelago CETA, through ESIN. Its objective is to identify and leverage the clean energy transition opportunities available to small island communities across the EU.

Engagement in the transition: In order to achieve its goals, NESOI is building a platform that provides first-step funding for islands' energy transition plans and serves as a one-stop-shop for islands seeking ideas and resources for implementing renewable energy projects. NESOI works closely with the Clean Energy for EU Islands Secretariat to provide training, technical support, cooperation opportunities, and robust funding opportunities to help islands convert their Sustainable Energy Action Plans into renewable energy projects, retrofit buildings and

energy infrastructure, reduce energy bills, create local jobs, and more. The organisation aims to activate 100 million euros in investments, achieve annual primary energy savings of 440 GWh, and avoid 160,000 ktCO2 of GHG emissions per year. NESOI has provided the necessary funding, supporting sustainable transition research and development agendas (CETAs) for the Mull Archipelago. NESOI are funding providers for this project and have worked with MICT in the past to develop projects.

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Emergency Services

Emergency services on the archipelago play a huge role in ensuring the safety and protection of the island communities. They have an interest in the future sustainability of the islands and how robust and prepared they are for the negative impacts of climate change.

Perspective on the Transition: As the role of the emergency services is to protect their citizens, a robust and well-prepared transition would be a priority for these organisations. As pollution is a known carcinogen and cause of asthma, transitioning to cleaner fuels and energies will be a priority for NHS Highlands. The HM Coastguard would like to reduce the number of adverse weather events which is something that will increase with climate change; hence they would like to mitigate the adverse effects of these events.

Engagement in the Transition: With transport assets covering road, marine and air transport the emergency services will be interested in cost and carbon cutting measures which may be suitable for their fleet and assets. This may include fleet electrification or lower carbon fuels (e.g., hydrogen). Further on-site renewables may be appropriate for certain buildings (e.g., health centres) on the Archipelago.

Local Energy Scotland (LES)

Local Energy Scotland is a Scottish organisation that works to support the development of local and community-owned energy projects in Scotland. The organisation provides information, guidance, and support to communities and businesses interested in developing renewable energy projects, with the goal of enabling them to generate their own clean, low carbon energy.

Perspective on the transition: Local Energy Scotland is committed to supporting the transition to a low carbon economy in Scotland and believes that local and community-owned energy projects can play a vital role in this transition. The organisation works to empower communities and businesses to take control of their own energy production and to contribute to the development of a more sustainable energy system in Scotland.

Engagement in the transition: Local Energy Scotland provides a range of services to support the development of local and community-owned energy projects in Scotland. These services include information and guidance on project development, access to funding and finance, and support with project management and delivery. The organisation also works with a network of partners to share knowledge and expertise and to promote the benefits of local and community-owned energy projects. Through its work, Local Energy Scotland aims to enable the development of a diverse range of local and community-owned energy projects that contribute to the transition to a low carbon economy in Scotland.

Economic Activities

Tobermory Distillery

Tobermory Distillery is a Scottish distillery that is committed to sustainability. The distillery works to minimise its environmental impact by reducing its energy consumption and carbon emissions, and by using locally sourced ingredients.

Perspective on the transition: Tobermory Distillery can play an important role in the transition to a low carbon economy on Mull and in Scotland, as a large and well-known distillery. This may include undertaking and promoting sustainable production practices, as well as engaging in low carbon transport and energy generation for local site use and distribution. The distillery is constantly looking for new ways to reduce its environmental impact and may form a suitable anchor load or high energy use customer for energy developments on Mull.

Engagement in the transition: Tobermory Distillery offers tours and tastings to the public, which allows visitors to learn about the distillery's practices. They are exploring ways to reduce their fresh water use by exploring higher gravity brewing, which also reduces the energy required to boil. Through its work, Tobermory Distillery aims to set an example for other distilleries and to contribute to the development of a more sustainable distillery practices. The replacement of their traditional cast-iron mash tun with a new, environmentally friendly semi lauter mash tun made of stainless steel allows for energy recovery of the water used in the mashing process.

Aquaculture Stakeholders

There are a large number of fisheries and aquaculture organisations and sites in Scotland dedicated to sustainable practices and the transition to a low carbon economy. On the Archipelago, these include:

Mull Fishermen's Association (MFA), an organisation that represents the interests of local fishers on the Isle of Mull. The organisation is committed to promoting sustainable fishing practices, protecting the environment, and supporting the well-being of the local community and fishers.

Inverlussa Mussels, a local mussel farm on the Isle of Mull that is committed to sustainable aquaculture practices. The farm is dedicated to producing high-quality mussels in an environmentally friendly manner, using sustainable farming techniques. Mussels are one of the most sustainable food products to come from our oceans as they filter pollutants from the water, and as they are farmed using aquaculture methods, they reduce pressure on wild fish stocks. Inverlussa current has several EV chargers installed and a fleet of hybrid PHEV vehicles.

Aird Fada Seaweed Farm is a 6-hectare seaweed owned by SWMID in the waters of Loch Scridain, south west Mull. The seaweed harvest is sold for uses such as foodstuff, sustainable packaging, livestock feed, soil regeneration and cosmetics.

The Mull Archipelago is home to 5 aquaculture companies, one of which is The Scottish Salmon Co (SSC). SSC is committed to sustainable practices, such as having a lower carbon footprint than most other companies in the sector and using less fresh water to produce fish. They are dedicated to reducing their environmental impact, promoting biodiversity, and

playing a role in the transition to a more sustainable aquaculture industry. The 4 other Scottish salmon sites on the Mull Archipelago also share this commitment to sustainable practices, reducing environmental impact and promoting biodiversity, and are dedicated to playing a role in the transition to a more sustainable aquaculture industry.

Perspective on the transition: These organisations and sites may play a role in the transition to a low carbon economy in Scotland. They are committed to promoting sustainable practices that minimise their environmental impact and to ensuring that their products are grown or caught in a healthy and safe environment. They are constantly looking for ways to improve their environmental impact.

Engagement in the transition: These organisations and sites engage in a range of activities to support the transition to a low carbon economy. This includes implementing sustainable practices, such as reducing the use of chemicals and promoting biodiversity, reducing eutrophication and nutrient run off. They also work with other organisations and companies to share knowledge and expertise and to promote sustainable practices. Through their efforts, these organisations and sites can set an example for others in their industries and contribute to the development of a more sustainable economy on Mull and Scotland as a whole.

Schools and Academia

Education

Primary Schools & High School

There are many primary and high schools in Scotland owned and managed by local communities or organizations, typically used for a variety of educational purposes.

There are six primary and high schools across the Mull Archipelago: Lochdonhead Primary School, Bunessan Primary School, Salen Primary School, Ulva Primary School, Tobermory High School, and Dervaig Primary School.

Perspective on the transition: A school owner or manager may have a variety of goals and objectives depending on the needs and priorities of students, parents, and the local community. However, most schools are committed to supporting the well-being and development of their students and strive to be environmentally sustainable in their operations, ensuring a stable future for their students. For example, by reducing their energy consumption and carbon emissions by make use of renewable energy sources. This can be a financial decision as it can also reduce energy bills or purely an environmental decision.

Engagement in the transition: Tobermory high school and Ulva primary school have already engaged in a range of activities to support the transition. They both have installed biomass boilers, a renewable heat source, to reduce their carbon footprint, and to reduce their environmental impact. Other academic establishments can take example and introduce methods, including upgrading insulation or installing energy-efficient lighting and appliances. The school may also seek to generate its own renewable heat, such as through the installation of solar thermal panels or a small-scale heat pump. In addition, schools can engage with the local community to promote sustainable practices and behaviours, such as recycling, reducing energy use and sustainable transport such as cycling. Through its efforts, schools can contribute to the transition to renewable heat sources and support the well-being and development of its students. Events on awareness and environmental education could be conducted at these establishments as well as discussions about a need for a clean energy transition.

4. Policy and Regulation

The UK and Scotland have set out ambitious targets for achieving net zero and supporting sustainable development through a number of policies, regulation, and legislation. This section sets out policies relevant to the Mull Archipelago's low carbon transition and opportunities arising from local development planning.

National Policies

United Kingdom

There are several key UK wide policies which are relevant to low carbon development and decarbonisation, including:

British Energy Security Strategy (2022): The UK plans to provide 70 GW of solar and 50 GW of wind by 2030. There is also an ambition to have 600,000 heat pumps installed per year by 2028. The government has pledged to support the Heat and Building Strategy with £3.9 billion in support to ensure energy efficiency in the UK housing stock. These policies demonstrate further, the need to map out the carbon emissions and energy use on the archipelago, allowing for the identification of potential for wind and solar project and identifications and implementation of low carbon heating opportunities and home energy efficiency.

Net Zero Strategy: Build Back Greener (2021): Sets targets to reduce the carbon emissions, one key message is the commitment that the UK will be totally powered by clean energy by 2035. This indicates a need for more renewable infrastructure on the Mull archipelago to ensure that the islands meet these ambitious targets. This demonstrates support for more sustainable infrastructure and projects such as the mapping of the carbon emissions and energy use of the archipelago. There is also a commitment to end the sale of new petrol and diesel cars and vans by 2030 and by 2035, all new cars must be zero emission at the tailpipe. The government is also pledging £12 billon in local transport systems to ensure more sustainable transportation.

Scotland

There are several key national policies which are relevant to low carbon development and decarbonisation, including:

Scotland's Energy Strategy and Just Transition Plan (2023, Draft): sets out ambitions for Scotland's energy future from 2023 onwards and has been released for consultation at the time of writing. Whilst changes may be made in the final plan, the overarching ambitions are expected to remain consistent, including:

- Installing of >20 GW of additional renewable electricity on- and offshore by 2030.
- Providing 5 GW or the equivalent of 15% of Scotland's current energy needs via hydrogen by 2030.
- Increasing contributions from solar, hydro, and marine energy to Scotland's energy mix.
- Accelerating decarbonisation of domestic industry, transport, and heat.
- Establishing of a national public energy agency – Heat and Energy Efficiency Scotland.
- Phasing out new petrol and diesel cars and vans by 2030 and car kilometres reduced by 20%.

- Generating surplus electricity, enabling export of electricity and renewable hydrogen to support decarbonisation across Europe.
- Improving energy security via Scotland's own resources and new energy storage.
- 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.

Development of renewable energy on Mull will contribute to several of these ambitions. Achieving heat and transport decarbonisation goals will require a widespread low carbon shift in infrastructure on the Mull Archipelago.

Fourth National Planning Framework (2023):

The NPF sets out a spatial plan for Scotland to 2045, with a 4th draft (NPF4) approved by the Scottish Parliament in January 2023 and adopted by Scottish Ministers in February 2023. The national planning framework sets out policies to achieve net zero with a focus on rebalancing planning systems to ensure the recovery of nature and climate change. This includes emissions reductions and adaptation to create a resilient framework for risks created by a warmer climate. To benefit nature and people, planning has been designed to nurture biodiversity and better connect biodiversity rich areas.

The NPF4 is built on several underlying spatial principles which support equitable and climate-aware planning:

- **Just transition**. Empowering people to shape their places and ensure the transition to net zero is fair and inclusive.
- **Conserving and recycling assets**. Making productive use of existing buildings, places, infrastructure, and services, locking in carbon, minimising waste, and building a circular economy.
- **Local living**. Supporting local liveability and improve community health and wellbeing by ensuring people can easily access services, greenspace, learning, work, and leisure locally.
- **Compact urban growth**. Limiting urban expansion so we can optimise the use of land to provide services and resources, including carbon storage, flood risk management, blue and green infrastructure, and biodiversity.
- **Rebalanced development**. Targeting development to create opportunities for communities and investment in areas of past decline and manage development sustainably in areas of high demand.
- **Rural revitalisation**. Encouraging sustainable development in rural areas, recognising the need to grow and support urban and rural communities together.

The NPF4 puts local communities and stakeholders front and centre to create liveable, healthier, and more sustainable places that build economic prosperity and contribute to net zero environmental ambitions. Relevant policies in relation to this project include:

- **Policy 1 Sustainable Places:** When considering all development proposals significant weight will be given to the global climate and nature crises.
- **Policy 2 Climate mitigation and adaptation:** To encourage, promote and facilitate development that minimises emissions and adapts to the current and future impacts of climate change.

- **Policy 3 Biodiversity:** To protect biodiversity, reverse biodiversity loss, deliver positive effects from development and strengthen nature networks.
- **Policy 4 Natural places:** To protect, restore and enhance natural assets making best use of nature-based solutions.
- **Policy 6 Forestry, woodland, and trees:** Development proposals that enhance, expand, and improve woodland and tree cover will be supported.
- **Policy 7 Historic assets and places:** To protect and enhance historic environment assets and places, and to enable positive change as a catalyst for the regeneration of places.
- **Policy 10 Coastal development:** To protect coastal communities and assets and support resilience to the impacts of climate change.
- **Policy 11 Energy:** To 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).
- **Policy 12 Zero waste:** To encourage, promote and facilitate development that is consistent with the waste hierarchy.
- **Policy 13 Sustainable transport:** To encourage, promote and facilitate developments that prioritise walking, wheeling, cycling and public transport for everyday travel and reduce the need to travel unsustainably.
- **Policy 17 Rural homes:** To encourage, promote and facilitate the delivery of more high quality, affordable and sustainable rural homes in the right locations.
- **Policy 19 Heating and cooling:** To encourage, promote and facilitate development that supports decarbonised solutions to heat and cooling demand and ensure adaptation to more extreme temperatures.
- **Policy 20 Blue and green infrastructure:** To protect and enhance blue and green infrastructure and their networks.
- **Policy 25 Community wealth building:** To encourage, promote and facilitate a new strategic approach to economic development that also provides a practical model for building a wellbeing economy at local, regional, and national levels.
- **Policy 29 Rural development:** To encourage rural economic activity, innovation and diversification whilst ensuring that the distinctive character of the rural area and the service function of small towns, natural assets and cultural heritage are safeguarded and enhanced.
- **Policy 30 Tourism:** To encourage, promote and facilitate sustainable tourism development which benefits local people, is consistent with our net zero and nature commitments, and inspires people to visit Scotland.
- **Policy 32 Aquaculture:** To encourage, promote and facilitate aquaculture development and minimise any adverse effects on the environment, including cumulative impacts.

Local Energy Policy Statement (2021):

The LEP Statement sets out the approach the Scottish Government wishes to promote to help and inform the decisions of all those participating in, or developing, local energy projects as Scotland's energy system transitions to a low carbon future. The ten key principles, which fall under five key themes:

- **People**: Undertake early engagement and tailoring support to the different ways people will want to engage.
- **Places**: Local energy projects should reflect local characteristic and focus on collaborative strategic approaches and partnership working.

- **Network and infrastructure**: All activity should provide a high level of security and quality of supply to all, and the design and operation of energy networks should consider the whole energy system while supporting local, regional, and national solutions.
- **Pathway to commercialisation**: Prioritise projects that demonstrate a commercially viable and replicable opportunity, in line with the principle of inclusive growth. Prioritise and act upon 'low regret' opportunities.
- **Opportunity**: Local energy projects should seek to support the creation of high value jobs and ensure a just transition for Scotland's workforce.

Particularly relevant to the Mull Archipelago and the Scottish Islands, the statement suggests that islands can be at the forefront of the transition to low carbon energy and commits the Scottish Government to publishing a Scottish Islands Energy Strategy document. It identifies the specific energy constraints, opportunities and local specificity of island localities and sets out key methods of addressing these through local energy development (e.g., LHEES).

National Islands Plan (2021)

The Islands (Scotland) Act 2018 requires that a report be presented to Parliament each year setting out the progress made towards delivery of the National Islands Plan. The Plan provides a framework for action in order to meaningfully improve outcomes for island communities. The Plan has 13 Strategic Objectives which the Scottish Government will use to direct work. Whilst all topics are relevant to all Scottish islands, particularly important to this energy study are:

- **SO1**: To address population, decline and ensure a healthy, balanced population profile.
- **SO2**: To improve and promote sustainable economic development.
- **SO3**: To improve transport services.
- **SO4**: To improve housing.
- **SO8**: To improve and promote environmental wellbeing and deal with biosecurity.
- **SO9**: To contribute to climate change mitigation and adaptation and promote clean, affordable, and secure energy.

Particular relevant outcomes include a commitment to 30% of public-owned ferries being low emissions by 2032, with aspirations to decarbonise across public and private fleets, commitments to locally owned renewable energy generation and developing net zero islands and developing island-based carbon reduction schemes (e.g., woodland planting).

Climate Change (Scotland) Act (2019): sets targets to reduce Scotland's emissions of all greenhouse gases to net-zero by 2045, with interim targets for reductions of at least 56% by 2020, 75% by 2030, and 90% by 2040. The Act requires Scottish Ministers to, when publishing an infrastructure investment plan, publish an assessment of the extent to which investment in accordance with the plan is expected to contribute to the meeting of the emissions reduction targets.

Energy Efficiency Route Map (2018): is underpinned by the Energy Efficiency Scotland programme, which has allocated over £1 billion pounds on tackling fuel poverty and improving energy efficiency since 2009. Energy Efficient Scotland delivers across two key policy areas of Government: fuel poverty and climate change. Because of this it has two main objectives:

- Removing poor energy efficiency as a driver for fuel poverty.
- Reducing greenhouse gas emissions through more energy efficient buildings and decarbonising our heat supply.

Energy Efficient Scotland includes work with Scotland's local authorities on the development of Local Heat & Energy Efficiency Strategies (LHEES).

Scottish Energy Strategy (2017): outlines the Vision for Energy in Scotland. This Vision specifically focuses on delivering a flourishing, competitive local and national energy sector, delivering secure, affordable, clean energy for Scotland's households, communities, and businesses. The Strategy acts to guide the decisions that the Scottish Government, working with partner organisations, needs to make over the coming decades. The vision remains guided by three core principles: a whole-system view; an inclusive energy transition; a smarter local energy model.

In 2019, a policy position paper was published by the Scottish Government, highlighting key priority areas for energy development in Scotland. These are:

- Decarbonisation of heat and energy efficiency, including £1.6bn committed to Heat in Buildings capital funding;
- Local Energy, including a renewed focus on delivering 2GW of locally-owned energy projects by 2030;
- Energy transition, including £62m Energy Transition Fund and a Hydrogen Action Plan to deliver net zero by 2045;
- Renewables, including the actions resulting from the Offshore Wind Policy Statement;
- Consumers, to gather and act on feedback in the energy sector;
- Strategy, to revise and renew energy strategies and pathways for Scotland.

Heat Policy Statement (2015): Setting out the future policy direction of heat in Scotland, including a hierarchy of objectives: reducing the need for heat, supplying heat efficiently and at least cost to consumers, and using renewable and low carbon heat. The policy sets out an ambition to achieve 1.5TWh of Scotland's heat demand to be delivered by district or communal heating and to have 40,000 homes connected to communal heating by 2020.

Scottish Planning Policy (2014): SPP set out national planning policy placing importance on a low carbon transition by prioritising the delivery of sustainable heat and electricity and planning for a zero-waste future. It has now been superseded by NPF4.

Carbon Neutral Islands Initiative: The CNI Project provides an opportunity to demonstrate the low carbon potential of islands as hubs of innovation. The 6 islands included in the project are hoped to act as catalysts for decarbonisation across all Scottish islands. For each of the islands in depth carbon audits, community action plans, and investment strategies are being developed.

Local Policy

Argyll & Bute Council formally adopted the Argyll and Bute Local Development Plan on the 26th of March 2015. The Argyll and Bute Local Development Plan 2 (LDP2) is currently in development and has been issued to the Scottish Government for examination and to resolve all final representations before planned adoption in 2023 / 24. This report refers to LDP2 in all instances. The Report of Examination was published in June 2023 by the Scottish Government Planning and Appeals Division (Argyll & Bute, 2023). This report recommends a series of alterations to LDP2 to reflect NPF4 policy, the most relevant of which are included below the summary of the LDP2 as it currently stands.

Argyll and Bute Local Development Plan 2 (LDP2, 2015)

The LDP2 is a statutory planning document, published in 2015, which provides guidance about built development to residents, developers, and investors. The broad outcomes of the LDP2 are to make Argyll & Bute: (1) a successful, sustainable place, (2) a low carbon place, (3) a natural, resilient place, and (4) a more connected place. Underpinning these outcomes is a commitment to supporting local and sustainable development which is in keeping with the aims of the local communities of the Mull archipelago.

A selection of relevant policies and statements which bear direct relevance to the archipelago are set out below.

Policy 04 – Sustainable Development

This policy is most relevant to sustainable development on the archipelago and shows broad support in the emerging LDP2 for the type of energy and regeneration activities planned on the Mull Archipelago.

> *In preparing new development proposals, developers should seek to demonstrate the following sustainable development principles, which the planning authority will also use in deciding whether to grant planning permission:*
>
> *a. Maximise the opportunity for local community benefit.*
> *b. Make efficient use of vacant and/or derelict land including appropriate buildings;*
> *c. Support existing communities and maximise the use of existing infrastructure and services;*
> *d. Maximise the opportunities for sustainable forms of design including minimising waste, reducing our carbon footprint, and increasing energy efficiency;*
> *e. Avoid the use of locally important good quality agricultural land;*
> *f. Utilise public transport corridors and active travel networks;*
> *g. Avoid the loss of important recreational and amenity open space;*
> *h. Conserve and enhance the natural and built environment and avoid significant adverse impacts on biodiversity, natural and built heritage resources;*
> *i. Respect the landscape character of an area and the setting and character of settlements;*
> *j. Avoid places with significant risk of flooding, tidal inundation, coastal erosion, or ground instability; and*
> *k. Avoid having significant adverse impacts on land, air, and water environment.*

Specific to the Mull Archipelago, there are a few relevant designations and allocations made in the 2015 LDP, including:

- National Scenic Area (NSA 19) – Loch na Keal, Isle of Mull
- Special Area of Conservation (10508) – Inner Hebrides and the Minches
- Wild Land Designation (08) – Ben More (Mull)
- Special Protected Area (SPA) (8613) – Cnuic agus Cladach Mhuile
- Marine Protected Area (MPA) (10474) – Sea of the Hebrides
- Areas of Panoramic Quality – Central, South and West Mull
- Development Management Zone (Countryside Zone) – Multiple, see Appendix A
- SSSI – Multiple, see Appendix A
- Geological Conservation Review – Multiple, see Appendix A

It is important to note the **National Scenic Area (NSA**) which is a nationally recognised designation which covers much of the West of Mull and all of Ulva and Gometra. The Council states in LDP2 (Policy 70):

> *Argyll and Bute Council will resist any development in, or affecting, National Scenic Areas that would have an adverse effect on the integrity of the area either individually or cumulatively, or that would undermine the Special Qualities[7] of the area unless it is demonstrated that:*
>
> *a) Any significant adverse effects on the landscape quality for which the area has been designated are clearly outweighed by social, environmental, or economic benefits of national importance; and*
>
> *b) The proposal is supported by an LVIA and consistent with the relevant Argyll and Bute Landscape Capacity Assessment.*

More specifically, the LDP2 addresses renewable energy development and proposes that the NSA designation covering much of the South of Mull would preclude any wind development where turbines heights are greater than 50m[8].

Regarding the **Wild Land** designation (Policy 72), the LDP states that:

> *Argyll and Bute Council will resist development proposals, located either within or outwith the defined Wild Land Areas, where it is determined that the proposal would significantly diminish the wild character of an Area of Wild Land, unless these adverse effects are clearly outweighed by social, economic, or environmental benefits of national importance.*

In relation to all other areas of international importance, including SPA and SAC, the LDP2 (Policy 74) states that:

> *Development not directly connected with or necessary to the conservation management of a site covered by the Conservation (Natural Habitats, etc) Regulations 1994 (as amended) and which is likely to have a significant effect on the site (either individually or in combination with other plans or projects) will be subject to an Appropriate Assessment. Where it cannot be ascertained that the development would not adversely affect the integrity of the site it will not be supported unless:*
>
> *ii) There is no alternative solution; AND,*
>
> *ii) There are imperative reasons of over-riding public interest that may, for sites not hosting a priority habitat type and/or priority species, be of a social or economic nature.*
>
> *Where the site hosts a priority habitat type and/or a priority species, the reasons referred to at ii) must relate to human health, public safety, or beneficial consequences of primary importance to the environment, or other reasons which in the opinion of Scottish Ministers are imperative reasons of overriding public interest.*

Regarding the **Countryside Zone** designation (Policy 02A), the LDP states that:

[7] As detailed in The Special Qualities of the National Scenic Areas; SNH (2010)
[8] Based on Argyll and Bute Landscape Wind Energy Capacity Study (2017)

> *"Within the Countryside Areas there is a presumption in favour of sustainable development where this is of an appropriate scale, design, siting and use for its countryside location, as detailed in the relevant subject policies. All developments will require a Landscape and Visual Impact Assessment demonstrating to the satisfaction of the Planning Authority, that the proposal can be successfully integrated into its land scape setting unless they are:*
>
> - *Infill; or*
> - *Rounding off; or*
> - *Redevelopment opportunities of clusters; or*
> - *Previously developed sites. Development adjacent to, but without settlement boundaries which are delineated in the Proposals Maps will not constitute infill, rounding off or redevelopment."*

In non-designation, or "*remote countryside area*" designations (Policy 02B), the only specific categories of development which can be considered are renewable energy related development; telecommunication / digital infrastructure; development which supports existing agricultural or aquaculture units; or "other recognised countryside activity."

