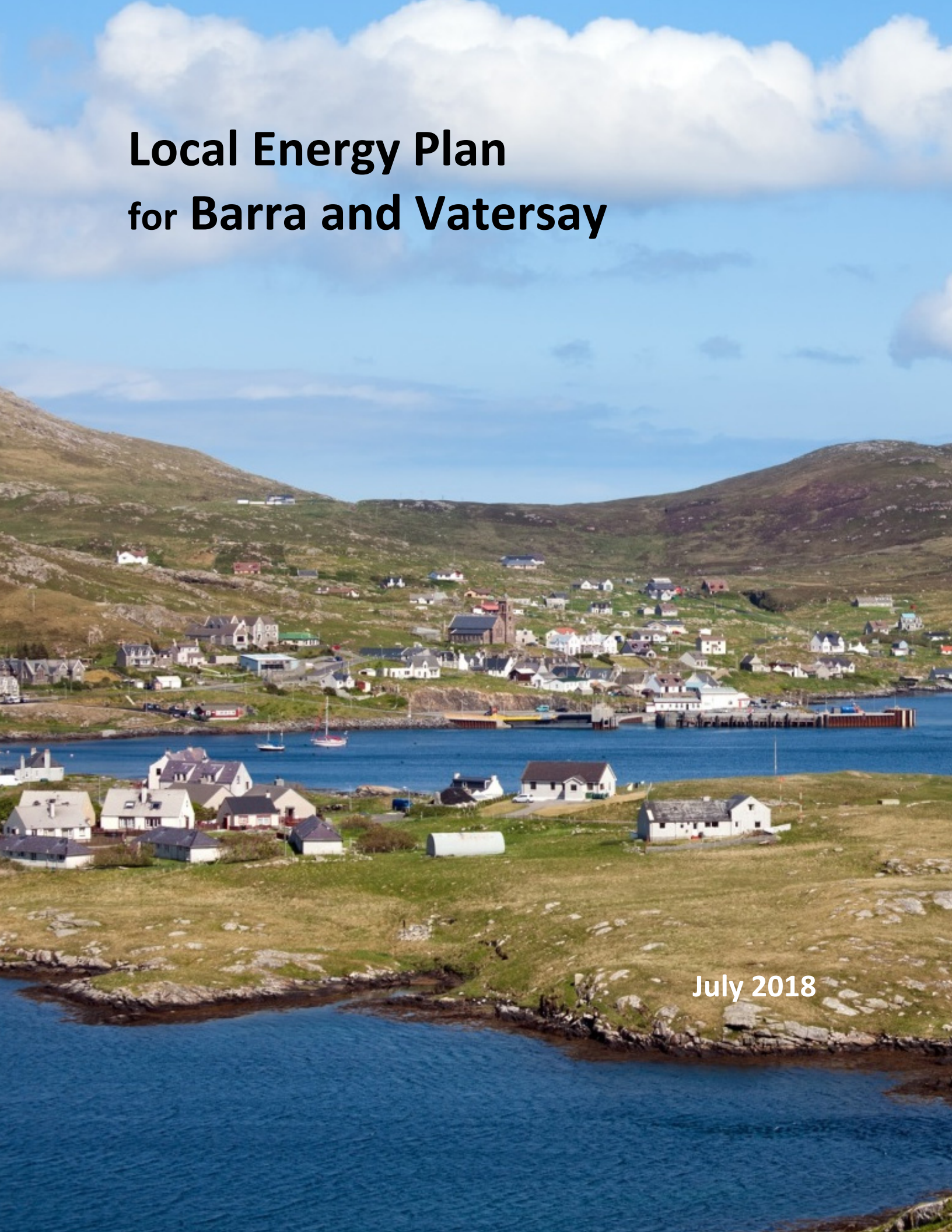
Local Energy Plan
for Barra and Vatersay



July 2018

A Local Energy Plan for Barra and Vatersay

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This Local Energy Plan has been developed to enable the community to look at its existing and future energy needs in terms of power, heat and transport and determine where it sees priorities for action. A separate non-technical summary document is also available that provides an overview of the plan.

The development of the plan has been led by a steering group that includes representatives from the Voluntary Action Barra & Vatersay, Coimhearsnachd Bharraidh agus Bhatarsaidh (Barra & Vatersay Community) Ltd, Castlebay & Vatersay Community Council, Northbay Community Council, Hebridean Housing Partnership, Barratlantic Ltd, Comhairle nan Eilean Siar, Local Energy Scotland, Home Energy Scotland and Community Energy Scotland.

The development of the plan has been funded as part of the COBEN project (**CO**mmunity **BEN**efits of Civic Energy), an EU Interreg (North Sea Region) funded programme with fifty per cent match funding through the Scottish Government's Community and Renewable Energy Scheme (CARES). CARES is delivered by Local Energy Scotland. Technical support and plan development has been undertaken by Wood Environment & Infrastructure Solutions UK Limited. Community consultation support has been provided by Community Energy Scotland.

Contents

1. Introduction

1.1 What is a Local Energy Plan?

A Local Energy Plan (LEP) enables the local community to look at its existing and future energy needs (in terms of power, heat and transport) and state where it sees priorities for action. It also identifies opportunities that the community determines offer practical action to support its current and future energy system developments.

Local Energy Plans are created by local communities rather than being developed for them by other bodies (e.g. local authorities or National Government). They set out key priorities and opportunities identified by the community, assisted by a range of other organisations who have an interest in this community. These include local residents, businesses, community organisations, local authorities, distribution network operators and local generators.

A key aspect of the development process is the ability for the local community to understand its own energy and transport systems, but also place them in context within the wider changes taking place across Scotland. It can therefore look for opportunities that offer local benefits consistent with national low carbon targets. These benefits can be:

- Direct - such as the generation of electricity or heat for local use displacing more expensive imported grid supplied electricity or fossil fuel.
- Economic - developing employment opportunities associated with energy supply (e.g. in hydrogen production) or enhanced efficiency (e.g. insulation and glazing work on homes).
- Indirect – such as a switch from diesel to electric vehicles reducing local emissions of particulates in car exhaust emissions and improving air quality
- Social – Production of local energy to supply homes in fuel poverty can reduce stress and enhance health outcomes for residents.
- Strategic – using energy storage mechanisms to maximise outputs from community owned generators, or use of technology to enable better trading of locally produced energy offer the community more effective use of its local resources

The LEP provides a start in the community's engagement with its energy needs. It offers a focus for immediate opportunities that can be developed in the short term. It also provides scope for longer term planning for further changes in the future.

1.2 Barra & Vatersay and its Local Energy System

The supply of power and heat to homes and businesses is viewed strategically at a national level. However, the local community in Barra & Vatersay also play a central role in shaping their energy needs. From a demand perspective, householders and businesses can look to reduce their energy needs through, for example, better insulation of buildings and using more efficient lighting and appliances. The roll out of smart meters enables better understanding of actual energy consumption, rather than relying on periodic meter readings (and estimated bills).

From a supply perspective, the Barra & Vatersay community can look to develop local generation to support their energy needs. This can be, for example, at an individual consumer level (e.g. solar panels on a roof) or at community scale such as investment in a wind turbine or hydro scheme.

Understanding the use of power, heat and transport energy in the community is the first step to being able to develop local energy systems. This has several benefits:

- End users can better understand the amount of energy they use (and the mix of requirements for power, heat and transport)
- The community as a whole can understand the size of energy demand and how this is proportioned between homes and businesses
- How much of this aggregate demand is met by existing local generation can be more easily understood
- Future energy requirements (e.g. new housing or business development) can be considered and compared with the size of existing demand
- Affordability and reliability of energy supply can be examined
- All these details can be collated in a single information source shared by everyone

This LEP provides a summary of details collated from the community in Barra & Vatersay through a number of engagement routes and events.

1.3 Overview of 'whole system' approach

Our energy needs, and how these are met reliably, cost effectively and without long term environmental consequences, are one of the key considerations for every community. UK and Scottish Government commitments to global efforts to reduce greenhouse gas (GHG) emissions mean significant changes to the way in which we supply, store and use energy. For this reason the present and future energy needs of a community are most usefully considered in a 'whole system' approach. In this way the overlapping impacts of how we use power, heat and transport can be considered at the same time, rather than being seen in isolation.

In order to apply a 'whole system' approach there needs to be a study boundary drawn in order to provide a primary area of focus. This doesn't exclude the linkages with neighbouring areas or opportunities that may be available within close proximity of the study area (e.g. land available for energy generation). The study boundary selected for use in the present plan for Barra & Vatersay is shown in Figure 1.

Figure 1 Local Energy Plan Boundary (Barra & Vatersay)

1.4 Aims and objectives

The wider consultation with the community on Barra and Vatersay, in combination with the views of the Steering Group, has developed an initial set of priorities that should be addressed within the LEP.

The findings of the survey demonstrate that there is good ongoing awareness of behaviours that assist in reducing the overall energy requirements within homes and businesses (demand management).

Building on this, issues relating to home energy use that were prioritised within the consultation are:

- Lower energy tariffs
- Insulation and draught proofing
- Upgrade of heating systems

In terms of transport three major areas of interest were:

- Support for uptake of electric vehicles
- Support for a community minibus
- Development of more walking and cycle paths

As for community scale energy projects the areas of priority were:

- Renewable energy supplying homes and businesses
- Bulk fuel purchase
- Large-scale renewables

Further details regarding the survey are provided in Section 5.3.

2. Local Infrastructure

Local Infrastructure Summary

Electricity – The size of local energy generators that can be connected to the existing grid network is currently constrained by sub-station capacity

Heating – There is no mains gas network serving Barra and Vatersay nor any existing district heating

Water – Energy use is predominantly required for the treatment and distribution of potable water

Transport – Existing local bus services provide links on the island. Ferry and air services provide vital links to the mainland and Outer Hebrides

2.1 Electricity

The Outer Hebrides network is fed via a high voltage 132 kV overhead transmission line extending across the Isle of Skye to Ardmore from Loch Lundie on the Fort William – Fort Augustus 132 kV circuit. At Ardmore the voltage is transformed to 33 kV via a 132/33 kV 45 MVA transformer which feeds two 33 kV sub-sea interconnector cables one to the northern isles (Lewis & Harris) and one to the southern isles (Uists and Barra) of the Outer Hebrides network. The distribution networks in the northern and southern isles are effectively independent networks fed from Ardmore in Skye.

The sub-sea link to the southern isles (14 MVA capacity) terminates at the Loch Carnan sub-station in South Uist feeding the “Loch Carnan” 33 kV distribution network. This includes the Barra circuit, an 11 kV circuit fed from the Pollachar substation in South Uist. The Pollachar substation feeds two 11 kV circuits one supplying Barra and the other supplying customers in the local area and north towards Drimore.

Barra and Vatersay is therefore connected into the grid supply point at Loch Carnan. The nature of this connection means that when there is any work carried out on either the distribution or transmission network then the grid supply is lost. At that point diesel generators, located on Barra, are operated to provide power for the islands.

The capacity of the grid to enable connection of large-scale renewable energy generation is therefore severely constrained. SSEPD, the network operator, provides a guide for generators as to the capacity in each local area to accept additional generation. Details are provided in Table 1.

Table 1 Existing Grid Capacity (Barra & Vatersay)[1]

Supply Point	Ardmore (Grid Supply Point)	Loch Carnan (Primary Sub Station)
Voltage (kV)	132/ 33	33 / 11
Transformer Nameplate Rating (MVA)	45	8
Transmission Status	Constrained	Constrained
Transmission Works	Construct new 132kV busbar substation near Dunvegan and a new 150 km 132 kV wood pole line back to Fort Augustus substation	NA
Transmission Reinforcement Completion Date	October 2021	NA
Distribution Status	Constrained	Constrained
Distribution Works	Pollachar Primary Substation - Increase Capacity	
Distribution Reinforcement Completion Date	March 2018	NA

SSEPD emphasise that, in the present supply situation, any significant size of renewable energy generation can be achieved only if there is a significant additional local energy demand for it to meet. Otherwise current capacity is limited to 3.6 kW per phase.

The majority of Barra operates on a three phase supply. The supply from Barra to Vatersay is single phase. In practice, this means a smaller limit to the amount of power that can be consumed within buildings on Vatersay. While single houses only require a single phase supply, larger buildings and commercial premises typically require a three phase supply.

This means that there is a constraint to any larger development or renewable generation on Vatersay.

2.1.1 Existing Local Generation

A Community wind turbine, operated by Coimhearsnachd Bharraidh agus Bhatarsaidh (Barra & Vatersay Community) Ltd (CBaB), has been in operation since May 2014. The single turbine is located in the North West of Barra with a rated output of 900 kW.

2.2 Heat

There is no mains gas network supply serving either Barra or Vatersay. There is some imported LPG predominantly used by kitchens in hotels on the island.

Heating oil is also imported on to the island for use in both domestic and non-domestic heating supply systems.

Solid fuel (coal and biomass) are also used to provide domestic heating.

There are no existing district heating (communal heating) systems presently operating on the islands.

[1] Details from https://www.ssepd.co.uk/ContractedDemandMap/?mapareaid=2 (Accessed June 2018)

2.3 Water

Water supply on the island is provided via the surface water supply which is treated at the Scottish Water operated treatment works. This was upgraded significantly in 2009.

Wastewater is predominantly managed via septic tanks, with a small sewer network within Castlebay.

2.4 Transport

2.4.1 Road

The A888 road provides a circuit around the island of Barra. This is a mixture of dual and single track road.

There is a Council funded bus service run by two local operators. The present timetable for service W32 operates approximately 10 journeys per day, with services scheduled to coincide with ferry sailings from Castlebay and Ardmhor as well as daily departures and arrivals at the Airport. Service W33 offers 4 buses a day running from Castlebay to Vatersay.

Annual passenger numbers for these services in 2017 were 9,594 (W32 service) and 869 (W33 service)[2].

General trends in bus passenger numbers are also available at regional level[3]. Data for 2017 shows a 10% fall in passenger numbers on bus services within the Highlands, Islands and Shetland; the figures for Scotland as a whole show a 3% fall. The total vehicle km travelled in the Highlands, Islands and Shetland region was 30 million, a decrease of 12% in comparison to 2016. The corresponding figure for Scotland is a 1% decrease to 327 million vehicle km.

Community Voluntary Action Barra and Vatersay also run a community bus service, operating two vehicles. This supports residents needing assisted transport to local amenities on the island.

2.4.2 Ferry

Two ferry services operate at present. The link to the mainland is via a daily single ferry service between Castlebay and Oban.

A second service is provided daily running between Ardmhor and Eriskay. This offers five sailings a day each way across the Sound of Barra.

A summary of carrying statistics[4] for the two routes is provided here (2017 data).

[2] Private correspondence from bus operator. 24% of passenger journeys were taken on the Scottish Transport Concessionary Card Travel Scheme

[3] https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-2017-edition/chapter-2-bus-and-coach-travel/ (Accessed April 2016)

[4] https://www.calmac.co.uk/corporate/carrying-statistics (Accessed April 2018)

Table 2 Carrying Statistics (Ferry Crossings to/from Barra 2017)

Route	Total Passengers	Total Cars	Total Coaches	Total Commercial Vehicles	Total Vehicles
Oban to Castlebay/ Lochboisdale	47,235	17,107	71	1,094	18,272
Oban to Coll/Tiree/Castlebay	5,382	1,839	0	232	2,071
Ardmhor (Barra) to Eriskay	59,887	22,975	148	1,908	25,031
All Routes	112,504	41,921	219	3,234	45,374

Table 3 Carrying Statistics (Ferry Services to/from Barra) – comparison of 2017 with 2016

All Barra Routes	2017	2016	% Change
Total Passengers	112,504	106,186	5.9%
Total Vehicles	45,374	42,129	7.7%
Total Cars	41,921	39,471	6.2%
Total Coaches	219	226	-3.1%
Total Commercial Vehicles	3,234	2,432	33.0%

2.4.3 Air

The airport on Barra is also served by a scheduled service to and from Glasgow Airport. There are around 1,400 flights per year to and from the island. All fuelling of aircraft is carried out in Glasgow. Latest figures for passenger numbers[5] show that 14,264 passengers passed through Barra Airport in 2017. This was an increase of 18.9% in comparison to 2016.

3. Characterisation of local area

3.1 Population of Barra and Vatersay

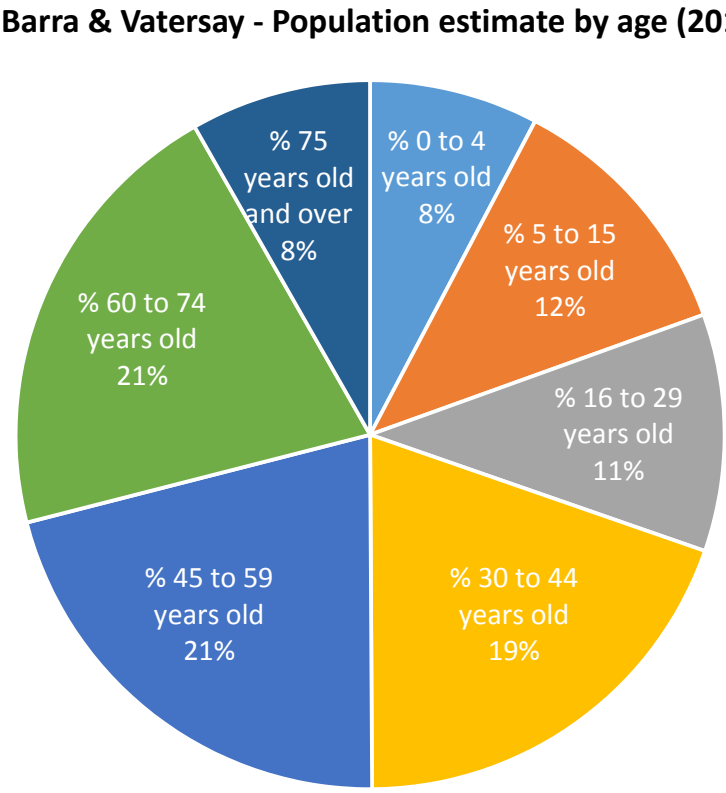
Population and Employment - summary

- The population has increased by 8% since 2001 (2011 Census figures)
- Under-16s comprise 20% of the total population; 16 – 60 year olds 51%; Over 60s 29%
- 69% of the population are economically active and typically travel to work by car

The 2011 Census data provides a population estimate of 1,264 for Barra and Vatersay (1,174 on Barra; 90 on Vatersay). This is an 8% increase on the 2001 total figure of 1,078 (Figure 2).

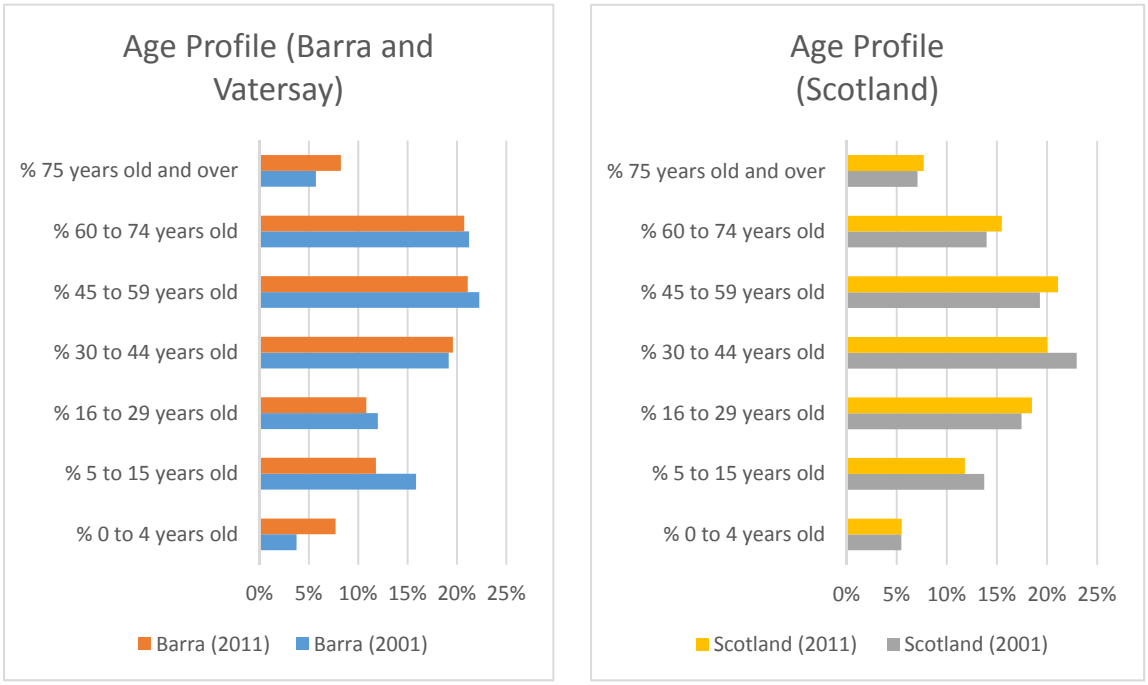
[5] http://www.hial.co.uk/whats-hot/hial-increase-passenger-numbers-yet-again/ (Accessed April 2018)

Figure 2 Age profile of residents within Barra and Vatersay



The demographic profile of the islands in comparison with that of Scotland as a whole is shown here.

Figure 3 Demographic Profile (Barra & Vatersay and Scotland)



3.2 Employment and journey to work

Of the island population, 69% are economically active; 31% economically inactive. In terms of economically active the majority (48%) are full-time employed, while 18% are self-employed.

Figure 4 Economically active population

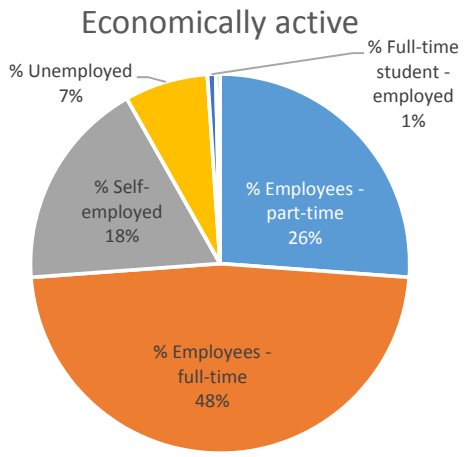
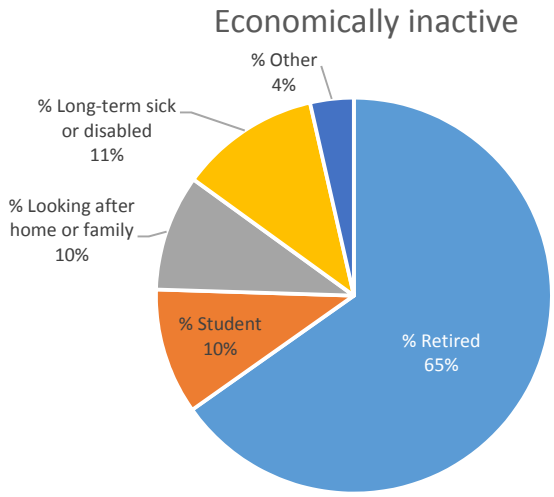


Figure 5 Economically inactive population



Of the economically inactive, 65% are retired, with a further 10% looking after home or family. This means that there is potentially a number of residential properties occupied during the day and requiring heat and power.

In respect of employment, the five largest sectors which employ people on the island (based on Census data) are summarised here.

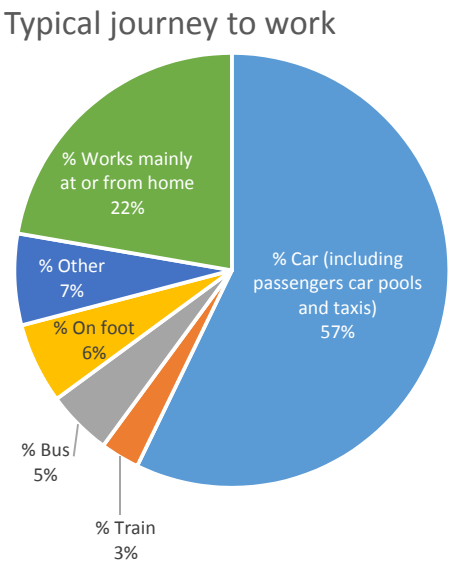
Table 4 Five largest employment sectors (Barra and Vatersay)

Employment sector	% of Local workforce
Human health and social work activities	17.4%
Transport and storage	16.3%
Education	14.1%
Accommodation and food service activities	9.9%
Construction	8.3%

Those in employment typically use the car to travel to work; 57% of commuting journeys are made by car with only 5% by bus. It is noted that 22% of people work mainly from home, which again suggests demand for electricity and heat will be sustained in a number of homes throughout each day.

Census data suggests that around 17% of people are employed and working off the island (on the mainland or elsewhere); the number of journeys by train relates to workers operating on the mainland.

Figure 6 Typical journey to work (Barra & Vatersay)



3.3 Residential

Residential Property - summary

- 74% of domestic properties in Barra and Vatersay are privately owned
- There are a broad mix of solid wall, cavity wall and timber frame construction types
- 51% of properties were built prior to 1984
- Electric heating is used by 46% of dwellings on Barra and Vatersay; oil heating makes up a further 49%
- Average fuel poverty rates are estimated at 56% (Scottish House Condition Survey)

Data available from the Energy Saving Trust Home Analytics database suggests that there are a total of 727 residential properties on Barra and Vatersay.

A short summary is provided here. Further details can be found in Appendix A, Section 1.

Table 5 Residential Property – Overview of characteristics

Characteristic	Details
Archetype	Detached (77%) and semi-detached (20%) dwellings predominate
Age	Around 66% of the housing stock is at least 35 years old; 51% were built in the pre-1984 era The largest proportion of housing stock was built during the period 1950 – 1983 (26%)
Tenure	Three quarters of properties are owner occupied; a further 11% are owned by the Housing Association
Construction Type	Solid wall construction predominates in pre-1950 properties; cavity and timber frame wall construction in the period 1950 – 2002
Primary Heating Fuel	Oil is the primary heating fuel in 49% of properties; electricity accounts for a further 46%
Estimated Energy Efficiency	Around 55% of all properties have an energy efficiency rating between E – G 51% of properties built before 1984 have a F-G rating The majority of properties built post 2002 have an energy efficiency rating of C

3.3.1 Residential overview

An overview of the predominant characteristics of the residential stock is provided here as a guide to the type of works (in terms of insulation improvements) that would need to be carried out in future.

Table 6 Summary of residential archetypes (Barra and Vatersay)

Age	Wall Type	Glazing	Loft insulation	Build type	Primary fuel	EPC Rating	Floor area (m^2)
Pre-1919	Solid wall	Double	100 - 249 mm	Detached	Electricity / Oil	F-G	103
1919 – 1949	Solid wall	Double	100 - 249 mm	Detached	Electricity / Oil	E - G	95
1950 – 1983	Cavity / Timber frame	Double	250 mm+	Detached	Electricity / Oil	E - G	95
1984 – 1991	Cavity / Timber frame	Double	100 - 249 mm	Detached	Electricity / Oil	D - E	103
1992 – 2002	Cavity / Timber frame	Double	100 - 249 mm	Detached	Electricity / Oil	C - D	109
Post 2002	Solid wall	Double	250 mm+	Detached	Electricity / Oil	C - D	115

3.3.2 Estimate of fuel poverty levels

The Scottish House Condition Survey provides the main source of information regarding the general condition of housing stock across Scotland[6]. This includes aspects of heating and insulation as well as characteristics of buildings and overall rates of fuel poverty.

Under the current definition, a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use[7].

The latest figures for the period 2014 – 2016 include the following details for the Comhairle nan Eilean Siar Council area.

[6] http://www.gov.scot/Topics/Statistics/SHCS (Accessed May 2018)

[7] Note that the Scottish Government has looked at an alternative definition of fuel poverty as recommended by a recent review panel http://www.gov.scot/Publications/2017/11/7715

Table 7 Fuel Poverty Statistics (Comhairle nan Eilean Siar – 2014 – 2016)

Characteristic	Parameter	CnES	Scotland
	% of LA	56%	31%
Age of Dwelling	Pre-1945	60%	36%
	Post-1945	53%	28%
House or Flat	House	55%	33%
	Flat	*	27%
Number of bedrooms	2 or fewer	65%	31%
	3	52%	31%
Tenure	Owner occupied	53%	29%
	Social Landlord	64%	35%
	Privately rented	*	31%
Household Type	Older	66%	45%
	Families	30%	17%
	Other	56%	29%

While specific figures for the domestic stock in Barra and Vatersay are not available, the dataset includes a probability estimate of each property being in fuel poverty. This is shown here.

Table 8 Estimated Probability of Fuel Poverty (Barra and Vatersay)

Probability of fuel poverty	Number of houses	Proportion of total housing
Less than 40%	319	44%
40-49%	81	11%
50-59%	56	8%
60-69%	107	15%
70-79%	99	14%
80-89%	61	8%
90-100%	0	0%

3.4 Non-residential

Non-Residential Property - summary

- Major non-residential energy users include the Castlebay and Eoligarry Schools, St Brendan's Hospital and Care Home and Barratlantic
- Hotels and accommodation are another significant element of non-domestic demand
- Electricity is the predominant source of energy demand

This section provides an overview of non-domestic energy users within Barra and Vatersay.

3.4.1 Local Authority

There are a number of local authority buildings, the main sites being the Castlebay and Eoligarry Schools as well as St Brendan's Care Home. Both school buildings use fuel oil for heating; heating in other buildings is provided via electric systems. A summary of annual electricity and heating oil consumption at the local authority sites is provided in Appendix A, Section 2.1.

3.4.2 NHS Western Isles

NHS Western Isles operate St. Brendan's Hospital on the same site as the local authority Care Home facilities. Energy use is a mix of electricity and heating oil (more details in Appendix A, Section 2.2).

3.4.3 Barratlantic

Barratlantic are a Fish, Shellfish and Processing company located at Ardveenish. The factory has a high demand for electricity all year round as summarised in Appendix A, Section 2.3.

3.4.4 Other Non-domestic users

Remaining non-domestic energy use is made up from a combination of:

- Hotels/ guest houses
- Airport
- Small retail, other small businesses
- Churches, community halls and amenities

3.5 Transport

Transport - summary

- 45% of residents in Barra and Vatersay have access to 1 or more cars/vans
- Current vehicles are predominantly diesel/petrol fuelled
- There are two existing electric vehicle charging point in Castlebay
- Shipping vessel fuel is the largest source of transport energy demand

3.5.1 Gas oil

Gas oil is used by local shipping vessels, much of which is purchased via Barratlantic. Annual fuel use is estimated at around 614,000 litres per year. Barratlantic's own fleet vessels use around 245,000 litres of fuel per year.

3.5.2 Petrol/Diesel

There is one single fuelling station on Barra and Vatersay within Castlebay. It has storage capacity for up to 21 m^3 of diesel and 17 m^3 of petrol.

3.5.3 Bus vehicle fuel

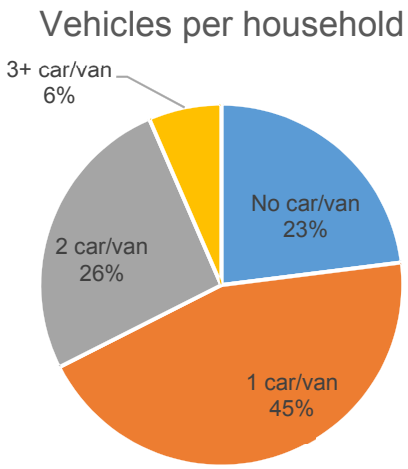
Community Voluntary Action Barra & Vatersay operate two vehicles – one Sprinter vehicle and the other a low floor vehicle. Both vehicles are fuelled with diesel. Combined fuel use is of the order of 5,500 litres per year.

MacNeil Coaches Ltd operate four vehicles (two 17-seater minibuses and two Midi coaches) that are all fuelled with diesel. Combined fuel use over an annual period is around 9,000 litres per year.

3.5.4 Household vehicles

The estimated total domestic vehicle ownership within Barra and Vatersay is 625 with the percentage breakdown of number of cars or vans per household (based on Census data) shown here.

Figure 7 Household transport (Barra and Vatersay)



No specific statistics in terms of vehicle fuel type and use are available to this Local Energy Plan. In order to estimate household vehicle energy use therefore, it has been presumed that the mix of vehicle fuel type will be similar to that for Scotland as a whole.

Statistics from Transport Scotland provide a breakdown of vehicle-km travel within each local authority region and by road classification. This can be combined with energy statistics that provide a breakdown of vehicle fuel usage estimated for each local authority area.

Using these base figures provides an average travel distance of 8,700 miles per year (14,100 km) per vehicle. This equates to annual fuel use of somewhere in the range of 900 – 1,000 litres of fuel at a cost of £1,200 - £1,350 per year.

3.5.5 Electric vehicles

The total number of electric vehicles (either fully electric vehicles or plug-in hybrids) on the road in Scotland during 2017 was 5,521. Of these 19 licenced vehicles were registered by owners in CnES (Q4 2017) with a total of 18 registered at the start of the year (Q1 2017)[8]. The detail of data available does not extend to the number of registered owners of electric vehicles within Barra & Vatersay itself.

At present there are two electric vehicle charging points both in Castlebay. One is at the ferry terminal (a 50 kW rapid charger) and the other at the CnES offices (a 7 kW fast charger). No data was available at present regarding electricity consumption at these charging points. A broader study carried out in Scotland during 2017[9] suggests the average electricity consumption per charge is around 9.8 kWh/charge (fast charger) and 10.2 kWh/charge (rapid charger).

3.6 Environment

Environment - summary

- There are a number of environmental and cultural heritage designations that would need to be taken into account in the design of any large scale local energy generation
- Wind resource in the LEP area can support medium scale wind projects
- Solar resource in the LEP area is moderate
- Hydro resource in the LEP area offers some potential for small-scale run-of-river hydro

Community scale energy generation will typically require planning consent prior to installation. An important factor in any planning consent is to take into account local environmental and cultural heritage designations. It is important that any impacts on the local environment are thought about at an early stage. This ensures that the environmental character of the area is maintained, while also avoiding costly or difficult negotiations when dealing with planning permission requirements.

In thinking about opportunities for local energy generation it is useful to consider what information is available regarding local renewable resources.

A summary of the key environmental designations and local renewable resources is outlined here.

Further details are provided in Appendix A, Section 3.

[8] https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01 (Accessed April 2018)
[9] https://www.racfoundation.org/wp-content/uploads/2017/12/Scotland_EV_Network_Makwana_Dec_17.pdf (Accessed June 2018)

3.6.1 Summary of environmental designations

Site of Special Scientific Interest (SSSI) - SSSIs are those areas of land and water that are considered best represent our natural heritage in terms of their; flora – i.e. plants; fauna – i.e. animals; geology – i.e. rocks; geomorphology – i.e. landforms; a mixture of these natural features. There is one SSSI on Barra at Eoligarry.

Special Area of Conservation (SAC) – A SAC protects one or more special habitats and/or species – terrestrial or marine – listed in the Habitats Directive. There is a large SAC covering a large area to the north west of the island.

Special Protection Area (SPA) – A SPA is a designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States of the European Union (EU) have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds. There is one SPA in the Barra area which is at Eoligarry, Barra.

Important Bird Area (IBA) – An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. There is one IBA near the study area, Eoligarry, Barra.

Marine and Inshore Fisheries Closed Areas (MCA) - Marine and inshore areas closed to fisheries or exempt from closure and their timing, as defined by EC, EU and Scottish Statutory Instrument (SSI) regulatory legislation between 1997 and 2010. Legislation relates to the EU Common Fisheries Policy which is currently under review (http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/common-fisheries-policy). There is one MCA within the study area covering Loch Obe.

Environmentally Sensitive Areas (ESA) – the ESA aims to conserve specially designated areas of the countryside where the landscape, wildlife or historic interest is of particular importance and where these environmental features can be affected by farming operations. There are nine areas classed as ESA.

Shell Fish Growing Areas and Shellfish Water Protected Areas - The Shellfish Waters Directive (2006/113/EC) ('SWD') was introduced to protect designated waters from pollution in order to support shellfish life and growth. There is a designation that is set in the Sound of Barra at the north of the island.

National Scenic Area (NSA) - The designation's purpose is both to identify our finest scenery and to ensure its protection from inappropriate development. There is one NSA to the north of the study area covering the west and south coast of Uist.

3.6.2 Cultural heritage designations

A summary of relevant cultural heritage designations is provided here. Further details are provided in Appendix A, Section 3.2.

Schedule Monuments – There are 18 scheduled monuments within 3 km of the LEP area.

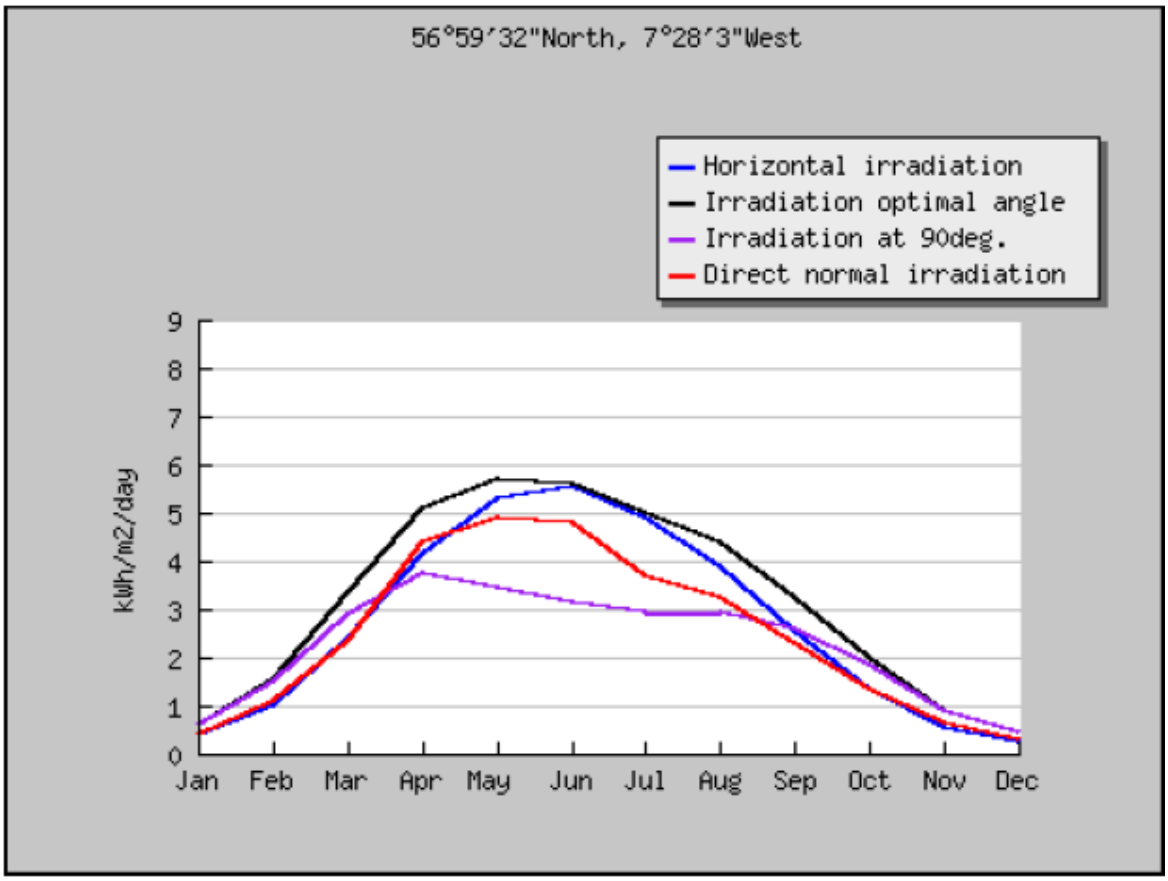
Listed buildings – there are a number of category A, B and C listing buildings within the LEP area:

- Category A (1 site)
- Category B (5 sites)
- Category C (7 sites)

3.6.3 Estimated solar resource

Barra can have a solar irradiance of up to 792 W/m^2. The potential annual irradiation for the LEP area is shown below.

Figure 8 Estimated annual solar irradiation[10]



Due to the lower annual irradiation of Barra solar technology (solar photovoltaic and solar thermal) commercial viability will depend on the purchase cost of equipment. Over the last few years the system costs have dropped dramatically enabling their installation in areas where previously they were prohibitively costly.

[10] Source: Photovoltaic Geographical Information System, EU Joint Research Council (JRC), http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=europe

3.6.4 Estimated wind resource

The wind resource in the area is very good with an available average wind speed of around 7.5 m/s at 10 m a.g.l.. However, due to a number of constraints the potential opportunities for medium to larger scale wind appear to be limited. Key considerations can be summarised as:

- There could be implications for radar (clutter on radar), and low flying aircraft (collision risk) as they come in to land at Barra airport;
- A number of environmental designations;
- Certain areas have a very good resource due to elevation and unimpeded winds from the Atlantic.

This means that medium or large-scale wind development will have more limited feasibility; smaller wind turbines, below 30 m to tip, are more likely to be less constrained. It is noted that local experience to date is that hub heights for Class 1a turbines have been lowered due to the local wind resource.

Further details are provided in Appendix A, Section 3.4.

3.6.5 Estimated hydro resource

There are a number of watercourses, burns and rivers on Barra and Vatersay, as shown here. Details of these can be found in Appendix A, Section 3.5. Potential sites will offer steeper sections where the difference in height (termed the head) is maximised; the average flow of water is the other key parameter that affects the amount of energy that can be generated. In the first instance this would suggest looking at the Allt Cruachain, Allt Alasdair, Abhainn a' Ghlinne and Allt a' Ghlinne areas.

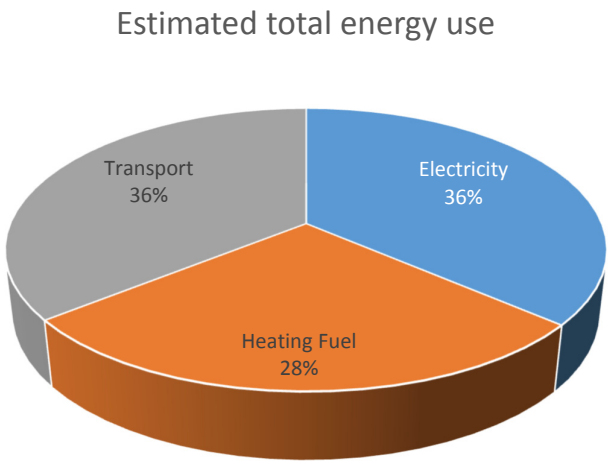
Table 9 Watercourses within Barra and Vatersay

Name of Burn / River	Length (m)	Height Max (m)	Height Min (m)
Abhainn Dubh	600	20	6
Abhainn nam Bhreac	993	36	6
Obe River	1,588	43	5
Abhainn Cuidhir	2,028	27	2
Allt Cruachain, Allt Alasdair	1,140	128	5
Abhainn a' Ghlinne	1,225	66	5
Allt a' Ghlinne	1,354	85	4
Duarry Burn, Abhainn Mhòr, Allt Gunnairigh	3,160	73	3
Allt Ruadh, Abhainn Mhòr, Allt Gunnairigh	2,789	132	2

4. Energy Baseline

Of the energy data available to the present study a summary of total energy use in the LEP area is provided here.

Figure 9 Total annual energy use (Barra and Vatersay LEP area)



A breakdown of these three areas of energy use is provided in the Table here.

Table 10 Breakdown of energy use (Barra and Vatersay)

Source	Annual Energy Use (GWh/yr)	Annual Carbon Emissions (tCO_{2e}/yr)
Residential, *of which:*	32.3	9,714
Electricity	13.9	5,362
Heating	10.8	2,487
Transport	7.6	1,865
Non-Domestic, *of which:*	11.0	2,968
Electricity	1.8	698
Heating	1.3	324
Transport	7.9	1,946
Total (All Sources)	43.3	12,682

4.4 Future changes in overall demand

The energy needs of the community continue to evolve as changes occur to existing buildings (renovations, changes of heating systems) and transport (increasing electric vehicle usage). Changes in energy needs at an individual household level do not have a significant impact on the overall energy needs of the community. By contrast, it is useful to understand the likelihood of any larger scale new development since this has a larger potential impact on the needs of the community and therefore the types of technologies (and scale of supply) that may be required.

The emerging Local Development Plan 2 (LDP2) does not propose large amounts of development across Barra and Vatersay. Further details are provided in Section 5.2. On this basis it is not anticipated that there will be a significant change in overall energy demand within Barra and Vatersay in the short to medium term.

5. Options Appraisal

5.1 Scottish context

Scottish context - summary

- The Scottish Government sees local energy solutions as a vital element of the wider transition taking place across Scotland in the way our energy systems operate
- Encouraging a greater sense of ownership and control among all communities is seen as beneficial, not only in terms of security of supply but also in realising the wider benefits of sustainable, affordable energy among homes and businesses
- No access to feed-in tariffs from April 2019 means local electricity generating schemes need to look to use the energy in the local area in order to gain greatest economic benefit

Scotland's Energy Strategy was published in December 2017[11]. It provides a route map that outlines the vision that the Scottish Government has of what our future energy systems and needs might look like from now out to 2050.

The overall vision is set out in the introduction to the document:

Our Vision

A flourishing, competitive local and national energy sector, delivering secure, affordable, clean energy for Scotland's households, communities and businesses.

This vision is guided by three core principles:

A Whole-System Approach – Work to date has focused heavily on the production of electricity using low carbon sources and improvements to the efficiency with which we use our energy. The strategy recognises that these are important areas of action but need to be worked on alongside heat and transport. All of these elements influence each other in the energy systems that we need to create in future

[11] http://www.gov.scot/Resource/0052/00529523.pdf

An Inclusive Energy Transition – Changes to the whole energy system are driven by a need to decarbonise our energy use in line with targets set out within the Climate Change (Scotland) Act. While this will show Scotland's contribution to global action on climate change, this needs to be done in a manner that is fair to everyone. This means ensuring that inequality and poverty are addressed as well as promoting a fair and inclusive jobs market. Greater efficiency in energy use by businesses and householders offers the opportunity to reduce bills (and associated carbon emissions) leading to lower fuel poverty levels and enhanced competitiveness for business. As part of efforts to ensure that benefits from the low carbon energy transition are enjoyed by all, the Scottish Government intends to create a new energy company. This will be publicly owned and run on a not-for-profit basis.

A Smarter Local Energy Model – Local energy economies are at the core of the transformation of Scotland's Energy Systems. Local solutions for local energy needs, linking local generation and use, provide a platform for vibrant local rural and urban communities. Local Heat & Energy Efficiency Strategies (LHEES) will provide prospectus for local area in terms of investment in energy efficiency, district heating and other heat decarbonisation opportunities.

Further details are available in Appendix A, Section 4.

5.2 Local context

Local context - summary

- Any community led energy projects will need to be developed in a manner that accounts for relevant existing planning policies and guidance documents
- Ongoing initiatives by CnES and other agencies are seeking to reduce overall fuel poverty levels and offer increasingly sustainable energy supply systems
- Community views on priorities for action relation to energy and transport have been collated through both workshop events and wider surveys

This section of the Local Energy Plan provides an overview of the relevant local planning policy and guidance and provides a local level context in terms of any known changes to energy and transport networks.

Further details are provided in Appendix A, Section 5.

5.2.1 Outer Hebrides Local Development Plan

The Outer Hebrides Local Development Plan (referred to as 'the Plan') sets out a vision and spatial strategy for the development of land in the Outer Hebrides looking forward over the next two decades. The Plan contains the land use planning policies which the Local Authority will use for determining planning applications. It also contains a number of development proposals for settlements and rural areas.

The Plan was adopted in November 2012 and is kept under review with an update every 5 years. Work is therefore ongoing on Local Development Plan 2 (LDP2)[12]. It is anticipated that this will be in place during late 2018.

Policy areas relevant to the present Local Energy Plan include:

- Policy DP3 – Housing – sets out requirements in relation to new development housing
- Policy DP4 Zero and Low Carbon Buildings – sets out requirements in respect of Building Standards and associated use of low or zero carbon technology.
- Policy EI 2 Water and Waste Water – sets out requirements regarding drainage and sewerage systems
- Policy EI 8 Energy and Heat Resources – relating to electricity grid reinforcement, infrastructure and renewable energy generation.
- Policy E 9 Transport Infrastructure – relating to transport infrastructure within, and serving the Outer Hebrides
- Policy EI 10 Communications Infrastructure – relating to infrastructure roll out plans of digital communications operators, community groups and other organisations.