LDP2 (para. 7.26) highlights several areas within the Archipelago as an area which would benefit from a **community plan or local place plan,** including Ulva, Tiroran Community Forest, and Adura Forest. These plans are community-led plans setting out proposals for the development and use of land. Introduced by the 2019 Act, these plans will set out a community's aspirations for its future development. Once completed and then registered by the planning authority, they are to be considered in the preparation of the relevant local development plan.

Policy 30 – The Sustainable Growth of Renewables

This policy provides the basis for energy generation infrastructure permitting in Argyll and Bute, with a strong focus on wind turbine permitting requirements. In general, renewable energy development is permissible in situations where environmental and visual impacts are considered acceptable within the limitations of the NPF4 and LDP2, and in particular **where sustainable development and community benefit can be clearly demonstrated**. The entirety of the Archipelago is considered an area of Significant Protection in relation to wind turbine development.

> *The Council supports renewable energy developments where these are consistent with the principles of sustainable development and it can be adequately demonstrated that there would be no unacceptable environmental effects, whether individual or cumulative, on local communities, natural and historic environments, landscape character and visual amenity, and that the proposals would be compatible with adjacent land uses. Proposals for new wind turbine developments over 50 meters high should be sited in appropriate locations in accordance with the Spatial Framework which shows in line with Scottish Planning Policy:*
>
> - *Areas where wind farms will not be acceptable.*
> - *Areas of significant protection.*
> - *Areas which may have potential for wind farm development.*
>
> *Applications for all wind turbine developments will be assessed against the following criteria:*
>
> - *Impacts on communities and individual dwellings, including visual impact, residential amenity, noise, and shadow flicker.*

- *Landscape and visual impacts, including effects on wild land.*
- *Effects on the natural heritage, including birds.*
- *Impacts on carbon rich soils, using the carbon calculator.*
- *Public access, including impact on long distance walking and cycling routes and those scenic routes identified in the NPF.*
- *Impacts on the historic environment, including scheduled monuments, listed buildings and their settings.*
- *Impacts on tourism and recreation.*
- *Impacts on aviation and defence interests and seismological recording.*
- *Impacts on telecommunications and broadcasting installations, particularly ensuring that transmission links are not compromised.*
- *Impacts on road traffic.*
- *Impacts on adjacent trunk roads.*
- *Effects on hydrology, the water environment and flood risk.*
- *Cumulative impacts arising from all of the considerations above.*
- *Net economic impact, including local and community socio-economic benefits such as employment, associated business, and supply chain opportunities.*
- *The scale of contribution to renewable energy generation targets.*
- *Effect on greenhouse gas emissions*

In assessing any application, the Council will additionally have regard to the opportunities for energy storage, local energy networks, and long-term environmental management of the site.

Policy 34 – Electric Vehicle Charging

This policy sets out the requirements for EV charging consideration within new developments and the lower limit for EV charging infrastructure within larger parking development types.

The provision of electric vehicle charge points or the infrastructure potential to accommodate future points requires to be considered as part of all new development which results in a new parking requirement and will be required as follows:

- *Residential communal off-street parking with over 10 spaces (either together or spread throughout a development): A minimum of 1 EV Charging Point or capacity/cable ducting for 1 EV Charging Point. In addition, an assessment should be undertaken of the capacity/cable ducting required to potentially upgrade in the future to every space and where possible this should be provided.*
- *All new build houses with private off-street parking to assess the potential for the capability/cable ducting to allow for the installation, where appropriate, of a minimum 7kw charger.*
- *Non-Residential Developments with over 10 parking spaces that attract a significant number of vehicles, in particular those which require to undertake a Transport Assessments: A minimum of 1 EV charging Point or capacity/cable ducting for 1 EV Charging Point. In addition, an assessment should be undertaken of the capacity/cable ducting required to potentially upgrade in future to 1 in 5 spaces and where possible this should be provided.*

The Report of Examination (Argyll & Bute, 2023) recommends a series of alterations to LDP2, which was published in 2015, to better reflect 2023 NPF4 policy. The publication of these changes would better align the LDP2 with NPF4 energy policy 'to encourage, promote and facilitate all forms of renewable energy' and update the criteria for assessing new wind developments. At present in LDP2, only the last of 19 assessment criteria for wind developments refers to the effect on greenhouse gas emissions. The Reporter's recommendations include the instruction to:

> *Modify the local development plan by:*
>
> *1. Removing the spatial framework in Diagram 7, page 56, from the proposed plan.*
>
> *2. Deleting the second sentence of Policy 30, page 54, from the proposed plan (from the word "proposals".....new wind turbine developments over 50 metres high.....to the end of the third bullet point).*
>
> *3. Amending the second bullet point in the list of criteria in Policy 30, page 54, by deleting the words "including effects on wild land".*
>
> *4. Adding a criterion to the bullet points in the list of criteria in Policy 30, page 54:*
>
> • *Impacts on trees, woods and forests.*
>
> *5. Replacing the fourth sentence in paragraph 5.29 of the proposed plan on page 54 … with the following text:*
>
> *"In considering landscape and visual impacts, Policy 30 should be read in the context of the development plan as a whole including the objectives and principles of NPF4 and its topic specific policies including Policy 11. In terms of landscape, and cumulative landscape impacts, guidance is provided within the Argyll and Bute Landscape Wind Energy Capacity Study 2017".*

Argyll and Bute Landscape Wind Energy Capacity Study (2017)

This landscape study was undertaken to assess sensitivity of local land character types in respect to wind energy development. The study focuses on several scales of wind turbine development, noting that:

- There is no scope for wind turbines >150m in Argyll and Bute, due to high sensitivity of the landscape and upland areas;
- There is very limited scope for large wind turbines (80 – 130m), with no scope for turbines identified on Mull or other islands within the archipelago.
- There is some scope for well-sited wind farms in Craggy Upland and Upland Forest Moor Mosaic landscape character areas. Craggy upland areas exist in the South of Mull, with medium sensitivity (20 – 35m), high-medium sensitivity (35 - 50m) and high sensitivity (>50m) to wind development.
- There is no scope for wind turbines >50m in settled coastal and loch fringes due to landscape sensitivity and visual impact. Some areas would be sensitive to turbines >20m, as defined in study spatial mapping.
- There is some scope for wind turbine projects (<80m) on Mull. This includes Craggy Upland areas and small-medium turbines within Mull Basalt Lowlands, covering much of the east of the Island.

Isle of Ulva Social and Economic Development Plan (2020)

Specific to the island of Ulva, the development plan was developed in 2020 to set out a development trajectory for the island. With few residents, the core aims of the plan are to support island repopulation via improving housing stock and building new homes; improving infrastructure on the island; revitalising and expanding agriculture; managing woodlands; improving tourist accessibility and marketing; to care for local cultural heritage; enhance biodiversity; and support marine industries and fishing.

North & Central Mull Community Development Plan (2016)

Conducted by MICT in 2016 via in person and online surveying, the NCMCDP provides an overview of the issues and opportunities facing North and Central Mull from a demographic and infrastructural perspective. Highlighted issues included the high value for community spirit from survey respondents, the strength of community action, value for safety, nature, health and education, and the benefits of Road Equivalent Tariff (RET) on ferries and upcoming superfast broadband installation.

Challenges in this area of Mull were found to be consistent with other islands, including outward migration, lower than average earnings, lack of job diversity, lack of services, and poor accessibility. Importantly, it also highlighted the fragility of the local economy, relying on a mixture of primary and tertiary (tourist) sectors, a fact which has been borne out by the negative economic impacts of COVID-19 on the islands.

South West Mull & Iona Development Group (SWMID)

The South West Mull and Iona Development group have produced several development plans. The Ross of Mull & Iona Community Plan 2011 sets out a plan for how to foster a proactive community which develop ideas and opportunities to achieve a balanced, socially, and economically viable and prosperous population. The plan covers the vision for population, physical infrastructure, economy and employment, culture and heritage, and community facilities and social infrastructure.

SWMID's Sustainable Tourism in the Community report (2021) sets out the relationship between tourism and the local community. It sets out principles to ensure that the prosperity from tourism not harm the natural environment and enhances quality of life for all residents.

Sound of Mull Marine Spatial Plan (2010)

Developed under the Scottish Sustainable Marine Environment Initiative, this spatial plan is designed to provide guidance and recommendations on future planning, regulation, and management in the Sound of Mull. This includes balancing safeguarding of the environment and heritage asset with socio-economic operation and benefit in the region.

The spatial plan defines areas of opportunity and constraint from marine and coastal perspectives, highlighting that the Sound of Mull is particularly sensitive from cultural and environmental perspectives, whilst supporting a large number of marine-based commercial operations (fishing, transport).

Investigation of Wind, Solar and Wave Energy Projects for Isle of Mull Scotland (2019)

An existing study from the EU secretariats Clean Energy for EU Islands, the report investigates the islands potential for large scale renewables. The islands have substantial potential for both wind and wave energy projects, with the southern peninsula identified as showing the most wind potential, specifically the Ross of Mull region. The report further suggests that there is significant potential for offshore wind in the area around the Archipelago.

The report finds that solar potential on the archipelago is less significant. Although solar capacity factors can reach 15% in the summer, generation potential is significantly impacted in winter months. A cost benefit analysis should be conducted to determine feasibility, in most cases small scale solar is still feasible and may be a suitable choice for decarbonising building energy.

The report identifies three options to harnessing wave energy on the islands: tidal currents, dynamic energy of waves and thermal gradients with annual potential of 800 TWh, 8,000 – 80,000 TWh, and 10,000 – 80,000 TWh respectively, indicating significant potential for dynamic and temperature gradient systems. The report took samples from Gometra, finding a peak wave power density potential of just over 50 kW/m and minimum just over 20 kW/m averaging 40kW/m. in January of 2015, a wave power density of 159 kW/m was recorded, highlighting the opportunity for wave power.

In summary, offshore wind sites can produce electricity at around £0.12/kWh – £0.4/kWh, which would be competitive with other forms of renewable energy generation in the UK (as of 2023). There is also significant opportunity for wave power in the form of thermal gradients and dynamic wave energy. (EU Secretariat, 2019)

Part 2: Islands' Transition Path

The second part of this report looks to the future, detailing the islands' path towards achieving a clean energy transition. This includes the community's vision for change, strategies to be pursued, an appraisal of the technological options, and the required transition governance and monitoring framework.

5. Community Vision

Community Workshops and the CETA Framework

Five community engagement workshops were conducted by Scene and MICT on the islands of Mull and Iona over 9th – 11th May 2023. The full results of each of these workshops is available in the appendix. This chapter outlines a framework for how to achieve a successful clean energy transition on the archipelago. A graphic representation of this framework is outlined below.

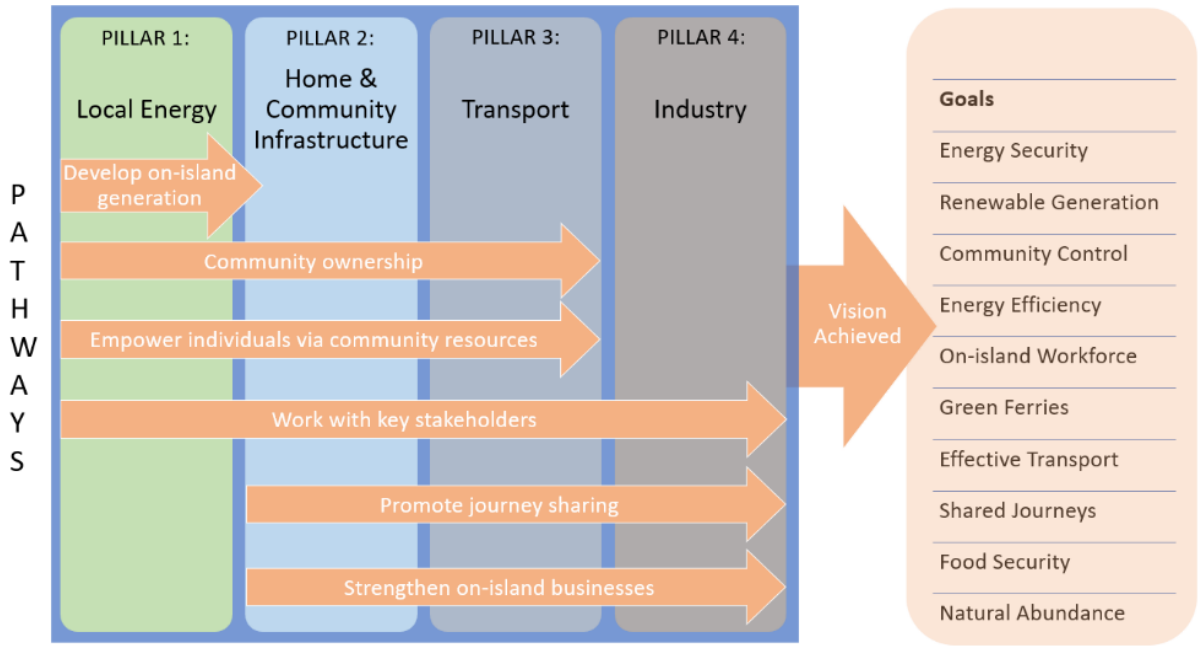

Figure 9: The Clean Energy Transition Framework

As can be seen in the framework graphic, the large scale of the transformation required means it is helpful for the approach to be broken down into:

- **Pillars** provide thematic groupings for the archipelago's transition and could, for example, be used as overarching "sections" for decarbonisation activities, each overseen and driven by separate individuals or groups.
- **Pathways** highlight potential interventions that cut across multiple pillars and sectors. The pathways are a group of activities or actions, often with common operational practices and ideas which may address several local priorities or emissions sources.
- **Principles** guide the decarbonisation process. Whilst not actions in themselves, nor end goals, they are the foundation for what successful action looks like.
- **Goals**, provide an end point to each pathway, and are the reason for action. This is the point at which the pathway is effectively complete, and the resulting impacts are realised.

The pillars, pathways and goals described in this chapter provide a mandate for community (and wider) sustainable development and action. This is part of the AMAZE project, which is driven by "actions" for zero emissions (The Archipelago of Mull Actions for Zero Emissions). Further information on the specific community goals, pillars, pathways, and principles are detailed in the rest of this chapter. In all cases these are borne from the discussions heard at the workshop, with all discussion points recorded and assigned to the relevant categories which together form the full framework.

Workshop Results: Goals of the Transition

The following vision statement is a summary of the community's goals for a clean energy transition. It brings together local priorities and needs, focusing on delivering sustainable development and achieving net zero in a way which:

A. Is locally defined and supported.
B. Utilises the resources available in the region.
C. Addresses key economic, social, and environmental issues relevant to the archipelago and the UK as a whole.

The Mull Archipelago is a net zero emissions, energy secure, self-reliant, and thriving place with efficient homes and transport systems, all driven by a local and community ethos.

Behind this vision statement are the following 10 goals, which describe what is happening in the community's future vision of a net zero archipelago.

1. **Energy Security**
   The islands are energy secure, with green local energy projects and networks.
2. **Renewable Generation**
   There is an abundance of renewable generation, and local generation serves local demand.
3. **Community Control**
   Low carbon projects are owned by, or for the benefit of, community, with collective thinking driving the transition.
4. **Energy Efficiency**
   Community support and creative solutions enable energy-efficient, low carbon and cheaper to run properties.
5. **On-island Workforce**
   An on-island workforce of green-energy specialists enable the transition.
6. **Green ferries**
   Reliable, regular, and green ferries prioritise island residents.
7. **Effective Transport**
   A joined-up and well-used public transportation system has aligned timetables, improved services and serves new areas, alongside an expanded EV charging network.
8. **Shared Journeys**
   Transport is efficiently used, with journeys sharing encouraged and supported.

9. **Food Security**
   A local ethos promotes food security and quality, supporting local businesses.

10. **Natural Abundance**
    The natural world is thriving - reforestation provides an enhanced carbon sink and supports tourism and the local economy.

Workshop Results: Pillars of the Transition

Discussion points at the workshops typically fell into five key themes:

1. Local Energy
2. Community and Home Infrastructure
3. On-Island Transport
4. Off-Island Transport
5. Industry

The number of discussion points raised in each theme can be seen in Figure 10, with Community & Home Infrastructure, Local Energy and On-island and Off-island Transport all popular topics, with Industry also raising some important discussion.

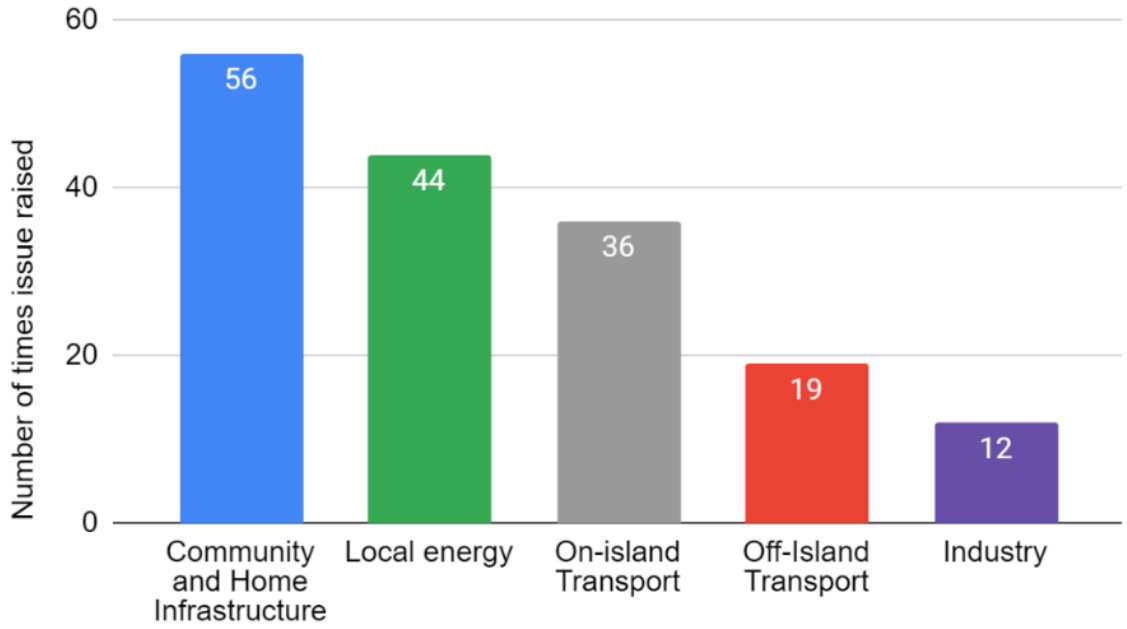

Figure 10: Themes of the workshop discussions

By combining on- and off-island transport together, this provides four "pillars" of the transition. An overview of the pillars and what they include is provided below, detailing the key themes of the energy transition on the Mull Archipelago.

Local Energy

The "Local Energy" pillar is primarily concerned with developing on-island generation. This was a popular topic at the workshops, accounting for a quarter of all the issues raised. Participants were enthusiastic about the potential and need for local energy with many ideas about locations and technologies. There is potential for generation across a range of technologies,

including wind, solar, hydro, biofuels and wave, alongside heating solutions such as air-source and ground-source heat pumps and potential for local heat networks. Energy security is a particularly important goal here, driven by the need to secure on islands fuel for heating and electricity supply. There is high interest in microgrids or co-located batteries as a solution to enable self-sufficiency and for energy to be used and benefit the local people.

Home & Community Infrastructure

The "Home & Community Infrastructure" pillar is a broad theme and encompasses the state of buildings on the islands, the low carbon workforce, waste infrastructure, and nature. This pillar encapsulates the most frequently raised issues including the need for home energy improvements alongside wider infrastructure, land, and support mechanisms. At the workshops there was a strong desire for education, information sharing, and an on-island workforce to help enable much-needed energy efficiency improvements. The need to empower individuals and encourage behaviour change by acting as a collective is an important consideration alongside issues of governance.

Transport (On-Island and Off-Island)

"Transport" was one of the most commonly raised themes of the workshops. There is a great need to decarbonise both on- and off-island transportation and align the different forms of travel to make a more effective system that works for residents. There is a focus on the need to work with the relevant operators to help improve services. The need to share journeys to help cut down unnecessary road and ferry miles is a common idea, whether as a car club, ride share scheme, or food and other delivery services. On-island Transport was most frequently brought up by Tobermory participants, with a unified approach to on-island transportation sought, which includes public transport, enabling EV and shared journeys and community access. Improving the ferry service was an important single issue, raised at every workshop. The community can see numerous ways that the service can be improved and need to be included in CalMac decision making as key stakeholders.

Industry

The pillar of "Industry" is an area that has substantial overlap with other pillars and is particularly concerned with farming and aquaculture as key industries of the islands. Food security and quality are prominent issues and were brought up at multiple workshops How to encourage reforestation was also high on the agenda.

Workshop Results: Pathways of the Transition

Pathways can help provide a useful framework for planning effective decarbonisation actions. The six overarching pathways that the community can take to enable the clean energy transition are:

i) Develop on-island generation.
ii) Community ownership.
iii) Empower individuals via community resources.
iv) Work with key stakeholders.
v) Promote journey sharing.
vi) Strengthen on-island businesses.

All ideas generated at the workshops fall under one of these pathways. They are thus common drivers of the transition across the archipelago. The strategies outlined in the following section provide an example of how the pathways can be utilised.

Workshop Results: Principles of the Transition

The below "principles" provide guidance for what successful action looks like. They are in the present tense and reflect those foundations for action that are held most important to the community.

Table 9: Community Guiding Principles

Local Energy
• Promote energy equity via shared community benefit or ownership, prioritising social justice. • Match demand to generation so that local energy is accessed by local people. • Follow the resources, matching renewable technology to the place and the need. • Enable energy security – developing local energy supply and network resilience.
Community and Home Infrastructure
• Empower individuals to improve the energy efficiency of homes and buildings through community support. • Enable collective thinking via community ownership of schemes, projects, and land. • Maximise existing resources and infrastructure available on the islands. • Make information accessible to improve education and awareness and encourage behaviour change.
Transport
On-Island: • Prioritise isolated communities, with a better public transport network. • Align existing systems to enable more efficient transportation usage. • Share journeys whether via car clubs, ride shares, or community delivery services. **Off-Island:** • Prioritise island residents as regular ferry service users. • Align existing systems - join up on and off island public transport links and deliveries. • Upgrade existing infrastructure – decarbonise the ferry fleet and improve reliability.
Industry
• Promote local production – improve food security and quality. • Own the solutions – use community-owned land for reforestation and plantations.

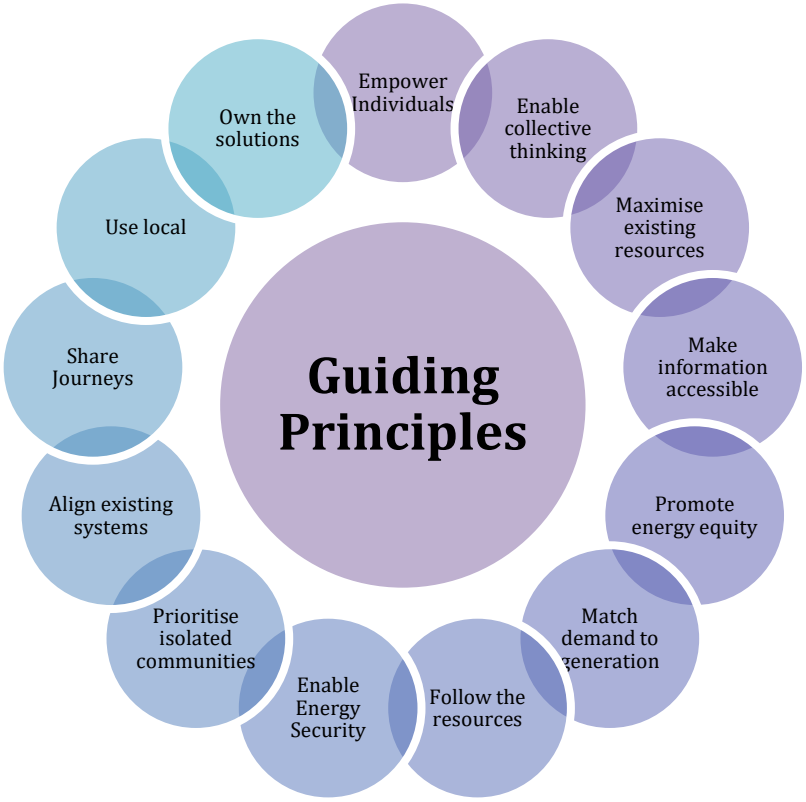

Figure 11: Guiding Principles

The Community Vision stated in this section is derived from the community workshop activities. Of course, whilst reflective of a consensus of highly motivated workshop participants, this was generated from a small minority of the overall population. There may be dissenting opinions held in the community and enacting the CETA process will involve developing the informed consent of the wider population.

6. Using the Framework: Forming Strategies

This section presents strategies which the community could implement as part of its clean energy transition, organised by the "pillar" it falls under and the pathway that it utilises.

Some strategies may naturally sit across more than one pillar and pathway. The below strategies are based on the ideas of the community across the five workshops - they are by no means exhaustive but an excellent starting point for action, along with the options appraisal of the next chapter.