5.2.2 Outer Hebrides Community Planning Partnership

This partnership includes all major public agencies working in the Outer Hebrides. It originally operated within a Single Outcome Agreement (SOA) that sets out a long term vision for the Outer Hebrides and some priorities to be addressed via Locality Planning[13]. This included specific initiatives and committed funding as well as key agencies involved in their delivery.

A more localised approach, aimed at empowering communities, has led to the development of a Local Outcomes Improvement Plan (LOIP), which is presently in draft[14]. It sets out priorities for the period 2017 – 2027 and replaces the original SOA.

The stated overall vision for the Plan is:

Our vision is to promote and realise the full potential of the Outer Hebrides as a prosperous, well-educated and healthy community enjoying a good quality of life, fully realising the benefits of our natural environment and cultural values

The priorities for the OHCPP over the next 10-20 years are set out under three main themes:

1. The Outer Hebrides retains and attracts people to ensure a sustainable population

2. The Outer Hebrides has sustainable economic growth and all our people have access to appropriate employment opportunities

3. The islands offer attractive opportunities that improves the quality of life, wellbeing and health for all our people

[12] https://www.cne-siar.gov.uk/planningservice/localdevplan.asp (Accessed April 2018)
[13] http://ohcpp.org.uk/index.php?option=com_content&view=article&id=121&Itemid=175 (Accessed April 2018)
[14] http://ohcpp.org.uk/index.php?option=com_docman&task=cat_view&gid=168&Itemid=237 (Accessed April 2018)

5.2.3 Outer Hebrides Fuel Poverty Strategy (2015 – 2025)

The vision of this strategy (developed by CnES and community planning partners) is that, by 2025, fuel poverty levels in the Outer Hebrides will have reduced in line with the Scottish average. This will be achieved through a range of actions aimed at:

- Improving the Energy Efficiency of Housing Stock
- Increasing the Income of the Poorest Households
- Reducing the Cost of Fuel

CnES recognise that the issue of fuel poverty is a triangular one, and there are particular issues to address within the Outer Hebrides regarding **Poor Energy Efficiency**, **High Fuel Costs and Usage** and **Low Incomes**. Tackling these issues means CnES working with multiple other agencies:

- Tighean Innse Gall (TIG), the local housing agency for the Outer Hebrides
- The Energy Advisory Service (TEAS) which provides an energy advice service to the local community, along with training and awareness raising
- Home Energy Scotland (HES)
- Hebridean Housing Partnership (HHP), the Registered Social Landlord for the Outer Hebrides
- Outer Hebrides Energy Efficiency and Advisory Forum
- The Scottish Government
- Highlands & Islands Enterprise (HIE)

The associated Action Plan targets each of the three issues identified.

5.2.4 Sustainable Energy Action Plan

This Action Plan was created by CnES in 2011 and includes a range of actions to support the Outer Hebrides to reduce carbon emissions. These were based around Renewable Energy, Energy Efficiency, Transport and Behavioural Change. Given the changing landscape since 2011 a review and prioritisation of actions was taken in 2016. Further details are provided in Appendix A, Section 5.4.

5.3 Community commentary on areas of action

At the heart of the development of the LEP are the views of the community of Barra and Vatersay. Initial public meetings in Northbay and Castlebay, in combination with display noticeboards in the community shop in Castlebay and an online survey were used as a means of gauging views regarding priorities and objectives to be addressed in the LEP. It also offered a chance for specific projects and opportunities to be raised for further consideration.

The survey was split into three main sections, specifically:

- Home Energy
- Travel
- Whole Island projects

A summary of responses is provided here. Further detail is provided in Appendix A, Section 6.

School visits were also undertaken to discuss the LEP with pupils (P5 – P7 and S1 – S3) and get their ideas for what might be included.

Table 11 Summary of community survey data (Barra and Vatersay)

Section	Current Behaviour	Challenges	Motivation for change or benefits to achieve	Projects
Home Energy	The majority of all respondents regularly consider energy efficiency behaviours at home	Key challenges: * Behaviour and habit * Cost * No challenges	Lower electricity and heating bills A warmer home Being more environmentally friendly	A lower energy tariff for residents (pay less for the energy you use) Home heating upgrade project (e.g. replacing old boilers, new control system) A local food produce growing and selling scheme
Travel	Two most common actions are: * choosing the use of the ferry rather than flying * walking rather than driving * Almost as many respondents do neither of these	Top three challenges: * Inconvenient / unreliable bus timetabling * Weather * Travel distance	Lower travel costs Being environmentally friendly Healthier lifestyle	Support to individuals to own electric vehicles Community minibus Walking and cycle paths Low emissions ferries
Whole Island Projects		* Access to funding * Apathy or lack of community support for change * Lack of support from local and/or Scottish Government	Lower fuel poverty More local jobs Making Barra & Vatersay more environmentally friendly More sustainable local businesses through lower fuel and electricity costs	Installation of renewable energy to supply homes and businesses Bulk purchase of fuel Large renewable projects

5.4 High level technology review

High level technology review - summary

- Wind resource is an important local asset
- A mix of solar PV, heat pumps and (more limited) small scale hydro generation is likely to offer a beneficial mix for Barra and Vatersay
- Large scale district heating is unlikely to be economic given existing larger heat generating assets and the overall scale of demand. Castlebay offers potential for a small scheme
- Any heating solutions involving supply of hot water for space heating will involve expensive retrofit for the majority of properties that use electric heating (dry system)
- Household scale battery storage is unlikely to offer substantial benefit given current tariffs (higher rates in daylight hours)

There a number of technologies that could be considered for use within the Barra and Vatersay area. The following section provides a brief overview of the major technologies that could be considered and some details regarding how they work and an overall suitability rating in the context of energy needs in Barra and Vatersay.

A simple Red/Amber/Green qualitative scoring system is used. Red means that the technology is not well suited to Barra and Vatersay's needs; Green means that it is well suited to Barra and Vatersay's needs.

Further details are provided in Appendix A, Section 7.

Table 12 Technology overview (Barra and Vatersay)

Overall Technology suitability for B&V	Technology	Commentary
HIGH	Wind	Wind resource is good in the LEP area. Opportunities for medium and small scale turbines are likely to exist
	Heat Pumps	Air-source heat pumps offer potential alternative to electric and oil based heating systems. Local experience suggests they are effective in different dwelling designs and can supply wet heating as well as underfloor systems. Ground source and water source heat pumps are more expensive options (more civil works are required during their installation). Fitting to existing properties is ideally linked with building fabric improvements.
MEDIUM	Hydro	There are a number of local water courses offering potential for small scale hydro schemes. These would need to use output energy locally to provide most economic benefit.

Overall Technology suitability for B&V	Technology	Commentary
	Solar PV	Rooftop solar PV offers potential for householders. There is limited immediate land area available within the LEP for larger ground-based systems
	District Heating	The size and distribution of heat demand in the LEP area is not well suited to a district heating scheme. Small scale clusters of housing served by a communal system may be viable.
	Energy storage	Household scale storage systems (linked to solar PV) are expensive. The benefit of solar-fed individual storage would be limited for THTC users given a lower tariff for electricity overnight. Multi-property storage systems could be viable.
	Fuel Cells	Some limited potential use in the LEP area if able to supply larger non-domestic building
	Electrolysers	Given potential wind output available due to constrained export capacity community-scale electrolyser systems could be viable. These would provide a means of producing hydrogen that could be used as a transport fuel.
	Biomass	Potential alternative to oil fired systems. Not a direct alternative for electrically heated properties (requires wet heating system)
LOW	Gas CHP	No mains gas supply to the LEP area makes this option expensive. Alternative gas supplies would need to be imported and processed prior to use in any system
	Solar Thermal	Given local solar resource there will be limited benefit from solar water heating for the majority of households and businesses. A supplementary heating system would need to also be in place.
	Energy from waste	The main potential route would be anaerobic digestion. Costs are likely to be prohibitive since there are no existing food waste collections in place for households. Scale of generation would be low.
	Biomass CHP	This is an expensive option and could not operate effectively at the scale of heat demand within the LEP area
	Tidal	The scale of system is likely to be larger than the demand for electricity in Barra and Vatersay. This will be constrained by present grid capacity and make the scheme unviable
	Wave	The scale of system is likely to be larger than the demand for electricity in Barra and Vatersay. This will be constrained by present grid capacity and make the scheme unviable

Overall Technology suitability for B&V	Technology	Commentary
	Geothermal	No previous studies have suggested that there is exploitable geothermal resource within the LEP area. Any system would be expensive to install (deep boreholes and associated civil works) and require the ability to supply all heat users via hot water. Those with electrical heating at present don't have the necessary plumbing in place

6. Review of local options

The earlier sections of the draft Local Energy Plan outline the baseline situation in Barra and Vatersay and the aspirations of the local community and Steering Group for the outcomes of the Local Energy Plan.

6.1 Energy infrastructure

Present grid electricity network operating constraints impede both the generation of revenue from electricity output from the community wind turbine (due to persistent curtailments) and further development of the local economy (limited capacity for further generation and lack of three phase supply on Vatersay). This is a wider issue for communities across the Western Isles and subject of ongoing dialogue between the DNO and other agencies. While there are a variety of potential investments in distribution and transmission systems, including potential for an inter-connector from Lewis to the mainland, timetables for delivery are unclear and neither are all potential initiatives likely to offer direct benefits to Barra and Vatersay.

A crucial element of local energy needs is the ability to increase the scale of local energy generation on Barra and Vatersay and be able to fully use this electricity across the local network. At present, any work on the Loch Carnan distribution network results in a switch to diesel generation to meet electricity requirements on Barra and Vatersay and curtailment of output from local generators. Ongoing dialogue with the DNO and relevant agencies is therefore important in ensuring that opportunities for more effective local area network management continue to be sought.

More broadly, support for local energy and transport needs may be enhanced by the development of an Energy Services Company (ESCo) operating across the Western Isles. Engaging with other organisations, including other development trusts and community bodies, regarding the remit of any ESCo and how it might operate to the benefit of all communities is an ongoing action.

Proposed Action Point #1

Continue and advance dialogue with DNO, CnES, relevant agencies and Scottish Government to address constrained local and distributed network in respect of local generation and supply.

Proposed Action Point #2

Continue dialogue with CnES and other relevant bodies regarding a Western Isles Energy Supply Company (ESCo) and associated benefits for Barra and Vatersay (as well as other communities).

6.2 Energy Saving Measures and Educational Framework

6.2.1 Energy Efficiency Awareness and Support

Support is already available to the community of Barra and Vatersay via a number of agencies including Comhairle nan Eilean Siar, Community Energy Scotland, Tighean Innse Gall, Home Energy Scotland, Resource Efficient Scotland and Energy Saving Trust.

- CnES has access to grant funding (which is from the Scottish Government Home Energy Efficiency Programmes Scotland – Area Based Scheme) to install energy efficient measures in eligible households. Tighean Innse Gall are the delivery agent and scheme administrator for HEEPS:ABS on behalf of CnES, installing measures and providing advice to households. As part of TIG's work, The Energy Advisory Service (TEAS) provide a free impartial, locally staffed energy advice service providing householders with the best ways to save energy and money. This includes home visits, drop-in sessions, electricity switching (TIGSwitch.com) and tariff advice as well as a referral mechanism and advisor for householders for HEEPS:ABS.
- Properties owned by the Hebridean Housing Partnership are required to meet national targets within the Energy Efficiency Standard for Social Housing (EESSH) to ensure their properties achieve a minimum standard of efficiency.
- Home Energy Scotland (HES) – provide clear and impartial advice on saving energy at home. HES help people access Government-funded energy efficiency schemes and support from local service providers. Their advice covers the actions that can be taken and support available to help save money on energy bills and transport costs. They provide information on home energy efficiency schemes and financial support available including:
    - Warmer Homes Scotland
    - Area-based scheme (see above)
    - Home Heating Cost Reduction Scheme
    - Scottish Government interest free loans and cash back
    - Renewable heat incentives and feed-in-tariffs
    - Information on grants, loans and support for consumers and businesses wishing to buy electric vehicles, get charging infrastructure etc.
    - Other local and national schemes as they become available.

  Home Energy Scotland is funded by the Scottish Government and managed by Energy Saving Trust.

- Resource Efficient Scotland – provide energy efficiency support to businesses. They can work with the local community and the steering group to raise awareness within the business community in Barra and Vatersay on what is available to them. They can:
    - Work with local business facing organisations and advisors to disseminate information on the support available
    - Provide stakeholder packs with promotional text and relevant case studies/testimonials for newsletters, emails, social media feeds etc. to assist with local engagement efforts

  The programme is delivered by Zero Waste Scotland and funded by Scottish Government and the European Regional Development Fund.

- Energy Saving Trust – provide clear and impartial advice on energy saving. This includes support in accessing funding through grant and loan schemes. Energy Saving Trust's work in

Scotland is funded by the Scottish Government, and transport advice is funded by Transport Scotland, the Scottish Government's national transport agency.

These agencies will continue to offer useful advice in relation to energy efficiency and energy saving measures that will be available to the community of Barra and Vatersay. This covers both:

- Support to householders
- Support to businesses and other non-domestic buildings

A community awareness event can be used as a means of reinvigorating awareness among the community of the extent of support presently available relating to tariff switching, energy efficiency and alternative energy and transport options.

In terms of non-domestic energy use it is useful to share the experience and knowledge of support mechanisms among businesses and other organisations. Barratlantic, for example, are presently engaged with Resource Efficient Scotland and Energy Saving Trust to review current energy and transport costs and identify potential saving opportunities. The outcomes of this work and experience of relevant support mechanisms is useful information to provide to the wider community in promoting ongoing action.

Proposed Action Point #3

Deliver community event to promote energy efficiency and opportunities for support in demand management, tariff switching and resource efficiency. Include low emission vehicles and associated support.

Proposed Action Point #4

Community to work with Barratlantic to promote local understanding and uptake in actions relating to energy efficiency and transport among non-domestic organisations.

6.2.2 Energy tariffs and market switching

The cost of electricity in Barra and Vatersay is high and it is well documented that there is a high level of fuel poverty. The consultation with the community highlighted lower energy tariffs as a key priority for action. There are a number of options for support:

- Ongoing work via Hebrides Energy to offer alternative energy tariffs for all households and businesses locally
- TIGswitch.com and support and advice via TIG
- Wider market opportunities for tariff switching

There are two main issues to address:

- Awareness among consumers as to the range of tariffs available and scale of potential savings that could be achieved
- Ongoing support to avoid savings being lost as tariff deals end and default standard tariffs are applied by energy supply companies

Proposed Action Point #5

Community to work with CnES and Citizens Advice Scotland, along with other agencies, to promote awareness of potential alternative electricity tariffs which residents can explore. Seek means of support to be provided in switching account details and subsequent follow up to avoid return to standard tariffs (where short term tariffs are available).

For properties heated by oil there is an opportunity to set up a heating oil club in Barra and Vatersay. There are a number of others in operation across Scotland. The basic premise of a heating oil club is the ability to achieve a bulk discount price by co-ordinating a single purchase for all members, rather than negotiating separately with suppliers. It also potentially smooths out short term supply availability issues given a larger single order.

Fuel purchase via Barratlantic, as several existing consumers do, may be the most cost effective route. Discussion with other heating oil purchasing bodies across the Western Isles, or via community-led initiatives such as DTAS[15], offer further opportunity to seek bulk purchasing power. Future co-ordination of purchases via a Western Isles Energy Services Company (ESCo) could be a medium term option.

Proposed Action Point #6

Continue to seek best value for heating oil purchase via bulk ordering through either existing networks or alternatives such as a heating club or similar.

6.2.3 Promotion of energy efficiency

There is an opportunity to provide educational information to Castlebay Community School and Eoligarry Primary School so the younger generation can benefit from the advice from the agencies listed above. Flyers and posters could be distributed in the local area. Connections can also be made with other schools in areas where LEPs have been developed, or communities that are keen to do so.

6.2.4 Water use and energy efficiency

Each household or business on Barra and Vatersay using hot water pays the associated cost of energy required to heat the water (electricity used in an immersion heater, LPG to feed a boiler etc.). In terms of energy use across Barra and Vatersay, Scottish Water also use a large amount of electricity in maintaining the supply of water to households and businesses (in treating and pumping water around the island). The cost to Scottish Water of these energy needs is passed directly to individual water customers as a component of annual Council Tax charges.

Saving water at a household or business level therefore offers direct cost savings on both energy and water bills. It also assists Scottish Water in saving energy in treatment/pumping costs, with a broader benefit to Scotland as a whole.

Home Energy Scotland and Scottish Water have worked together on a pilot community programme in Galashiels that sought to encourage the community to engage with water efficiency. Households were provided with a free water saving brochure and free water saving devices (aerated showerheads, shower timers, kitchen and bathroom tap aerators, “Hippo” cistern displacement devices, universal plugs, and trigger-guns for hoses).

A similar community-based programme is to be rolled out on Barra and Vatersay.

Proposed Action Point #7

Implement awareness programme centred on water efficiency and benefits of more efficient water use to individual households and businesses.

6.3 Energy efficiency measures

The direct impact of any measures to improve energy efficiency will depend on the individual properties. However, the Home Analytics database dataset provides a means of estimating the

[15] http://dtasoilbuying.org.uk/about-us (Accessed April 2018)

impact of a range of energy efficiency interventions across the residential stock in Barra and Vatersay. This therefore offers an indication of the scale of impact that this can provide.

While delivery of these measures is best delivered in conjunction with CnES and other agencies, it is useful to consider the relative impact of these individual measures. A summary is provided here.

Table 13 Insulation and energy efficiency measures (residential stock)

Measure	Estimated Capital Cost (£)	Estimated Energy Cost Saving (£/yr)	Estimated Energy Saving (kWh/yr)	Estimated Carbon Emission Saving (tCO_{2e}/yr)
Replacement of incandescent lightbulbs with LED equivalent	£13,728	£13,680	185,854	61
Loft insulation top-up	£79,352	£10,307	140,035	46
High efficiency storage heaters	£2,028,897	£87,538	1,189,295	387
Replacement of existing oil boilers	£1,112,400	£90,418	1,228,424	400
External wall insulation	£2,596,270	£71,267	968,240	315
Underfloor insulation works	£1,166,486	£78,490	1,066,365	347
Replace entry doors with modern equivalent	£537,865	£18,566	252,239	82
Install A-rated windows (uPVC frames)	£2,813,284	£50,076	680,337	221
Installation of Solar PV	£2,931,660	£54,997	747,197	243

The larger and more disruptive works would be the delivery of external wall insulation and replacement of existing electric heaters with high efficiency storage heaters.

In terms of the energy cost savings delivered for each pound of expenditure, the cavity wall, room in roof insulation and loft insulation measures are estimated to offer a simple payback in a period of up to 5 years.

Internal wall insulation and underfloor insulation is estimated to offer a simple payback in a period of 10 – 15 years.

The remaining measures would offer a simple payback in excess of 20 years.

Alongside the existing funding schemes and programmes described in Section 6.1 the Scottish Government is currently developing its SEEP (Scotland's Energy Efficiency Programme) to be delivered from 2020. This will encourage investment programmes of works that combine action in social housing and owner occupied dwellings in order to target a small geographical location.

Proposed Action Point #8

Continue to work with relevant agencies to promote and support improvements to building fabric and heating systems among all households across Barra and Vatersay. Target EPC C rating as minimum standard. Seek to use local installers where suitably qualified in order to maintain skills and employment in the area.

6.4 Small scale renewables

6.4.1 Existing Residential

In terms of retrofitting existing buildings, the main opportunities for renewables in the first instance are roof mounted solar PV (where suitable roof areas exist) or small scale wind turbines (6 kW) where there is sufficient curtilage around the property.

Given solar irradiance levels any solar water heating systems at individual household scale will not be capable of delivering all the hot water needs of dwellings so would be supplemented with another heat supply. In smaller properties there may be issues with physical space to site the additional water tank associated with the solar collector.

Micro-CHP systems available in the market at present all require a mains gas supply so are not relevant to the needs of Barra and Vatersay.

Heat pumps (either air or ground source) provide an alternative means of heating where replacing oil heating systems. The heat pumps will typically offer maintenance cost savings in comparison to the oil system. However, the heat output will be lower than for the conventional radiator system used in the case of oil. It is therefore most beneficial where additional insulation works are carried out in advance of the installation. Larger sized radiators will also be required to optimise heat emission. Heat pumps are therefore not ideally suited to older properties, particularly those of stone wall construction. However, direct experience on the islands (Hebridean Housing Partnership) suggests that households benefit from the installation of air source heat pumps, even where only limited additional fabric improvement works have been possible.

Proposed Action Point #9

Explore community owned delivery or investment in solar PV and small scale renewables to support extension of direct energy supply to residents on Barra and Vatersay. This could include options for co-ordinating bulk purchase of solar PV (for example) via Coimhearsnachd Bharraidh agus Bhatarsaidh (CBaB) or other support. Promote other small-scale renewables as suitable for homes/businesses.

6.4.2 New Build

Any new build properties, or those being extensively renovated, will benefit from enhanced insulation in line with present Building Standard requirements. This would mean heat pumps become more effective as a primary source of heating.

Roof design can also incorporate solar PV to provide additional on-site generation.

Proposed Action Point #10

Seek designs for new build dwellings that use heat pumps where appropriate and practicable as the primary heat source alongside high levels of insulation and fabric. Look for opportunities to retrofit during renovation of existing dwellings.

6.5 Large scale renewables

6.5.1 District heating

The density of heat demand on Barra and Vatersay is typically low, therefore not lending itself to large scale district heating (communal heating) schemes. Previous studies have investigated opportunities for heat networks to supply housing in Vatersay and various buildings in Castlebay.

An initial review of the previous feasibility work in respect of the proposed Vatersay scheme suggests that the heat load is simply too small to make any scheme economic. There is little base load supply and therefore the diversity of demand would be too low to enable effective modulation of heat output from any boiler to meet the needs of the system efficiently.

In the case of Castlebay, however, there is more scope for development. If Castlebay School and Swimming Pool were included as a base load, as well as potential extension to St Brendan's Hospital, then this offers a base load that could supplement demand among the neighbouring residential properties.

The network would be capable of delivering instantaneous domestic hot water and water for space heating via radiators. Heat interface units (HIUs) would need to be installed in individual houses; these are about the size of a compact boiler. This potentially offers a route to lower cost heating for houses connected to the district heating scheme.

A more detailed feasibility study would be needed to look at the infrastructure of the network and optimal design.

Proposed Action Point #11

Undertake feasibility study for district heating scheme incorporating Castlebay School and Swimming Pool and redevelopment at St Brendan's Hospital.

6.5.2 Wind turbines

Given existing constraints in terms of grid capacity large scale wind turbines in excess of a MW capacity will be severely curtailed in operation making them economically unviable.

The hosting of a second turbine of similar size at the site of the existing community turbine has been discussed. This could be feasible, with due consideration of existing planning consents and planning policy guidance from CnES regarding siting of wind turbines on Barra and Vatersay.

To provide most benefit to the community any additional turbine would need to supply its output direct to new, additional sources of demand in the community. This would mean either development of additional buildings adjacent to the turbine to utilise electricity directly, or use of a storage mechanism. Potential options include:

- Set up a small business unit with office or small workshop space and supply power directly from the wind turbine. Supply to additional electric vehicle charging points would be feasible since the output from the turbine is far in excess of the scale of demand required by charging points.

- Battery storage with capacity to charge the battery at peak output periods from the turbine and then discharge at lower output periods. However, this relies on the ability to transfer power via the local grid network and may not therefore be able to generate sufficient revenue to make the scheme viable (discharging at night would likely attract a lower tariff than during the day for example).
- Use an electrolyser to generate hydrogen using electricity output from the existing wind turbine, and any subsequent capacity. Hydrogen can be stored and then used either a fuel (feeding transport such as buses or ferries) or re-used to generate electricity via a fuel cell.

Production of hydrogen would offer a potential route to use existing constrained capacity on the operational turbine, while also offering the potential of extending local generating capacity.

Typical electrolysers available on the market at present can produce around 400 kg of hydrogen per day.

Hydrogen for transport

Trials of hydrogen fuelled buses elsewhere, such as in Aberdeen, have shown the potential for these vehicles to be used more widely. Each vehicle is powered using an on-board fuel cell that uses hydrogen to generate electricity to power the bus. A similar model of operation would be true for cars and light vans. HGVs are another potentially growing market for hydrogen fuel, given the size and weight of these vehicles and the associated scale of batteries required if an electric-only drive train system is used. As an example, the Outer Hebrides Local Energy Hub (OHLEH) project based at Creed Park on Lewis is looking to purchase a hydrogen fuelled refuse collection vehicle for use in the Stornoway area. The vehicle will be fuelled by hydrogen produced locally at site[16].

In the short term it is also possible to retrofit internal combustion engines to use a fuel blend that includes hydrogen.

The recently announced funding for the Hyseas III project[17] will see the building and launch of a car and passenger ferry fuelled with hydrogen. Hydrogen to fuel the ferry will be produced via constrained wind generation on Orkney. There is ongoing work to look at how hydrogen might be used a fuel for ferries operating routes on the West coast of Scotland.

The viability of using hydrogen as a transport (or heating fuel), in part, rests on the cost of production. It is most likely to be cost effective in situations where existing renewable energy generation can be used (particularly where that generation is curtailed – as in the case of Barra and Vatersay).

Hydrogen for heating

Trials in Oban have looked at introducing hydrogen into the existing SGN operated gas network. It is feasible to do so, without compromising safety of end use appliances. It is possible that hydrogen injection into the wider mains gas network across the UK will become more prevalent. This offers a potential emerging market for hydrogen.

Domestic cookers and boilers capable of being fuelled by hydrogen are not at a commercially available stage of development.

[16] http://communityenergyscotland.org.uk/ohleh.asp (Accessed June 2018)
[17] https://www.internationales-verkehrswesen.de/hyseas-iii-hydrogen-ferry/ (Accessed June 2018)

Proposed Action Point #12

Explore potential for local hydrogen production using community wind generation. Market availability to consider ferry operators, hauliers and bus operators.

6.5.3 Anaerobic digestion

Biodegradable waste can be chemically treated in suitable digester tanks to produce a biogas that can be used as a vehicle fuel or as a means of generating electricity. The main factors influencing the viability of such schemes are the scale of waste available and its energy content (calorific value). Fish processing waste, for example, has relatively high energy content while animal manure has a low energy content. The main challenge in setting up an anaerobic digestion plant on Barra would be the logistics of collecting household waste to feed the digester and any ability to supplement this with non-domestic waste from local authority buildings or Barratlantic (for example).

6.5.4 Tidal/wave power

The economics of marine energy generation, either tidal or wave devices, is extremely challenging. There is limited scope to attract grant funding and the present market mechanism to supply power means participating in an auction process with no guarantee of securing a fixed income via an agreed price from the grid. This, in turn, makes securing investment difficult. To achieve development scale these schemes therefore tend to be at multi-MW scale and consequently expensive to develop.

Previous proposals have looked at the potential for wave and tidal devices operating within and around Barra. None of these schemes would be economically viable at present. There is also, in the medium term, no means by which any such schemes could export power to the wider grid other than via a new (expensive) landfall connection to the mainland.

6.6 Transport

6.6.1 Promoting adoption of electric vehicles

The wider phasing out of new sales of diesel and petrol vehicles within the UK (timetabled for 2032 in Scotland) provides momentum for the uptake of electric vehicles or other low emission vehicles fuelled with hydrogen.

There are existing grant schemes in place to support homes and businesses with the cost of charge point installation. An existing grant scheme also discounts the price of new electric vehicles at the point of sale (i.e. the purchaser does not have to apply for it) and EST provides a 6 year interest free loan up to £35,000 to help with the purchase cost of any new ULEV.

While the initial capital cost of an electric vehicle can be higher than a conventional vehicle, there are significant ongoing maintenance savings due to ULEVs having few moving parts, and fuel cost savings with the cost of charging vehicles being far less than the equivalent fuel cost of petrol or diesel. The price difference between internal combustion engine (ICE) vehicles and electric vehicles is steadily narrowing. In terms of range, the electric vehicles on the market are well capable of travelling distances across the Islands (mid-range vehicles typically capable of travelling 100 miles on a single charge).

In the first instance a general promotion event on Barra, potentially offering a test drive of an electric vehicle, and offering information and advice as to what existing support there is to ownership would benefit the community in its transition to low carbon transport.

More broadly, the potential for a car club can be explored with the community and local agencies. This could be a wider Western Isles' wide initiative, linked to promotion of tourism as well as support

to households and businesses. Lease models offer a potentially lower cost access route to electric vehicles for householders. A pool of electric vehicles operated as a car club also offers a means of public agencies and businesses also benefiting from access to vehicles for work related travel. Web-based applications enable smart booking systems to be implemented.

Proposed Action Point #13

Develop promotional and awareness event to showcase electric vehicles and bring multi-agency representatives to highlight sources of advice and support to adoption of electric vehicles. Potentially rolled into single event as per action point #3. Discuss potential for development of a car club with pool of electric vehicles operated as part of a wider Western Isles model.

6.5.2 Community minibus

An electric or hydrogen fuelled minibus operating on Barra and Vatersay would provide a positive role model in terms of adoption of low emission vehicles. It would also potentially offer more flexibility in service delivery given its cost of operation in terms of miles travelled (in comparison to existing diesel equivalents).

Smart scheduling via existing travel planning applications provide a means of extending the existing bus services on the island by offering more reliable means of requesting services to stop than at present. A new low emission minibus could operate half a circuit of the island, in conjunction with an existing bus, to provide flexibility in travel times to suit local needs. This could benefit the general service operators at present, as well as the services currently provided by Community Voluntary Action Barra and Vatersay. There is also potentially larger interest in users arriving at the airport giving increasing passengers numbers coming on to the island.

Initial cost of investment could be developed through a partnership between Community groups, the bus operators and CnES.

Extending the use of buses on the island will also extend the fuel demand, either for locally generated electricity (battery only vehicles) or for hydrogen (hybrid vehicles). This will support the economics of local generation.

One potential area of support is via EST who can provide a Sustainable Transport Review for the bus operators to look at potential savings. EST may also be able to provide a 6 year interest free loan of up to £50,000 for an EV mini-bus (as part of a wider HGV loan scheme). Applications are reviewed on a case by case basis.

Proposed Action Point #14

Speak with bus operators and Community Voluntary Action Barra and Vatersay, alongside other agencies, to explore potential for electric or hydrogen fuelled bus to supplement existing services.

6.5.3 Extension of charging infrastructure

As noted earlier there are existing electric vehicle charging points at the ferry terminal and at the Council offices in Castlebay. These facilities have not been widely used to date. However, to support wider adoption of electric vehicles there could be additional charge points installed at the airport and at Ardmhor. These would support electric vehicles in the north and east of the island while also 'joining up' journeys that vehicle users can make along the length of the Outer Hebrides. EST can provide funding for workplace charge point infrastructure through ChargePlace Scotland.

Given that the existing charge points are free to use it is difficult to see there being scope for any size of charging fee per use to be introduced if a community operated charging point were

introduced. However, if it was of rapid charger design then it might be possible to charge a small fee since it would offer convenience in terms of onward journeys.

Proposed Action Point #15

Explore potential community investment in extending existing charging points for electric vehicles.

6.5.4 Active Travel

One of the findings from the wider community survey was the limited extent of pavements within towns and villages and the lack of dedicated cycle routes to encourage more active travel patterns.

There are limitations to the extent to which cycle paths can be introduced, given best practice guidance regarding the width of such paths and line of sight for other road users.

Extending pavements could support ongoing wider environmental management of road networks in terms of sustainable drainage and improved run off.

Given the promotion of the Hebridean Way as an attractive cycle route, enhancing cycle routes on Barra will help to ensure that cyclists want to spend time on Barra and Vatersay as well as other destinations along the route.

There are short term e-bike trials available through Home Energy Scotland (1 – 3 week trial) to encourage communities to consider these as a travel option. Interest free loans to enable the purchase of e-bikes are available for both households and businesses[18].

CnES is working with HITRANS to develop an Active Travel Strategy for the Outer Hebrides. The aim is to improve conditions for both walking and cycling on public roads and footways in the inhabited islands between Barra and Lewis. The Active Travel Strategy will consider a wide variety of projects, and seek to develop priorities for action over the next five to ten years.

Possible improvements range from adding new or wider places to walk and cycle along existing streets, to entirely new off-road paths in the countryside, to better information, marketing and advertising.

Community engagement events took place in May 2018 (including one in Castlebay) and a wider public consultation ran until mid-June 2018.

Proposed Action Point #16

Discuss with CnES emerging details with Active Travel Strategy and opportunities for enhancements or improvements to current active travel routes (walking and cycling).

6.6 Development of smart grid

The value of an electrical grid system is the ability to balance the supply of electricity with the demand (loads) placed upon the system. At sufficient scale this ensures that voltage and current levels remain within required limits for the safe operation of appliances and equipment. This is carried out via the national transmission and distribution network.

Trials, such as those on Mull[19] and in Fintry[20], have looked at the potential to use a similar approach but at a more local scale. In the case of Mull, for example, a local hydro scheme output was matched

[18] Further details available at http://www.energysavingtrust.org.uk/scotland/grants-loans/ebike-loan and http://www.energysavingtrust.org.uk/scotland/grants-loans/ebike-business-loan (Accessed June 2018)
[19] http://www.accessproject.org.uk/ (Accessed May 2018)
[20] http://smartfintry.org.uk/ (Accessed May 2018)

to charging requirements for electric heaters in individual homes. The system was able to prioritise the heaters in order of those that needed to be charged most urgently.

These more localised systems offer the potential to enable more efficient use of local energy generation by avoiding periods where electricity is either purely exported to the wider grid or is curtailed due to lack of capacity on the grid.

There are three elements to development of a smarter grid on Barra and Vatersay:

1. Enabling more transparency in measuring import of electricity into the Barra and Vatersay network, export of electricity from Barra and Vatersay and instantaneous local energy generation (smart grid control system)
2. Means of communication between end consumers and local energy suppliers (smart meters)
3. Management of power flows and billing arrangements (need for more direct private wire connections or use of 'virtual private wire' in aggregating consumers and/or suppliers)

The development of a smart grid control system would be the first step in development, enabling power flows at the local level to be better understood in the context of the present DNO policy regarding curtailment that applies to all local generators across the Western Isles.

To support this system smart meters installed in individual homes, businesses and at sites with electricity generation need to be capable of two-way communication so that demand can be signalled by individual buildings and these requests can be processed by the supplying assets. There also needs to be further work by the DNO to assess the ability of the local grid to cope with the anticipated power flows. This should include the delivery of three phase power to Vatersay.

While there is an ongoing roll out of smart meters across the UK, led by the larger electricity suppliers, there is no standard design for all providers. This means potential meters offered by any given DNO do not necessarily offer true two-way communication supporting a future smart grid.

In a fully operational smart grid, local energy generation from wind turbines, solar PV and any other significant sources, as well as potential battery storage, could be linked together to deliver electricity requirements in the local Barra and Vatersay area.

Proposed Action Point #17

Continue dialogue with DNO regarding development of smart grid capacity on Barra and Vatersay. Support roll out of smart meters that will facilitate two-way communication between local consumers and supply assets.

6.7 Summary of potential opportunities

A summary of the opportunities reviewed is provided here.

Further details regarding the initial estimate of impacts and benefits of each measure are included in Appendix A, Section 8.

Table 14 Description of measures summary

#	Measure	Description of measure	Total Rating
1	Replacement of incandescent lightbulbs with LED equivalent	Carry out programme of replacement of incandescent bulbs with LED equivalent within households	HIGH
2	Loft insulation top-up	Programme of loft insulation upgrades to ensure minimum 250 mm thickness in relevant households	HIGH
3	High efficiency storage heaters	Programme of replacement of storage heaters with modern equivalent in relevant households	HIGH
4	Replacement of existing oil boilers	Programme of replacement of existing boilers in households with oil use as primary heating fuel	MEDIUM
5	External wall insulation	Programme of external wall insulation work on relevant households	HIGH
6	Underfloor insulation works	Programme of insulation work to be installed beneath wooden floors in identified households	HIGH
7	Replace entry doors with modern equivalent	Programme of replacement of main entry doors to households with modern insulated equivalent	LOW
8	Install A-rated windows (uPVC frames)	Programme of replacement glazing for relevant households	MEDIUM
9	Installation of Solar PV	Programme of installation of domestic scale Solar PV on appropriate housing. Potential to develop community body to co-ordinate investment and/or installation	HIGH
10	Installation of small scale wind	Installation of small scale wind turbines on domestic scale. Potential to develop community body to co-ordinate investment and/or installation	MEDIUM

#	Measure	Description of measure	Total Rating
11	Air source heat pump	Look to use air source heat pumps where appropriate and practicable as part of heating solution for new build properties alongside high levels of building fabric and insulation.	HIGH
12	District heating scheme within Castlebay	Carry out feasibility study looking at potential district heating using Castlebay School and Swimming Pool as base load. Potentially incorporate St Brendan's Hospital redevelopment	HIGH
13	Hydrogen production from community wind turbine	Explore potential market for use of hydrogen fuel and how that might be met via production of hydrogen using output from the community wind turbine	HIGH
14	Community minibus	Look to extend existing service and community bus routes through use of low emission minibus and smart on demand timetabling	HIGH
15	Extend existing public electric vehicle charging points	Explore community involvement in extending public charging network (potentially sites at Ardmhor and the Airport)	MEDIUM
16	Seek to increase amount of pavements and cycle paths across Barra and Vatersay	Discuss with relevant agencies potential for development of safer routes for walking and cycling around the islands	LOW
17	Smart meters	Installation of smart meters in homes and businesses to begin process of enabling smart grid for local electricity grid management	HIGH
18	Tidal barrage	Development of a tidal barrage offshore to generate electricity supplied into Barra and Vatersay	LOW
19	Tidal array	Development of a tidal array offshore to generate electricity supplied into Barra and Vatersay	LOW
20	Anaerobic digestion	Generation of biogas and electricity from food waste for use in local community	LOW

7. Summary of proposed actions

A summary of proposed actions is provided here. A list of relevant parties that would need to be consulted in progressing these actions is given against each action point. This does not imply any scale of resourcing or financing that would be available in each case.

Table 15 Summary of action points

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
1	Continue and advance dialogue with DNO, CnES, relevant agencies and Scottish Government to address constrained local and distributed network in respect of local generation and supply	Seek enhancements to local electricity grid network both internally and in respect of the distributed and transmission networks serving the Western Isles	SSEN CnES CBaB Community Councils Community Energy Scotland	Short / Medium
2	Continue dialogue with CnES and other relevant bodies regarding a Western Isles Energy Supply Company (ESCo)	Explore potential remit of Western Isles ESCo and how that might benefit energy supply for all communities	SSEN CnES CBaB Community Councils Community Energy Scotland	Short / Medium
3	Deliver community event to promote energy efficiency and opportunities for support in demand management, tariff switching and resource efficiency. Include low emission vehicles and associated support	Raise awareness among community in Barra and Vatersay of existing support services available to homes and businesses (link with Action 13)	Local Energy Scotland Home Energy Scotland Resource Efficient Scotland Energy Saving Trust CnES CBaB Tighean Innse Gall HITRANS Sustrans	Short

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
			Community Energy Scotland	
4	Community to work with Barratlantic to promote energy and transport action among non-domestic consumers	Share knowledge and understanding of support to non-domestic users and potential actions around energy and transport	CBaB Barratlantic Community Councils	Short
5	Provide support and advice around tariff switching	Offer support and advice to households and businesses regarding electricity tariff switching and maintaining awareness of changes to tariffs in the market	CnES Hebridean Housing Partnership Tighean Innse Gall Citizens Advice Scotland	Short
6	Ensure heating oil purchasing options offer best value for residents and businesses	Promote bulk purchase of oil for residents and businesses	Barratlantic A&C Maclean DTAS CBaB	Short
7	Community joint venture water efficiency project	Implement awareness programme centred on water efficiency and benefits of more efficient water use to individual households and businesses	Scottish Water Home Energy Scotland CBaB Community Councils	Short
8	Continue to improve fabric, insulation and space heating within local residential properties, targeting EPC C rating as minimum standard. Where possible use local installers	Secure funding for ongoing improvement works to insulation, building fabric and space heating as appropriate to building form, age and wall construction	CnES Hebridean Housing Partnership Home Energy Scotland Warmworks Scotland	Short / Medium

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
			Tighean Innse Gall	
9	Small scale solar PV development and other small-scale generation	Explore community opportunity for collective install of solar PV on Barra and Vatersay Promote other small-scale renewables as suitable for homes/businesses	CnES CBaB Community Energy Scotland Local Energy Scotland	Short / Medium
10	Seek to use heat pumps where appropriate as primary heat source	Seek designs for new build dwellings that use heat pumps where appropriate and practicable as the primary heat source alongside high levels of insulation and fabric. Look for opportunities to retrofit during renovation of existing dwellings	CnES Hebridean Housing Partnership Private Developers Community Councils Community Energy Scotland Local Energy Scotland	Short / Medium
11	District heating (Castlebay)	Carry out feasibility study for district heating scheme centred around Castlebay School and St Brendan's Hospital	CnES NHS Western Isles Hebridean Housing Partnership CBaB Home Energy Scotland	Short
12	Community wind turbine and hydrogen production	Explore potential for local hydrogen production using community wind generation. Market availability to consider	CMAL CnES Bus operators	Short

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
		ferry operators, hauliers and bus operators	Voluntary Action Barra & Vatersay CBaB Barratlantic SGN Lews Castle College	
13	Promote awareness of electric vehicles and look at potential for a car club	Develop promotional and awareness event to showcase electric vehicles and sources of advice and support (link with Action 3) Discuss potential for development of a car club with pool of electric vehicles operated as part of a wider Western Isles model	CnES NHS Western Isles Hebridean Housing Partnership CBaB Barra Car Hire Local Taxi Services Emergency Services Fleet (NHS) Post Office Community Councils	
14	Community minibus	Speak with bus operators and Community Voluntary Action Barra and Vatersay, alongside other agencies, to explore potential for electric or hydrogen fuelled bus to supplement existing services	Bus operators Community Voluntary Action Barra & Vatersay CBaB CnES Community Councils	Short
15	Extension of EV charging infrastructure	Explore potential for community involvement in	CnES CalMac	Short / Medium

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
		extending electric vehicle charging points	HIAL HITRANS Isle of Barra Hotel Transport Scotland Barra Car Hire CBaB	
16	Active Travel	Discuss with CnES emerging details within Active Travel Strategy and opportunities for enhancements or improvements to current active travel routes (walking and cycling)	CnES Community Councils CBaB NHS Western Isles Sustrans HITRANS Outer Hebrides Tourism	Medium
17	Smart grid development	Seek development of localised grid management system	SSEN CnES CBaB NHS Western Isles Hebridean Housing Partnership HIAL Barratlantic Scottish Water	Medium

Appendix A Supporting Information

A.1 Residential

Data available from the Energy Saving Trust Home Analytics database suggests that there are a total of 727 residential properties on Barra and Vatersay.

A.1.1 Property by tenure

Around three quarters of the total domestic building stock on Barra & Vatersay is owner occupied (74%) with a further 10% privately rented. Housing Association owned stock accounts for a further 11%.

A summary is provided here.

Table A.1 Housing stock on Barra and Vatersay (by tenure)

Tenure	No. of properties
Owner Occupied	538
Housing Association	82
Privately Rented	73
Local Authority	30
Unknown	4
	727

A.1.2 Building form and age

In terms of the building form of property and age, these details are summarised here.

Table A.2 Property type and age (Barra and Vatersay)

Property Type	Pre-1919	1919 - 1949	1950 - 1983	1984-1991	1992-2002	Post 2002	Sub Total
Detached	52	115	100	90	154	47	558
Semi-detached	0	8	82	32	16	8	146
End-terrace	1	0	2	0	0	0	3
Mid terrace	0	0	1	0	0	0	1
Flat in mixed use	3	0	0	0	0	0	3
Small block of flats	8	0	4	0	0	0	12
Unknown							4
% of total	8.8%	16.9%	26.0%	16.8%	23.4%	7.6%	727

Around two thirds of domestic properties are at least 35 years old; the majority of these properties were built in the period from 1950 onwards.

In terms of the typical building form then the predominant type is detached dwellings (77%), with semi-detached properties making up around 20% of the total stock.

A.1.3 Construction type and age

The way in which housing is constructed determines what form of insulation can be used to enhance overall energy efficiency. A summary of wall construction type in terms of age of property and archetype is provided here.

Table A.3 Property archetype and wall construction type (Barra and Vatersay)

Property Type	Cavity	Solid	System Built	Timber Frame	Unknown	Sub Total
Detached	149	217	14	178		558
Semi-detached	52	25	7	62		146
End-terrace	2	1				3
Mid terrace	1					1
Flat in mixed use	1	2				3
Small block of flats	2	2		8		12
Unknown					4	4
Sub total	207	247	21	248	4	727

Table A.4 Wall construction type and age (Barra and Vatersay)

Wall Construction	Pre-1919	1919 - 1949	1950 - 1983	1984-1991	1992-2002	Post 2002	Sub Total
Cavity wall	2	21	59	65	55	5	207
Solid wall	56	92	40	8	8	43	247
Timber frame	6	1	80	49	105	7	248
System Built	0	9	10	0	2	0	21
Unknown							4
Sub total	64	123	189	122	170	55	727

A.1.4 Primary fuel use and overall energy efficiency

An overview of the primary fuel used in residential properties and the overall energy efficiency of the building stock is provided here.

The energy efficiency of a property depends on its physical characteristics. Factors such as the age of construction, the dwelling type, the heating and hot water systems in use and the extent to which the building fabric is insulated, all affect energy efficiency. Domestic energy efficiency ratings in Barra and Vatersay varies greatly depending on building type and age.

Around 60% of the present stock is rated in the lower categories of E - G. Only 15% of properties have an energy efficiency rating of C.

Figure A.1 Energy Efficiency of property by age (Barra and Vatersay)

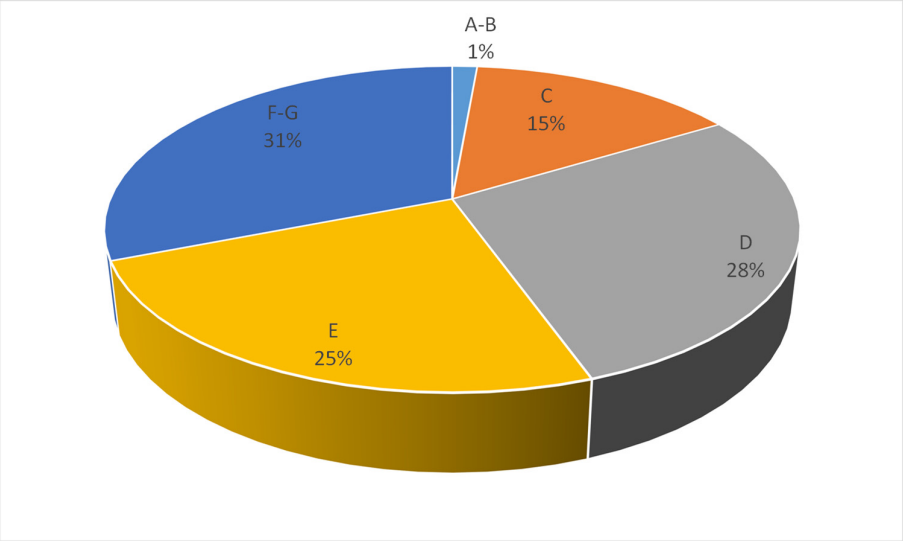


Table A.5 EPC Rating by Property age (Barra and Vatersay)

EPC Rating	Pre-1919	1919 - 1949	1950 - 1983	1984-1991	1992-2002	Post 2002	Sub Total
A – B	7	3	0	0	0	0	10
C	0	0	6	17	49	36	108
D	1	2	48	47	87	19	204
E	2	54	60	30	31	0	177
F – G	54	64	75	28	3	0	224

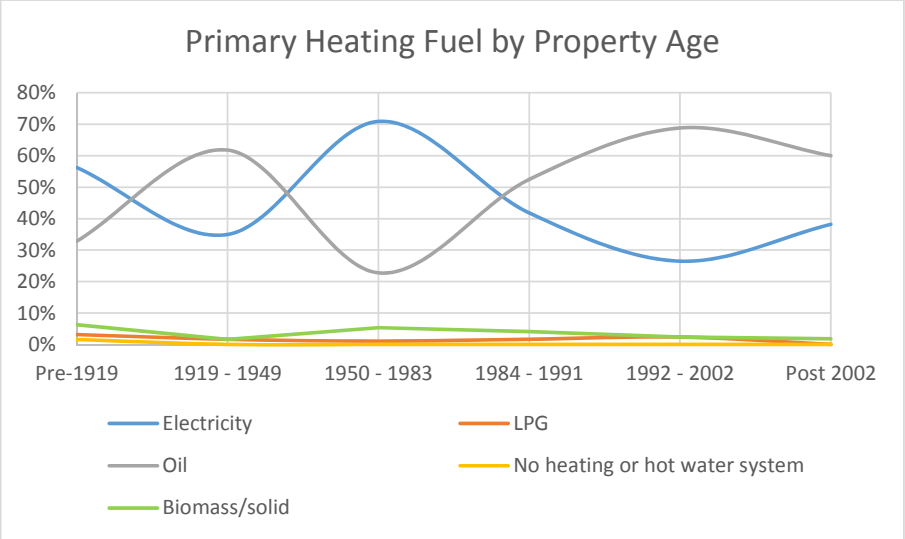
In terms of primary fuel used for heating, the dominant sources on Barra and Vatersay are electricity and oil.