Strategies are targeted towards "Addressable Emissions" – as noted in the Energy System Description (Section 2), decarbonising ferry and livestock emissions are beyond the direct control of island communities and are better seen from a national perspective. "Addressable Emissions" are the emissions that the islands communities have the greatest control over and therefore are the focus of this community action plan. Of course, in the long-term livestock and ferry emissions need to be decarbonised or offset by gains elsewhere to be true net zero islands.

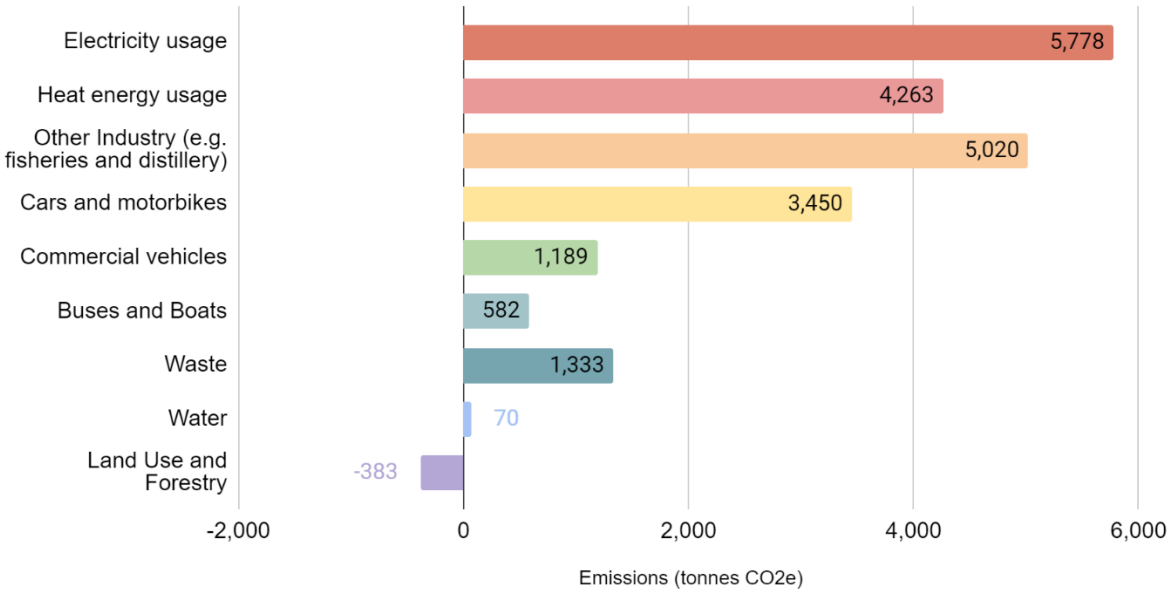

Figure 12: Total "Addressable" emissions (tonnes CO_2e)

Pillar 1: Local Energy

Table 10: Local Energy: pathways and strategies

Pillar 1: Local Energy	
Pathway Utilised	**Strategy**
Develop on-island generation	Conduct feasibility studies into solar arrays, hydro, wind, or other technologies (see Chapter 8) at specific sites of interest. This may include storage and supply opportunities, such as co-located batteries, or microgrid opportunities.
Community ownership	Undertake feasibility studies exploring local heat network solutions, with Tobermory a key site of interest. Maintain efforts to secure funding for the Iona heat network proposal. Explore community ownership or community benefit solutions for new renewable generation: • Green Energy Mull may offer an example and framework for developing projects. (See Chapter 5). • Prioritise the local demand as end-users and include throughout the process. • Pursue generation opportunities at community-owned sites, such as at halls or community-owned forests and land. Maximise islands renewables generation in the short to medium term, despite grid constraints, to further energy security: • Pursue micro generation schemes – such as solar, run of river hydro, wave, or wind – whether at community-owned sites or by working with other organisations. • Include co-located battery storage in renewables projects. Matching supply to demand - using the principles of microgrids – can increase network headroom. • Work with SSEN and seek funding to enable Active Network Management at suitable generator sites, e.g., community-owned Garmony hydro.
Empower individuals via community resources	Establish an overarching community group, forum and/or hub points for "Mull Archipelago Energy" (see also pillar 2). This could provide: • A forum for residents to support each other in energy matters, such as installing solar PV, heat pumps or retrofits. • A trusted information source, including on indicative costs, grant and loan availability, and Energy Saving Trust links. • A database of local PV, heat pump and retrofit installers. • Collective purchasing and installation of domestic low carbon solutions, such as solar PV or ASHP, to reduce material and installation costs.

Pillar 1: Local Energy	
Pathway Utilised	**Strategy**
Work with key stakeholders	Liaise with local businesses, public organisations, farmers, and landowners to investigate development or co-development opportunities. Engage in continued dialogue with the DNO (SSEN) regarding the archipelago's constrained substations and distribution network, including discussion of connection, co-location, and active network management opportunities. Work with Argyll and Bute Council to further local energy production: • Collaborate on key opportunities, especially when involving existing council projects (e.g., Iona breakwater) • Maintain challenge to LDP2 and wind energy development criteria, in line with the Reporter's recommendations. Continue campaign for local energy tariffs, which would enable locally produced electricity to be sold at more affordable prices.

Pillar 2: Home & Community Infrastructure

Table 11: Home & Community Infrastructure: pathways and strategies

Pillar 2: Home & Community Infrastructure	
Pathway Utilised	**Strategy**
Community Ownership	Use community-owned forests to protect biodiversity, promote carbon sequestration, and enable energy security via on-islands timber. Implement local zero waste hubs to foster circular economy activities, e.g., swap shop, repair, and food sharing.
Empower individuals via community resources	Encourage individuals to improve their homes' energy efficiency via retrofit (i.e., insulation, double glazing, draught proofing). This could be enabled by establishing an overarching community group for Mull Archipelago Energy (see also pillar 1). This could provide: • Information events, guidance and experience sharing. • A database of local installers, indicative costs, and funding options. Also, one for local tradespeople who can repair and restore items, for waste reduction. • Community usage of thermal imaging camera to show the community how much heat is lost from buildings. • Collective purchasing to reduce material and installation costs. Support home retrofitting via: • Collective home surveys and decarbonisation plans grouped by housing type. Shared access reduces costs, provides collective support, and prepares householders for the future. • Inform and encourage householders to apply for Warmer Homes Scotland and Home Energy Scotland funding. • Seek external funding to offer retrofitting and energy efficiency upgrades as a service to householders where government support is not available. Organise volunteering as a collective for nature restoration and maintenance work, e.g., the Bog Squad or Tireragan for peatlands. Build on the existing initiatives of community groups and residents, and cultivate engagement from across the islands, including from the younger cohort.

Pillar 2: Home & Community Infrastructure	
Pathway Utilised	**Strategy**
Work with key stakeholders	Organise as a community for outreach and/or lobbying with the council regarding: • New housing developments to meet high efficiency standards and including renewable generation and low carbon heating as standard. • Improving on-island waste infrastructure, including on-island sorting capability. Work with relevant governance agencies and landowners to protect woodland areas and biodiversity. Inform and work with private landlords and tenants to implement retrofitting and energy efficiency upgrades via the Private Rented Sector Landlord Loan. Work with existing on-island fuel suppliers (e.g., timber, heating oil) to increase energy security and reduce frequency of fuel deliveries: • Investigate ways to ensure essential fuel resources are kept on islands. Monitor all new infrastructure projects for low carbon implementation opportunities: • Lobby for the inclusion of renewable energy generation alongside existing developments, e.g., Iona Breakwater. • Seek higher energy efficiency performance for new developments.
Strengthen on-island business	Connect local businesses with Business Energy Scotland for a free energy efficiency or solar PV assessment. This is the gateway to SME loans for low carbon technology installation. Provide incentives for people to work or stay on the islands: • Renewable technology training for on-islands tradespeople. Organise an upskilling session for suitable local tradespeople via the mobile heat pump training centre (energy saving trust, 2023). • Forge links with the University of the Highlands & Islands (UHI) and encourage young people on the islands to take part in UHI training courses.

Pillar 3: Transport

Table 12: Transport: pathways and strategies

Pillar 3: Transport	
Pathway Utilised	**Strategy**
Community Ownership	Extend transportation system to underserved communities, following the example of Ulva Community Transport. A community bus could be tailored to local needs. Develop community EV charging solutions, such as via community-owned points, home point sharing, or at housing associations.
Empower individuals via community resources	Encourage private EV purchases via community sharing of information and resources, including on available funding. This could be done via a community energy group (see pillars 1 & 2).
Work with key stakeholders	Engage with CalMac, as the operator for four of the five ferry services. Key changes sought may include: • Prioritisation for residents in the booking process. • Ferry schedule alignment with wider public transport links. • Long-term transition towards electric or hydrogen powered vessels in operation. Open dialogue with bus operator West Coast Motors to explore improvements and opportunities for decarbonisation, including: • Ensure timetable alignment with the ferry schedule. • Discussion of opportunities for implementing electric buses, including whether depot charging needs could be assisted by community generation or chargepoints at Craignure Hall. Work with local businesses to encourage development of charging network, particularly in underserved areas, and inform them on available funding streams and benefits. Work with council to develop better active travel infrastructure. Support the work done by existing transport groups: • Building on existing initiatives to extent leverage and improve outcomes. (E.g., Community Transport Groups, M&I Ferry Committee, West Coast Motors.)

Pillar 3: Transport	
Pathway Utilised	**Strategy**
Promote Journey Sharing	Establish an EV car club so that residents are less reliant on individual private vehicles. Renew and improve the Mull and Iona Ride Share scheme.

Pillar 4: Industry

Table 13: Industry: pathways and strategies

Pillar 4: Industry	
Pathway Utilised	**Strategy**
Work with key stakeholders	Include farming and aquaculture workers in community energy action groups as an important local industry and key player: • Support industry workers: understand and prioritise their needs, including with decarbonisation of current practices. • Assess current land use and opportunities for the archipelago to produce more of its own food. • Assess feasibility of, and discuss, co-developing renewable generation projects with farmers and landowners. Establish supplier networks to help improve food quality and prices. Work with other large emitters such as the Tobermory Distillery and explore decarbonisation solutions, such as via biomass or digesters. Build on the existing initiatives of community groups and residents: • Support MESS to develop and widen its current low waste initiatives. • Work with the Tireragan Trust, SWMID, Torosay Hills Restoration Project and other community landowners to promote sustainable forestry, wilderness protection and carbon sequestration.
Promote Journey Sharing	Work with on- and off-island businesses to develop food delivery services from the mainland to reduce vehicle and ferry usage.
Strengthen on-island business	Work with local food producers, vendors, and the local community with the aim of reducing food miles by: • Establish more regular farmers' markets to promote local businesses and reduce food miles. • Promote the use of local shops and produce for food shopping.

7. Technology Options Appraisal

This chapter provides a high-level overview of the decarbonisation potential of technologies or wider sustainable development solutions detailed in the community vision and pathways to net zero.

The analysis provides a basis for comparison of options and draws attention to the feasibility of various decarbonisation strategies. It may be used as a "starting point" for exploring the possible pathways to achieving the community transition vision. Several of the most viable technologies may warrant further, more detailed, feasibility analysis. The options provided represent the most common and feasible solutions that involve community actions, themed across each emissions sector.

In each case a high-level scenario has been modelled, summarising the overall decarbonisation potential of technologies or actions. These are presented in the Figure 13 and provide an initial indication of the scale of emissions reductions possible with successful community action. For context, overall baseline emissions total 36,000 tonnes CO_2e, with 5,800 tonnes from electricity usage, 4,300 tonnes from non-electric heating, 12,000 tonnes from transportation, and 8,900 tonnes from waste and land.

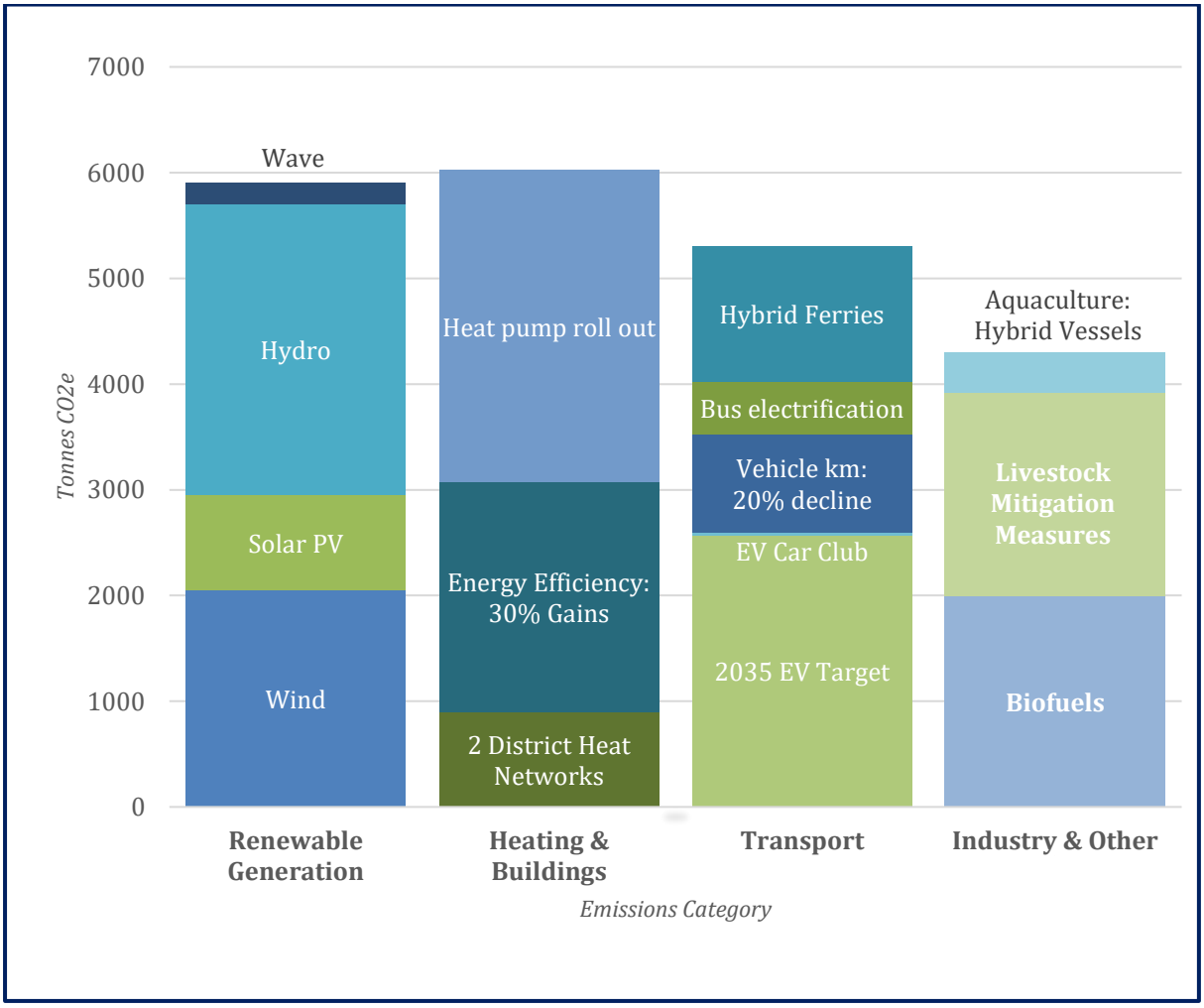

Figure 13: Decarbonisation Potential: Indicative scenarios

A. Electricity

Installing new renewables capacity is crucial to accelerate the archipelago's clean energy transition beyond the ongoing decarbonising of the UK electricity network. The UK-wide net zero transition requires a high level of electrification – including heating and transport – with associated increases in electrical load. On-islands renewables can contribute to the transition locally and within the national electrical grid context, whilst also contributing to the long-term energy security of the islands.

This section assesses the islands' energy generation potential for a range of renewable technologies given local constraints. Whilst wind and solar are the technologies forecast to bear the bulk of renewable energy expansion in Argyll and Bute, Scotland, and the UK as a whole, the summary table below highlights that run-of-river hydro also offers growth opportunities for the archipelago.

Generation potentials are presented as indicative estimates according to an "ambitious" but realistic assessment of potential future energy production on the islands that can be feasibly instigated with the help of community action given current constraints. However, the range of technologies explored here emphasise that there is no one size fits all solution – the optimal renewable technology is that which is best suited to a particular site and context.

There are manyfold community benefits associated with renewable energy development across the islands, including economic benefits via local employment, increased economic activity and energy export. However, this must be balanced with maintaining the health of existing economic industries, and environmental considerations. For example, ornithology is an important feature of environmental tourism, and any new developments must be sensitive to habitats.

Table 14 – Archipelago renewable generation indicative scenarios

Renewable Technology	New Generation Potential		Cost estimate[9]	Archipelago Capacity Factor
Rooftop Solar PV	2,000 MWh	2,100 kW	~£1,200 / kW	10% – 12%
Ground-Mounted Solar PV	1,500 MWh	1,500 kW	~£1,100 / kW	10% – 12%
Onshore Wind	8,000 MWh	*2,600 KW*	~£1,600 / kW	30% – 40%
Onshore Wind if constraints eased[10]	*17,500 MWh*	*5,400 kW*	*£1,600 / kW*	*35% - 45%*
Hydro (all)	10,700 MWh	3,500 kW	~£1,200-3,000 /kW	30% – 40%
Wave	800 MWh[11]	500 kW	~£5,000 / kW	10% – 15%

[9] Cost data from (BES, 2022), (IRENA, 2022) and (University of Strathclyde)
[10] The constraints that currently restrict larger wind turbines are Argyll & Bute planning restrictions and grid capacity.
[11] An illustrative example of two 250kW AquabuOY absorbers

Network Capacity

The electricity network on Mull is highly constrained due to an ageing and unsuitable grid supply infrastructure and distribution network, as well as low levels of investment in network management and upgrade. There is no transmission-level capacity on the islands, which has a 11kV/33kV distribution network and is connected to the mainland via three 33kV subsea cables. Iona is connected to Mull via 11kV three-phase cables which is due for replacement, and Ulva is connected by single-phase 11kV cabling.

Table 15 provides detail on these network constraints. The heavily constrained grid supply point (GSP) at Taynuilt, which has zero headroom capacity, is a major block for large-scale on-islands generation. Any on-islands generation must serve local demand, or have flexible dispatch, such as via co-location with storage. SSEN, the distribution network operator (DNO), has suggested that required upgrades will be pushed back from 2024 to 2034. SSEN are in the process of upgrading the cabling between Taynuilt and Tullich in a £10m project which may lessen local constraints (SSEN, 2022).

However, even without this upstream constraint there are capacity constraints at some of the islands' substations, further limiting new local connections. This is particularly the case in the central Mull area serviced by the Salen substation, and the much smaller Tioran Bridge substation. The Dervaig substation has green site classification and over 5MVA headroom, and thus North Mull is the area most likely to have availability for new generation, albeit still small-scale given the wider network constraints. Of course, all projects for the installation of generation must be assessed by SSEN for whether site connection is possible according to their export thresholds (SSEN, 2023b).

Table 15 – Archipelago Network Constraints (SSEN, 2023)

	Taynuilt	Dervaig	Kinloch	Lochdon-head	Salen	Tioran Bridge
Area served	North-West A&B	North-West Mull	South-West Mull	South-East Mull	Central Mull	West-Central Mull
Connection Type	Grid Supply Point	Primary Substation	Primary Substation	Primary Substation	Primary Substation	Primary Substation
Nameplate Rating (MVA)	90	8	2.5	1	2.5	0.1
Available Headroom (MVA)	0	5.36	2.80	1.3	0	0.11
Upstream Status	Constrained	Constrained	Constrained	Constrained	Constrained	Constrained
Site Classification [12]	Red	Green	Amber	Amber	Red	Red

[12] The Site Classification is a guide to the capacity for new connections, with green referring to less constrained supply points (SP), amber to moderately constrained SP, and red to highly constrained SP.

With a growing drive to decarbonise via the electrification of heating and transport, these restrictions may place significant limitations for the realisation of the archipelago's ambitions. The community is limited by SSEN timetabling for network upgrades, including at the local substations, mainland transmission network and the Taynuilt Grid Supply Point.

Flexibility Potential

However, until these constraints have lifted, energy storage, demand management, active network management and other flexibility solutions are required to enable on-islands renewable generation. Such solutions also bring the benefits of energy security, a buffer in the case of surplus power production and can lead to the avoidance of some expensive local grid upgrades. Solutions include:

- **Battery storage:** Batteries offer the simplest solution to energy storage and are well-suited to co-location with renewable generators. The leading technology is currently Lithium-Ion, but there are a range of alternatives with a rapidly improving technological outlook, including solid-state and flow batteries amongst others.
- **Capacity Trading:** The SSEN Transition innovation project may present an opportunity for capacity trading between existing generators (particularly those that have "firm connection" but low-capacity factors) to release connection capacity (SSEN, 2023). The ESO Connections Reform Project is considering long-term changes to better align local supply and demand interactions (National Grid, 2023).
- **Microgrids and demand-matching:** Self-sufficient energy systems can operate disconnected from the grid by balancing distributed energy generation with flexible demand loads and storage.
- **Pumped storage hydropower:** Although typically conducted at a large scale, small-scale pumped hydropower can make a significant contribution. SEPA are reviewing guidelines in step with NPF4.
- **Run-of-river Hydropower:** Suitable existing schemes may be upgraded to provide a flexible supply. This may be a way to install additional renewable generators (to power the pumping) without the need for new firm connection.
- **Green Hydrogen:** Green hydrogen is a transportable storage medium and can be used to produce eFuels for transportation and marine propulsion. However, this high cost, technologically immature solution may rely on excess renewable generation for economic viability.

As an example of the potential value of flexibility, the zero available headroom for new connections at Salen substation (Table 15) is currently caused by nearby run-of-river hydro connections with capacity factors of 30-40%. A combination of active network management, storage and/or capacity trading could enable increased generation without increased "firm connection" requirements.

Solar Photovoltaics (PV) - Rooftop and Ground-Mounted

Solar PV (photovoltaic) is well-placed as one of the cheapest generation technologies, yet in 2022 constituted only 1.3% of Scottish renewable generation (1.3%) (Scottish Renewables, 2023). 89% of UK solar installations are domestic (typically rooftop PV), and 4.3% of Argyll and Bute households have solar installations (compared to 5.8% UK-wide), with a much smaller role for larger scale commercial ground-mounted arrays (BEIS, 2023). The Archipelago currently has very low penetration of solar PV, producing around 110 MWh per year.

A 1kW rooftop solar PV system is typically made up of 4 panels and takes up 8m^2 roof space. The PV system can also be paired with battery storage to increase self-consumption.

Ground-mounted solar arrays are typically associated with "solar farms" but can also be well-suited for domestic installations with the appropriate space. This can provide increased yield at similar cost thanks to the capability for installation at the optimal tilt and azimuth angles. The rural nature of the archipelago makes ground-mounted installations a feasible option for homeowners with space, farmers, and landowners.

Generation Potential

The Mull archipelago receives an average solar irradiance of 800 - 950 kWh/m^2 (Global Solar Atlas, 2023). As can be seen from Figure 14, the highest solar irradiation resource is in south-west Mull and Iona, where average irradiance is 940 kWh/m^2, compared to 860-870kWh/m^2 in Tobermory and the east coast.

Figure 14: Mull Archipelago Global Horizontal Irradiance (kWh/m2) (Global Solar Atlas, 2023)

Roof Mounted Solar PV

We estimate that a high level of rooftop solar PV penetration across all suitable homes and businesses would be capable of 2.1 MW installed capacity and produce over 2,000 MWh per year across the archipelago. The average capacity factor is 11.0%, with 10.9% in Tobermory but 11.2% in the south-west. Generation potential results are presented in Table 16.

Suitable homes and businesses are defined using area specific housing typography, ownership status, conservation/heritage area status, area-specific capacity factors, and building orientations, conservation/heritage, and census data. Under this ambitious scenario, we estimate that rooftop solar PV could be installed on 29% of homes and 45% of businesses across the archipelago. 62% of this installed capacity comes from detached house owners due to greater roof space and greater self-utilisation resulting from higher building electrical demand.

Ground Mounted Solar PV

Ground-mounted solar is a resource with greater maximum potential, given the large availability of rural space. A solar farm on one small 7-acre field in south-west Mull could have 1 MW capacity, producing ~981 MWh per year, or 1,200 MWh with tracking technology. More moderately sized 10kW arrays could be suitable for businesses, houses with land and other open spaces and take up approximately 100m^2 (8x12m^2). 50 such arrays (averaging 10kW) would produce 490 MWh. However, implementing more sizable arrays can be prohibited by capital costs, few self-consumption benefits, and network capacity. Nonetheless many farmers partner with energy companies for larger scale solar installations.