Table A.6 Primary fuel and property age (Barra and Vatersay)

Primary fuel	Pre-1919	1919 - 1949	1950 - 1983	1984-1991	1992-2002	Post 2002	Sub Total
Biomass/solid	4	2	10	5	4	1	3.6%
Electricity	36	43	134	51	45	21	45.6%
LPG	2	2	2	2	4	0	1.7%
Oil	21	76	43	64	117	33	49.0%
No heating system	1	0	0	0	0	0	0.1%

The changing proportion of the predominant fuel use can be seen here. It can be seen that more modern properties have moved from using electrical heating to oil as the primary fuel source.

Figure A.2 Predominant primary fuel by age of property (Barra and Vatersay)



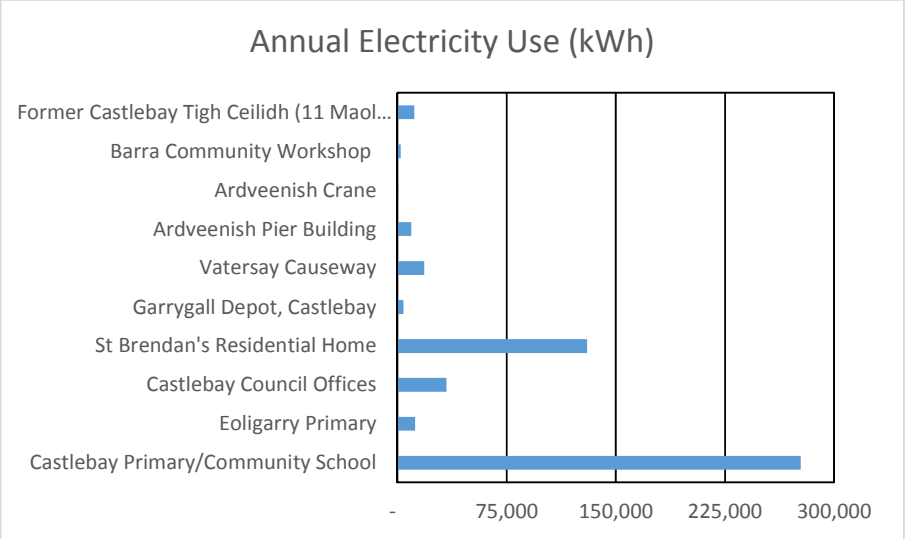
A.2 Non-residential

This section provides an overview of non-domestic energy users within Barra and Vatersay.

A.2.1 Local Authority

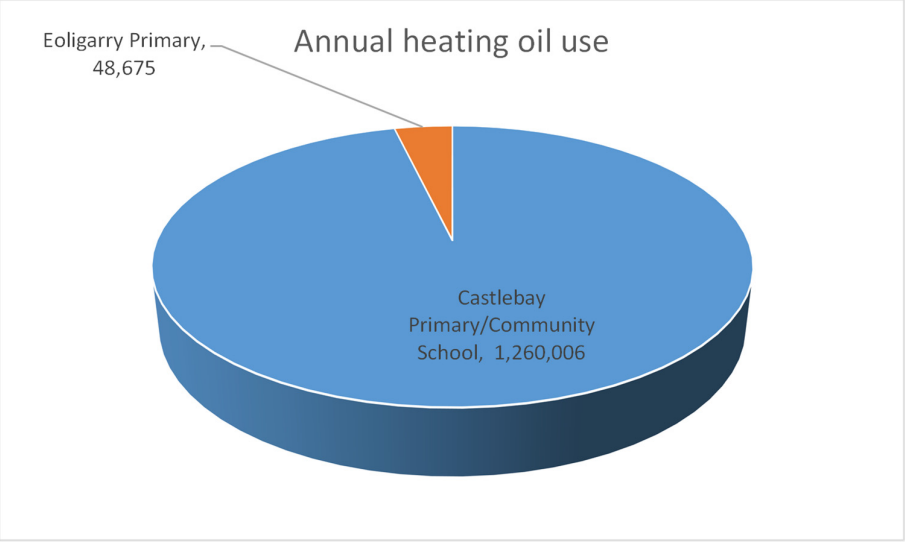
There are a number of local authority buildings, the main sites being the Castlebay and Eoligarry Schools as well as St Brendan's Care Home. A summary of annual electricity consumption at the local authority sites is provided here.

Figure A.3 Annual electricity consumption (local authority sites)



Both school buildings use fuel oil for heating and annual consumption in these cases is shown here.

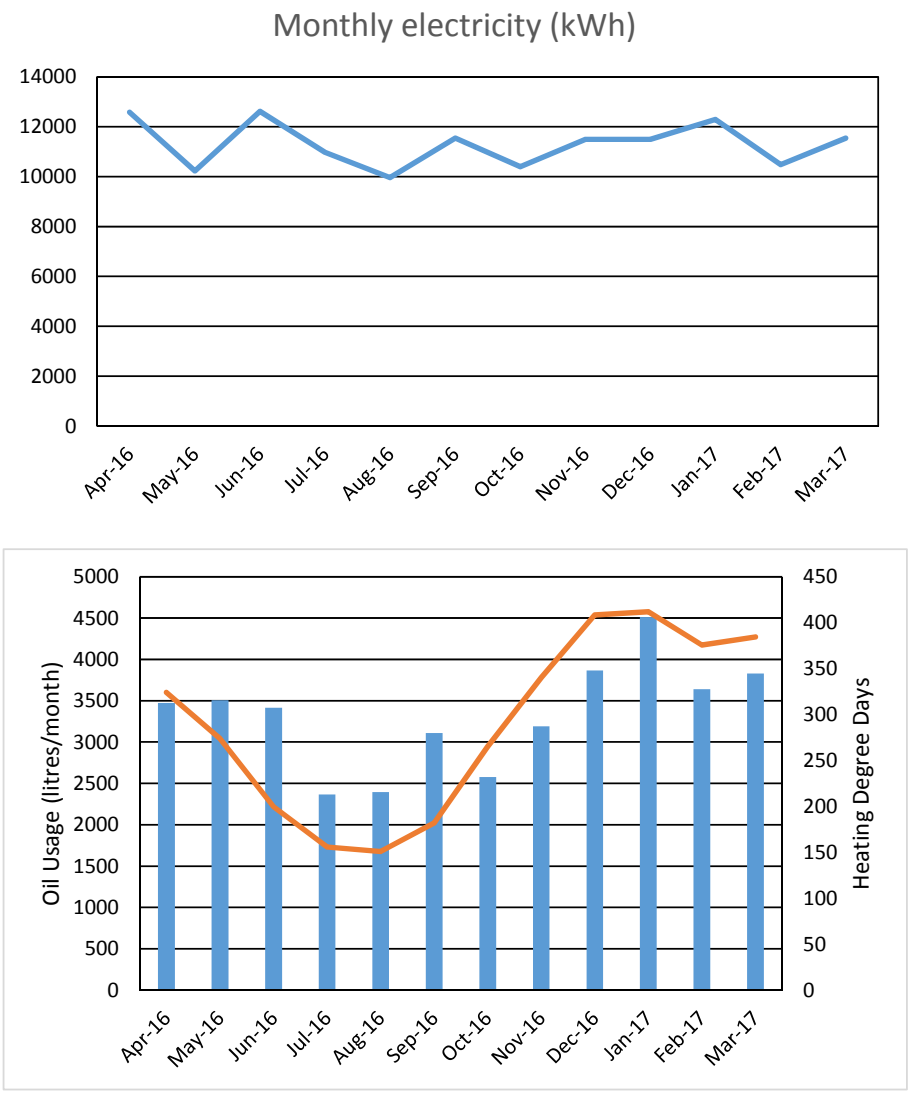
Figure A.4 Heating oil consumption (schools)



A.2.2 NHS Western Isles

NHS Western Isles operate St. Brendan's Hospital on the same site as the local authority Care Home facilities. Energy use is a mix of electricity and heating oil. A summary of annual consumption is provided here.

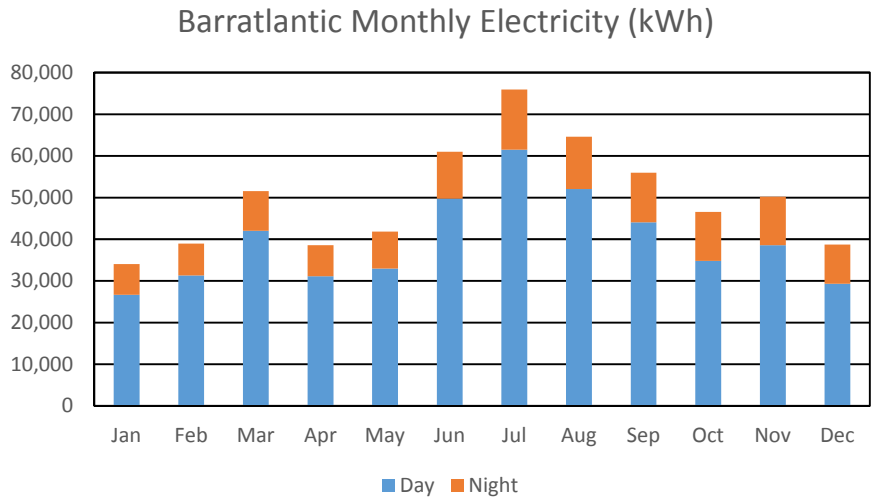
Figure A.5 Annual electricity and heating oil consumption (St Brendan's Hospital)



A.2.3 Barratlantic

Barratlantic are a Fish, Shellfish and Processing company located at Ardveenish. The factory has a high demand for electricity all year round as shown here.

Figure A.6 Barratlantic annual electricity demand



A.3 Environment

In considering potential opportunities for use of different energy supply technologies it is important that any impacts on the local environment are thought about at an early stage. This ensures that the environmental character of the area is maintained, while also avoiding costly or difficult negotiations when dealing with planning permission requirements.

Small scale technologies used on individual buildings, such as Solar PV panels for example, will generally have little or no impact on local environments and habitats. Large scale community assets, such as a large wind turbine, for example, need to consider the potential impacts on a wider area than the scale of the present LEP boundary.

For these reasons it is useful to look in a little more detail regarding environmental designations and cultural heritage listings within a 3 km radius of the present LEP area. A summary is provided here.

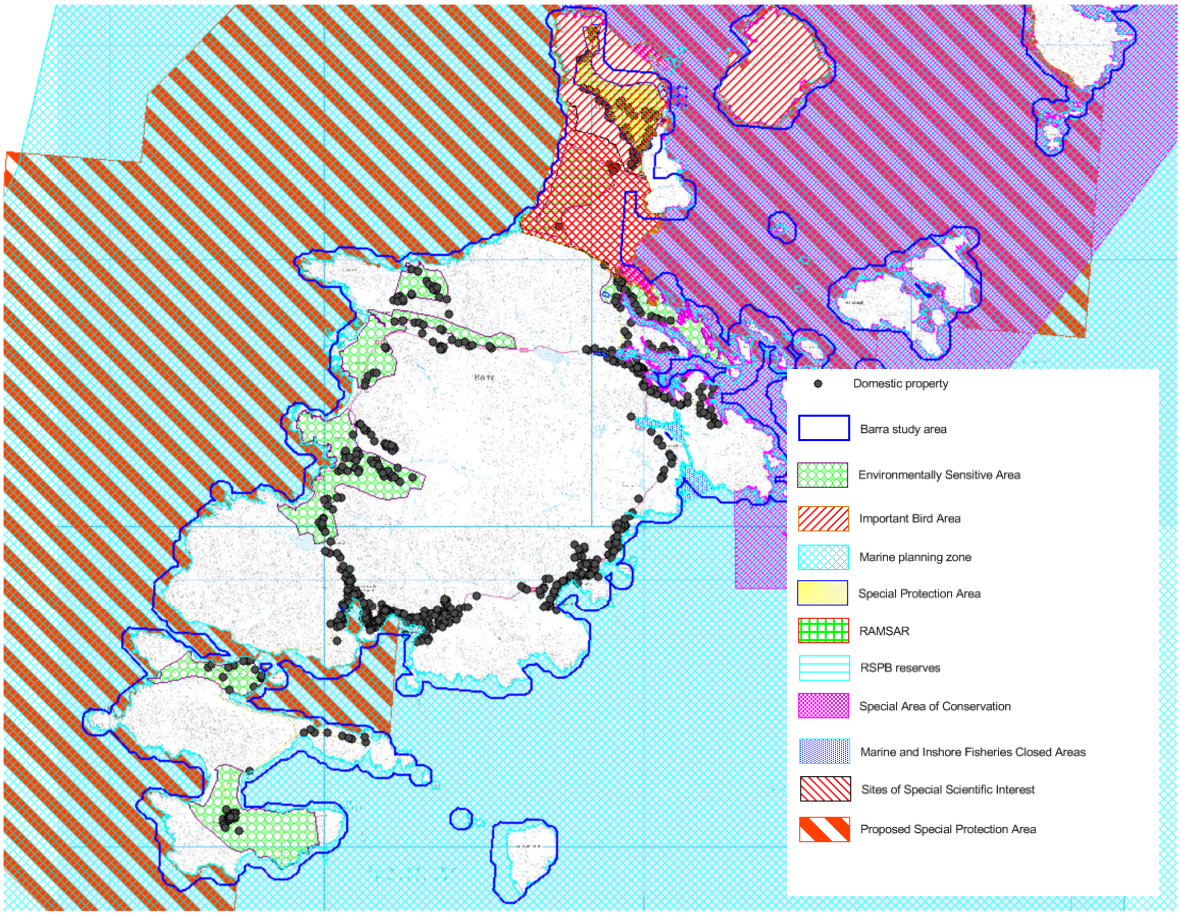
A.3.1 Summary of environmental designations

The map below provides an overview of environmental designations relevant to the LEP area. Further details are provided here.

Site of Special Scientific Interest (SSSI) - SSSIs are those areas of land and water that are considered best represent our natural heritage in terms of their; flora – i.e. plants; fauna – i.e. animals; geology – i.e. rocks; geomorphology – i.e. landforms; a mixture of these natural features. There is one SSSI on Barra at Eoligarry. The scientific importance of Eoligarry rests largely in the outstanding range of well-developed active erosional features and processes that are unrivalled in any beach–dune–machair system of comparable size in the Hebrides.

Special Area of Conservation (SAC) – A SAC protects one or more special habitats and/or species – terrestrial or marine – listed in the Habitats Directive. There is a large SAC covering a large area to the north west of the island. It is designated for its sandbanks and reefs.

Figure A.7 Barra and Vatersay Environmental Designations



Special Protection Area (SPA) – A SPA is a designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States of the European Union (EU) have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds. There is one SPA in the Barra area which is at Eoligarry, Barra. The site comprises sand dunes, cultivated machair and croftland, together with small areas of wetland and rough pasture. This combination of cultivation, including hayfields with damp grassland and marsh, provides habitat that supports a breeding population of Corncrake Crex, crex of European importance. There is also a proposed marine SPA[21].

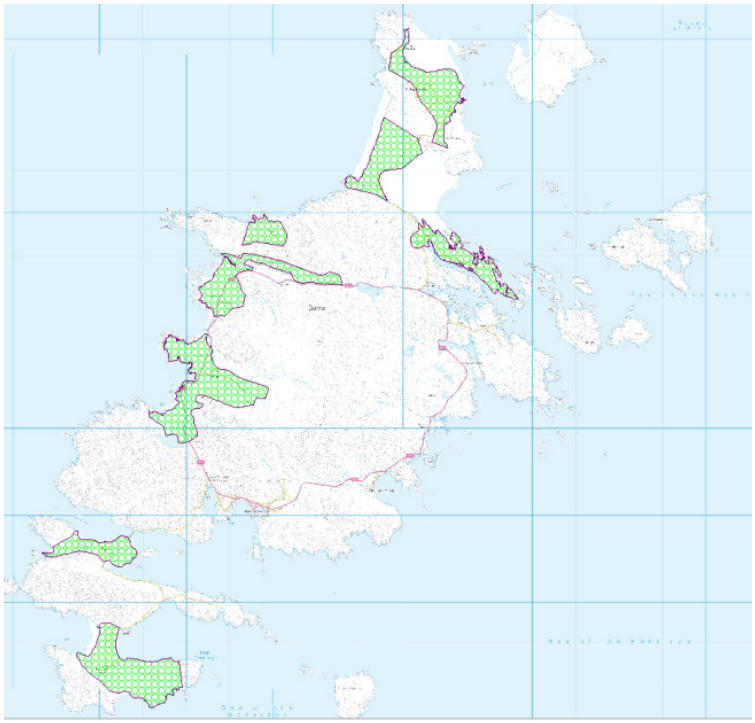
Important Bird Area (IBA) – An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. IBA was developed and sites are identified by BirdLife International. Currently there are over 12,000 IBAs worldwide. There is one IBA near the study area, Eoligarry, Barra. The site comprises the machair-covered isthmus of Eoligarry and low-lying islands. Intertidal cockleshell banks are abundant. The IBA is also nationally important for wintering Calidris maritima (330 birds, 1992, 2%). Branta leucopsis are from the Greenland breeding population.

[21] https://www.nature.scot/sites/default/files/2017-12/Marine%20Protected%20Area%20%28Proposed%29%20-%20Site%20summary%20document%20-%20West%20Coast%20of%20the%20Outer%20Hebrides.pdf

Marine and Inshore Fisheries Closed Areas (MCA) - Marine and inshore areas closed to fisheries or exempt from closure and their timing, as defined by EC, EU and Scottish Statutory Instrument (SSI) regulatory legislation between 1997 and 2010. Legislation relates to the EU Common Fisheries Policy which is currently under review (http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/common-fisheries-policy). The areas relate to several marine species including Anchovy, Cockle, Cod, Haddock, Hake, Herring, Mackerel, Norway Pout, Plaice, Salmon, Sea Trout, Sandeel, Scallops, Sprat and Orange Roughy; and several fishing methods including Beam trawl, Bottom trawl, Creel, Dredging, Otter trawl, Gill nets and Towed nets. There is one MCA within the study area covering Loch Obe.

Environmentally Sensitive Areas (ESA) – the ESA aims to conserve specially designated areas of the countryside where the landscape, wildlife or historic interest is of particular importance and where these environmental features can be affected by farming operations. There are nine areas classed as ESA, as shown here.

Figure A.8 Barra and Vatersay Environmentally Sensitive Areas



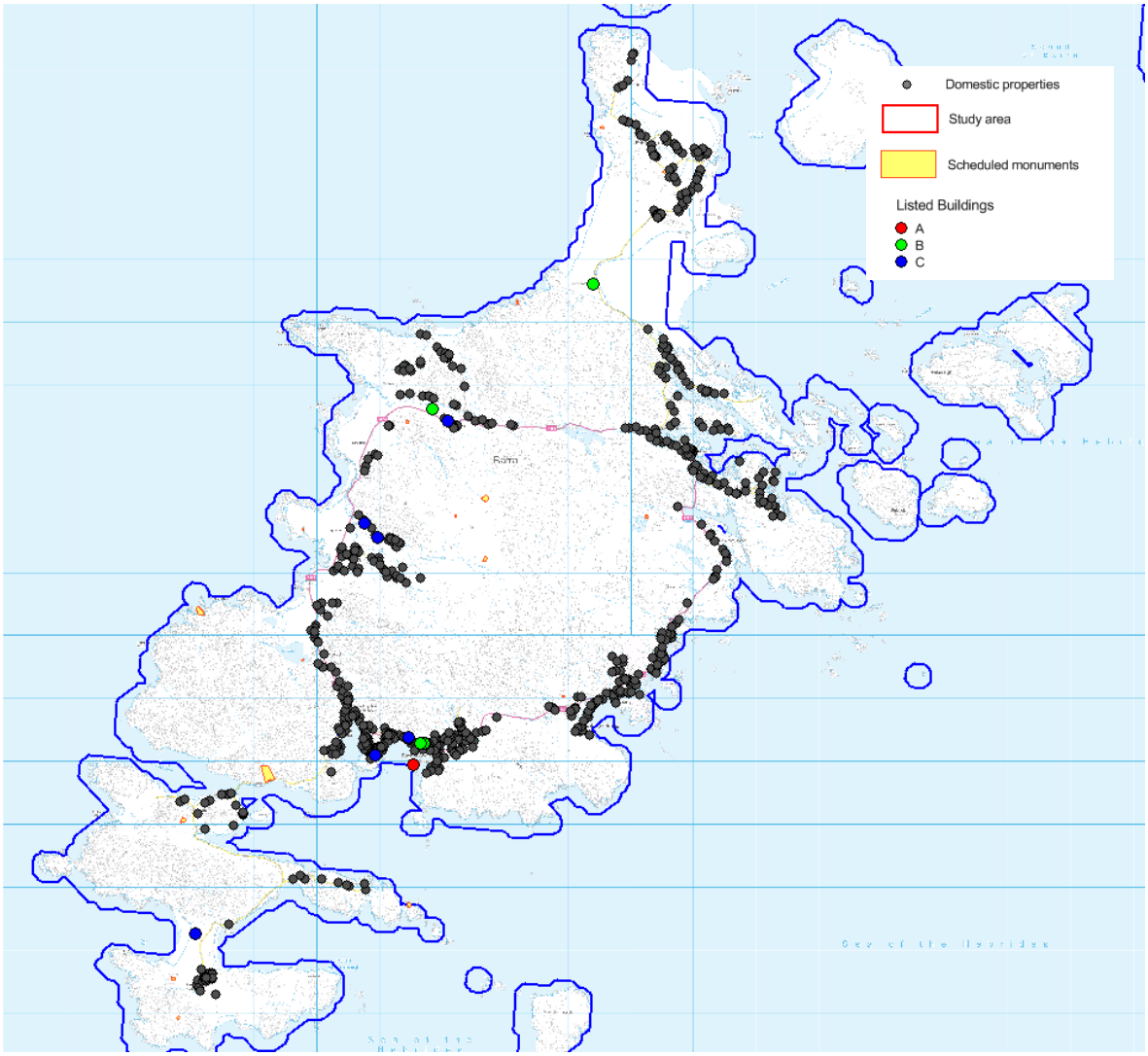
Shell Fish Growing Areas and Shellfish Water Protected Areas - The Shellfish Waters Directive (2006/113/EC) ('SWD') was introduced to protect designated waters from pollution in order to support shellfish life and growth. There is a designation that is set in the Sound of Barra at the north of the island.

National Scenic Area (NSA) - The designation's purpose is both to identify our finest scenery and to ensure its protection from inappropriate development. There is one NSA to the north of the study area covering the west and south coast of Uist.

A.3.2 Cultural heritage designations

A summary of relevant cultural heritage designations is provided here.

Figure A.9 Barra and Vatersay Cultural Heritage Designations



Schedule Monuments – There are 18 scheduled monuments within 3 km of the LEP area –

Dun Bharpa, chambered cairn 800 m NE of Balnacraig	Cille Bharra, church, two chapels, and seven grave markers, Barra
Ben Rulibreck, dun 570 m NE of, Vatersay	Alt Chrisal, multi-period settlement 750 m ESE of Gortein, Barra
Dun a'Chaolais,broch, Vatersay	Loch nic Ruaidhe, dun, Barra
Dun Mhic Leoid, tower, Loch Tangusdale	Breibhig, standing stones, Barra
St Michael's Chapel, chapel, Port na Cille, Barra	Dun Ban, promontory fort and broch
Grianan, chambered cairn 550 m SW of Dun Cuier,dun	Cille Bhrianain, chapel and burial ground, Uinessan, Vatersay
Tigh Talamhanta, aisled house, Allasdale	Beinn Ruilibreac, standing stones and enclosure 360 m ESE of, Vatersay
Dun Chlif, dun 1200 m NW of Ben Erival	Kisimul Castle, Castlebay, Barra
Dun Scurrival, dun, Eoligarry	

Listed buildings – there are a number of category A, B and C listing buildings within the LEP area:

Category A

- Kisimul Castle

Category B

- Castlebay, Church of Our Lady Star of the Sea
- Castlebay, Church of Our Lady Star of the Sea, Presbytery
- Castlebay, The Square
- Cuier, Manse
- Suidheachan Shell Grit Factory

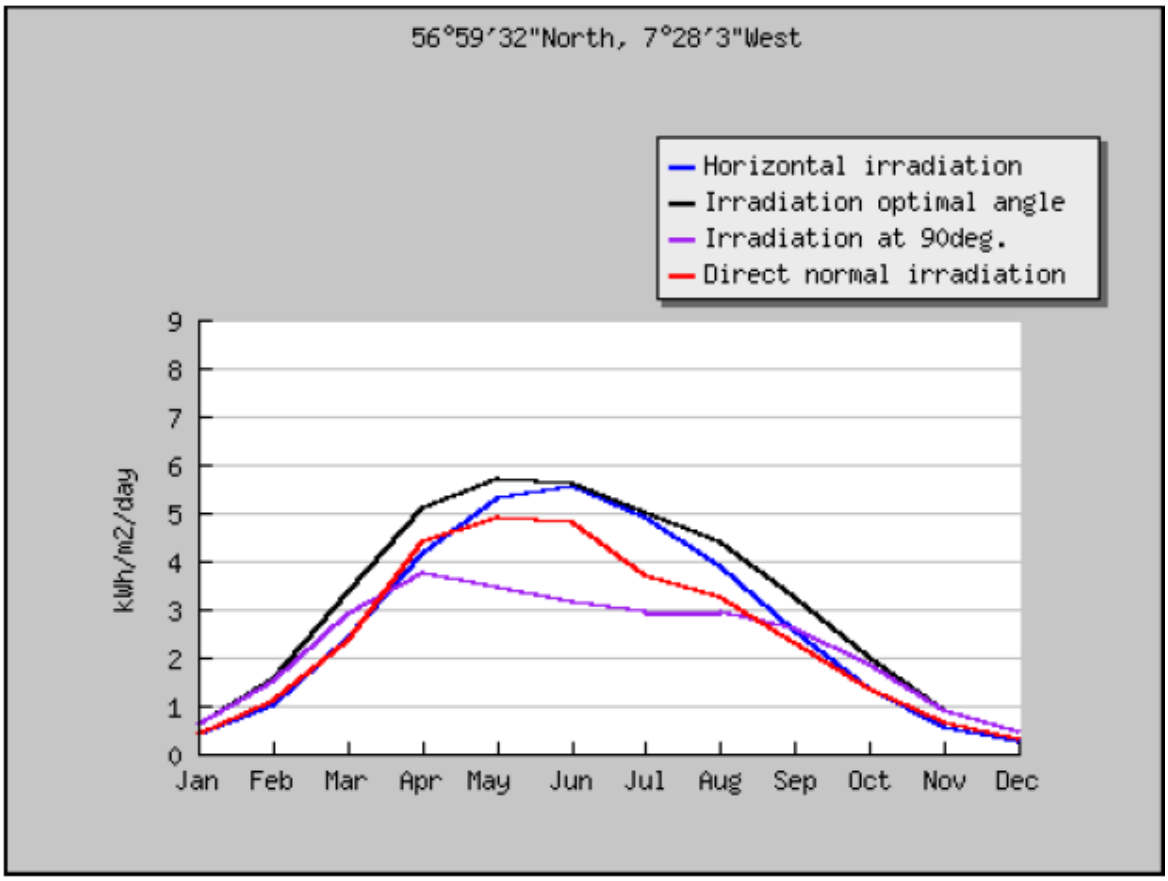
Category C

- 87 Horogh
- Borve, 123 Garriemore
- Castlebay, Bagh A'chaisteil, Schoolhouse
- Castlebay, School and Boundary Wall
- Craigston, St Brendan's R.C. Church
- Cuier, Parish Church and Churchyard
- Vatersay, Annie Jane Monument

A.3.3 Estimated solar resource

Barra can have a solar irradiance of up to 792 W/m^2. The potential annual irradiation for the Barra LEP area is shown below. In terms of available resource, it is a lot lower than other parts of the UK.

Figure A.10 Estimated annual solar irradiation[22]



Due to the lower annual irradiation of Barra solar technology (solar photovoltaic and solar thermal) commercial viability will depend on the purchase cost of equipment. Over the last few years the system costs have dropped dramatically enabling their installation in areas where previously they were prohibitively costly.

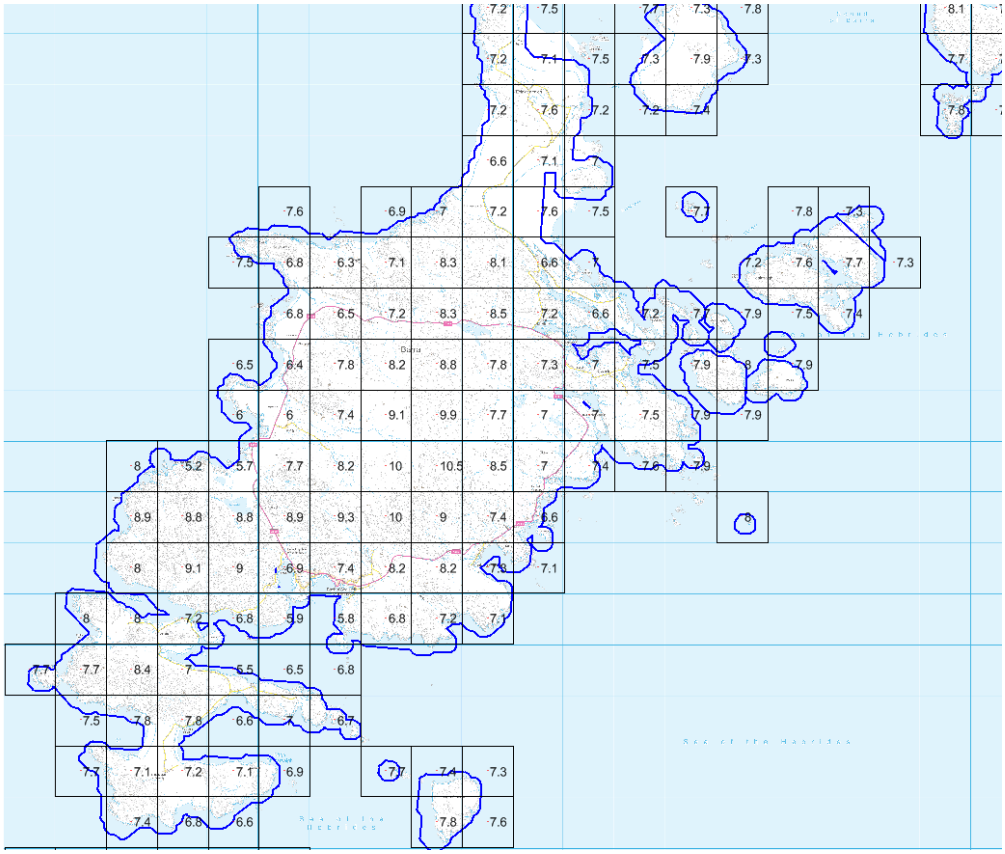
[22] Source: Photovoltaic Geographical Information System, EU Joint Research Council (JRC), http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=europe

A.3.4 Estimated wind resource

The wind resource in the area is very good with an available average wind speed of around 7.5 m/s at
10 m a.g.l.. However, due to a number of constraints the potential opportunities for medium to larger scale wind appear to be limited. Key considerations can be summarised as:

- There could be implications for radar (clutter on radar), and low flying aircraft (collision risk) as they come in to land at Barra airport;
- A number of environmental designations;
- Certain areas have a very good resource due to elevation and unimpeded winds from the Atlantic.

Figure A.11 NOABL[23] Wind Speed at 10 m above ground level



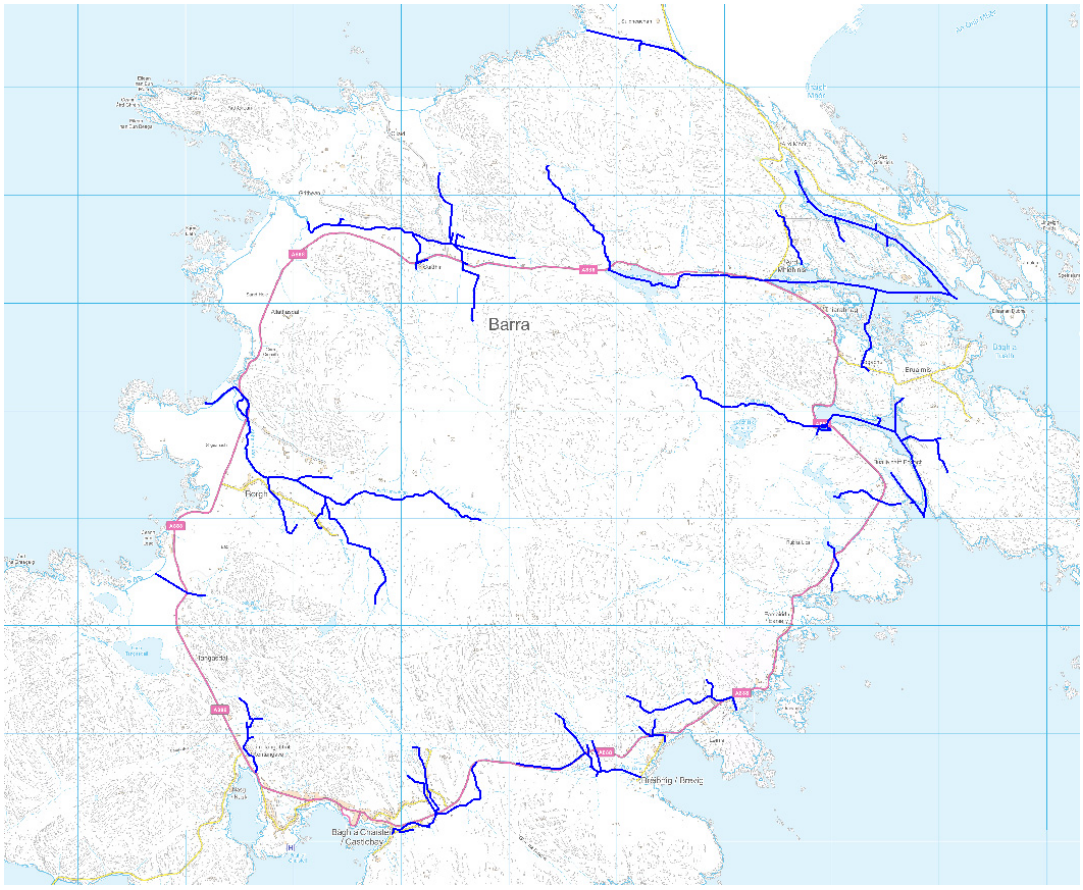
Wind development needs to be consistent with the Supplementary Guidance for Wind Energy Development published by CnES. This is particularly important in the event of developments of two or more turbines with a tip height of 70 m or more.[24]

[23] Source: http://webarchive.nationalarchives.gov.uk/20121217154048/http://www.decc.gov.uk/en/content/cms/meeting_energy/wind/onshore/deploy_data/windsp_databas/windsp_databas.aspx (Accessed April 2018)
[24] https://www.cne-siar.gov.uk/media/3432/map-1-comhairle-spatial-strategy-for-wind-farms.pdf (Accessed April 2018)

A.3.5 Estimated hydro resource

There are a number of watercourses, burns and rivers on Barra and Vatersay, as shown here.

Figure A.12 Watercourses around Barra



A.4 Options Appraisal - Scottish context

Scotland's Energy Strategy was published in December 2017[25]. It provides a route map that outlines the vision that the Scottish Government has of what our future energy systems and needs might look like from now out to 2050.

The overall vision is set out in the introduction to the document:

This vision is guided by three core principles:

A Whole-System Approach – Work to date has focused heavily on the production of electricity using low carbon sources and improvements to the efficiency with which we use our energy. The strategy recognises that these are important areas of action but need to be worked on alongside heat and transport. All of these elements influence each other in the energy systems that we need to create in future.

An Inclusive Energy Transition – Changes to the whole energy system are driven by a need to decarbonise our energy use in line with targets set out within the Climate Change (Scotland) Act. While this will show Scotland's contribution to global action on climate change, this needs to be done in a manner that is fair to everyone. This means ensuring that inequality and poverty are addressed as well as promoting a fair and inclusive jobs market. Greater efficiency in energy use by businesses and householders offers the opportunity to reduce bills (and associated carbon emissions) leading to lower fuel poverty levels and enhanced competitiveness for business. As part of efforts to ensure that benefits from the low carbon energy transition are enjoyed by all, the Scottish Government intends to create a new energy company. This will be publicly owned and run on a not-for-profit basis.

A Smarter Local Energy Model – Local energy economies are at the core of the transformation of Scotland's Energy Systems. Local solutions for local energy needs, linking local generation and use, provide a platform for vibrant local rural and urban communities. Local Heat & Energy Efficiency Strategies (LHEES) will provide prospectus for local area in terms of investment in energy efficiency, district heating and other heat decarbonisation opportunities.

[25] http://www.gov.scot/Resource/0052/00529523.pdf

These in turn are built on six priorities:

Scotland's Energy Priorities

Consumer engagement and protection

We will work hard to protect consumers from excessive or avoidable costs, and promote the benefits of smarter domestic energy applications and systems

Energy efficiency

We will continue to take direct and supporting actions to improve the use and management of energy in Scotland's homes, buildings, industrial processes and manufacturing

System security and flexibility

Scotland should have the capacity, the connections, the flexibility and resilience necessary to maintain secure and reliable supplies of energy to all of our homes and businesses.

Innovative local energy Systems

We will empower our communities by supporting the development of innovative and integrated local energy systems and networks

Renewable and low carbon Solutions

We will continue to champion and explore the potential of Scotland's huge renewable energy resource, and its ability to meet our local and national heat, transport and electricity needs – helping to achieve our ambitious emissions reduction targets

Oil and gas industry strengths

We will support investment, innovation and diversification across our oil and gas sector, working with industry to advance key priorities such as maximising the recovery of remaining resources, subsea engineering, decommissioning and carbon capture and storage

In Scotland at present 51% of the energy we consume is used to heat homes and businesses; around 79% of homes use natural gas as their heating fuel. Transport energy use accounts for another 25%,

predominantly via road vehicles. The final 24% is electricity use. While just over 75% of electricity generation in Scotland came from low/zero carbon sources in 2015, there is work needed in the areas of heat and transport in order to deliver sufficient carbon emissions reduction to meet Scotland's climate change targets.

There is no single vision for the long term changes we will see in the generation, supply and use of electricity, heat and transport systems.

There is potential for greater use of electricity in heating homes and businesses as well as powering electric vehicles. However, this also requires changes to the way in which we manage demand for electricity and the control systems we use to match supply and demand.

In an electricity led world:

- Heat pumps and smart storage heaters are used to heat homes and businesses
- Demand management and smart meters enable an efficient electricity supply network
- Cars and vans are electrically powered and a national network of public charging points operate alongside those in our homes
- HGVs and ferries are operated using hydrogen fuel (or as electric/hydrogen hybrids)
- There is limited use of bioenergy and natural gas by businesses
- UK wide management of electricity transmission networks includes interconnectors with Europe and a smart grid approach is required to manage the demands in distribution

An alternative approach is to use greater amounts of low carbon gas – sources can include biogas (from anaerobic digestion) and hydrogen (potentially produced from electrolysis or via steam methane reforming in combination with carbon capture storage).

In a hydrogen led world:

- Hydrogen boilers and fuel cells replace natural gas and fossil fuel boilers in heating within homes
- Hydrogen fuel and fuel cell technology is used in cars, vans, and larger vehicles. Fuel cells have helped shift freight from road to rail and ferries are also predominantly hydrogen fuelled
- Hydrogen replaces natural gas in commercial use and off grid businesses use heat pumps and district heating systems
- Gas demand is met from a variety of sources; this includes import of natural gas from Europe and globally
- Carbon capture storage is used at large industrial facilities

In reality it is likely that elements of both these scenarios will be implemented depending upon local needs. What these scenarios show is that there will be significant change in the way our energy systems work and extensive investment required to enable these changes.

An important aspect of these changes is the role of local energy solutions, as the increase in low/zero carbon energy generation means more distribution of generation away from traditional large scale power stations. The benefits of local solutions, particularly in areas where access to national infrastructure is limited, can be multiple in terms of consumers and local economies.

Local Heat and Energy Efficiency Strategies (LHEES) will be a mandatory requirement of local authorities. Led by local authorities, working with communities, these will set out long term

priorities (15 – 20 years) within an area in terms of energy efficiency, decarbonisation of heat and district heating opportunities.

Communities will be empowered wherever possible to develop and commission local energy system plans where they are the full or part owners of the final scheme. Local projects will seek, as far as possible, to use existing energy infrastructure before seeking new transmission or distribution requirements. This aims to make best use of available investment and ultimately maintain affordable energy costs for end users.

At the heart of this process is the 'whole system' approach and inclusivity:

- Systems designed and developed in line with local need;
- Active, energy efficient consumers (both residential and non-residential);
- Lower annual energy bills; and
- Opportunities for local supply chains and investment in local businesses.

Support for local energy systems will continue via Scottish Government investment streams such as Community and Renewable Energy Scotland (CARES), the Low Carbon Infrastructure Transition Programme (LCITP) and the Energy Investment Fund (EIF).

Community-owned renewables projects generate income, which communities can reinvest. This has the potential to create jobs, deliver local services and increase population as a result. Increasing the level of shared ownership of energy projects can play a big role in this process.

In summary, the Scottish Government sees local energy solutions as a vital element of the wider transition taking place across Scotland in the way our energy systems operate. Encouraging a greater sense of ownership and control among all communities is seen as beneficial, not only in terms of security of supply but also in realising the wider benefits of sustainable, affordable energy among homes and businesses.

A.5 Options Appraisal - Local context

This section of the LEP provides an overview of the relevant local planning policy and guidance and provides a local level context in terms of any known changes to energy and transport networks.

A.5.1 Outer Hebrides Local Development Plan

The Outer Hebrides Local Development Plan (referred to as 'the Plan') sets out a vision and spatial strategy for the development of land in the Outer Hebrides looking forward over the next two decades. The Plan contains the land use planning policies which the Local Authority will use for determining planning applications. It also contains a number of development proposals for settlements and rural areas.

The Plan was adopted in November 2012 and is kept under review with an update every 5 years. Work is therefore ongoing on Local Development Plan 2 (LDP2)[26]. It is anticipated that this will be in place during late 2018.

Policy areas relevant to the present Local Energy Plan can be summarised as:

[26] https://www.cne-siar.gov.uk/planningservice/localdevplan.asp (Accessed April 2018)

Policy DP3 – Housing

Land for housing needs may be delivered via individual/private sites and those specifically listed in the plan. Requirements are set out in terms of affordable housing units and the density of development appropriate for future development.

There is one site listed in LDP2 on Barra as a potential site for housing development with an area of 0.51 Ha. This is shown here.

Figure A.13 LDP2 Potential allocation for housing development

Policy DP4 Zero and Low Carbon Buildings

All Planning applications for new buildings must demonstrate that the carbon dioxide emissions reduction target as required by Scottish Building Standards has been met with at least 15% of this target being met through the use of low or zero carbon technology.

Policy EI 2 Water and Waste Water

New developments will be required to adopt the principles of Sustainable Drainage Systems (SuDS). The Comhairle will support retrofitting of SuDS and the controlling of surface water through the use of permeable surfaces and green roofs.

Sewerage: - New buildings in settlements with public sewerage systems, and developments of 25 houses or more in unsewered settlements, will be required to connect to the public sewer. Any alternative method must not adversely impact the environment or neighbour amenity.

Private waste water systems should discharge to land.

Water: - New developments in areas with public water supplies will be required to connect to the public water supply. In situations where there is no, or an inadequate, public water supply the details including the sufficiency and wholesomeness of the private water supply will require to be demonstrated.

Policy EI 8 Energy and Heat Resources

The Comhairle will support proposals that contribute to meeting the targets and objectives of the National Planning Framework 3, the Climate Change Act, and the National Renewables Infrastructure Plan in relation to electricity grid reinforcement, infrastructure and renewable energy generation.

Development proposals for all scales of onshore wind energy development will be assessed against the Supplementary Guidance for Wind Energy Development. The Comhairle supports the principle of wind farm development in *Areas with Potential for Wind Farms* subject to a satisfactory assessment against other policies in this plan and the Supplementary Guidance. Many of these areas, particularly in the Uists, will however be constrained by MoD radar. The Supplementary Guidance will give further details of the radar constraints. The Comhairle will also consider wind farm development in *Areas of Constraint, with potential in certain circumstances* subject to a satisfactory assessment against other policies in this plan and the Supplementary Guidance. The Comhairle will not support wind farm developments in *Areas Unacceptable for Wind Farms*.

Proposals for all other renewable energy projects and oil and gas operations (including land based infrastructure associated with offshore projects) will be required to demonstrate all the following:

a) appropriate location, siting and design including the technical rationale for the choice of site;
b) no significant adverse impact (including cumulative) on: landscape, townscape and visual aspects; natural, built and cultural heritage resources; the water environment; peatlands; aviation, defence and telecommunications transmitting and receiving systems, e.g., broadband; public health and safety, and amenity (including noise); neighbouring land uses, transport management and core paths;
c) appropriate decommissioning and site reinstatement arrangements;
d) phasing arrangements, where appropriate;
e) the contribution towards meeting national energy supply targets and local economic impact.

Micro generation renewable energy developments, not subject to the Supplementary Guidance for Wind Energy Development, will be required to meet criteria a) to c) above and all the following criteria:

f) the proposal does not have a significant adverse direct, indirect or cumulative impact on residential amenity; and
g) colour, form, finish and height are appropriate to the setting and are designed to minimise visual impact and distraction; and
h) sufficient information is provided to enable a balanced assessment of any other likely effects of the development.

The type, scale and size of the proposed development will have a significant effect on the way the Comhairle will consider an application and the level of accompanying information that will be required. Conditions and, where necessary, a planning agreement may be used to control the detail of the development. Non-permanent elements of a development will be granted permission consistent with their lifespan and/or projected period of use.
In line with the Zero Waste Plan the Comhairle will support 'energy from waste' developments subject to wider Plan policies. Opportunities to co-locate or connect with district heating schemes or heat producers should be investigated.

Policy EI 9 Transport Infrastructure

The priority areas for the upgrading and development of the transport infrastructure within, and serving the Outer Hebrides, are:

a) the spinal and inter island routes;
b) the airports at Barra, Balivanich and Stornoway;
c) ports and harbours, including ferry facilities for mainland and inter island connections.

Development proposals associated with new or improved transport infrastructure and traffic management measures will be required to meet all of the following:

1. fit with the character of the area in relation to the Development Strategy and the immediate surrounding area and include a landscaping plan;
2. utilise a sustainable drainage system (SuDS) to deal with surface water;
3. accommodate pedestrians (within settlements) and cyclists, and secure improved road safety related to the proposal, in particular around schools, community or leisure facilities.

The Comhairle will support the provision of electric car charging points in new development (subject to appropriate design and layout).

Note in the LDP2 is made of environmental enhancements to be made within the Castlebay area, primarily relating to improvements to the harbour and pier infrastructure and refurbishment of the public areas within Main Street and surrounding area.

Policy EI 10 Communications Infrastructure

The Comhairle recognises the importance of digital connectivity for social, economic and civil resilience and is supportive of the infrastructure roll out plans of digital communications operators, community groups and other organisations. Opportunities for the provision of digital infrastructure to new homes and business premises should be explored as an integral part of development. This should be done in consultation with service providers so that appropriate, universal and future-proofed infrastructure is installed and utilised.