Table 16 – Solar PV Ambitious Scenario

Area	Feasible Rooftop Capacity (kW)				Capacity Factor	Yearly Generation (MWh)
	Total	Businesses	Homes	Of which Detached Homes		
North-West Mull, Ulva	609	63	546	429	11%	**587**
Tobermory	599	156	443	256	10.9%	**572**
South-West Mull, Iona	430	74	356	272	11.2%	**422**
Mull Central and South	478	68	409	363	10.9%	**457**
Mull Archipelago	**2116**	**362**	**1,754**	**1,320**	**11%**	**2,037**
	Small Scale Ground Mounted Capacity					
Mull Archipelago	50 x 10kW arrays				11.1%	**486**
	Medium Scale Ground Mounted Capacity					
Mull Archipelago	1 MW				11.2%	**981**
Mull Archipelago total, all solar						**3,504**

Production is highly seasonal. Rooftop solar capacity factors in south-west Mull range from over 20% to less than 2% in peak/trough months. However, this seasonal generation may be well suited to tourist-facing businesses with heightened summer electricity demand. Solar also provides complementary energy generation to wind, resulting in a more balanced energy mix. To enhance flexibility, promote archipelago self-reliance and enable connections to a constrained network, energy storage may be required.

However, even the combination of ambitious rooftop solar PV uptake, ground-mounted arrays and a 1 MW wind farm produces around 3,500 MWh, equivalent to just 15% of current electricity demand. Nonetheless an expansion of solar capacity - rooftop solar in particular - would be a viable and valuable contribution to a renewables network, providing energy security and bill savings for householders and businesses. Excess energy generation can be exported at the SEG tariff rate. Upfront installation costs can be supported by Scottish Government loans and grants such as the Home Energy Scotland Grant and Loan, Warmer Homes Scotland, Private Rented Sector Landlord Loan, and SME Loan schemes.

The SSEN 2045 Consumer Transformation scenario, translated to the archipelago context, is for 858 kW in small-scale solar (National Grid, 2022). This is very achievable given the 2.1MW capability outlined above and would require installations across 36 businesses (18% of total) and 192 homes (12% of total).

Wind Energy

Wind produces 78% of Scottish renewable generation but just 12% of archipelago generation, with 291 kW of installed capacity across 11 sites, mostly in south-west Mull. Only one turbine (Glengorm) has over 60kW capacity and 8 turbines less than 25kW capacity. Installing higher capacity turbines is difficult due to landscape, visual sensitivity, environmental factors, and network constraints meaning wind generation must occur on the small scale, connected to the local distribution network.

Generation Potential

Mull has good average wind speeds of 9.0 m/s at 50m, 10.8 m/s in the 10% windiest areas (Global Wind Atlas, 2023). As shown in Figure 15, wind speeds are highest in the central and western Mull, Ulva, and Iona. Yet these are areas where there are also environmentally sensitive and protected areas, with the entire south-west coast also part of an area of panoramic quality (APQ).

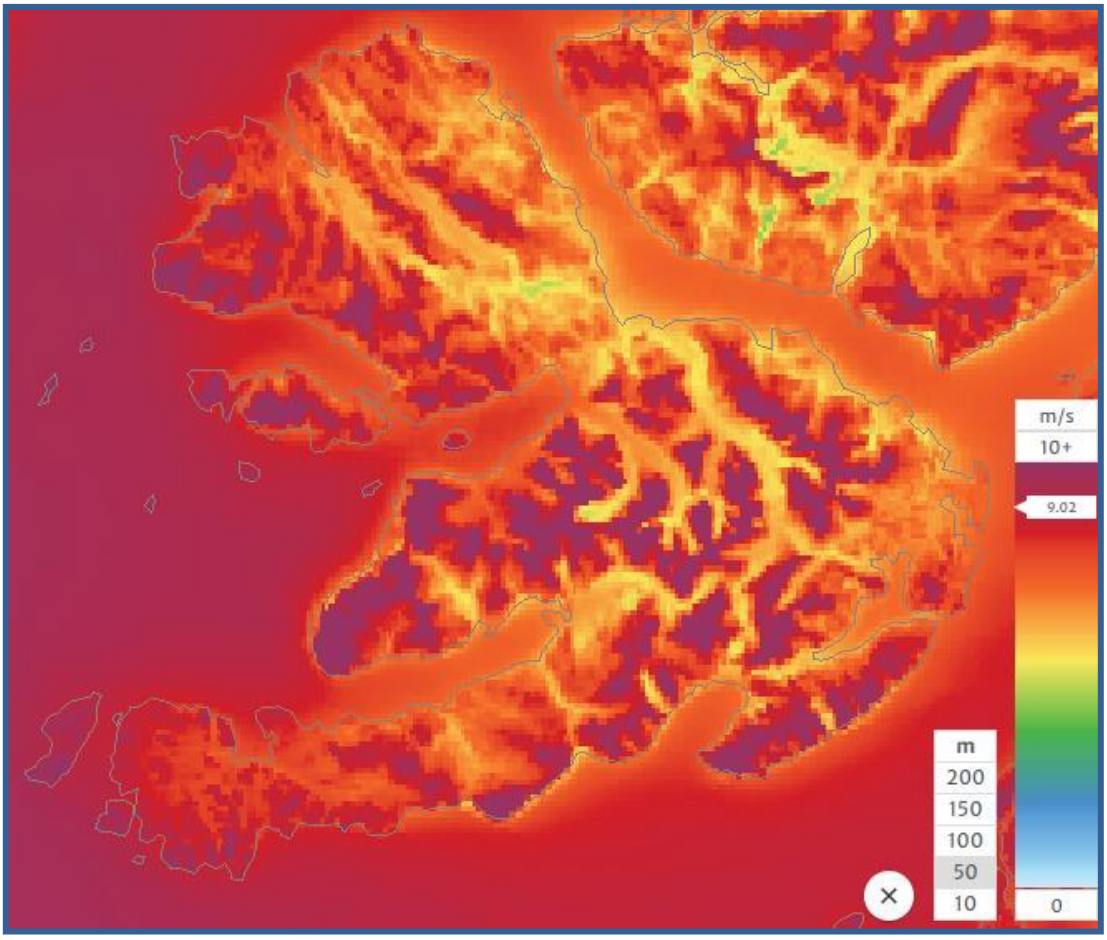

Figure 15: Mull Archipelago Average Wind Speed at 50m (Global Wind Atlas, 2023)

The council's Landscape Wind Energy Capacity Study (Argyll and Bute, 2017) provides guidance for each area typography of the archipelago. Any wind turbine development in

Mull must be below 85m height, and more likely below 50m in height - approval is highly site specific and dependent on the visual impact along with other criteria. Based on the landscape capacity study guidance and excluding any areas and hub heights designated with "High" or "High-Medium" sensitivity, we have modelled the generation potential of moderately sized developments in specific feasible areas, namely:

- **Location 1, High Stepped Basalt:** 2 x 600kW (50m) and 4 x 200kW (25m) turbines in "high stepped basalt" areas, typically in the north of Mull.[13]
- **Location 2, South-West Boulder Moors and Basalt Lowlands:** 2 x 200kW turbines in the "boulder moors" and "basalt lowlands" areas of the south-west.[14]
- **Location 3, Craggy Uplands:** 1 x 200kW turbine in the Carn Ban "craggy uplands" area of the south west.[15]

Generation estimates for the above sites are presented in table 16 (Global Wind Atlas, 2023). These provide a high-level indication of the generation capacity of such new developments: the combined 2.6 MW capacity produces over 8,000 MWh per year, equivalent to all existing on-island generation. The community can look to maximise opportunities where there is both high wind potential and discreet visual and environmental impacts. Of the locations tested, the south-western site has the highest capacity factors, although the northern sites also produce good output. Capacity factors are 5% higher at the higher 50m hub height, rather than 25m. Generation potential is seasonal - peak months generate treble that of trough months. The highest winds are typically in the winter months, with early summer the least windy. A key constraint may be the availability of moderately sized turbines, with production increasingly going to high power output models.

[13] The "high stepped basalt" designation is typically found across North Mull, but also in some areas of South Mull. There is "medium sensitivity" to turbines > 50m. Development opportunities are in contained hills/valleys that do not obstruct views. Must avoid disruption of views of the Loch na Keal NSA and APQ. (Argyll and Bute, 2017).

[14] The "boulder moors" designation is found in the Ross of Mull. The "basalt lowlands" designation is found in the south-west and north of Mull. There is high sensitivity to turbines > 50m. Limited opportunities if dramatic coastline and Brolass views, sense of wilderness and rocky stepped slopes of the Ardmeanach peninsula are not obstructed. (Argyll and Bute, 2017)

[15] The "craggy uplands" designation is found in small pockets of the south-west. There is "high sensitivity" to turbines > 50m. Must avoid disruption of the dramatic views and woodland. (Argyll & Bute Council , 2020)

Table 17: Wind Generation Potential per site and turbine size

	Location 1, High Stepped Basalt	Location 2. South-West Boulder Moors and Basalt Lowlands	Location 3, Craggy Uplands
Turbine	**200 kW turbine, @ 25m height**		
Av. Capacity Factor (%)	33.0%	34.9%	28.7%
Energy Generation (MWh/turbine/year)	578	611	503
Ratio High to Low (monthly average)	2.95	2.78	2.94
Number included in scenario	4	2	1
Turbine	**600 kW turbine, @ 50m height**		
Av. Capacity Factor (%)	37.9%	*Not currently permitted at these locations*	
Energy Generation (MWh, year)	1,989		
Ratio High to Low (monthly average)	2.76		
Number included in "ambitious" scenario	2		
	Combined Scenario (2 x 600kW, 7 x 200kW)		
Energy Generation (MWh, year)	8,017		

Of course, even turbines of these sizes may not be possible due to network, planning, and public sentiment constraints, although community ownership solutions can help lessen public objections to wind energy. Micro-generation is a possible alternative, yet the exponential effects of increased hub heights and blade lengths means smaller turbines produce disproportionately lower power. (This is unlike solar power, where array size is proportional to output.) Almost 500 10kW (11m) turbines are required to match the generation from the above scenario, or over 100 25kW (18m) turbines. A feasible "micro-generation" scenario of 20 x 10kW turbines and 10 x 25kW turbines would produce around 1,000 MWh per year. The small-scale wind industry has not recovered from the removal of Feed in Tariff support, with the full cost of wind generation under 50 kW as high as £7,500 / kW (Mull Wind Power, 2023).

As noted in section 4, as of June 2023 the Argyll & Bute Local Development Plan (LPD2) has received recommendations from the Scottish Government Reporter. It is not aligned with NPF4, Scottish law since February 2023. The community plays a key role in maintaining pressure on Argyll & Bute Council to develop planning policy which places higher priority on the low carbon benefit of prospective new renewable generation. The enaction of such alterations may lessen future barriers to local wind developments.

An illustration of the possible gains from larger permitted turbines alongside an easing of network constraints is as follows:

- A 1MW community-owned turbine at 80m in an ideal "high stepped basalt" location could generate an estimated 3,550 MWh per year, almost half the combined scenario from 9 smaller turbines (above).
- The addition of three more 600kW turbines (thanks to the relaxation of planning rules in alternative locations) could generate an estimated 5,970 MWh per year.

As an island grouping with shallow, open water out to the south-west, offshore wind could also be explored as an option. However, the challenges are numerous:

i) All surrounding waters are designated "Special Area of Conservation" and all but the south a "Marine Protected Area," with additional local fishing impacts.
ii) The constrained and low voltage local network mean prospective offshore turbines would be connected to the mainland, not the archipelago.
iii) Offshore wind turbines are more than 50% more expensive than onshore turbines.

Hydropower

Hydropower is one of the oldest renewable technologies, with strong Scottish heritage. It is the main on-islands generator (85%), with 2.5MW capacity producing 7,500 MWh per year. Most generation comes from three sites in central Mull. This includes the 400kW run-of-river Garmony site, owned by Green Energy Mull, a community benefit society. Six smaller scale generators collectively produce 1,830 MWh per year. Thus, production potential for even micro-generation sites is promising, comparing favourably to small-scale solar and wind.

Generation Potential

Any prospective generation is limited by environmental considerations. These constraints are most severe for larger scale hydro storage sites which require dams to be built and can destroy habitats. Run-of-river sites can be more feasible but must not have an adverse impact on river flows, fish passage, and sediment transport. Scottish Government regulatory guidance is tiered according to proposed scheme size: under 0.35 GWh (~100 kW); 0.35-1.75 GWh (~50 0kW); and over 1.75 GWh (SEPA, 2015). Sites of 100 kW and below may face a simpler regulatory process, whilst generation over 500 kW must fulfil more stringent criteria.

The natural resource potential is abundant, particularly in central Mull, characterised by rivers flowing from high elevations. SWMID owns the Tiroran forest which was identified as having potential for two run of river sites in a Mott Macdonald feasibility study, although a CARES feasibility request stated that these schemes were not viable without FITs. The community (MICT) also own the 200 ha Ardura forest.

Table 18 details the generation potential from an ambitious scenario for 21 new hydro sites, including a breakdown of 100kW, 200kW and 500kW sites and typical capacity factors. These can only be high-level indications, as run of river capacity factors are highly site specific and dependent on river flow and turbine characteristics. This scenario would generate over 10,000 MWh per year, bringing the total including existing hydro to around 18,200 MWh. This is 85% of current electricity demand – although this underlying demand may double by 2045.

These results indicate that small-scale hydro could be an effective way of achieving archipelago self-reliance, especially if combined with storage or active network management technology. Pumped hydro storage (PHS) would offer an ideal solution as a dispatchable

generator responsive to grid constraints. However, PHS viability is subject to a suitable site being located. [16]

Table 18 – Mull Archipelago Hydro Generation Scenario

Capacity (kW)	**50**	**100**	**200**	**500**
Av. Capacity Factor (%)	35%	35%	35%	35%
Energy Generation (MWh/site/year)	150	310	610	1,530
Feasible generation (count, new sites)	4	10	4	3
Total Feasible Generation (MWh/year, new sites)	**10,730**			
Total Hydro Scenario (MWh/ year, inc. existing sites)	**18,230**			

Wave and Tidal

Wave and Tidal are two separate technology groupings still at an early maturity stage but may be worth consideration in the longer term with reduced installation costs and improved capacity factors. Wave technologies are onshore, nearshore (10 - 25m depth) or offshore (>40m depth) with cost versus wave potential trade-offs.[17]

Generation Potential

The Clean Energy for Islands report assesses the archipelago's power potential alongside a detailed description of the theoretical basis for wave energy and technological overview (EU Secretariat, 2019). This EU report assesses the tidal potential to be 'low' and so focuses instead on the encouraging wave potential.

Although the wave potential of the archipelago is lower than north-western Scotland, it nonetheless has promise for capture. Coll and Tiree shelter the archipelago's north and west, which receives less than 20 kW/m. However, the southwest coast has a high wave resource and EU reporting (EU Secretariat, 2019) states it receives an annual average 40 kW/m at the measuring point, ranging between 20kW/m and 50 kW/m over 19 examined years. This provides good power potential, albeit at high inter-annual variability (see Figure 16) (EU Secretariat, 2019). There is also significant seasonal variability, with wave power density highest in the winter and peak months 5 – 10 times higher than trough.

In general, wave energy could produce some local power to Iona and south-west Mull. For example, wave energy devices could feasibly be incorporated into existing breakwater structures, including the proposed Sound of Iona project. Yet wave energy generation is likely to only contribute a fraction to overall generation, at least in the medium-term. Wave energy currently has low output given the size of devices - Mocean Energy's Blue X wave attenuator

[16] Hydro storage provides base load supply with peak time flexibility. Pumped hydro storage provides a valuable peak-load supply. Run-of-river schemes offer base load but do not typically have storage capabilities, although can include regulated water flow (IHA, 2023).

[17] 41% of wave energy devices are point absorbers (bobbing buoys). Other designs include wave attenuators (cylindrical with hinged points) or terminators (which capture the waves).

is 20 metres long, 38-tonnes and a power rating of just 10kW (Mocean Energy). However, in deeper waters (<50m), devices such as the AquabuOY absorber (250kW, with a 6m diameter and 30m depth) could be capable of 400 MWh per year in the Sound of Mull, with an estimated 19% capacity factor given the area's wave power potential.

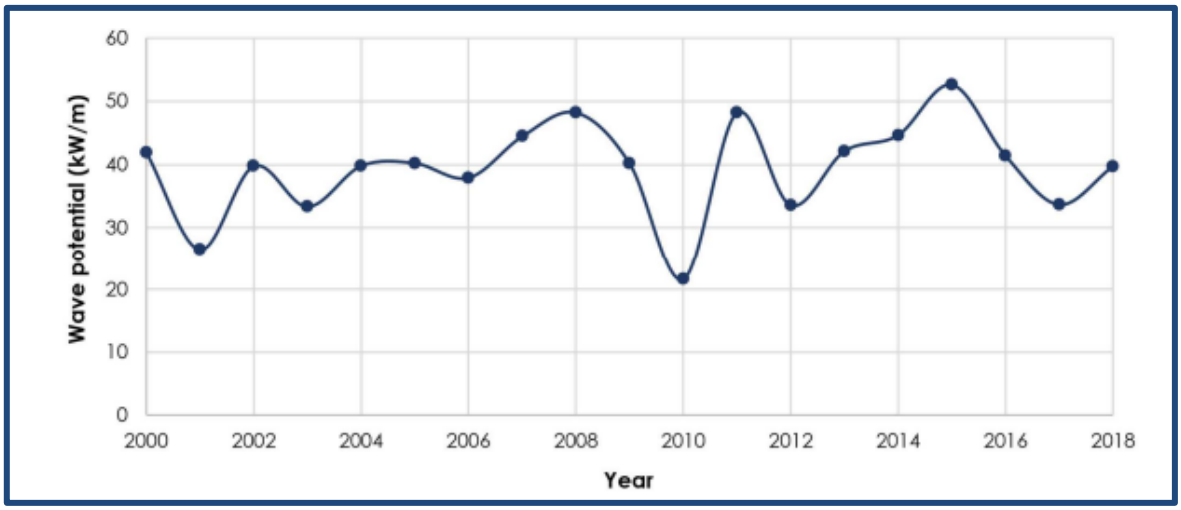

Figure 16: Annual average wave power potential in South-West Mull (kW/m) (EU Secretariat, 2019)

B. Heating

Non-electric heating systems supply one third of archipelago heating demand yet are responsible for 60% of the heating emissions (See section 2). Transitioning heating oil, coal, and LPG systems to electric heating (using air- and ground-source heat pumps) is the most effective decarbonisation pathway.

Hydrogen may only be a longer-term solution due to technological immaturity, and biomass burning is associated with damaging air pollution. Energy efficiency improvements, both for homes and businesses, are a vital tool for reducing overall energy usage (and hence emissions) and enabling heat pump technologies.

Local Heat Network

Description

Local heat networks, using heat from air- or ground-source heat pumps, provide a reliable supply of heat to households within limited areas. On the Archipelago, this would look like several small, local heat networks serving distinct communities.

A District Heating Network (DHN) delivers hot water from one (or more) energy sources through a series of underground pre-insulated pipes, to heat individual buildings in a closed loop system. Each connected building receives energy through a Heat Interface Unit (HIU) or directly from the network, which replaces the need for individual boilers at each building. Whilst in widespread use across northern European countries, due in large part to infrastructure investment decisions their deployment in the UK to date has been limited. There are significant benefits from supplying heat through heat networks, including:

- Highly efficient generation with substantial CO_2 emissions reduction.
- Cost savings from improved efficiency, and more predictable prices.
- Improved load characteristics spread across the sites.

- Increased energy security if using local fuel sources or local renewables.
- Modern HIU have similar control and maintenance requirements as modern boilers.
- HIU interacts with buildings internal heat network (e.g., pipes, radiators).

Decarbonisation Potential

Feasibility studies are required to assess the viability of local heat networks on the archipelago. This includes the potential for the thermal resource to be harnessed via ground-source heat pumps, or via centralised biomass-powered generation. A service and consumer price at least equivalent to existing sources of heat supply is required to justify development.

However, as an illustration, two 100-building local heat networks using 100% renewable energy could save approximately 900 t CO_2e carbon emissions thanks to a three-fold reduction in energy usage (1,250 MWh) and renewable energy source.

Densely populated locations, such as Tobermory, could also be favourable, with costs reduced thanks to the small distances heat would need to be moved. A low temperature borehole-based ground-source heat network proposal has been developed for Iona, including a distributed network approach to more remote properties which could be replicated elsewhere on the island. In the case of the Iona Heat Network, the project received significant funding but is currently on hold due to a lack of funding and the negative impacts of the Covid-19 pandemic on previously secured funding (Iona Renewables, 2023).

An assessment by consultants, Ricardo Energy and Environment, found that a series of ground-loop district heating systems and / or ground- or air-source heat pumps could make effective use of the unique environmental resources of islands, stating that there are opportunities for small district heating systems, using shared ground loop systems or non-domestic sites as anchor loads. These opportunities represent a sustainable source of electric heating for the growing domestic, commercial, and touristic developments on islands. (Ricardo, 2016)

No generation potential is associated with heat networks as they are a supply approach, with adaptability across all heat generation technologies. Further information on technology-specific decarbonisation impacts can be found in the following section.

Energy efficiency (Domestic)

Energy efficiency in homes is a crucial factor in reducing domestic carbon emissions, improving quality of life, and tackling fuel poverty. Energy efficient homes require less energy to heat, making them more comfortable to live in and cheaper to run. By 2033, the Scottish Government aims that all homes will have an Energy Performance Certificate (EPC) rating equivalent to EPC C or better, and EPC B by 2032 for the social rented sector (Scottish Government, 2023). In practice, high energy efficiency in homes includes wall, roof and floor insulation, energy efficient lightbulbs, draught-proofing, and double or triple glazed windows.

Decarbonisation Potential

The archipelago has significantly lower energy efficiency housing than Scotland as a whole. An analysis of EPC data from 2022/23 (sample of 365) reveals an average performance rating of 57 (D) compared to 70 (C) across Scotland (Scottish Government, 2023). Substantial decarbonisation gains can be made by retrofitting and improving the building fabric. However, the below figure shows the scale of change required. 73% of Mull homes do not meet the grade C standard, far behind Scotland as a whole, and a third of properties are rated E or worse. These poor energy efficiency results are partly due to the archipelago's large share of detached homes, which make up 57% of the total (22% across Scotland) - Tobermory

is the archipelago outlier with only 37% of homes detached. 50% of homes are owner-occupied.

Affordable housing is one of the biggest issues facing the community, and aligning the need for new housing along with sustainable housing is a challenge. It is vital that new builds do not exacerbate or "lock in" the energy efficiency problem on the islands. Whilst building energy efficient buildings with low carbon heating systems can be associated with a higher upfront cost, these implementations lead to substantially lower running costs and avoid expensive, or difficult future retrofitting work. Although planning permission is in the purview of the council, communities can be effective lobbyists for change and make their voices heard in the consultation process.

Shared community access to local decarbonisation resources, advice, shared experiences, and local engineers via a community energy hub can help facilitate the decarbonisation of homes. Collective purchasing, group building surveys and providing information on funding sources can help facilitate retrofitting for homeowners. It can be harder effect change in the private rented sector – landlords should be included as key stakeholders as part of the CETA process and encouraged to utilise public funding schemes such as the Private Rented Landlord Sector Loan (See Appendix A on funding opportunities).

LETI's Climate Emergency Retrofit Guide targets energy efficiency improvements of as much as 60-80% for the average UK home (LETI, 2021). This level of energy efficiency savings would reduce carbon emissions by 1-1.5 tCO_2e for the average archipelago dwelling. Even an average 30% improvement in energy efficiency across the archipelago would reduce energy usage by over 6,000 MWh and save 1,500 tCO_2e.

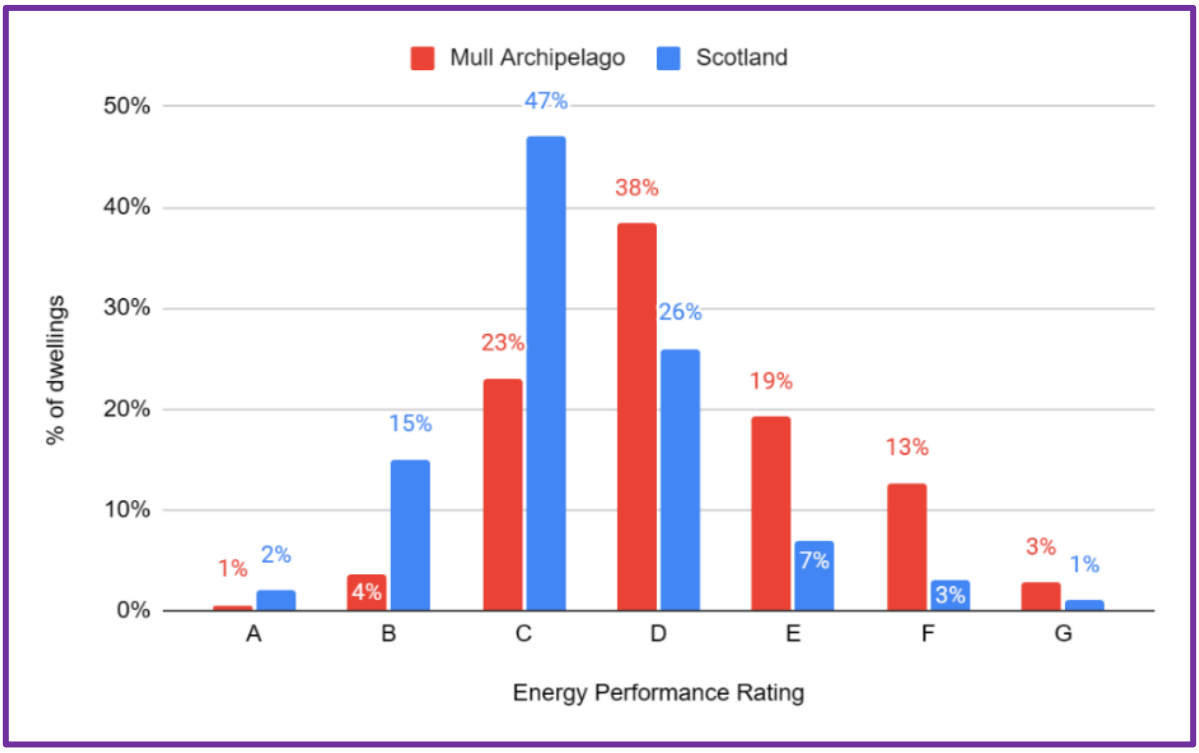

Figure 17: Mull Archipelago EPC ratings (Scottish Government, 2023)

Community activity can lessen the barriers to conducting retrofitting work. Householders with similar housing types in a local area may organise shared access to assessors and suppliers. Conducting the work as a collective can reduce costs and increase trust. The Warmer Homes Scotland Grant (see Appendix B) provides 100% grant funding for energy efficiency, heating and renewables improvements for homeowners or tenants in receipt of qualifying social security payments who live in a home with a poor energy rating. The Home Energy Scotland Grant can help other householders and Private Rented Sector Landlord Loan offers interest-free loans for landlords.

Heat Pumps (Domestic)

The most common form of domestic heat pump is the air-source heat pump (ASHP). These are an economical and low-carbon space heating solution for homes which are well-insulated and thus should often be implemented alongside energy efficiency improvements.

The Scottish Government has set a target for the 'vast majority' of oil, LPG, and coal homes to convert to zero emissions heating by 2030. With no gas network on the archipelago, this means that the estimated 62% of homes across the archipelago with these heating systems are high priority targets for decarbonisation. These 62% of homes are responsible for over 3,000 tCO_2e, similar in scale to all car journeys on the islands.

Decarbonisation Potential

To match SSEN's Consumer Transformation scenario for heat pumps would require installations across 41% of archipelago homes by 2030. Although most homes are well suitable for heat pumps, the need in many cases for concurrent energy efficiency improvements may slow the pace of roll-out on the islands. A ClimateXChange report on zero emissions heating for Scottish island communities highlights some of the challenges faced (climateXchange, 2023). The pace of decarbonisation may be slowed by the availability of heat pump qualified engineers across the islands - ASHP installation costs increase by £2000-£3000 due to additional travel requirements and materials. However, the Energy Skills Partnership have developed a mobile training centre that can be used for industry up-skilling or re-skilling across Scotland (energy saving trust, 2023). Organising as a community to conduct individual heat decarbonisation measures as a collective can help reduce overall barriers and costs.

Such ambitious installation of heat pumps across 41% of an even distribution of islands homes would reduce energy usage by an estimated 5,500 MWh and lead to a carbon saving of 1300 tCO_2e at current electricity carbon intensity. This could rise close to over 2,000 tCO_2e reduction with a net zero electricity source.

Shared community access to local decarbonisation resources, advice, shared experiences, and local engineers via a community energy hub can help facilitate the decarbonisation of homes. The Home Energy Scotland Grant and Loan provides a funding option of up to £7,500.

Non-domestic Heat

The largest share of archipelago non-domestic heating demand comes from Tobermory (35%), followed by central, south, and east Mull (28%), southwest Mull (21%), northwest Mull (15%), and Iona (1%). We estimate that this is led by energy use in the quaternary sector (41% of total).

Decarbonisation Potential

As with homes, installing an ASHP provides on-site generation in a non-invasive way, with multiple heat pumps or ground-source good options for larger premises. If there is rooftop space or an area of unused land, installing electrical generation systems can further decarbonise the heating system and reduce running costs. Organisations such as schools or other large demand properties may act as potential hub locations for more significant local heat networks, which can provide heat to a combination of domestic and non-domestic homes.

As with homes, energy efficiency may be a key obstacle to implementing heat pumps in non-domestic properties across the archipelago. Based on the last 10 years of non-domestic EPC data, 78% of non-domestic properties are graded G and have poor efficiency (Scottish Government, 2023). This compares to 51% graded G in Scotland in the same time period.

Business Energy Scotland offers an energy efficiency support and advice service for Scotland's small and medium sized enterprises (SMEs), managed by the Energy Saving Trust (see Appendix B). Financial support is also available through the Scottish Government's SME loan and cashback scheme, which offers up to £100,000 to support the implementation of carbon-saving measures such as renewable heating and insulation, with up to £20,000 cashback available in some instances. The CARES Community Building Fund can also provide grant support for low carbon technologies.

Biomass

Biomass generation provided over 5% of the UK electricity supply in 2022, more than solar (Energy Dashboard, 2023). However, this mostly originates from very large-scale solid biomass or biogas power plants, with smaller scale generation typically linked to industry. The low carbon credentials of biomass generation are only secure if the biomass was truly sustainably sourced – the Committee for Climate Change (CCC) recommends prioritising biomass for use in sectors with otherwise limited decarbonisation solutions (UK Parliament, 2023). There are also substantial air pollution impacts.

Generation Potential

The Archipelago has several large forestry areas, including the community-owned Ardura forest which has 110ha dedicated for timber crop. Forestry is a key industry on the islands and timber is used for local heating needs and export.

As noted in the energy description, the Tobermory Distillery is the largest single energy user on the island and uses 400 MWh electricity and 8000 MWh Fuel Oil (Scottish Islands Federation, n.d.). Utilising biomass technologies could be a very feasible decarbonisation pathway for the high heat process requirements of the distillery. Installation of high efficiency biomass boilers could utilise the sustainable on-island timber resource, whilst anaerobic digester plants can produce biogas from wastewater, spent solid barley and other waste products from the distillery process. Combined Heat and Power systems can recover excess heat to be used for

electrical processes. Switching to a net zero (sustainably sourced biomass or biogas) as a fuel source at the Tobermory Distillery could save up to 2000 tCO_2e.

C. Transport

Emissions from transportation originate from private vehicle usage and ferry transportation, with commercial vehicles, bus, coach, and boat trips providing a much smaller share. With 40% of emissions attributable to tourists, any decarbonisation pathway must address emissions by non-local stakeholders. Ferry decarbonisation is a long-term goal, whilst an expanded public charging network can encourage electric vehicle usage by visitors, as can EV car clubs and hire schemes.

Electric Vehicle Ownership

Electric vehicles are forecast to grow rapidly across the UK, accelerated by the UK ban on new petrol or diesel cars by 2030. Based on census and DfT data we estimate that only 1.2% of the archipelago residents' 1,950 cars and vans are currently electric (battery or hybrid), compared to 1.9% in Scotland (DfT, 2023). Electric vehicles are the most mature and scalable low carbon technology for passenger vehicles. However, the expansion of availability and choice is urgently required - there are currently 73 EV models available to buy in the UK, versus 389 ICE models.

Decarbonisation Potential

Figure 18 presents a central forecast for electric vehicle growth across the archipelago, with over 20% of vehicles expected to be electric by 2030. It is based on a combination of National Grid's future energy scenarios (National Grid, 2022) for battery and hybrid cars and vans. It is anticipated that there will be ~425 EVs on Mull in 2030 and ~1,600 EVs in 2040 across all EV types. Battery EV cars are expected to grow 24-fold by 2030, with hybrids playing a declining role post-2030. This level of EV growth would reduce emissions by 1,000 tonnes CO_2e by 2030, 2,600 tonnes CO_2e by 2035, and 3,700 tonnes CO_2e by 2040.

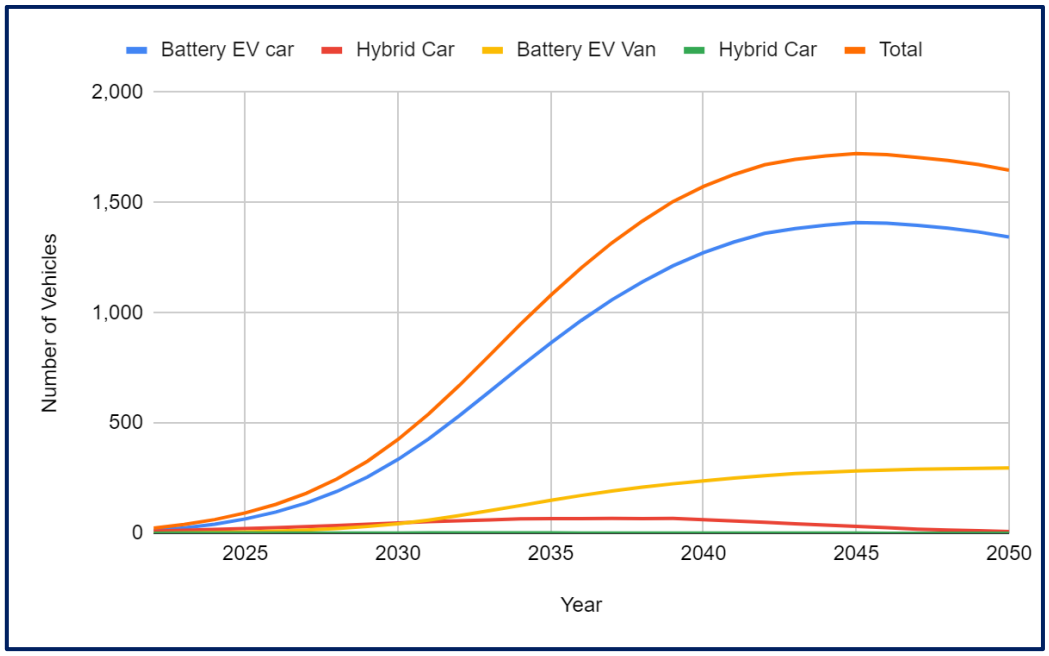

Figure 18: Resident's Electric Vehicle ownership growth forecast by EV type (National Grid, 2022)

This rapid EV rollout will markedly increase archipelago electricity demand. When including tourists' public chargepoint demand, total EV demand is estimated 1,030 MWh in 2030, peaking at 4,000 MWh in 2045 (Figure 19). Our modelling suggests that EV growth will be fastest amongst tourist vehicles in the short-term, responsible for 38% of EV electricity demand on the archipelago in 2030, before falling back to 32% by 2045.

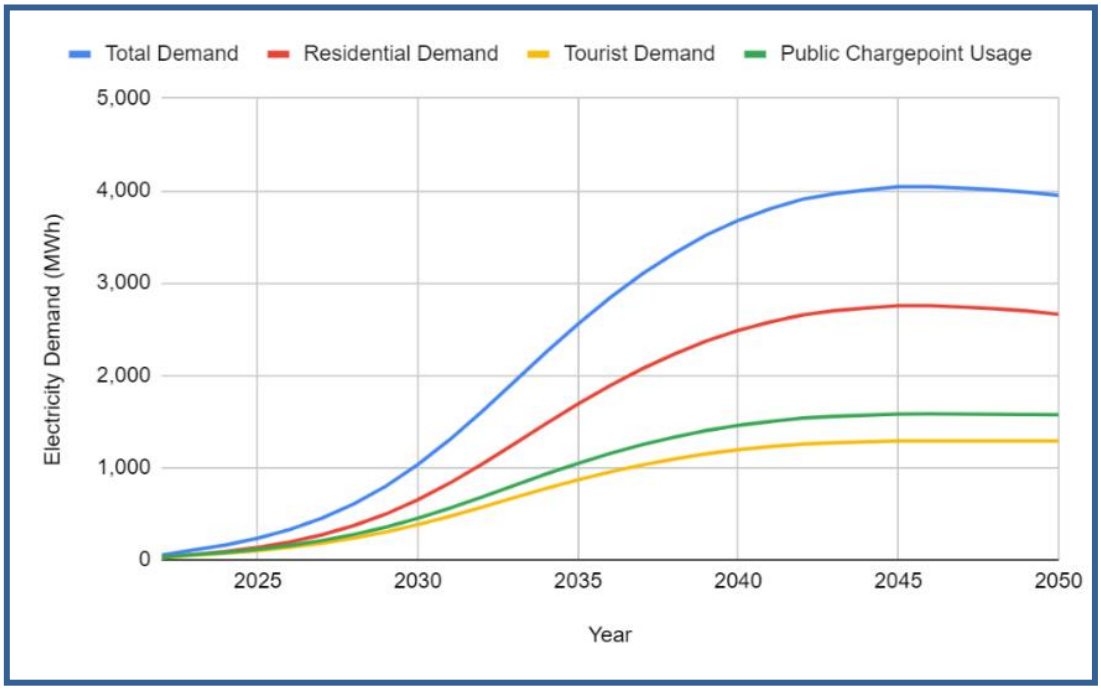

Figure 19: Electricity demand from residents' and tourists' EVs, forecast (National Grid, 2022)

Community action can help propel EV growth to match or exceed that outlined above. The imminent tourist demand makes public chargepoint access across the islands a decarbonisation priority over the next 10 years. Replacement of ICE (Internal Combustion Engine) vehicles with EVs can be aided by access to EV car club vehicles. Private EV purchases can be encouraged with the community sharing of information and resources such as through energy advice hubs. For example, the Used Electric Vehicle Loan provides interest free financing for Scottish residents.

Charging Network

Private chargepoints are the most common charging type, whether at the home (typically low power, 7kW or less), at a place of work, or at private fleet charging locations, typically using national grid electricity. Public chargepoints are openly accessible, available at car parking spaces, businesses, and roadsides. The private-public distinction can be broken down by community sharing of points - third party services such as JustPark allow communities to shared private chargepoint access.

The EV Charging Behaviour Survey (Element Energy, 2019) found that just 10% of charging took place at public chargepoints, compared to 75% at the home and 15% at the workplace. However, an extensive public network is particularly important on Mull due to the prevalence of tourist journeys and long distances between destinations. Public chargepoint usage is also required for those without home charging capability. In Scotland, most public chargepoints are operated by ChargePlace Scotland. The most common "fast" 22kW charging speed fully

charges a typical EV in around 3 hours. However, a "rapid" charging infrastructure (typically 50kW) enables longer journeys and alleviates range-anxiety amongst drivers.

Decarbonisation Potential

Table 19 catalogues Mull's 13 public chargepoints by area. The UK has set a target for 300,000 chargepoints by 2030. Mull is halfway to its share of this target of 29 public chargepoints. Whilst the demographics of Mull (characterised by low population and large land area) means it is not always suitable to compare to Scotland-wide figures, this Mull-specific target is based on total vehicle distances travelled, including by tourists, and is a useful barometer for progress. Central Mull already exceeds its 2030 target with 7 chargepoints, all in the Craignure area. In contrast, Tobermory needs another 7 chargepoints to reach targeted levels. 16 of the current 26 connectors on the 13 Mull chargepoints are fast variants (3x7kW, 2x11kW, 9x22kw), with 9 rapid connectors (2x25kW, 3x43kW and 6x50kW) at Craignure car park, Ledaig car park, and Fionnphort. Further information on the archipelago's public chargepoints can be found in the AMAZE Feasibility Study on Electric Vehicles & Renewable Energy Hubs.

Table 19 – Mull public changepoints by area and 2030 target.

Mull Public Chargepoints	Mull Archipelago	North-West Mull and Ulva	Tobermory	South-West Mull and Iona	Mull Central
Chargepoint Devices	13	2	1	3	7
2030 Devices Target	29	9	8	5	6
% Progress to 2030 Target	45%	22%	12%	55%	114%
% devices with rapid charge capability	31%	0%	100%	33%	29%

Public chargepoints should reflect the islands context. For example, extending the time limit on slow charging near ferry ports (beyond the current 4 hours) could enable residents to charge whilst travelling to Oban.

With the majority of new chargepoints likely to be installed at homes, community education and resource support may be helpful. The EV ChargePoint Grant provides funding of up to 75% towards home devices. For non-domestic charging, the Business Chargepoint scheme provides 50% grant funding for SMEs and 75% for third sector organisations in Scotland. Community-owned sites, including at community halls, would be eligible for this support.

EV Car Club

MICT are investigating the feasibility of an EV Car Club, with analysis to be published in 2023 with the support of NESOI. This would involve 7 community halls across the islands as EV vehicle hub sites, with associated charging facilities and renewable generation.

Decarbonisation Potential

The availability of an EV car club can effectively contribute towards decarbonising car journeys. Firstly, by directly replacing journeys otherwise made by ICE vehicles. Secondly, overall car ownership can decline thanks to car club vehicle access. In Scotland, an average 17 cars are replaced by each car club vehicle, and 16% of members sell their car after joining the club (CoMoUK, 2022).

Active Travel

The Scottish Government has set a target for a 20% reduction in car kilometres by 2030 (Scottish Government, 2022). Promotion of Active Travel can be a highly effective method for emissions mitigation, with shorter car journeys replaced by walking, wheeling, or cycling. Active travel is best linked with public transport or car club journeys. It is also achieved by reducing travel needs via more local destinations and journey sharing. Mode switching to active travel requirements include improved cycling infrastructure and access; pavement accessibility; clean and safe travel environment; "20 Minute" neighbourhoods; well-lit routes.

Decarbonisation Potential

Whilst the archipelago has numerous routes for leisure walking and cycling, there is reduced suitability for active travel for everyday journeys. Just 30% of work or school journeys are 5km or less, compared to 78% in Scotland (Census, 2023). Additionally, the single-track road network and large distances involved makes active travel difficult to implement. However, active travel infrastructure could be improved within settlements, particularly Tobermory, with improved pavement and bicycle access.

It may be viable for eBike hire to be included as part of the (above) EV car club scheme, or for active travel journeys to be encouraged for reaching the car club hubs. Indeed, eBike hire sits alongside car clubs in several successful ventures, such as the Moray and Strathaven car clubs, with Strathaven also providing an eCargo bike delivery service. Working with the summer providers of rented ebikes to make these more easily available to locals during the off-season may be a further way to encourage active travel.

Argyll and Bute are yet to implement an active travel plan but have appointed consultants to identify the best options for an active travel route (Argyll & Bute, 2022). The council has received £771,900 from the Places for Everyone programme for active travel routes, although none of this as yet has been designated to be spent on the archipelago.

The successful Mull and Iona Ride Share scheme is indicative of the underlying demand for car sharing, with the scheme most popular with women, under 35s and Tobermory residents. A drive to renew and refresh the scheme across the archipelago to increase participation numbers is a viable decarbonisation solution for reducing journeys.

Achieving the Scottish government target to reduce car kilometres by 20% would reduce vehicle emissions on the archipelago by 900 tonnes CO_2e.

Bus and Coach travel

The Scottish Government set a target to replace the majority of diesel buses by 2023, a target highly likely missed. Electric or hybrid buses are the most feasible current technologies, although this could be supplemented by hydrogen or eco-fuel alternatives.

A decarbonisation strategy for bus and coach travel is also about facilitating increased public buses to replace car journeys - travelling by diesel bus instead of petrol car cuts per km journey emissions by 50%. The current emissions from the archipelago's three public buses, community transport, and coach tours is presented in the below table.

Table 20: Mull archipelago public bus, community transport and coach emissions

Public Bus Route	Destinations	Distance Travelled per year (km)	Emissions (tCO_2e)
494	Tobermory to Calgary	43,000	55
95/495	Tobermory to Craignure	108,000	138
96/496	Craignure to Fionnphort	100,000	128
Ulva Ferry Community Transport		~22,000	4
Coach tours (West Coast Tours, Turas Mura, etc.)		~137,000	172

Decarbonisation Potential

As the end user, community organisations have the capacity to enter into dialogue with bus and coach operators and the council to explore decarbonisation solutions. As noted in Chapter 2, the electrification of, for example, the 95/495 bus would have a similar effect to the electrification of 60 cars. However, the capability for electric buses and coaches on the islands may be limited by lack of charging infrastructure. The Energy Savings Trust provide a Sustainable Transport Business review for fleet vehicles, which may support public transport companies to decarbonise.

Ulva Community Transport's hybrid bus and electric car have demonstrated the capability for the community to establish their own bus and transportation routes, tailored to the needs of the community. This model of providing low emission transportation may be developed in other parts of the islands to augment the infrequent public bus timetable. Each of the 3 public bus services only operate 3 – 4 times per day, and less on weekends.

Hybrid Ferries

The Archipelago's five ferry routes produce twice the emissions than that of all the cars on the islands, with 76% of this coming from the main Oban - Craignure crossing and over half attributable to tourists (see section 2). 4 of these routes are run by Caledonian MacBrayne (Figure 20), and the foot passenger Ulva Ferry is run privately. The Fishnish - Lochaline Lochinvar vessel is a diesel-electric hybrid vehicle, one of only three electric hybrids in the Caledonian MacBrayne fleet, and results in 20% fuel and emissions reduction for the route.

Figure 20: CalMac operated ferry routes (CalMac, 2023)

Decarbonisation Potential

Currently, fully electric technologies are not advanced enough to be implemented as a decarbonisation solution for the largest vessels. Large scale emissions reductions - beyond the 20% reduction gained via hybrid ferries - is thus a medium to long-term goal, and reliant on the operator, CalMac. Even in the accelerated net zero pathway of the UK Government's Domestic Maritime Decarbonisation Plan emissions do not start to decline until after 2030. In that report, the main low carbon fuel forecast to be used is hydrogen-derived ammonia, with a smaller role to play in the long-term for electricity, methanol, and shore power (DfT, 2022).

However, ferries are easier to decarbonise than other large vessels where there are shorter, predictable crossings - electric vessels with storage capacity may still become the dominant ferry technology. Norway has seen some success in electrifying ferries - the all-electric MV Ampere carries more cars and passengers than all but the Isle of Mull vessel (Oban - Craignure crossing), which is more than twice the size (Energy Monitor, 2023b).

Other ways of decarbonising the overall carbon impact of ferries include aligning timetables with public transport timetables[18], and incentivising passenger-only crossings. The carbon emissions associated with one passenger is just 7% that of a car, and 0.3% that of a coach according to UK government carbon intensity factors (UK Government, 2023).

[18] It should be noted that bus timetables are ordinarily fairly well-aligned with ferry timetables. However, the unreliable Winter 2022 ferry timetabling meant that this alignment broke down, causing sustained disruption for residents.

D. Waste

Waste may make up a small part of total archipelago emissions (3.9%), but it is a key area to decarbonise. Decarbonisation depends on council level improvements in waste infrastructure, supported by local behaviour change, such as reduce, reuse, recycle campaigns or waste reduction projects.

Waste Infrastructure Improvement

Archipelago-wide emissions from waste are twice the national average due to Argyll & Bute's high landfill rates, the council ranking 4th highest out of 32 Scottish local authorities in 2019.

Recycled materials from the archipelago are transported and sorted on the mainland. The latest Argyll and Bute Waste Strategy Report identified Mull's Glengorm landfill site as near capacity (Argyll & Bute, 2021). It is to be extended beyond the limits of the 2021 Scottish Government ban on biodegradable municipal waste in landfills. The Scottish Government target is for only 5% of all waste to be landfilled by 2025.

Decarbonisation Potential

In their Waste Strategy report, Argyll & Bute Council have suggested three main avenues for improving waste infrastructure on the Mull archipelago:

- Conducting an options appraisal to assess the most cost-effective methods for diverting waste from landfill.
- Developing waste transfer operations at the existing archipelago sites to allow the council to sort and separate waste otherwise destined for landfill, with recyclable material transferred off the islands. Diverting biodegradable landfill waste to recycling stations provides the largest emissions reduction opportunity for the archipelago.
- Expanding the capacity of landfill services to enable continuation of landfill services for waste that is not subject to the government ban.

Community groups have a role in mobilising and pressurising the council to act, to prioritise islands infrastructure renewal, and to utilise funding available via Zero Waste Scotland. A full appraisal of waste infrastructure options and feasibility analysis is required to assess whether there is scope for on-islands sorting of waste for all households, given the available resources of the islands.

Reduce, Reuse, Recycle Campaign

Reducing consumption, which includes re-use of materials is the most effective method for cutting emissions. Besides this, reuse and recycling means resources are kept in a closed loop, which is particularly important in an island context, where waste is often transported significant distances.

Decarbonisation Potential

Community-led education and advice initiatives for homeowners and businesses can have a significant impact on levels of recycling and waste reduction. This is a viable emissions reduction opportunity for communities which should not be overlooked. The council has stated that it does not have a separate budget to develop specific promotion of reduce, reuse,

recycle, but will work with national campaigns, such as those administered by Zero Waste Scotland (Argyll & Bute, 2021).

Alongside more general information campaigns, community action can involve the establishment of community hub sites that makes reduction and reuse easier for local people. The MESS Project (Mull and Iona Environmentally Sustainable Solutions) is a community-driven venture and has made a large impact in reducing waste on the islands since it was established in 2002 (MESS, 2023). The project has two "Island Castaways," charity shops in Bunessan and Craignure, and a summer pop up shop in Tobermory, which encourage re-use. MESS has conducted carbon education initiatives, runs repair workshops and provides business recycling services. The project has also tackled food waste with a community fridge, Tobermory food waste collection and recycling bins.