Proposals for new mast sites should be supported by:
a) an explanation of how the proposed equipment fits into the wider network; and
b) a statement on alternative options considered including justification that mast sharing has been explored and the reasons why it is not suitable or possible; and
c) details of the design, including height, materials and other components of the proposal.

In addition, an assessment of visual impact may be required for proposals close to housing, sited in sensitive landscapes or a National Scenic Area or where they may impact upon the setting of a Listed Building or Scheduled Ancient Monument or where this information is considered necessary to inform an assessment of the proposal.
The removal of redundant masts and equipment and restoration of the site will be a condition of planning consent.

A.5.2 Outer Hebrides Community Planning Partnership

This partnership includes all major public agencies working in the Outer Hebrides. It originally operated within a Single Outcome Agreement (SOA) that sets out a long term vision for the Outer Hebrides and some priorities to be addressed via Locality Planning[27]. This included specific initiatives and committed funding as well as key agencies involved in their delivery.

A more localised approach, aimed at empowering communities, has led to the development of a Local Outcomes Improvement Plan (LOIP), which is presently in draft[28]. It sets out priorities for the period 2017 – 2027 and replaces the original SOA.

The stated overall vision for the Plan is:

Our vision is to promote and realise the full potential of the Outer Hebrides as a prosperous, well-educated and healthy community enjoying a good quality of life, fully realising the benefits of our natural environment and cultural values

The priorities for the OHCPP over the next 10-20 years are set out under three main themes:

1. The Outer Hebrides retains and attracts people to ensure a sustainable population

To facilitate this, the OHCPP will focus on the following areas

a) There is housing across the islands which meets the needs of all of our people and is affordable to them to heat and maintain over the life of their home.
b) The Outer Hebrides is known as and promoted as an attractive place to visit, live, learn, work and invest and has a recognisable brand with strong, positive and consistent promotion.
c) Our young people are knowledgeable about the opportunities of remaining on the islands to live, work and learn
d) Our islands are connected with high quality, affordable and reliable broadband, mobile networks and transport connections

2. The Outer Hebrides has sustainable economic growth and all our people have access to appropriate employment opportunities

To facilitate this, the OHCPP will focus on the following areas

a) The Outer Hebrides is an area of innovation and investment which secures a sustainable and vibrant job market with well-paid opportunities.
b) A skilled workforce for the future that provides opportunities for all our people in the islands
c) Support the expansion of access to childcare to enable parents to access employment, training and education
d) A vibrant and innovative SME sector which plays a key role in creating sustainable employment and economic growth in the Outer Hebrides

3. The islands offer attractive opportunities that improves the quality of life, wellbeing and health for all our people

[27] http://ohcpp.org.uk/index.php?option=com_content&view=article&id=121&Itemid=175 (Accessed April 2018)
[28] http://ohcpp.org.uk/index.php?option=com_docman&task=cat_view&gid=168&Itemid=237 (Accessed April 2018)

To facilitate this, the OHCPP will focus on the following areas

a) All children and young people have the opportunities to access to play and recreational activities, and facilities within their communities.
b) The Outer Hebrides provides a quality natural space where our people can experience, enjoy and value opportunities for sport, leisure and recreational activities
c) Address factors contributing to social isolation.
d) Communities will have access to a range of innovative transport solutions which reduce isolation and increase access to services.

The priority areas relating to affordable housing (both in terms of supply and in the capacity to heat homes effectively) and access to innovative transport solutions are immediately relevant to the LEP.

A.5.3 Outer Hebrides Fuel Poverty Strategy (2015 – 2025)

The vision of this strategy is that, by 2025, fuel poverty levels in the Outer Hebrides will have reduced in line with the Scottish average. This will be achieved through a range of actions aimed at:

- Improving the Energy Efficiency of Housing Stock
- Increasing the Income of the Poorest Households
- Reducing the Cost of Fuel

CnES recognise that the issue of fuel poverty is a triangular one, and there are particular issues to address within the Outer Hebrides:

Poor Energy Efficiency - Many island homes are large, inefficient buildings with 40% of homes built before 1950. 23% of homes are of solid wall construction, extremely difficult to treat with energy efficiency measures, and a further 20% are of mixed construction, for example a solid wall home with cavity wall extension.

High Fuel Costs and Usage - Fuel costs in the islands are significantly higher than on the mainland. 66% of island householders spend over £1,500 on fuel per annum with 42% spending more than £2,000 per annum. The type of fuel used seems to make little difference to these statistics. 77% of those who use electricity for heat are in Fuel Poverty, 69% of those who use heating oil and 85% of those on pre-payment meters.

Low Incomes - The Outer Hebrides have the second lowest incomes of all Local Authority areas in Scotland with 35% of households receiving income in the range £7,501 to £16,000. 94% of households in the lower bracket, £0 to £7,500, are in Fuel Poverty.

Tackling these issues means CnES working with multiple other agencies:

- Tighean Innse Gall (TIG), the local housing agency for the Outer Hebrides
- The Energy Advisory Service (TEAS) which provides an energy advice service to the local community, along with training and awareness raising
- Home Energy Scotland (HES)
- Hebridean Housing Partnership (HHP), the Registered Social Landlord for the Outer Hebrides
- Outer Hebrides Energy Efficiency and Advisory Forum
- The Scottish Government
- Highlands & Islands Enterprise (HIE)

The associated Action Plan has three themes as summarised here.

Table A.7 Outer Hebrides Fuel Poverty Strategy Action Plan

Theme	Area	Actions
Improve the energy efficiency of housing stock	Energy Efficiency	• Delivery of Home Energy Efficiency Programme Scotland (HEEPS) Area-Based Scheme. • Review impact of energy efficiency programmes and quantify future investment requirements and priorities. • Increase deployment and uptake of energy efficiency solutions which are packaged and costed and categorised as simple/moderate/challenging. • Seek to influence the scope and implementation of Green Deal. • Monitor effectiveness of Scottish Government's HEEPS Energy Assistance Package at delivering in rural & island areas and lobby for an increase in future resources. • Examine scope for establishing Council Tax rebate scheme. • Support provision of energy information and advice through local advisory services, with particular focus on vulnerable households and families living in poverty. • Approach Scottish Government, UK government and OFGEM with solutions for tackling Fuel Poverty. • Ensure policy direction through the Local Housing Strategy. • Delivery of Hebridean Housing Partnership's Investment Programme.
Increase the income of the poorest households	Income maximisation	• Deliver OHCPP Economic Regeneration Strategy 2013-2020. • Increase employment levels in the Outer Hebrides. • Increase average incomes in the Outer Hebrides. • Deliver a range of benefit maximisation initiatives. • Ensure joined-up and comprehensive access to crisis support. • Undertake actions to address levels of debt in the Outer Hebrides. • Support local Energy advice agencies to offer advice to Priority Assistance clients to improve income and manage debt.
Reduce the cost of fuel	Energy costs and self-sufficiency	• Explore local opportunities for SMART metering and demand-side management initiatives. • Support micro-generation for domestic and non-domestic customers. • Investigate feasibility of District Heat scheme/s. • Highlight inequality in electricity costs in the Outer Hebrides and seek to address this. • Pursue creation of a community tariff for the Outer Hebrides • Pursue local electricity supply opportunities through creation of Outer Hebrides Energy Supply Company. • Support lobbying and campaigning in respect of respect of oil-related fuel and delivery costs

A.5.4 Sustainable Energy Action Plan

This Action Plan was created by CnES in 2011 and includes the following vision for the Outer Hebrides:

'…with appropriate support we believe that the Outer Hebrides in the year 2020 will be characterised by:

a diverse and growing population with a balanced demographic structure allowing young people to move freely as lifestyles change and allowing effective public services;

a dynamic renewable energy sector of international renown providing the base for new forms of economic activity;

a high quality environment, which maintains bio-diversity;

a private sector that is a high-level economic contributor;

a tourism industry which has developed the Outer Hebrides as a world-class destination;

a confident community, utilising new forms of land and sea ownership;

communities which are globally connected through a high quality transport infrastructure and leading-edge communications systems;

Stornoway has grown significantly and has been developed as a world-class entry-point to the Outer Hebrides;

UHI Millennium Institute provides a university campus, a network of learning centres and numerous students who are part of the community; and,

a diverse range of quality, modern, social and leisure facilities, with a high value placed on Gaelic culture and heritage.'

The SEAP included a range of actions to support the Outer Hebrides to reduce carbon emissions. These were based around Renewable Energy, Energy Efficiency, Transport and Behavioural Change. Given the changing landscape since 2011 a review and prioritisation of actions was taken in 2016. The set of actions presently being reported on are:

1) Energy Generation and Storage: Support the development of 50 MW community owned renewable generation throughout the Hebrides
2) Energy Generation and Storage: Develop energy storage demonstration project
3) Identification and installation of appropriate EE measures for OH domestic properties (private and social housing sector)
4) Energy efficiency information and advice leading to demand reduction and behavioural change in public sector, community and third sector organisations
5) Energy Efficiency: Promote use of LED and low energy lighting across all sectors
6) Energy Efficiency: Promote deployment of smart meters in the Outer Hebrides
7) Reduce business mileage and the impact of unavoidable business mileage by developing and implementing low carbon business travel policies
8) Promote Battery Electric Vehicle ownership and car clubs in the community
9) Encourage public and private sector to invest in BEV e-car pool cars
10) Support roll-out of electric vehicle charging infrastructure
11) Install speed-limiters on public sector vehicle fleets
12) Explore use of Hydrogen Fuel Cells in public transport

A.6 Community commentary on areas of action

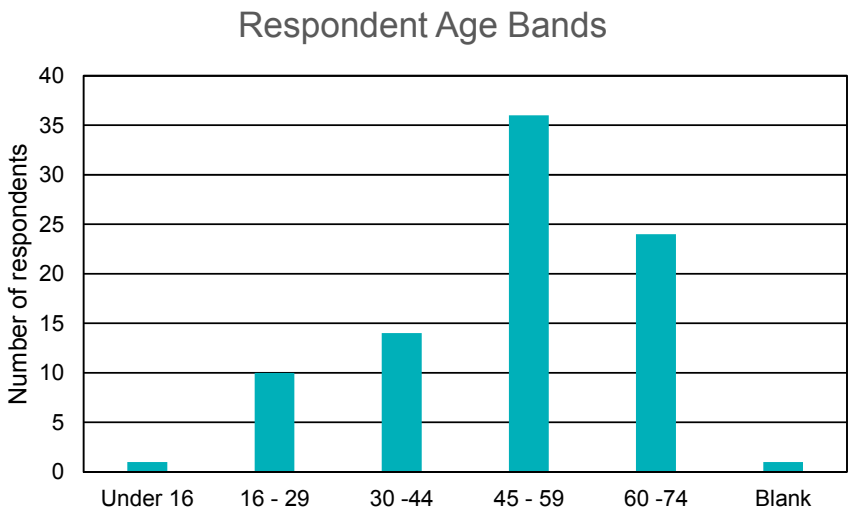
At the heart of the development of the LEP are the views of the community of Barra and Vatersay. Initial public meetings in Northbay and Castlebay, in combination with display noticeboards in the Buth Bharraidh shop in Castlebay and an online survey were used as a means of gauging views regarding priorities and objectives to be addressed in the LEP. It also offered a chance for specific projects and opportunities to be raised for further consideration.

The survey was split into three main sections and a summary of responses is provided here.

Overview of respondents

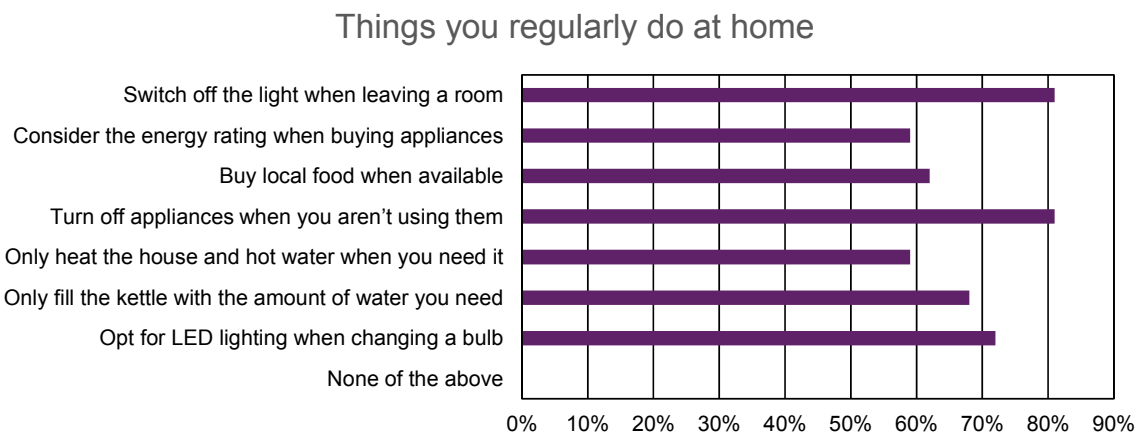
A total of 88 respondents answered the online questionnaire, with 74 providing full responses.

Location	Number of respondents
Castlebay	27
Northbay	11
East side	15
West side	13
Eoligarry	9
Vatersay	4
Other	7



Energy related action already taken at home

Respondents were asked to select those behaviours that they currently undertake at home.



Respondents were also asked what challenges they face in following these practices. The main themes were:

- Behaviour and habit – 10 responses
- Cost 9 responses
- No challenges – 8 responses
- Restriction by existing system or energy requirements – 6 responses
- Availability of alternative goods/appliances – 5 responses
- Restricted local food availability – 4 responses

The full list of responses is summarised here.

Theme	Number of Responses
Behaviour and habit	10
Living with others who don't carry out the same practices.	Family Home with three children.
Trying to remember when in a hurry	Children
Working shift patterns means no set routine.	Changing habits
Breaking bad habits	only getting the kids to switch off lights but i guess that is normal
Time	I am not the only person in the house! Appliances with clocks are a pain to turn off due to the reset/flashing light.
Cost	9
Expense	Additional cost of local produce. Retention of heat in house and hot water being hot when needed.
With the on cost of electric to the isles learn I am more cost efficient	mainly increased cost of purchase of appliances and bulbs
Money	COST
Cost of oil for heating and cost of led bulbs	Cost

Theme	Number of Responses
Cost	
No challenges	8
None, at most remembering to switch things off	None
none	None Really
None find it easy enough	none
no challenge easy common sense actions	I'm not sure that I do face challenges carrying out these actions.
Restriction by existing system or energy requirements	6
Old fashioned light fittings that only take old fashioned bulbs (e.g, lights with dimmers)	Getting bright enough light bulbs
Being able to save money. Heating the house in such a cold climate	We are a daycare centre for the elderly and need heating on however all lights and appliances are off
House is a 100 year old stone cottage. Very difficult and expensive to heat and therefore cools down quick when turning off heaters etc. Running as a B and B involves problems with having to leave lights, heating on, etc. Power cuts and bad weather causing lack of electricity and shortage of food brought in to the island.	each LED light have a reduced lighting area than traditional bulbs
Availability of alternative goods/appliances	5
Not a lot of choice when buying appliances: 2nd hand ones usually bad energy rating	Availability of efficient bulbs etc on the island
Sourcing light bulbs of appropriate wattage. Central heating system requires water and heating to be on together.	Availability.
Availability of appliances and LED lighting prices	
Restricted local food availability	4
The availability of local food is not great.	lack of local food
trying to get good produce	Lack of choice when buying food.

Main motivation to review energy use in the home

What would be your main motivation to review your energy use in the home? Please rank in order of importance (1 being the most important)	1	2	3	4	5	Weighted Average
Lower electricity and heating bills	41	14	2	3	3	1.62
A warmer home	13	28	8	6	5	2.37
Being more environmentally-friendly	13	14	31	1	3	2.47
Supporting local food producers	4	2	14	29	10	3.66
Less miles travelled for food deliveries	1	5	9	17	28	4.10
Other (please specify)					Warmer home - n/a Being more efficient (second most important) Electricity from renewables	**Note: Lower score means higher level of support**

Which home energy projects would you like included in your Local Energy Plan?

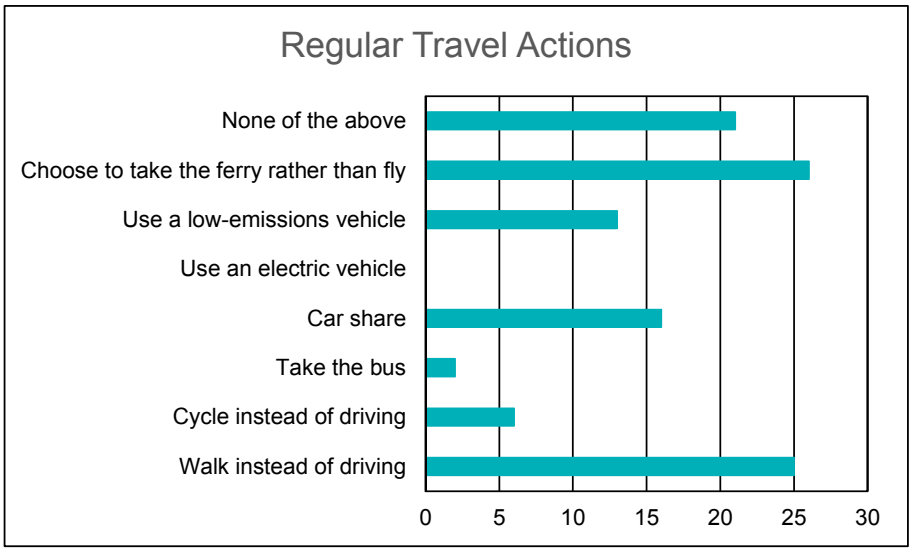
The Local Energy Plan will recommend projects to take forward in Barra & Vatersay. Which home energy projects would you like included in your Local Energy Plan? Please pick 3 and rank them in order of importance (1 being the most important)	1	2	3	Weighted average
A home insulation and draught-proofing project	8	10	17	2.26
A support and advice service helping you to reduce energy	3	2	6	2.27
An LED light bulb replacement scheme in Barra & Vatersay	3	7	11	2.38
Home heating upgrade project (e.g. replacing old boilers, new control system)	15	14	17	2.04
A lower energy tariff for residents (pay less for the energy you use)	38	19	8	1.54
A local food produce growing and selling scheme	5	17	5	2.00

Note: Lower weighted average score means higher level of support

Other

- No preference for 3rd choice
- Whole community initiative: Another 2 turbines for community consumption via hydrogen generation etc.
- Replacing outdated light fittings to use LED
- LED Lightbulb scheme should include fittings. We were visited by an insulation government representative (free scheme). He said he didn't do wooden buildings
- Home energy upgrade that doesn't require people to be on Benefits to qualify
- project to encourage householders to move from oil / solid fuel to electricity to increase local demand and justify further renewable generation. Also scheme to trial an autonomous bus service on the island, bringing sustainable mobility to all.
- Locally produced energy, for example from biodigesters for sewage.

Please tick all of the actions you regularly take when travelling to, from or around Barra & Vatersay



What challenges do you face in trying to carry out these actions?

Challenge	Number of responses
Inconvenient/unreliable bus timetabling	20
Weather	17
Travel distance	7
Lack of safe cycle routes	6
Time / timetabling constraints	6
Reliability of ferry	5
Cost of EV	5
Lack of footpaths	4
Limited ferry crossing	3
Cost of bus	3
Health factors	2
Cost of ferry/air	2
Restricted flight availability	1
None	6

The full list of responses is provided here.

Disability, infrequency of buses, no neighbours to car-share (so out at different times)	Poor bus service is shortsighted: They reduce it as they say the numbers are poor but it is a self fullfilling problem in that council creates a situation where cars are essential. Bad for poor/elderly/students	Poor bus times, expense of buying a new car, time taken to use ferry, expense of ferry and train ticket versus cheap flight, ferry unreliable (less reliable than flight)
Weather and limited ferries. No footpaths	Very poor bus service. No cycle paths	Limited choice of ferry crossing. Weather, no footpath
Bus: not regular enough to suit day-to-day	Choice. Lack of safe walking routes	Ferry cancellations. Severe weather. 16 miles to get supplies
Bus service times not always suitable. Flying more reliable than ferry. State of roads deter cycling.	Weather. Depending on urgency of travel dictates choice	Weather
Weather, distance and hills preclude cycling and walking to work most of the year. Electric vehicles are too expensive still. Bus service is all but non-existent. Will always take the plane over the ferry - 50mins to Glasgow rather than a 5hr ferry journey and a 3 hr car journey - I'm not sure the plane is much worse for the environment.	Would like to walk or cycle more but there isn't suitable paths on the road side. Too scared of cars when standing on the side of road	Time scales and arthritis in walking, , and also ferry takes at least 5 hours
Weather	Weather	ferry disruptions
Bus times and frequency not suitably is	none	weather conditions, timetable of buses doesnt fit in with working hours.
Lack of time	Bus times aren't always convenient	bus timetables not suitable
N/A	None	None
Weather	Time-poor	Would like an electric car but far too expensive. Bus timetables not convenient
Lack of availability	Weather	Time cost. Financial cost and availability of bus. Cost barrier for e-vehicles
all service users use adapted bus to access service and staff need cars to carry out caring duties	Would cycle more however the kerbs are too high and dangerous	Poor public transport. Poor roads for walking and cycling, climate not suitable.
weather, distance, infrequent bus timetables & limited routes	Air travel only when seat available which is very rare	Children ??
I would like to walk more but distance makes that problematic. Taking the bus is not an option as there is rarely a bus. I regularly take the ferry but this is not a choice over the plane but so that I have a car to use while on the mainland.	Wind rain cold, distance. Cant afford an electric car. buses only really work for the with regular hours or retired people- very poor service and not cheap for minimum wage workers coming from north of the island.	Appalling public transport service. It doesn't work!!!!!
Nil	distance from Castlebay and need the to use car for work	Timetable and onward connection issues
Weather, lack of cycle provision	Weather	Cost
Cost is a major consideration with regard to electric vehicles and low emissions vehicles. Taking buses is often impractical, for example in getting to and from work due to restricted timetable and routes. walking and cycling are fine when the weather suits but impractical over long distances or in anything but summer weather.		

What would be your main motivation to reduce your energy use in regard to travel?

What would be your main motivation to reduce your energy use in regard to travel? Please rank in order of importance (1 being the most important)	1	2	3	4	Weighted average
Lower travel costs	36	8	12	7	1.84
Being environmentally-friendly	17	26	17	3	2.10
Healthier lifestyle	17	18	16	10	2.31
Less reliance on imported petrol/diesel	9	15	13	24	2.85
Other (please specify)	Making the island fossil free				

Note: Lower weighted average score means higher level of support

Which travel projects would you like included in your Local Energy Plan?

The Local Energy Plan will propose travel projects to take forward in Barra & Vatersay. Which travel projects would you like included in your Local Energy Plan? Please pick 3 and rank them in order of importance (1 being the most important)	1	2	3	Weighted average
Car clubs/shared vehicles	3	2	3	2.00
Support to individuals to own electric vehicles	21	4	10	1.69
Low emissions ferries (e.g. electric or hydrogen powered ferries)	8	19	5	1.91
Electric bikes	1	7	8	2.44
Community minibus	17	8	7	1.69
Low emissions buses (e.g. electric or hydrogen powered buses)	4	12	12	2.29
Walking and cycling paths	15	13	11	1.90

Note: Lower weighted average score means higher level of support

Other

- One evening bus service to take a circuit of the island, meeting the ferry and picking up people having a meal or drink out who could get their vehicle back the next day.
- An evening bus to meeting the Oban boat and circle the island (could be used for transport from pub/meal).
- Save on car hire?
- Pavements would be a help
- Should repair roads before building cycle/walking paths. Improved road surface reduces energy and car maintenance costs.
- Walking and cycling paths are a must
- There is no paths outside castlebay
- better paths in barra would make all the difference, there is nothing outside of castlebay which makes it a nightmare for bikes prams etc
- trial Ericsson or other autonomous bus on the island. Also look at integrating all the bus services- public service bus, school buses, Barratlantic bus, Bus Bharraigh
- I am not sure how relevant low emissions buses would be - more important to actually have buses. Also car clubs would suggest you have enough people going the same places at the same time. I do wonder how much these questions are actually gee red to the situation in Barra and Vatersay.
- Bus service of decent use to residents and visitors
- Better public transport services - ie more frequent and/or flexible.