There is scope for a continuation and expansion of MESS activities with the support of the community and additional funding streams. MESS provides a ready-made vehicle for promoting further waste reduction initiatives and has a host of ideas for next steps. Inspiration for future activities can also be found from other waste community groups, such as Shrub, a co-operative community organisation based in Edinburgh where the community can swap preloved items in return for Swap shop tokens, use the Food Sharing Hub, or attend events and workshops throughout the year. They received funding from the National Lottery's Community Led Grant and provide accessible Resource packs for how to run a Clothes Swap or a Swap Shop, Collections, and provide a Fabric Awareness booklet (Shrub, 2023).

E. Land

Emissions from the Land sector, including forestry sequestration, land use and livestock emissions, make up 20% of total archipelago emissions, dominated by the emissions from livestock, which are presented in section 2. Mitigation of these emissions depend on enhanced sequestration through archipelago-wide woodland protection, soil management, and livestock management.

Community Protection and Expansion

Archipelago woodlands sequestered over 1,000 tCO_2e per year, although this is mostly offset by other land use emissions from grassland, cropland, and settlements. Protecting (and extending) the islands' forestry and woodland is therefore a decarbonisation priority. The archipelago has existing areas designated as ancient woodland areas, as well as the vast National Scenic Area (NSA) designation across the west.

Decarbonisation Potential

There are several ongoing projects on the islands which promote sustainable forestry. MICT are in a good position to instigate measures that protect biodiversity and carbon sequestration via their ownership of the Ardura Forest. With over half of this 200ha forest designated as being for commercial timber crop, particular care must be taken that timber is sustainably harvested, with replanting conducted with maximum carbon sequestration and forestry health as priorities. Accreditation from organisations such as the Forest Stewardship Council UK or UK Woodland Assurance Scheme can help ensure high standards (FSC, 2023). SWMID have owned the Tiroran Community Forest since 2015 and manage it for the benefit of the local community. Similar care should be taken that timber is sustainably harvested, and indeed

SWMID have also purchased a sawmill. With tourism a key industry on the islands, a thriving natural world is also important for tourism and the local economy. The Torosay Hills restoration project, spanning a 3,000ha, is an exciting project committed to rewilding and restoring woodland and peatland environments, coupled with reduced sheep and deer grazing (Torosay, 2023). There may be opportunity for further areas of rewilding across the archipelago. Rewilding can be highly beneficial for carbon sequestration as well as promoting biodiversity, species protection, and an additional draw for tourism. The Tireragan Trust works to protect 625 hectares of conservation importance in the south west tip of the Ross of Mull (Tireragan Trust, 2023). Alongside protecting biodiversity and the wild landscape, the trust has instigated a peat restoration project with the help of volunteers. Further volunteer-led work to restore peatland across the islands can help increase the islands' existing "carbon sink".

The North Mull Land Management Plan is currently in consultation, meaning that community groups and residents are capable of making their voices heard regarding the community priorities. As of 2023, the plan's 'primary objectives' are numerous, with timber production, restoration of ancient sites and protection of key habitats just a handful of those stated (Forestry and Land Scotland, 2023). In terms of more general archipelago-wide land management, climate-centred spatial planning is essential.

Industry solutions: Farming

Farming emissions originate from enteric fermentation and manure management, alongside cropland management and machinery usage. This is a large share of total archipelago emissions but is outsized due to the archipelago's very high land area per capita. Therefore, it is not helpful to compare these emissions to emissions from the energy usage of a small population of ~3000. They are better placed in national context, where they are five times less than the Scottish average on a per km basis. Agriculture as a whole constitutes 17% of Scotland's total emissions (Scottish Government, 2023).

Farming is an integral and highly valued part of island life. Any community climate action proposed in this report is centred on encouraging the usage of local produce and is supportive of the local industries. Any changes to farming practices are of course the sole purview of farmers and landowners. However, there may be joint opportunities between community groups and farmers, such as via co-beneficial renewable energy installations or farmers' markets.

Decarbonisation Potential

Direct emissions abatement is in the responsibility of farmers and landowners via adjustment of land, manure, or livestock management techniques. Better Climate's "Climate Change Focus Farms" offer an example of the sustainable farm improvements which can both reduce emissions and running costs (Farming for a Better Climate, 2021). A Scottish Government study found that implementing a series of measures has the potential to cut emissions for Rearer Finisher units (the complete beef cattle chain) by over a third (Scottish Government, 2022). The biggest impacts come from reducing the age of slaughter to 18 months, reducing the age at first calving from 3yrs to 2yrs, improving grassland management and the usage of methane and nitrification inhibitors.

There are several producers' markets across the archipelago, including the Craignure Producer's Market and Tobermory Open Air Market. There may be opportunities to instigate markets in additional locations and encourage the community to buy local produce, which is

farmed in a sustainable manner, and support local food shops. The Mull Slaughterhouse trades as a co-operative society and provides abattoir and butchery services to the islands. An increase in local use of the butchery can help reduce the associated transportation emissions from meat consumption and support the local economy.

Industry solutions: Aquaculture

The Archipelago aquaculture industry is an important industry on the islands, with a mixture of 19 shellfish and 11 finfish sites, including several salmon sites, operated by 13 companies. Emissions originate from fuel usage from finfish sites.

Decarbonisation Potential

As with farming, emissions are driven by industry actors with reduced scope for community intervention. However, the Sound of Mull Spatial Plan set out policy guidelines and information for achieving sustainability in the marine environment (Scottish Sustainable Marine Environment Initiative, 2010). More broadly, the Electrifying the Fleet report (Marine Conservation Society, 2023) highlights the challenges facing industry decarbonisation. Current licensing procedures encourage the use of fuel inefficient boats, and improvement in battery technology is required. However, hybrid systems can be viable and are increasingly being utilised.

Funding Solutions

Obtaining funding is a key barrier to overcome when instigating community-led decarbonisation actions. The below tables summarise the specific funding sources which are available as of June 2023. It is themed by emissions sector for ease of use, but it should be noted that many of the schemes are flexible in what projects they can be used for.

A detailed catalogue of funding options with more information and links is available in **Appendix A** and can be used as a guide for funding community projects.

Table 21 – Available Funding Streams

Activity	Funding Streams
Renewable Generation	**Domestic Generation:** Home Energy Scotland Grant and Loan Private Rented Sector Landlord Loan Smart Export Guarantee Warmer Homes Scotland **Non-domestic and large-scale generation:** Business Energy Scotland assessments SASC Bridge Finance Scottish Hydro Electric Community Trust SME Loan Scheme. Triodos Renewable Energy Finance
Heat and Buildings	**Homes:** Home Energy Scotland Grant and Loan Private Rented Sector Landlord Loan Warmer Homes Scotland **Non-Domestic:** Business Energy Scotland assessments CARES Community Building Fund SME Loan Scheme. **District Heat Network:** CARES Community Heat Development Programme District Heating Loan Fund Energy Industry Voluntary Redress Scheme Scotland's Heat Network Fund **General:** Crown Estate Scotland Community Capacity Grants Programme Highlands and Islands Enterprise – Green Grant Fund
Transport	**Electric Vehicles and Chargepoints:** Business Chargepoint Funding Scheme Domestic Chargepoint Funding Scheme EV Chargepoint Grant Scottish Shared Transport Knowledge Centre Sustainable Transport Business Review. The Workplace Charging Scheme Used Electric Vehicle Loan for Business **Active Travel:** eBike Grant Fund. eBike Loan.

	Paths for All Scotland Cycle Repair Scheme Used Electric Vehicle Loan **Buses:** Sustainable Transport Business Review Zero Emission Bus Market Transition Scheme **Air Pollution:** Clean Air Schools Framework. Living Streets **General:** CalMac Community Fund
Waste	Baillie Gifford Community Fund Circular Economy Investment Fund National Lottery Awards for All Scotland National Lottery Community Fund Recycling Improvement Fund Social Enterprise Net Zero Transition Fund Suez Communities Fund Scotland
Land	**Farming and Food:** Agri-Environment Climate Scheme. Integrated Land Management Plans Preparing for Sustainable Farming Specialist Advice **Nature Preservation:** NatureSave Trust SUEZ Communities Fund The Scottish Land Fund
Other community projects	Baillie Gifford Community Fund CalMac Community Fund Climate Engagement Fund Crown Estate Scotland Community Capacity Grants Programme Energy Industry Voluntary Redress Scheme Highlands and Islands Enterprise – Green Grant Fund National Lottery Awards for All Scotland National Lottery Community Fund Social Enterprise Net Zero Transition Fund StartupMull The Waterfall Fund

Challenges

This subsection summarises some of the core challenges that the community faces in enacting a clean energy transition:

Local Grid Constraints:

- The Taynuilt Grid Supply Point has zero headroom capacity.
- SSEN network upgrades have been delayed.
- Local Distribution Network Constraints: 3 of 6 on-island primary sustained have red classification for constrained headroom. Only Dervaig is classified green.

National Policy: Local Energy Markets

- The Local Energy Bill passed in 2023 with Clause 272 and 273 removed.
- This is a blow to the development of local energy markets, community and small-scale generators, and consumers.

Planning:

- As it stands, the Local Development Plan (LDP2) is not favourable to renewable generation, particularly wind developments.
- The Scottish Government Reporter has recommended changes to LDP2 to better align it with national policy (NPF4).
- The current volume of national planning applications, under a rapidly changing regulatory framework, results in slow and inconsistent responses to prospective renewable developments.

Funding Availability

- Funding streams for community decarbonisation are limited and can be competitive.
- For example, Scottish communities are not eligible for the £10m Community Energy Fund.

Building Fabric

- Three quarters of archipelago homes do not meet EPC Grade C Standards.
- Older, rural buildings can be more expensive and/or difficult to retrofit.

Local Expertise

- Shortfall of on-island workforce and skills for conducting retrofitting and low carbon installation.
- Bringing workers on-island increases the costs of home and business energy improvements.

Island location:

- Transportation and logistics for sourcing the materials for renewable energy technologies, retrofitting and other measures can be expensive, and reliant on ferry crossings.
- Some of the archipelago does not have adequate connectivity for smart metering, although other options such as second-generation meters (SMETS2) or broadband connectivity may be viable.

Behavioural Change:

- Decarbonisation requires behavioural change across society involving:
    - Vehicle usage, vehicle ownership and travel patterns.
    - Home and business decarbonisation measures.
    - Waste reduction
    - Livestock rearing and food consumption.
- Some residents may be resistant to change, having particular needs or issues that must be addressed.

Community Organisation and Buy-In:

- The large geographical spread of communities across the archipelago makes sustaining a unified archipelago transition a challenge.

Landlords:

- With 31% of archipelago dwellings in the rental sector, implementation of low carbon home energy is reliant on landlord action.

Dependence on external stakeholders:

- Decarbonisation is not solely in the hands of the community.
- Ferry decarbonisation is dependent on action by CalMac and technological development.
- Home and business decarbonisation and renewable generation is strongly influenced by national policy and funding support.

Tourism:

- 17% of Archipelago emissions are attributable to tourists.
- Seasonal fluctuations in energy demand from tourists.

8. Transition Governance

This chapter provides a review of existing governance structures and institutions from the perspective of the Mull Archipelago, and the governance requirements in line with a future vision for low carbon islands.

Figure 21 provides an overview of existing governance actors and relationships on the islands.

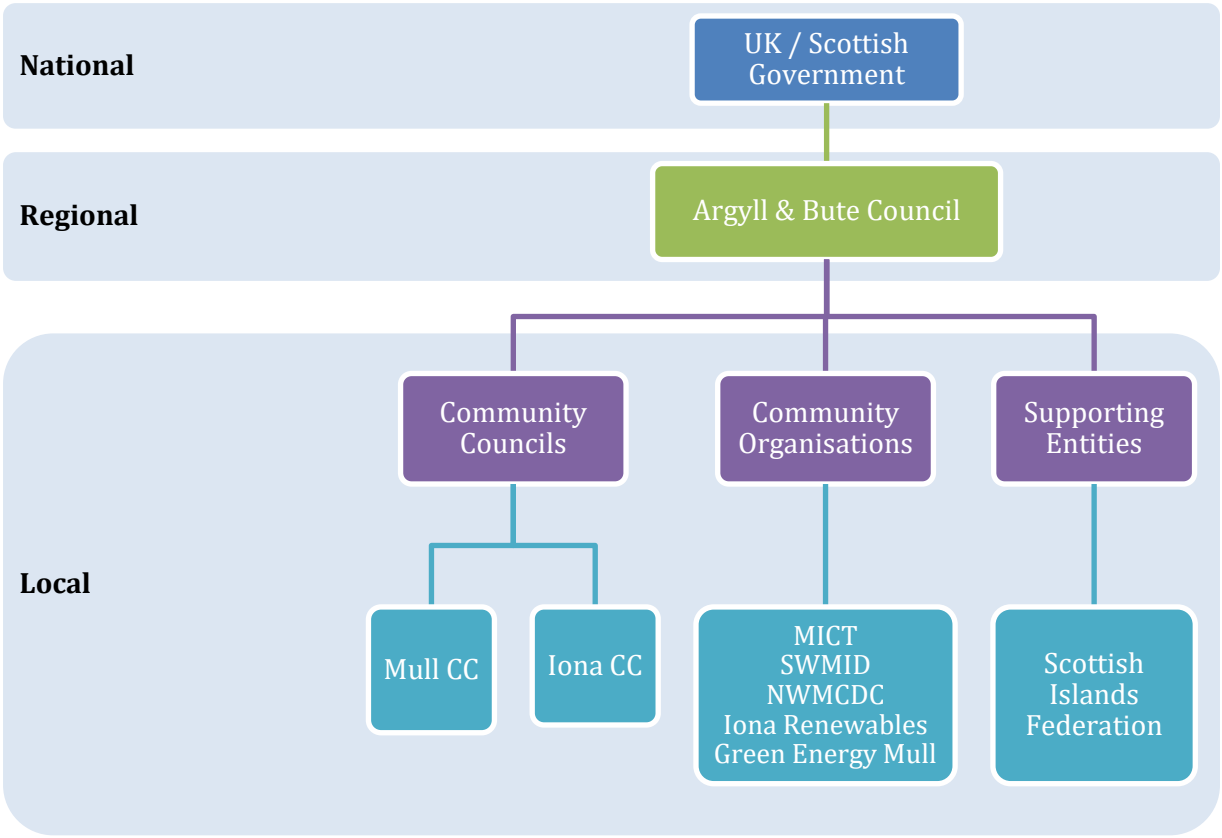

Figure 21: Governance hierarchy from the perspective of the Mull Archipelago

Transition Governance

Understanding existing governance structures and institutional relationships is important in defining constraints and opportunities in relation to a low carbon transition. These institutions will inevitably play a critical role in defining the scope and speed of the transition, with collaboration critical to ensuring a locally appropriate but nationally supported transition.

For reporting purposes, the current and future governance of the energy transition on the Mull Archipelago is described in relation to the archipelago's vision (Chapter 5).

A. Energy Security

Vision: The islands are energy secure, with green local networks augmented with microgrids.

Current Governance:

Energy security across the Mull archipelago is the responsibility of the UK Government. Energy security is of national importance, and the Government ensure appropriate protections are in place for consumers and national grid by placing requirements on energy smart appliances and the organisations who control them (load controllers). The Energy Security Bill (2022) is an example of the UK Government's recent legislative initiatives to deliver widescale clean, affordable, and secure energy systems across the UK.

At a local scale, security falls under the governance of local distribution network operators (DNOs), who control energy generation, transmission, and distribution assets across the island.

Future Governance:

Large-scale (i.e., National) energy security across the Mull Archipelago will remain a matter of UK Governmental responsibility.

The DNO will play a core role in ensuring sustainable and consistent electricity supply on Mull, with the potential for collaboration between public, commercial, and community energy entities and the network operator. Furthermore, energy networks across the island may be developed and augmented to provide secure, reliable, and affordable energy to remote communities across the archipelago.

Improving generation of electricity and production and storage of heating fuels (e.g., biomass, woodfuel) would lead to greater island self-sufficiency. Projects may be undertaken by public, private or community entities, although consenting of larger developments will necessitate Argyll & Bute Council, Scottish (and UK) Government support in some instances.

With existing community-led generation on Mull, collaboration between community entities may provide a route to developing smaller scales of energy generation, fuel production, storage, and supply networks.

Public and community entities are best suited to energy demand reduction roll out, providing educational resource, implementing domestic and non-domestic energy efficiency programmes, as well as undertaking energy monitoring and management projects.

B. Renewable Generation

Vision: There is an abundance of renewable generation, and local generation serves local demand.

Current Governance:

Management of large-scale renewable energy generation across Mull is currently the responsibility of DNOs and energy developers. These are organisations which manage and operate the generation and distribution of renewably generated energy to island consumers.

National and regional governments also play major roles. The Scottish Government encourage development of Scotland's renewable resources to meet emission reduction targets. Financial and technical support are consistently offered to incentivise renewable generation. The local council authority, Argyll, and Bute Council (A&BC) have also increased their delivery of renewable energy developments in recent years in order to promote sustainable economic development across the region. Renewable generation across the West of Scotland is also currently enabled by the Argyll and Bute Renewable Energy Alliance (ABRA).

ABRA is a multi-organisational body that promotes renewable development across Argyll and Bute, acting as a key mechanism assisting with the delivery of A&BC's climate action plans. ABRA includes the likes of, A&BC, the Scottish Government, Highlands & Islands Enterprise, Marine Scotland, Scottish Power Renewables, Scottish and Southern Energy, Scottish Natural Heritage, and Skills Development Scotland.

Renewable generation opportunities are also facilitated, albeit on smaller scales – by local action groups such as the Mull and Iona Community Trust (MICT), South West Mull and Iona Development (SWMID) and Green Energy Mull (GEM).

Future Governance:

Further development of renewable generation and storage will lead to greater energy self-sufficiency across the archipelago, driven by public, private or community bodies.

Governmental bodies, energy supply companies and DNOs will continue to remain responsible for the management of large renewable generation assets across the archipelago. Energy suppliers and DNOs will maintain and expand the supply of accessible renewable energy for communities across the archipelago.

National and regional governmental support networks will continue to promote and incentivise future renewable developments across Mull.

Local action groups will continue to act as a platform for islander decision making. Island communities, council authorities, and energy distributors will work together to further realise energy targets determined in climate action plans. Small-scale generation infrastructure may be developed by community entities, potentially alongside public and private sector stakeholders (e.g., shared ownership, joint ventures).

C. Community Control

Vision: Low carbon projects are owned by or benefit the community, with collective thinking driving the transition.

Current Governance:

Community-led control is currently driven by local action groups. MICT, SWMID, NWMCDC and other organisations emphasise collective community thinking for the benefit of local development projects across Mull.

The Archipelago's community bodies have long track records of delivering successful community development projects, addressing problems of geographic isolation and economic and social exclusion in remote and rural communities. Recent example of community-led success is the Garmony Hydro scheme, operated by Green Energy Mull (GEM). GEM operates 400 kW run of river system, generating approximately 1 GWh of power annually. Generated energy is sold to the grid, with profits distributed as grants to local community projects across Mull. As of 2023, approximately £230,000 has been awarded to 96 local projects since the inception of the scheme.

Future Governance

Organisations such as MICT, SWMID, NWMCDC, Iona Renewables, and GEM will continue to play vital roles in advocating for community-led development projects across the island.

MICT is leading the CETA project and is working closely with Scene and NESOI to develop a transition agenda, providing engagement through regular meetings, workshops, and communication with local councils. The MICT Climate Action Steering Group plays a key role in this process and acts as the main decision makers. With development of this CETA, it is anticipated that the involvement of other community groups is expanded, thus furthering community action and collaboration across the islands.

Off-island action groups may further engage Mull communities. Organisations such as the Scottish Islands Federation (SIF) exist to promote and advance the interests of island communities. The SIF has worked alongside the Scottish Government's Islands Team on the delivery of the National Islands Plan community consultation process. As a result, the SIF now has a dedicated National Islands Plan Project Officer in place to support plan implementation and to further facilitate island community engagement. Utilisation of networks such as these offers a valuable opportunity to link the energy transition of Mull within wider national development trends.

D. Energy Efficiency

Vision: Community support and creative solutions enable energy-efficient, low carbon and cheaper to run properties.

Current Governance:

Energy efficiency across Mull is promoted by local action groups and individuals. Community organisations can be instrumental in encouraging local energy efficiency initiatives for both retrofit and new build contexts. The Mull and Iona Eco charter (2022) pushes local businesses to pursue ecological approaches to their business operations. The charter particularly emphasises the importance of sustainability and energy efficiency of the island's economy.

Local and regional government also facilitate energy efficiency. The Scottish Government's 'Local Heat and Energy Efficiency Strategies' (LHEES), and 'Energy Efficient Scotland: Area Based Schemes' are both currently available to Mull residents and businesses, offering both technical and financial support. The Scottish Government's LHEES is an example of national and local government collaborative efforts - used to positively assist small-scale development in rural communities.

Future Governance:

Further collaboration between national and regional government bodies – and the increased involvement of local community action groups should be promoted. The continuation of existing energy efficiency support and incentives should be maintained, to offer island communities effective backing to realise energy efficiency targets.

Public and community bodies are well suited to energy demand reduction roll-out, engaging with home and business owners, providing educational resource, implementing wide energy efficiency programmes, and undertaking energy monitoring and management works.

Defining local energy efficiency action plans and guidance may help to facilitate uptake, whilst setting out rules for future sustainable development. This could include Neighbourhood planning or new build guidance, although enforcement would only be possible with the support of A&BC and in line with National Planning Policy Framework (NPPF) and supporting regulations.

E. On-Island Workforce

Vision: An on-island workforce of green-energy specialists enable the transition.

Current Governance:
Most technical renewable energy expertise and skilled-workforce is found amongst public sector and private commercial energy specialists, most of whom are based off-island. Local action groups such as MICT and SWMID encourage the upskilling and involvement of local communities in developmental projects. There are some individuals with low carbon, heating, electrical and wider environmental expertise who may be supported to deliver projects as part of the transition or to benefit from upskilling in particular area of focus.
Future Governance:
Renewable energy specialists from the public and private sectors will continue to manage or participate in larger-scale energy developments across the archipelago. Community efforts may focus on the upskilling of island residents to play active roles in the energy transition. Increased technical expertise of island workforce may encourage the community-management of the island's renewable and natural resources. Those in need for services and technologies – e.g., home heating decarbonisation – could be linked to required service providers both on and off-island to increase uptake. Aggregation of works for off-island service providers can help to reduce costs to customers, whilst building a market for the service provider and securing their long-term involvement with the energy transition.

F. Green Ferries

Vision: Reliable, regular, and green ferries prioritise island residents.

Current Governance:
Passenger and vehicle ferry transportation links to and from the Isles of Mull and Iona are currently managed and operated by Caledonian MacBrayne (CalMac). CalMac is a subsidiary of holding company David MacBrayne Ltd., which in turn is owned by the Scottish Government.
Future Governance:
CalMac will maintain daily operation and management of the ferry services to and from Mull and the Scottish Mainland. Decarbonising Mull's ferry links would require significant co-operation between relevant parties. Efforts to decarbonise the ferry fleet would require substantial technical and financial resources. Relevant national or regional governmental transportation bodies can offer financial support or specialist expertise. Local action groups can ensure that future alterations to ferry services meet the needs of local communities and visitors to the island. Consultation and engagement with action groups is anticipated.

G. Effective Transport

Vision: A joined-up and well-used public transportation system has aligned timetables, improved services and serves new areas, alongside an expanded EV charging network.

Current Governance:

Public transportation across the Isle of Mull is currently the responsibility of Argyll and Bute Council, and since 2013 bus routes have been operated by West Coast Motors.

Several private enterprises offer car and bike hire, catering to tourists. Car hire is available from Harbour Garage in Tobermory, and Mullcarhire in Craignure. On yer Bike is based in Salen and offers bicycle and electric bike hire. Three taxi companies serve the island: Island Taxi, Mull Taxi Service, and Chris' Hire.

Future Governance:

An integrated cross-organisational approach to transport management across the island is required. Facilitating workshops and forums for transport providers may help to identify mutually beneficial opportunities and develop discussions around decarbonisation actions.

Route operators and council regulatory bodies will continue to play major roles in offering accessible public transportation across the island.

Local community organisations and individuals should be involved and consulted in decision-making processes regarding public transport, such as timetable changes, new routes, and other future alterations to service.

H. Shared Journeys

Vision: Transport is efficiently used, with journeys shared as the norm.

Current Governance:

Local action groups are currently at the forefront of journey sharing schemes across Mull. Since 2013 MICT have operated the Ulva Ferry Community Transport Scheme, a sustainable community transport across the island – responsible for transporting residents to and from work, and for social and essential journeys. Registered charities also offer journey sharing schemes, such as the Ross of Mull & Iona Community Transport Scheme.

Future Governance:

Increased co-operation between community action groups, current transport operators and local authorities (A&BC) is anticipated to increase the frequency and scale of community-operated transportation across Mull. Such schemes will prove beneficial in providing an integrated, accessible, and efficient transport alternatives across the island.

I. Food Security

Vision: A local ethos promotes food security and quality, supporting local businesses

Current Governance:

National Government has responsibility for the sustainable upkeep of food security across the UK and Scotland. The UK Government's Department for Environment, Food & Rural Affairs (DEFRA) leads on food-related policy on behalf of the government, whilst other public bodies are responsible for the physical food supply and security. Examples include The Agriculture and Horticulture Development Board, UK Health Security Agency, and the Food Standards Agency.

Argyll and Bute Council are responsible for the health of the local population, and responsible for public food security across the West of Scotland. Council bodies manage food safety and standards - including food crime, hygiene, private water supply standards and local public sector food provisions.

Food security across Mull is determined by food production and distribution, carried out by agricultural, fishery, and retail industries. At present, the island's agricultural industry is not capable of self-sufficiency, and the island requires most produce to be imported from the mainland. As a result, Mull's dependency on imports - ferry links and haulage companies - for food security is significant.

Future Governance:

National food security will remain responsibility of the UK Government, and relevant governmental offices.

Argyll and Bute will continue to be responsible for regional public and food health across the region.

Increasing co-operation between consumers and producers may increase the consumption of locally produced goods. Active promotion of local businesses and agriculture will aid in reducing the island's dependence on imported produce and is the first major step in securing the island's self-sufficiency and long-term food security. Local community action groups can be involved to steer the direction of local food security incentives to best suit local needs and desires.

J. Natural Abundance

Vision: The natural world is thriving - reforestation provides an enhanced carbon sink.

Current Governance:
Multiple organisations are accountable for the natural resources and natural management across the Mull Archipelago. Examples include the National Trust for Scotland, Royal Society for the Protection of Birds (RSPB), Historic Environment Scotland, the Crown Estate Scotland, local marine and land nature reserves, resident agricultural landowners, and all forms of government (UK, Scottish and council authority). Local community action groups also play roles in the maintenance and care of Mull's natural spaces. For example, since 2015 SWMID have been responsible for the management of Tiroran Community Forest and Sawmill – to the community's benefit.
Future Governance:
The organisations responsible for the upkeep and care of Mull's natural spaces and resources will remain the same. Governmental bodies, and charitable trusts will remain the key and decision-makers regarding natural environment and resources across the archipelago. Increased co-operation between management authorities and community organisations will encourage integrated approach to natural management across the island. Increasing input from local community action groups such as MICT or SWMID will ensure residents continue to play a role in maintaining natural resources across Mull.

9. Monitoring and Implementation

On commencement of the initiatives outlined in CETA, a monitoring framework is required to ensure efforts deliver set targets and have the desired effects across the Mull Archipelago. Effective monitoring also ensures that the pathways and strategies of CETA sufficiently comply and meet community visions and stakeholder targets. Listed below are the main topics to be monitored, monitoring approaches, and specific actions.

CETA	Ensure that CETA is utilisied by Mull community	- Share with island community - Promote via NESOI channels - Support development of further CETAs across Mull
Commmunity Engagement	Ensure outcomes are shared with community	-Raise awareness through events and one-to-one engagement -Promote involvement of community in the active management of island
Community Engagement	Share and explore collaboration opportunities	- Work alongside resident organisation to action recommendations - Facilitate collaboration between communities and stakeholders
Public Sector Engagement	Engagement with A&BC to secure support	- Communicate intentions to Argyll and Bute Council - Collaborate on key opportunities
Energy Demand	Monitor impact of demand reduction projects	- Conduct EPCs and similar energy audits - Long-term monitoring of energy use / billing
Energy Generation	Monitor impact of energy generation projects	-Long-term monitoring of energy generation -Assess feasibility for community-owned energy generation -O&M provider monitoring
Revenue / Cost Savings	Monitor cost savings / revenue to ensure financial impact	- Collect and eveluate cost data from Mull residents - Monitor company accounts
Energy Supply	Monitor energy supply to facilitate DNO collaboration	- Collect grid data locally (e.g., energy monitoring) - Work with DNO to establish grid use and mutually beneficial projects - Obtain funding from DNO
Transport Initiatives	Monitor popularity and effectiveness of transport initiatives	- Involve local residents as part of decision-making processes - Regular feedback and monitoring of transport demographics
Road Mapping	Set out roadmap with business plan for Mull	-Regular review of milestones and programme progress - Involve local stakeholders in discussions
Design Guide	Create island sustainable design guide setting out rules for future development	- Reviews of design guide - Informing stakeholders of design guide

Transition Team

The Transition Team is responsible for both implementing and monitoring the archipelago's Clean Energy Transition Agenda. From this overarching Transition Team, we recommend working groups to be responsible for each of the "Pillars" of activity, to enable clarity, delineation of tasks, and for stakeholders and/or team members with relevant skills to be utilised in their relevant area.

The Transition Team consists of:

- **The AMAZE steering group** as lead parties. The group led the CETA development process.
- **Mull and Iona Community Trust (MICT)** as the main community body and liaison. They have been involved in an organisational capacity from the project's outset and have experience implementing a range of energy and climate-focused projects.
- **Community Residents and Businesses** during the crucial five community workshops which determined the CETA vision. Further engagement and dissemination activities are critical to securing support for, and buy-in to, the CETA action plan.
- **Other Stakeholders:** A range of other stakeholders have been involved in the CETA reporting phase of the project, with input from NESOI, Argyll & Bute Council officials.

The Transition Team should be widened for the project implementation stage. This includes more formal involvement from other community-oriented groups and organisations:

- Increased AMAZE steering group membership from the wider community, local business owners, and landowners, ensuring representation from all areas of the archipelago.
- Mull and Iona Community Councils.
- Scottish Island Federation
- Other community organisations, including South West Mull & Iona Development (SWMID) and North West Mull Community Woodland Company (NWMCWC)
- Business groups on the archipelago, such as the Mull Fisherman's Association and Tobermory Harbour Association
- Local Schools

Dissemination, detailed project development, and implementation must be conducted with the support of key stakeholders across energy / emission sectors. This should include (but is not limited to):

- Argyll and Bute Council
- Caledonian MacBrayne
- Scottish and Southern Electricity Networks (SSEN)
- Chargeplace Scotland
- Local Energy Scotland
- NatureScot
- Historic Scotland
- Local businesses (agriculture, tourism, hospitality, industry, aquaculture).

Appendix A: Funding Opportunities

Appendix A catalogues some of the available funding sources with links and a summary of the support available. It is themed by emissions sector, although many of the funding streams are applicable to many different project types.

Renewable Generation

Domestic Generation

Home Energy Scotland Grant and Loan (HES)

Timescale: Subject to availability while funds last or end of financial year – first-come, first-served basis.

Area: Scotland

Funding is available for homeowners for low-carbon improvements to help create a warmer, cheaper to run home. These improvements are classed as either energy efficiency improvements or renewables systems. Energy efficiency improvements include solid wall insulation electric heating, glazing, insulated doors, loft, floor, or cavity wall insulation. Eligible Renewables systems improvements include heat pumps, PV panels, solar water heating, energy storage or connections to heat network scheme.

Grant funding is for up to 75% of the combined costs of improvements under each of the two categories, up to the maximum of £7,500, or £9,500 if qualifying for rural uplift. Additional interest-free loans are available and administered by the Energy Savings Trust. For example, implementation of a heat pump is available for £7,500 grant plus an optional £7,500 loan.

Applications are completed through Home Energy Scotland.

https://www.homeenergyscotland.org/funding/grants-loans/

Private Rented Sector Landlord Loan (PRSLL)

Timescale: Ongoing availability

Area: Scotland

Private property owners are eligible for a loan for energy efficiency improvements or renewables systems. This is interest-free for landlords with 5 or fewer properties, otherwise is currently 3.5% APR. The improvements must be recommended as suitable for the property in an EPC, Rental Property Energy Improvements or Home Renewables Selector Report.

https://www.homeenergyscotland.org/funding/private-landlord-loans/

Smart Export Guarantee (SEG)

Timescale: Ongoing availability – in place since 2020.

Area: UK

The Smart Export Guarantee is a tariff (currently 15p/kWh with Octopus) paid to small-scale generators for renewable electricity that they export to the grid. This replaced the Feed-in Tariff scheme in 2019. There are additional rules and tariffs for if this includes an energy storage system, which can store electricity from the grid before exporting it later on (brown electricity).

https://energysavingtrust.org.uk/advice/smart-export-guarantee/

Warmer Homes Scotland (WHS)

Timescale: Ongoing availability

Area: Scotland

The Warmer Homes Scotland Grant provides grant funding for energy efficiency, heating and renewables home improvements covering 100% of all costs. The programme is for homeowners or tenants in receipt of qualifying social security payments (such as DLA, Universal Credit, ESA, Income Support, etc) who live in a home with a poor energy rating.

https://www.homeenergyscotland.org/funding/warmer-homes-scotland/

Non-domestic and large-scale generation

Business Energy Scotland assessments (BES)

Timescale: Ongoing availability

Area: Scotland

These are typically the gateway to an SME loan. This free assessment is available for all SMEs and assesses the business capability for energy efficiency measures or solar PV installation. The waiting time is currently at least 6 months.

https://businessenergyscotland.org/smeloan/

CARES Community Building Fund (CBF)

Timescale: Planned funding until March 2025.

Area: Scotland

Let's Do Net Zero Community Buildings Fund from Scottish Government's Community and Renewable Energy Scheme (CARES) supports communities to engage with, participate in and benefit from the energy transition to net zero emissions. The fund opened in May 2022 and helps community organisations reduce their building energy costs and greenhouse gas emissions. Grants of up to £80,000 (max 80% of eligible project cost) are available for the installation of renewable technologies such as heat pumps.

The fund is planned to run until the end of March 2025, subject to funding availability. Funding is available for many types of self-managed community buildings, including village halls, community centres and hubs, sports facilities and faith buildings Applicants must be constituted non-profit distributing community organisations, including organisations with

charitable status, which are established and operating across a geographically defined community or faith groups.

https://localenergy.scot/funding/lets-do-net-zero-community-buildings-fund/

SASC Bridge Finance

Timescale: Ongoing

Area: UK

SASC provides secured loans of up to £15m to enable communities to build or acquire projects which address the four sustainable development goals of affordable and clean energy, innovation and infrastructure, sustainable cities, and climate action.
https://www.socialandsustainable.com/sasc-bridge-finance/

Scottish Hydro Electric Community Trust
Timescale: Applications close September 2023 this year.
Area: SSE distribution area
Grants (with up to 50% match funding) are available for charities or community projects to help with the cost of electricity supply connections required for the project. This could be a new connection or an upgrade to an existing supply.
https://www.shect.org/

Scottish SME Loan Scheme (SME)
Timescale: Ongoing availability
Area: Scotland
Interest-free loans of up to £100k are available for energy and carbon-saving upgrades for businesses. Upgrades may be for heating and ventilation, renewable heat technologies, improved insulation, LED lighting, or solar panels. Eligible organisations are small and medium-sized enterprises (SME), not for profit organisations or charities. A cashback grant of 75% of eligible costs can be claimed for energy efficiency or renewables measures. The SME Loan Scheme has already provided over £26m in loans for more than 950 projects.

Triodos Renewable Energy Finance (TREF)

Timescale: Ongoing Availability

Area: UK

Triodos Bank is an example of private banking debt financing available for profitable projects. They offer expertise and funding for viable renewable energy projects. They have financed more than 580 small and large-scale energy projects whether solar, hydro, wind, energy efficiency, storage, heat, or transport. As well as working with more established generators they have worked with community energy groups such as the Awel Co-op. Loan sizes are up to £20m.

https://www.triodos.co.uk/business-lending/large-loans/renewable-energy-and-environment

Heat and Buildings

Homes

See Domestic Generation above, for more information:

Home Energy Scotland Grant and Loan

Private Rented Sector Landlord Loan

Warmer Homes Scotland

Non-domestic

Business Energy Scotland Assessments and **SME Loan Scheme**

See Non-domestic Generation (above) for more information:

CARES Community Building Fund (CBF)

Timescale: Planned funding until March 2025.

Area: Scotland

Let's Do Net Zero Community Buildings Fund from Scottish Government's Community and Renewable Energy Scheme (CARES) supports communities to engage with, participate in and benefit from the energy transition to net zero emissions. The fund opened in May 2022 and helps community organisations reduce their building energy costs and greenhouse gas emissions. Grants of up to £80,000 (max 80% of eligible project cost) are available for the installation of renewable technologies such as heat pumps.

The fund is planned to run until the end of March 2025, subject to funding availability. Funding is available for many types of self-managed community buildings, including village halls, community centres and hubs, sports facilities and faith buildings Applicants must be constituted non-profit distributing community organisations, including organisations with charitable status, which are established and operating across a geographically defined community or faith groups.

https://localenergy.scot/funding/lets-do-net-zero-community-buildings-fund/

District Heat Network

CARES Community Heat Development Programme (CHDP)

Timescale: Expected to be available until 2024, subject to funding.

Area: Scotland

This programme works with eligible community organisations and groups of householders to help develop their ideas for locally generated, low and zero carbon heat projects. Successful applicants receive technical support to appraise the feasibility of their project. This includes advice on the next steps and potential routes for funding. Projects may include groups looking to collectively buy heat pumps or energy efficiency improvements, shared heating systems or a community heat network.

https://localenergy.scot/funding/community-heat-development-programme/

District Heating Loan Fund (DHLF)

Timescale: Ongoing Availability

Area: Scotland

The Scottish Government's District Heating Loan Fund is designed to help address the financial and technical barriers to district heating projects. Loans of more than £1 million are available as low interest unsecured loans. Since 2011, £20 million has been lent to 53 different projects across Scotland.

https://energysavingtrust.org.uk/programme/district-heating-loan-fund/

Energy Industry Voluntary Redress Scheme (VRS)

Timescale: Phase two of the scheme opened for funding in May 2022, with the third funding round open until January 30th, 2023. Registered organisations will be notified for future funding rounds.

Area: UK

This scheme is funded by energy companies who have breached Ofgem Rules. Registered charities, community interest companies, co-operative societies and community benefit societies can apply for funds to deliver energy related projects that help those most at risk from cold homes and high energy bills. The minimum grant that can be requested is £20,000 and can fund 100% of the project cost to cover both capital and revenue measures.

https://energyredress.org.uk/announcements/ps3-million-available-charities-and-community-groups-support-vulnerable-energy

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Scotland's Heat Network Fund (SHNF)

Timescale: For projects commissioned by March 2026.

Area: Scotland

The Scottish Government are making £300 million available over the next parliamentary session to support the development and rollout of zero emission heat networks across Scotland. Capital grant funding of up to 50% of the total eligible costs is available for capital-ready projects.

https://www.gov.scot/publications/heat-network-fund-application-guidance/

General

Crown Estate Scotland Community Capacity Grants Programme

Timescale: Applications open in August 2023

Area: Within 5 miles of the coast or Crown estates

This fund provides up to £50k for coastal communities for early-stage self-sustaining community enterprises that will promote sustainable development and/or help regenerate buildings and places. Net zero could be a central feature of a project and funding can support activities such as salaries, feasibility studies and business plans and community consultations.

https://www.foundationscotland.org.uk/apply-for-funding/funding-available/crown-estate-scotland

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Highlands and Islands Enterprise – Green Grant Fund

Timescale: Open for applications until July 2023

Area: Highlands and Islands

This fund provides a grant of £25k to £150k which can cover 50% of total project costs. It is available for social enterprises or businesses to reduce energy usage, make improvements to the building fabric, install renewables, support EV infrastructure, or reduce waste.

https://www.hie.co.uk/support/browse-all-support-services/hie-green-grant-fund/

Transport

Electric Vehicles and Chargepoints

Business Chargepoint Funding Scheme (BCFS)

Timescale: Ongoing availability

Area: Scotland

Grant funding is available to cover 50% of the costs for SMEs in a rural area of Scotland (not applicable to Carluke, but would be for Braidwood or Law, etc), or 75% of the costs for third sector organisations in any area of Scotland. Eligible organisations are those which currently operate plug-in vehicles, employ staff who operate plug-in vehicles or will have high levels of chargepoint usage from other sources such as from visitors.

https://energysavingtrust.org.uk/grants-and-loans/business-charge-point-funding/https://energysavingtrust.org.uk/grants-and-loans/business-charge-point-funding/

Domestic Chargepoint Funding scheme (DCFS)

Timescale: Ongoing availability

Area: Scotland

Grant funding of up to £300 is available towards the cost of purchasing and installing home chargepoints for electric vehicles. It is administered by the Energy Saving Trust and funded by Transport Scotland. It is available either for rural and remote electric vehicle owners (route 1) or used electric vehicle owners who utilised the Used Electric Vehicle Loan.

https://energysavingtrust.org.uk/grants-and-loans/domestic-charge-point-funding/

EV Chargepoint Grant (EVCG)

Timescale: Ongoing availability

Area: UK

Grant funding of up to £350 is available towards a maximum of 75% of the costs of an EV home charger and installation. This is only available if you own flats or apartments or are a renter of any accommodation type. This is administered by the Office for Zero-Emission Vehicles (OZEV). You are able to claim both for DCFS and EVCG if eligible.

https://www.gov.uk/government/collections/government-grants-for-low-emission-vehicles

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Scottish Shared Transport Knowledge Centre (SSTKC)

Timescale: Ongoing availability.

Area: Scotland

The Scottish Shared Transport Knowledge Centre provides a central source of information for communities on how to set up an EV car club. Transport Scotland fund this to provide advice

and support to community groups or local authorities. This includes general information on community car or bike share schemes, funding opportunities, how to work with planners, past funding data and contacts. There is also bespoke advice available to help design successful schemes.

https://knowledge.como.org.uk/

Sustainable Transport Business Review (STBR)

Timescale: Ongoing Availability

Area: Scotland

The Energy Saving Trust offers a free review service to help organisations in Scotland become more efficient with their transport and travel arrangements. This consists of an analysis of the current situation, recommendations, and a rationale for changes. This results in both emissions reduction and money savings.

A bespoke fleet review service analyses the operational efficiency of a vehicle fleet such as buses or delivery vehicles, reviews the type of vehicle being used and provides expert advice with a sustainability focus. This is funded by Transport Scotland.

https://energysavingtrust.org.uk/wp-content/uploads/2020/10/Fleet-reviews-KLE015-01-0521.pdf

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The Workplace Charging Scheme (WCS)

Timescale: Ongoing availability

Area: UK

This is a voucher-based scheme that provides eligible applicants with support towards the upfront costs of purchase and installation of EV chargepoints. It is a UK-wide scheme run by the Office for Zero-Emission Vehicles (OZEV) and covers up to 75% of the total costs for businesses, charities, or public sector organisations. This is capped at £350 per charging socket. Eligibility criteria are wide, open to most organisations which have a need for charging equipment or an intent to encourage uptake amongst staff.

https://www.gov.uk/guidance/workplace-charging-scheme-guidance-for-applicants

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Used Electric Vehicle Loan (UEVL)

Timescale: Ongoing availability

Area: Scotland

The Used Electric Vehicle Loan provides interest-free financing for Scottish residents of up to £30k. Financing is available for fully electric used cars, vans, motorcycles, or mopeds bought from a dealership.

https://energysavingtrust.org.uk/grants-and-loans/used-electric-vehicle-loan/

Used Electric Vehicle Loan for Business (UEVLB)

Timescale: Ongoing availability

Area: Scotland

An interest-free loan of up to £30k is available to cover the cost of purchasing a used electric car or van, or £5k for an electric motorcycle or moped. Total funding available for a limited company is capped at £90k, or £75k for sole traders.

https://energysavingtrust.org.uk/grants-and-loans/used-electric-vehicle-loan-for-business/

Active Travel

eBike Grant Fund (eBGF)

Timescale: Funding is closed for 2022/23 – further funding opportunities expected in 2023/24.

Area: Scotland.

Community groups can apply for Transport Scotland grant funding to adopt eBikes, etrikes, and eCargo bikes. In Category A, up to £25k is available towards projects that provide opportunities for people to trial eBikes. In Category B, up to £200k is available towards large-scale fleets of pool bikes or public bikeshare/hire schemes promoting large scale uptake of eBikes.

https://energysavingtrust.org.uk/grants-and-loans/ebike-grant-fund/

eBike Loan (eBL)

Timescale: Subject to availability on a first-come first-served basis – new loan stream expected summer 2023.

Area: Scotland

An eBike loan is funded by Transport Scotland and managed by the Energy Saving Trust. An interest-free loan is available for individuals that can be used for 2 eBikes (capped at £3k each), a family cargo bike (capped at £6k) or an adapted cycle.

https://energysavingtrust.org.uk/grants-and-loans/ebike-loan/

Paths for All (PfA)

Timescale: Ian Findlay Path Fund and Smarter Choices, Smarter Places Open Fund ongoing with no deadline date;

Area: Scotland

Paths for All have a range of funding opportunities for communities to ensure access to good quality, multi-use places to walk and be active.

The Ian Findlay Path Fund is a £1.5m Active Travel fund open to community groups to support the improvement of path networks. Grants are available for between £10k and £100k.

The Smarter Choices, Smarter Places Open Fund is available for community organisations to change people's everyday travel behaviour by encouraging more people to walk, wheel or cycle for short journeys, or access public transport for longer journeys. Grant funding of £5k to £50k is available for activities such as: consulting with communities on path improvements, mapping local walking and cycling routes, producing local active travel maps, providing signage for pedestrian and cycle friendly routes, holding events or training sessions.

https://www.pathsforall.org.uk/cmp-grants

Scotland Cycle Repair Scheme (SCRS)

Timescale: Ongoing Availability

Area: Scotland

This scheme, funded by Scotland, covers the cost of repair and maintenance work for up to £50 for standard bikes and £100 for non-standard bikes.

https://www.cyclinguk.org/ScotCycleRepair

Used Electric Vehicle Loan (UEVL)

Timescale: Ongoing availability

Area: Scotland

The Used Electric Vehicle Loan provides interest-free financing for Scottish residents of up to £30k. Financing is available for fully electric used cars, vans, motorcycles, or mopeds bought from a dealership.

https://energysavingtrust.org.uk/grants-and-loans/used-electric-vehicle-loan/

Buses

Sustainable Transport Business Review (STBR)

Timescale: Ongoing Availability

Area: Scotland

The Energy Saving Trust offers a free review service to help organisations in Scotland become more efficient with their transport and travel arrangements. This consists of an analysis of the current situation, recommendations, and a rationale for changes. This results in both emissions reduction and money savings.

A bespoke fleet review service analyses the operational efficiency of a vehicle fleet such as buses or delivery vehicles, reviews the type of vehicle being used and provides expert advice with a sustainability focus. This is funded by Transport Scotland.

https://energysavingtrust.org.uk/wp-content/uploads/2020/10/Fleet-reviews-KLE015-01-0521.pdf

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Zero Emission Bus Market Transition Scheme (ScotZEB)

Timescale: Phase 2 open for bids from spring 2023.

Area: Scotland

This £500k grant, funded by Transport Scotland and administered by Energy Saving trust, targets SME bus and coach operators and other small transport operators to replace their fleet with zero emission alternatives. Applications have closed for phase 1. Phase 2 is open for bids in spring 2023. There are three funding streams, with stream 3 the largest funding opportunity and focused on repowering Scottish diesel buses with a zero-emission power train. Stream 1 supports SME operators to assess which technology is best for them and how it can be implemented.

https://energysavingtrust.org.uk/grants-and-loans/zero-emission-bus-market-transition-scheme/

Air Pollution

Clean Air Schools Framework (CASF)

Timescale: Freely available resources

Area: UK

The Clean Air Schools Framework is a free, online tool to help every school create a tailored clean air action plan to tackle air pollution in and around the school. Tailored actions are provided in response to a questionnaire that cover: a campaign for change using the school's and student voices, awareness raising resources for pupils and the local community, air pollution reductions from school operations and ventilation advice, school gates pollution.

https://www.transform-our-world.org/programmes/clean-air-for-schools

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Living Streets (LS)

Timescale: Freely available resources

Area: UK/Scotland

Living Streets provides free resources on air pollution and active travel campaigning such as through the walk to school campaign. Living Streets also operate the Healthier Safer Streets programme, funded by Transport Scotland. This involves co-producing a local neighbourhood walking improvement project with the involvement of local community groups.

https://www.livingstreets.org.uk

https://www.livingstreets.org.uk/products-and-services/projects/healthier-safer-streets-in-scotland

General

CalMac Community Fund

Timescale: Currently closed, but fund normally opens for applications several times per year

Area: Communities in which CalMac operates

Grant funding of up to £2000 is available for communities such as the archipelago, where CalMac operates. It favours volunteer-led groups with funding available for projects which tackle local and community transport, poverty, health and wellbeing, or social isolation. The fund provides examples of suitable projects as those helping to connect community groups through transport or outreach, addressing lack of services, improvements to community spaces or upskilling and training individuals to provide local services.

https://www.foundationscotland.org.uk/apply-for-funding/funding-available/calmac-community-fund

Waste

Baillie Gifford Community Fund

Timescale: Applications close September 2023

Area: Scotland

Grants of up to £15k over three years are available for grassroots community organisations to address food insecurity and social isolation. Funding is aimed at helping people access nutritious food, limit food waste, provide community activities or offer preventative projects.

https://www.foundationscotland.org.uk/apply-for-funding/funding-available/baillie-gifford-community-fund

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Circular Economy Investment Fund

Timescale: Successor Fund due to open in early 2023.

Area: Scotland

The Circular Economy Investment Fund, managed by Zero Waste Scotland, has invested £12.5m in over 60 projects for SME. A successor fund is due to by established in 2023.

https://www.zerowastescotland.org.uk/circular-economy/investment-fund

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Recycling Improvement Fund (RIF)

Timescale: 5-year fund from 2021.

Area: Scottish local authorities.

Zero Waste Scotland manages the £70m five-year Recycling Improvement Fund, which provides capital funding grants for local authorities to improve recycling infrastructure. To date, 22 grants have been awarded to 17 different local authorities. Argyll & Bute has not received any funding.

https://www.zerowastescotland.org.uk/content/recycling-improvement-fund

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Social Enterprise Net Zero Transition Fund

Timescale: Ongoing availability. Loans must be settled by March 2031.

Area: Scotland

This fund is operated by Social Investment Scotland and Zero Waste Scotland and provides loans from £10k for social sector organisations. Eligible projects include re-use or repair services, strategic behavioural change, or other circular economy practices, as well as sustainable transport, energy efficiency and renewable development.

https://www.socialinvestmentscotland.com/learning-hub/social-enterprise-net-zero-transition-fund/

SUEZ Communities Fund

Timescale: Current applications close August 2023

Area: Scotland

Grants of up to £20k or £50k (depending on the scheme) are available for community improvement projects which provide community-based recycling, re-use, and waste prevention capability. Other suitable projects include for land reclamation, public amenities, biodiversity, or historic buildings.

https://www.zerowastescotland.org.uk/content/recycling-improvement-fund

Land

Farming and Food

Agri-Environment Climate Scheme (AECS)

Timescale: Applications open until March 2023, or June 2023 depending on category.

Area: Scotland.

This scheme promotes land management practices to protect Scotland's natural heritage, water quality, manage flood risk and adapt to climate change. Funding support can be for Slurry Storage, organic conversion and maintenance or agri-environment categories.

https://www.fas.scot/environment/biodiversity/agri-environmental-climate-scheme-aecs/

Integrated Land Management Plans (ILMP)

Timescale: Ongoing availability.

Area: Scotland.

All farming and crofting businesses are eligible for a detailed plan where an experienced farm business advisor identifies opportunities and cost savings. This typically includes an assessment of strengths, weaknesses and opportunities, a review of biodiversity and conservation methods, a financial performance analysis and identification of risk areas. Scottish Government Funding is available for up to £1,200 of consultancy costs.

https://www.fas.scot/integrated-land-management-plans-ilmps/

Preparing for Sustainable Farming (PSF)

Timescale: Ongoing availability but currently overbooked.

Area: Scotland.

This Scottish Government support focuses on incentives for farmers and crofters to help them understand their carbon emissions and sequestration, identifying recommendations to lower emissions and increase efficiency. The first phase is currently open for funding, where applications are for carbon audits or soil sampling and analysis.

https://www.ruralpayments.org/topics/all-schemes/preparing-for-sustainable-farming--psf-/

Specialist Advice (SA)

Timescale: Ongoing availability.

Area: Scotland.

Specialist advice from the Scottish Farm Advisory Service is available with up to £1,000 in funding. This takes a deeper analysis at a particular topic, such as a Carbon Audit action plan (New), soil and nutrient management or climate change adaptation.

https://www.fas.scot/specialist-advice/

Nature Preservation

Naturesave Trust

Timescale: Application windows open several times per year

Area: UK

This scheme provides grants of up to £5k to community groups, with the theme of the current funding round being river and shoreline pollution. Past projects awarded funding include a tree planting programme, food waste reduction, upcycling hubs, solar arrays, and nature restoration.

https://www.naturesave.co.uk/naturesave-trust/

The Scottish Land Fund (SLF)

Timescale: Ongoing availability.

Area: Scotland.

The Scottish Land Fund supports rural and urban communities to become more resilient and sustainable through the ownership and management of land and land assets, with grants available of up to £1m. This is funded by the Scottish Government and delivered through the National Lottery Community Fund.

Awarded projects have included for community purchase of important local buildings, woodland, potential sports areas, and recreational spaces.

https://www.tnlcommunityfund.org.uk/funding/programmes/scottish-land-fund

Range of community Projects

Climate Engagement Fund

Timescale: Deadline for entry 1 September 2023

Area: Scotland

Funding of between £50,000 and £100,000 is provided by the Scottish Government with the aim of building understanding of the climate emergency across communities and supports climate engagement activities.

https://www.gov.scot/publications/climate-engagement-fund/

National Lottery Awards for All Scotland (NLA)

Timescale: Ongoing availability

Area: Scotland

Funding of between £300 and £10k is available to community organisations which bring communities together, improve local places and spaces, or help people reach their potential.

https://www.tnlcommunityfund.org.uk/funding/programmes/national-lottery-awards-for-all-scotland#section-4

National Lottery Community Fund (CF)

Timescale: Ongoing availability

Area: UK

The National Lottery's Community Fund supports community organisations with a social purpose to improve the places in which they live and the wellbeing of those most in need. Funding is available from £10k to £150k for people-led, connected and strengths-based projects.

https://www.tnlcommunityfund.org.uk/funding/programmes/grants-for-community-led-activity#section-2

StartupMull

Timescale: Applications can be received at any time

Area: Mull and the surrounding islands

Grant funding of £5k to £10k are available to help promising new businesses (less than 12 months old) that benefit the Mull archipelago community to get off the ground. The purpose of the fund is to grow resilience for the islands by supporting start-ups.

https://www.foundationscotland.org.uk/apply-for-funding/funding-available/startupmull

The Waterfall Fund

Timescale: Ongoing. Several funding rounds in 2023.

Area: Mull, Iona, and the surrounding islands

The Waterfall Fund was established as an independent charity by MICT in 2015 to receive the net profits from the Garmony Hydro Scheme and to distribute them as grants to local community projects. The Waterfall Fund runs several funding programmes, including the Large Grants Programme which provides funding of up to £5,000, and the Sustainability fund which provides up to £2,500 for individuals, community groups or businesses who want to implement micro scale renewable energy or energy efficiency projects.

https://thewaterfallfund.co.uk/funds/

Appendix B – AMAZE workshops

Community Workshops

Five community engagement workshops were conducted by Scene and MICT on the islands of Mull and Iona over 9th – 11th May 2023. These took place in community halls across the islands: Iona Village Hall, Bunessan Hall, Craignure Village Hall, and Aros Hall in Tobermory. These workshops were carried out with the goals of:

- Understanding the priorities of the island residents to forge a community vision for the future of energy and carbon on the Mull Archipelago.
- To engage island residents and business-owners in the process of creating the Clean Energy Transition Agenda.

The workshops included a drop-in session, a presentation from MICT and Scene, and a community vision building workshop.

Scene presented the results of the energy baseline assessment, showing the significant areas of energy demand and emissions. Following this, the concepts of the CETA pillars and transition pathways were presented with examples to give attendees an idea of how improvements and change may be achieved. During the workshop portion of the events, attendees discussed the issues which were important to them. This data and an overview of the discussions were recorded by Scene.

Scene has synthesised the ideas discussed during these sessions into a community vision statement alongside the community's key goals for what the green future of the islands looks like. These are presented in chapter 5. The proposals, thoughts, and ideas, as discussed by the community, have been fashioned into clear "pathways" for how to achieve each goal, themed into "pillars," underpinned by "principles."

Workshop objectives

The primary objectives of the workshop events are to:

- Introduce the AMAZE project and the baseline understanding of energy and carbon use on the Mull Archipelago.
- Present and discuss low carbon options and opportunities on the Mull Archipelago.
- Define a community vision for future low carbon development on the Mull Archipelago.

The secondary objectives of the workshop events are to:

- Present and discuss transport on the Mull Archipelago, with a focus on low carbon travel.
- Surveying of participants to understand travel patterns and interest in lower carbon travel.

Outcomes from the workshops

Across the workshops, 49 islanders (excluding members of the MICT committee) were in attendance and contributed their opinions and ideas for the community vision.

Table 22: Summary of AMAZE workshop attendances

Location	Attendees	Notes
Bunessan	19	7 from Scene and AMAZE
Craignure	8 & 14 (two events held)	3 from Scene and AMAZE / 3 from Scene and AMAZE
Iona	15	8 from Scene and AMAZE
Tobermory	17	3 from Scene and AMAZE

The ideas discussed, broadly fell into the themes of energy generation, energy demand, on-island transport, off-island transport, and waste. Summaries of the findings from each event can be found below.

Bunessan

Bunessan is a small community situated on the Ross of Mull in the south-west of the Isle of Mull. The AMAZE workshop event was held in the Bunessan Community Hall on Tuesday 9th May 2023, from 17:00 until 20:00.

Figure 22: Bunessan AMAZE workshop attendee ideas map.

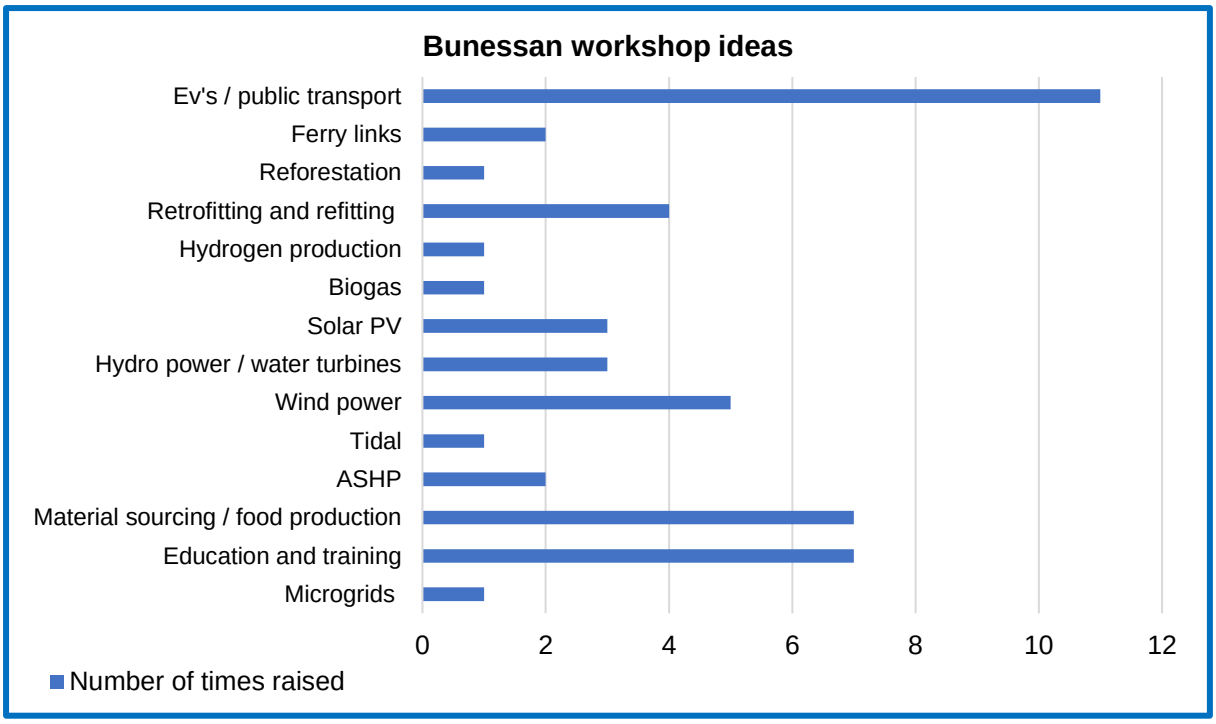

Figure 23: Community ideas raised at the Bunessan AMAZE workshop.

Table 23: Additional information supplied by attendees at the Bunessan AMAZE workshop.

Idea Name	Additional Information
Education and Training	Emphasis on information exchange and community involvement. Forming a group of trusted tradespeople and installers. Could grant schemes be introduced to incentivise local communities?
Material sourcing / food production	Collective purchase and delivery of essential goods (e.g., Island farmers collectively buying animal feeds) to reduce transport costs and emissions. Create community owned land to encourage self-sustainability ownership.
Wind-power	Potential locations for future wind farms – Tiroran, and Dùn da Ghaoithe.
Solar PV	Possibility of installing solar PV at community facilities, such as Bunessan Village Hall.
Biogas	Possibility of establishing micro-biogas plant.
Ferry links	Possibility of syncing ferry services to on-island and off-island transportation links (island bus services, mainland train services etc).
EV's / public transport	Encourage take-up of EV usage and transport behavioural change (electric public transport, e-bikes at community hubs, carpooling schemes, efficient driving styles). Successful examples witnessed on the Isle of Lewis and Kyle of Lochalsh.

Craignure

Craignure is a village on the eastern coast of the Isle of Mull and operates as the main ferry port on the island. Two AMAZE workshop events were held within the Craignure Community Hall on Wednesday 10th May 2023, at 11:00 to 14:00 and 17:00 to 20:00 respectively.

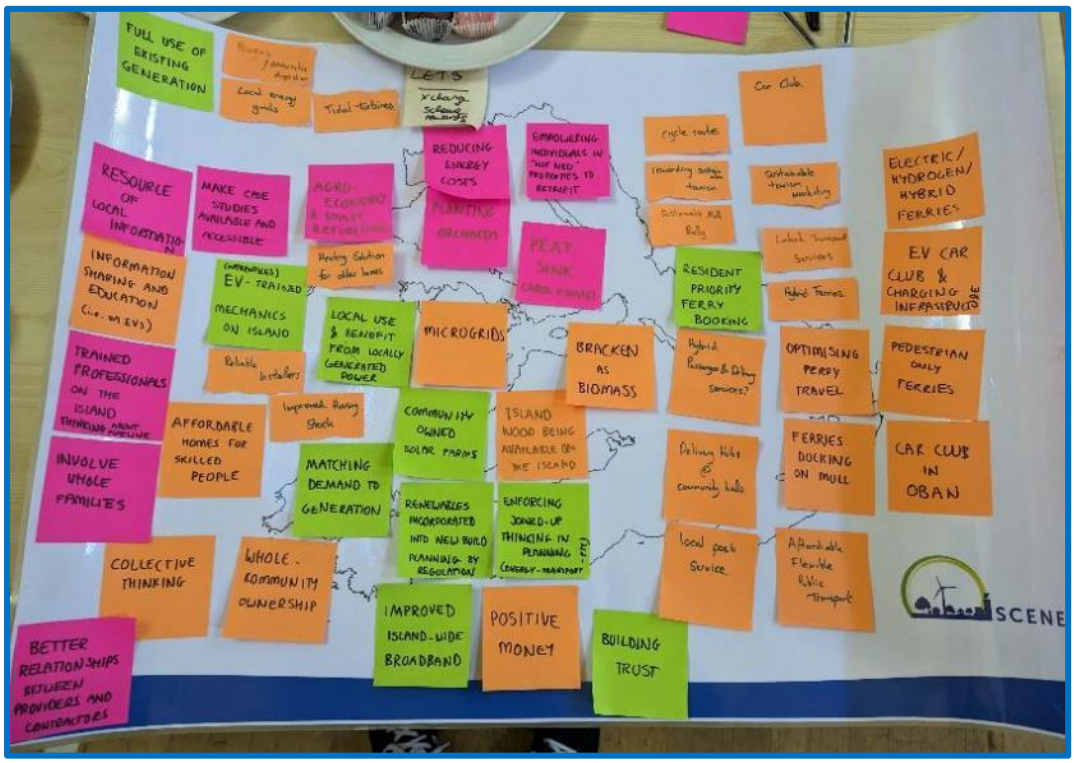

Figure 24: Craignure AMAZE workshop(s) attendee ideas map.

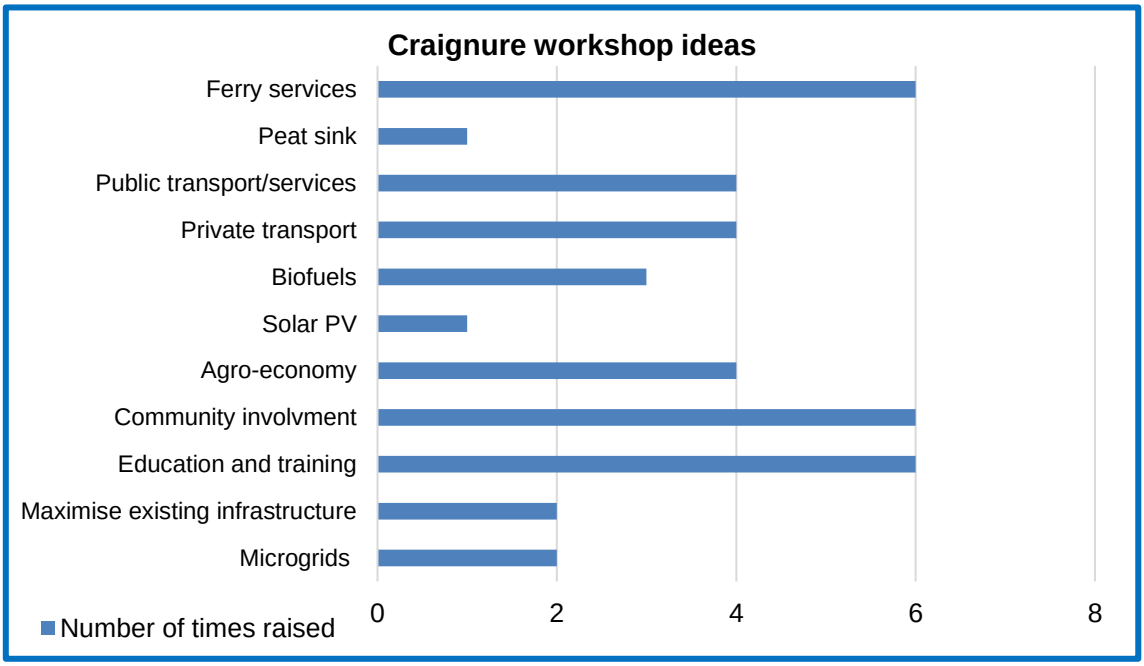

Figure 25: Community ideas raised at the Craignure AMAZE workshops.

Table 24: Additional information supplied by attendees at the Craignure AMAZE workshops.

Idea Name	Additional Information
Microgrids	Encourage local use and local benefit of energy resources. Attempts to match energy demand to energy generation across the island.
Maximise existing infrastructure	Empowering islanders to retrofit existing properties / spaces.
Community involvement	Whole community ownership of energy resources. Collective thinking and community participation in future projects. Improved relationships between providers and consumers – "positive money" to go towards island's development.
Biofuels	Biogas and biomass facilities across the island.
Private transport	EV-trained mechanics to support and facilitate the transition to electric powered transportation.
Ferry services	Resident-priority bookings system. Sync ferry services to on-island (island bus services) and off-island (mainland trainline) public transportation services.

Iona

Iona is a small island just off the western tip of the Ross of Mull, with a resident population of approximately 170. The AMAZE workshop event was held in the Iona Village Hall on Tuesday 9th May between 11:00 and 14:00.

Figure 26: Iona AMAZE workshop attendee ideas map.

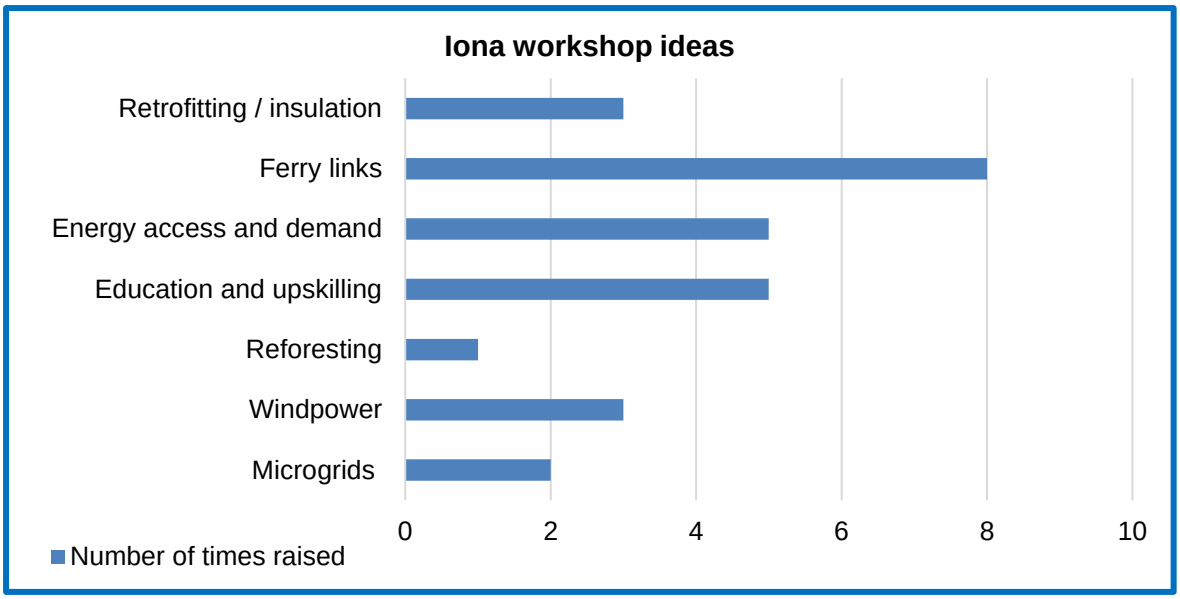

Figure 27: Community ideas raised at the Iona AMAZE workshop.

Table 25: Additional information supplied by attendees at Iona AMAZE workshop.

Idea Name	Additional Information
Microgrids	Establish independent local grids to lower fuel costs for isolated communities. Residents are aware of some energy security concerns.
Wind power	Turbine system for the Ross of Mull and the Isle of Iona.
Education and upskilling	Information exchange between and from outside local community. Introduce case studies for local people to understand what can be achieved.
Energy access and demand	Emphasis on "demand matched generation." Liked to microgrids, local access to locally produced energy.
Ferry links	Local devolution of ferry services to Ross of Mull. Tunnel link to access Mull mentioned.

Tobermory

Tobermory is the largest settlement, and capital of the Isle of Mull. The AMAZE workshop event was held within the town's community centre, Aros Hall - on Thursday May 11th between 11:00 and 14:00.

Figure 28: Tobermory AMAZE workshop attendee ideas map.

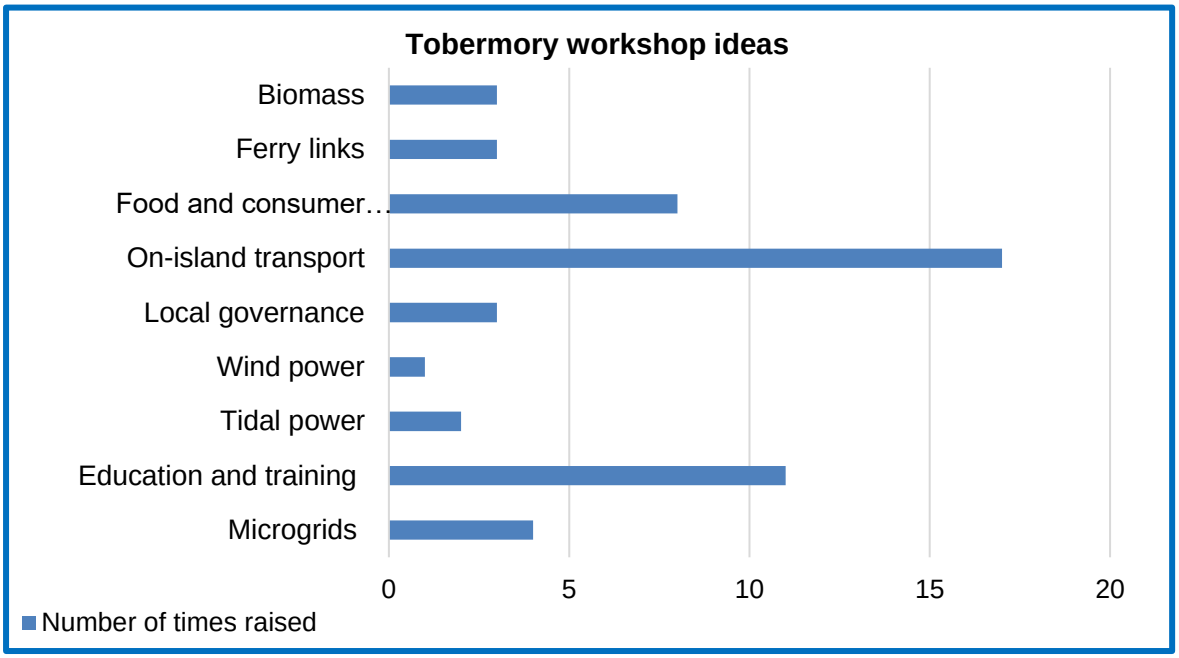

Figure 29: Community ideas raised at the Tobermory AMAZE workshop.

Table 26: Additional information supplied by attendees at Tobermory AMAZE workshop.

Idea Name	Additional Information
Microgrids	Decentralise power supplies, locally generated power can be used by local communities. Pursue energy equity across island.
Education and training	Access to high-skilled maintenance of energy systems, reliable network of specialist tradespeople. Island construction industry to shift toward renewable energy. Building trust and accountability within communities across Mull.
Local governance	Administrative support to local communities. Grant schemes and financial incentives to encourage take-up of new energy initiatives.
On-island transport	Limit amount of tourist / visitor vehicles that come to the island.
Ferry links	Upgrade ferries to hydrogen or electric powered. Include other aspects of marine industry in future initiatives.

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