What benefits would you most like to see come from whole-island energy projects in Barra & Vatersay?

What benefits would you most like to see come from whole-island energy projects in Barra & Vatersay? Please rank in order of importance (1 being the most important)	1	2	3	4	Weighted average
Lower fuel poverty	40	10	9	5	1.67
Making Barra & Vatersay more environmentally friendly	13	19	7	20	2.58
More local jobs	16	18	21	8	2.33
More sustainable local businesses through lower fuel and electricity costs	10	20	21	13	2.58

Note: Lower weighted average score means higher level of support

Other

- Education and awareness

Which whole-island energy projects would you like included in your Local Energy Plan?

The Local Energy Plan will propose projects to take forward in Barra & Vatersay as a whole. Which whole-island energy projects would you like included in your Local Energy Plan? Please pick 3 and rank them in order of importance (1 being the most important)	1	2	3	Weighted average
District heating (e.g. shared heating for groups of houses/businesses)	5	12	10	2.19
Bulk purchase of fuel	6	8	4	1.89
Installation of renewable energy to supply homes and businesses	36	10	6	1.42
Large renewable projects	10	16	15	2.12
Energy storage (e.g. batteries)	1	5	7	2.46
Support for more local food production	5	6	10	2.24
Solar lighting for walkways and populated areas	4	8	11	2.30

Note: Lower weighted average score means higher level of support

Other

- But keep lighting to a minimum, there is already too much.
- We don't want any street lights
- Petrol price reduction. We don't want streetlights.
- Making empty unused buildings available for new businesses
- Getting the whole community interested/in agreement
- encouraging businesses and households to move all=electric using local renewables at a reduced tariff
- Energy storage by manufacturing hydrogen from surplus wind generated power.

What challenges do you think Barra & Vatersay may face in carrying out any of the suggestions above?

Theme	Number of responses
Access to Funding	21
Apathy or lack of community support for change	11
Lack of support from Local Authority and/or Scottish Government	8
Transport of assets and materials	5
Ability to develop cycle or foot paths	3
Size and nature of community	3
Planning and related consents	3
Other	3
Weather, time for crop growth	2
Remote location	2
Maintenance costs of new infrastructure	1
Land ownership	1

A full list of responses is provided here.

Funding	Money for infrastructure	Finance
Funding, local capacity to make it happen. Re cyclepath: dealing with roads/bridges/ditches/crofts = barriers, but MOST worthwhile project.	Initial costs may be high with transportation of goods but the longer term objective will outweigh theses initial investments. Introduction of simpler actions such as LED lighting can have an immediate impact, change the mindset of individuals and reduce the carbon printout on the Island whilst working to the longer term objectives.	Funding for the projects, tariffs on energy production, time invested for food production, poor care of livestock feeding them to eat plants/veg (sheep not kept fenced in)
Getting grants/subsidies/ANY funds from the Government	Remote locality. Population with low incomes	Apathy in general - need a lot of voices to gain/maintain attention
Maintenance costs	Money	Planning and construction costs, delays etc.
Short sightedness and lack of aspirations from the council and organisations	Getting the finance	Lack of footpaths, property landowners, financial costs
Weather	Local businesses reluctant to allow community growth.	Getting the authorities to realise Barra's potential
As small community receiving funding	Funding	Finding the funding
Competing with prices for cheap imported food	The road system does not lend itself to walkways or cycle paths	no challenges, if they arise barra will overcome them
Price, logistics, local politics.	Changes will take time - need to maintain momentum	Obtaining the necessary funding to proceed with these projects
Transporting materials	CnES	Funding
the first and possibly greatest challenge will be getting a high level of public engagement and commitment to any plan. After that there will be significant cost and	Rural environment, poorly insulated homes, cost of transporting fuels and services. Lack of scope to expand through low population.	Systems approach needed - district heating and renewable energy for homes/business would require more renewables which would require storage.

technological challenges. Finally there are likely to be significant challenges arising from consenting the projects and resistance form vested interests.		
Financial	some local businesses have a monopoly & will object to a change in the status quo.	Ofgem for local pricing and Westminster government for FITs
Changing opinions	Barra and Vatersay have a small population living in geographically disparate areas.	Infrastructure and willingness of community to take forward
It takes years for anything to happen. All talk no action!!!!!!	Council ignorance and apathy.	Gaining full support of the community, together with local authority and central government
Funding	Money	Money

Any further comments?

- Need to work with local development company (CBaB)
- Barra and Vatersay would be a brilliant place for an electric car trial - e.g. a subsidised rental scheme for islanders for several years that would give feedback to electric vehicle companies.
- Some work has already been carried out regarding local food production, I think that a concentrated effort could encourage a change in habits.
- To include the possibility of retro fitment of a hydro turbine in Vatersay causeway for the production of electricity with the added benefit of reducing the silting up of Castlebay by reintroducing a through flow of current from the tide
- A key challenge will be in identifying the right people to drive change. Need to build community trust.
- Energy is the big question of our time, but we should now be focussing not just on renewable energy production but also value added projects. This could be offering free energy to new businesses, or reduced tariffs for households.
- There is huge potential here, from biodigesters to the production of hydrogen using surplus energy. Any plan needs to have joined up thinking and should also include tidal and oceanic swell energy production.
- I would very much like the local energy plan tackle in a meaningful way the challenges that islanders face, such as fuel poverty. It will take bold decisions in the face of opposition. I hope that the island will benefit all islanders and not just a few families.

A.7 High level technology review

There a number of technologies that could be considered for use within the Barra and Vatersay area. The following section provides a brief overview of the major technologies that could be considered and some details regarding how they work and an overall suitability rating in the context of energy needs in Barra and Vatersay.

A simple Red/Amber/Green qualitative scoring system is used. Red means that the technology is not well suited to Barra and Vatersay's needs; Green means that it is well suited to Barra and Vatersay's needs.

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
Gas Fired Combined Heat and Power	A gas fired gas turbine (engine) where electricity is generated and heat is recovered for use from engine cooling systems and exhaust.	Output is available at all times.	CHP and other LZC technologies have to complement rather than clash.	Not eligible for RHI or FiT Unlikely to attract grant Good quality CHP can lead to reduction in Climate Change Levy paid on gas via CHPQA scheme.	Low risk – Gas Fired CHP is a mature technology, well understood and reliable when maintained.	No mains gas supply, and no other local sources of gas (e.g. landfill gas) nearby so not a viable option. Many providers of technology mean that it is competitively priced. Maintenance contracts are typically carried out under contract by the supplier.	Expect ROI to range from 5-8%.	**LOW**
Wind	The wind blows and rotates the blades of the wind turbine which then transforms the kinetic power of the wind into electricity.	Wind is an intermittent source of energy and output can vary from full rated output of the turbines to zero.	A wind turbine can be coupled with other systems (which are not wind dependent) to cover the user needs e.g. solar PV or energy storage.	Unlikely to receive any grant funding or incentives via FiT or CFD	Mature renewable energy system. Large scale turbines are constrained by grid capacity and other local planning considerations. Smaller domestic	Well established technology with range of turbines to suit client requirements. Many providers of technology mean that it is competitively priced.	Average project cost for a turbine ranges between £1,000 to £6,000 per kW installed depending on the scale. ROI can range from 5% to 10% depending on funding mechanisms.	**HIGH**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
					scale turbines viable; some potential for medium scale if grid capacity solution is found.	Maintenance contracts are typically carried out under contract by the manufacturer.		
Solar PV	Solar Photovoltaic (PV) technology works on the principle that energy from the sun is converted to electricity.	Hours of daylight only without storage with reduced output over winter	Building specific or would need to be considered part of overall baseload of electricity supply technologies to avoid grid export and increase ROI.	Feed in Tariff available at a rate per kWh produced depending on the size of the installation (up to 5 MW). Note that this will not be available from April 2019.	Solar PV technology is well established and therefore low risk. Relatively low solar resource in comparison to other regions of UK	Supply chain and after sales are well established with competitive market space.	Typical cost is £1,000 per installed kWp. Typical ROI is less than 8% with simple paybacks over ten years.	**MEDIUM**
Solar Thermal	Solar thermal systems absorb and use the sun radiation to heat up water or other mediums. This thermal energy can then be used to provide hot water, contribute to the heating (solar heating) or cooling (solar cooling) of a building.	Output is available during the hours of daylight only although it can be stored. Typically best installed at close to the point of use.	Typically installed to operate in conjunction with a conventional boiler or electric heater. Can also be combined with other renewable energy systems. i.e.	It is possible that solar thermal will be removed from list of technologies that qualify for RHI support. Unlikely to attract any grant funding.	Mature technology and considered as relatively low risk. Relatively low solar resource so would need higher input from supporting heat source to ensure	There are many providers of technology which means that it is competitively priced. Maintenance contracts can be placed with either equipment suppliers or	A 100 m^2 system would cost around £70,000 and would save around £1,000 per annum without RHI. It cannot be considered an attractive investment with an ROI of less than 2%. RHI is available for systems below 200 kWth and	**LOW**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
			Heat pumps for COP improvement.		sufficient hot water	specialist contractors.	this would improve ROI to 6% to 8%.	
Fuel Cells	A fuel cell is a device that converts the chemical energy from a fuel into electricity due to a chemical reaction (no combustion).	Available at all times as long as there is fuel. A significant potential issue is that the nature of the process means that there would be little use for the lower grade heat that is available from a fuel cell installation.	Potential to be combined with CHP systems and other renewable technologies. Potential key role in enabling use of hydrogen as source of electricity production and in operating ULEV vehicles.	Large fuel cells do not currently attract FiT or RHI. It is possible that the innovative use of the technology could attract grant funding.	Technology does not have extensive track record in the UK and would carry a medium to high risk. Most likely to be used in transport rather than as a stationary source of heat and power.	Emerging technology and aftersales support would be subject to a maintenance contract with the supplier.	The technology has significantly higher costs per kW than conventional CHP and would have an ROI of ~ 8% (less if lower grade heat cannot be recovered).	**MEDIUM**
Energy from Waste – Gasifier or Anaerobic Digestion	Energy from waste systems convert the fuel source into useable energy. This can include electricity, heat and transport fuel. Waste streams are typically converted into energy by combustion, gasification or anaerobic digestion.	Available at all times as long as there is fuel (waste). Backup system required during maintenance periods.	Energy from waste systems would require sizing so as not to clash with other LZC technologies. For example, if a biomass direct firing system has been sized for heat baseload, an energy from waste system	Depending on the system, Feed in Tariff could be available for electricity generated and RHI for heat.	Relatively mature technology. Main issue is delivery of feedstock. Given no immediate waste collection sources and competition from the existing Energy Recovery Plant in	Well established technology which remains relatively expensive.	The costs of AD systems will depend on whether the system is heat only or combined heat power. The scale of the installation will also be a factor. Costs for a heat only system range from £1,500 to £2,000 per kW thermal output. On £ per kWe basis, AD CHP systems range	**LOW**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
			would need to ensure that heat is not rejected to atmosphere.		Stornoway there would not be enough feedstock to make this a viable option.		from £2,500 to £5,000 per kW electrical output. ROI will depend on a number of factors including capital costs, financial incentives, value of waste streams and how much energy could be used on site. Typical ROIs can range from 8-12% with simple paybacks ranging from 8-10 years.	
Energy Storage	Energy storage systems are devices which capture the energy produced, usually using a renewable source, to use it at a later time. Energy storage systems can be used to assure an efficient use of the electricity produced by renewable systems such as wind and solar PV which are not always available to meet the user demand.	Energy is available on demand as long as the battery is charged. An example could be that wind turbine electricity is used to charge a battery during periods when wind generation occurs. The system would then supply a site during periods of higher electricity charges.	Battery type energy storage systems can easily be integrated with renewable and non-renewable electricity production systems.	Energy storage does not qualify for FiT or RHI but could potentially attract grant funding as part of an innovative installation.	The technology is still developing. Commercial applications and risks are relatively high. There is limited evidence base of operational systems that have been installed for an extended period of time.	There is only a limited number of commercially viable electricity storage systems but ongoing maintenance is understood to be minimal. Difficult to develop revenue stream given limitations of present grid connections	Battery energy storage systems are a relatively new product for the commercial market. Whilst costs are expected to fall as the manufacturing base increases, current costs range from £750 to £2,000 per installed kWh of storage capacity depending on scale. A domestic battery system linked to a Solar PV array in Barra & Vatersay might provide	**MEDIUM**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
		The system could also mitigate the electricity supply outages and disruptions that may occur.					an ROI of 2% to 5% and typically an 8-10 year simple payback. This relies on use of electricity to displace grid demand at peak prices.	
Biomass Boiler	Biomass systems generate energy using biological material. There are a number of different types of energy conversion methods such as biomass direct firing.	Output is typically available at all times as long as there is fuel. Biomass is also typically sized not to be the sole means of energy generation so backup systems such as gas fired boilers/burners will be required to cover energy demands during maintenance periods and in the case of an interruption to biomass fuel supplies.	An additional capacity direct fired biomass system would require sizing so as not to clash with other LZC technologies.	RHI eligible. Grant finding unlikely given technology maturity and RHI support	Biomass direct firing is considered to be low risk. Technology is well established. Expensive system to retrofit for electrically heated homes given requirement for new hot water supply pipework. Could work well for new development	Many providers of technology mean that a scheme can be competitively tendered. Maintenance contracts can be carried out under contract by the supplier. It is essential that maintenance is carried out in accordance with manufacturer's guidance. Fuel supply will be imported from off the island.	Project economics will be sensitive to three main points; 1. sourcing biomass fuel at a competitive price. 2. Access to RHI for the new installation ROI would be expected to be 8% to 10%.	**MEDIUM**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
Biomass CHP	This technology is based on the combustion of biomass to create steam. The steam is then supplied to a steam turbine generator. This generates electricity which is typically used on site to reduce the import of grid electricity. This would typically be a back pressure steam turbine so that exhaust steam can be used with a process.	Output is typically available at all times as long as there is fuel. Biomass CHP is also typically sized not to be the sole means of energy generation so backup systems cover energy demands during maintenance periods and unplanned outages.	A biomass CHP system would require sizing so as not to clash with other LZC technologies. For example, if a biomass CHP has been sized for electrical baseload, then it may limit the opportunity for installing additional electricity generation such as wind turbines or solar PV.	RHI eligible - There is a dedicated Biomass CHP tariff. This applies to qualifying heat produced from the turbine and used within a process rather than condensed. Grant finding unlikely given technology maturity and RHI and CFD support.	There are few examples of biomass CHP systems and this technology would be considered medium risk. For maximum efficiency this would need to be several MW in size. This would make use of the heat output difficult to match with Barra and Vatersay residents' needs. The electrical output would be constrained by local grid capacity – and impossible on Vatersay given existing single phase supply	Many providers of technology mean that a scheme can be competitively tendered. It may be logical to procure on a turnkey basis for the two main elements of the project; the biomass boiler and the steam turbine. Maintenance contracts can be carried out under contract by the suppliers of boiler and turbine. It is essential that day to day maintenance is carried out in accordance with manufacturer's guidance. Fuel would need to be imported on to the island.	The nature of this LZC technology means that reference pricing is more difficult than other technologies such as wind and solar PV. 5 MWe biomass CHP package with grate boiler and steam turbine is likely to cost £15M to £20M dependent on technology used. Project economics will be sensitive to being able to source biomass fuel at a competitive price and access to Contract for Difference for electrical output. The ROI would be expected to be 3% to 6%. However, these figures should be treated with caution given the uncertainties detailed above and that	**LOW**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
							further investigation is required.	
Heat Pumps	A heat pump is a device which transfers energy from a source to another via a refrigerant. Heat pumps can be used in cooling or heating mode depending on the requirements. Heat pumps can use heat sources from air land or water (including the sea).	Output is available at all times only the efficiency (COP) of the heat pump will vary depending on the source temperatures.	It would be unusual for a large heat pump to operate in conjunction with a CHP or biomass heat scheme given that both depend on a heat sink to operate efficiently. The heat pump compressor can be run with a renewable electricity production system to cover its electricity needs.	RHI range per kWh generated depending on the type of heat pump (air, water, ground source) with no limit in capacity. Very unlikely that a heat pump based heating system would be considered innovative so unlikely to qualify for any grant funding.	Heat pumps are a mature technology with relatively low risk. Local experience with air source heat pumps is that they are effective in most property types and offer running cost savings. May offer opportunity to use in serving needs of a small number of dwellings via a communal system. Not well suited to properties with low fabric insulation given lower heat output	Many providers of technology mean that it is competitively priced. Maintenance contracts are typically carried out by a specialist refrigeration contractor.	Costs increase significantly with ground and water source systems due to the need for civils. With RHI and typical energy prices, the ROI would be expected to be 8% to 10% and is very much dependent on RHI income. Simple payback is likely to be more than ten years.	**HIGH (although at small scale)**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
Geothermal Energy	Geothermal energy is a thermal energy derived from the heat generated and stored in the earth. Geothermal energy systems harness the heat from the earth to produce heat and or electricity. Installations typically have a heat pump as a means of energy transfer.	Available at all times when installed at a location that is suitable.	Consideration would have to be given to ensure that output energy does not clash with other LZC technologies such as heat pumps, CHP or biomass	RHI available for deep geothermal.	Still considered as an emerging technology in the UK and would be considered as high risk. Viability would be extremely sensitive to local geology and system design Studies to date don't highlight Outer Hebrides as an area with significant geothermal potential	The geothermal energy industry is not well established and there are few companies supplying this technology. The same can be said of after sales support although many of the components are similar to what would be used in a large heat pump scheme.	The developing nature of this technology in the UK means that it is not possible to provide estimated costs or ROI. Information from the Scottish Government would suggest that a cost of £1M to £2M per installed MW output has been achieved for some schemes overseas.	**LOW**
District Heating	District heating, also known as communal heating, is considered to be a secondary LZC technology in that it does not generate renewable energy but can provide a means of delivering both conventional and	Output is available at all times so long as there is a source of thermal energy supplying the system. In most DH schemes, the end user is supplied via a heat	Would need to be considered with other technologies. District heating could be supplied by a number of LZC technologies.	Would not currently attract FiT or RHI as DH is not in itself a renewable technology. May attract grant funding as part of a LZC scheme	Medium risk – Reasonably established technology with many successful commercial applications in Scotland although	There are a number of companies who operate in the domestic district heating space, given favourable economics.	Costs of a DH scheme are difficult to estimate at this point due to the fluidity in relation to chosen generation	

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
	renewable heat energy to a group of end users.	interface unit (HIU). The HIU normally features a heat exchanger and a heat meter for measuring energy supplied and to bill the end user.		supplied by an innovative technology such a large scale heat pump.	there have been examples of poor design that have led to the DH scheme being oversized and operating at a loss. Difficult to retrofit for electrically heated dwellings given need for hot water distribution pipework and larger heat emitters within the dwellings		technology and end users. ROI again depends on chosen generation technology and end users. But based on previous schemes, we would suggest that ROI is likely to be less than 7%. DH schemes normally work on a project lifecycle basis of 40 years.	**MEDIUM (small scale for new build)**
Hydro	Run-of-river schemes rely on the difference in height (head) between the input and output to a turbine. The other key factor in the power output achievable is the water resource (flow rate) passing through the turbine. An alternative design uses a dam to create a reservoir of water with a regulated flow then run through a turbine	Run-of-river schemes offer electricity output all year round. The output will vary with the flow rate of water.	Hydro schemes tend to be remote in location and so the energy output is typically not used alongside other LZC technologies	Hydro run-of-river schemes are presently eligible for FiT funding (at a scale below 5 MW). This will be removed in April 2019.	The technology is well established and there are a number of different turbine designs that can be selected based on head and flow conditions. There are a few burns in the area	There are multiple suppliers and design consultants operating in this area with experience of installing community scale projects	Capital costs for a run-of-river scheme are around £5,000 - £7,000 per kW of capacity. Lifecycle operating basis is 25 years.	**MEDIUM**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
	to generate electricity. The reservoir is topped up by pumping water back up from the discharge point				that may be suitable for a small hydro scheme. Larger schemes would be constrained by present grid capacity			
Tidal	One device design is an underwater capture device (similar to a wind turbine). An alternative option is to use a barrage to capture tidal differences in order to generate electricity	Tidal schemes will generate electricity all year round. Output will vary with peak tides	Tidal schemes typically operate independently of other technologies	No direct eligibility for FiT or grant funding	There are a limited range of technologies in the market at early stages of maturity. The scale of system is likely to be larger than the demand for electricity in Barra & Vatersay. This will be constrained by present grid capacity and make the scheme unviable	The supply chain is small	Schemes are typically several MW in scale and so costly to install. ROI is typically low	**LOW**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
Wave	Wave energy converting devices capture energy from waves and convert it into electricity	Electricity output from these devices is available all year round.	Generally little interaction with other technologies	No direct eligibility for FiT or grant funding	The technologies are not fully mature and there are limited options to select from. The scale of system is likely to be larger than the demand for electricity in Barra & Vatersay. This will be constrained by present grid capacity and make the scheme unviable	The supply chain is limited and typically bespoke for an individual project's needs	Wave energy schemes are costly to install and offer low ROI	**LOW**
Electrolyser	An electrolyser uses electricity to split water into hydrogen and oxygen gases. These gases can be sold to third parties. Hydrogen can be used as a vehicle fuel or storage fuel that can be converted back into electricity.	The electrolyser can operate at any point when it is supplied with electricity	Using renewable energy from devices such as wind turbines that are constrained by grid connections means that more locally generated energy	There are no incentive schemes for use of electrolysers	The technology is mature, though a number of more recent designs are emerging This would be most suited for	The supply chain is limited	Prices range from £2,000 - £3,000 / kW of capacity.	**MEDIUM**

Technology	Description	When is energy available?	Interaction with other technologies	Incentives Available	Technology maturity/risk	Supply chain maturity and after sales	High Level Costs and Typical ROI	Overall Technology suitability for Barra & Vatersay
			can be stored as hydrogen and used either to generate electricity (using a fuel cell) or as a fuel for a boiler or vehicle		use with a wind generator that is curtailed in order to maximise use of the energy generated. Would need market for output hydrogen.			

A.8 Summary of potential opportunities

A summary of the opportunities reviewed is provided here.

Table A.8 Description of measures summary

#	Measure	Description of measure
1	Replacement of incandescent lightbulbs with LED equivalent	Carry out programme of replacement of incandescent bulbs with LED equivalent within households
2	Loft insulation top-up	Programme of loft insulation upgrades to ensure minimum 250 mm thickness in relevant households
3	High efficiency storage heaters	Programme of replacement of storage heaters with modern equivalent in relevant households
4	Replacement of existing oil boilers	Programme of replacement of existing boilers in households with oil use as primary heating fuel
5	External wall insulation	Programme of external wall insulation work on relevant households
6	Underfloor insulation works	Programme of insulation work to be installed beneath wooden floors in identified households
7	Replace entry doors with modern equivalent	Programme of replacement of main entry doors to households with modern insulated equivalent
8	Install A-rated windows (uPVC frames)	Programme of replacement glazing for relevant households
9	Installation of Solar PV	Programme of installation of domestic scale Solar PV on appropriate housing. Potential to develop community body to co-ordinate investment and/or installation
10	Installation of small scale wind	Installation of small scale wind turbines on domestic scale. Potential to develop community body to co-ordinate investment and/or installation
11	Air source heat pump	Look to use air source heat pumps as part of heating solution for new build properties alongside high levels of building fabric and insulation.

#	Measure	Description of measure
12	District heating scheme within Castlebay	Carry out feasibility study looking at potential district heating using Castlebay School and Swimming Pool as base load. Potentially incorporate St Brendan's Hospital redevelopment
13	Hydrogen production from community wind turbine	Explore potential market for use of hydrogen fuel and how that might be met via production of hydrogen using output from the community wind turbine
14	Community minibus	Look to extend existing service and community bus routes through use of low emission minibus and smart on demand timetabling
15	Extend existing public electric vehicle charging points	Explore community involvement in extending public charging network (potentially sites at Ardmhor and the Airport)
16	Seek to increase amount of pavements and cycle paths across Barra and Vatersay	Discuss with relevant agencies potential for development of safer routes for walking and cycling around the islands
17	Smart meters	Installation of smart meters in homes and businesses to begin process of enabling smart grid for local electricity grid management
18	Tidal barrage	Development of a tidal barrage offshore to generate electricity supplied into Barra and Vatersay
19	Tidal array	Development of a tidal array offshore to generate electricity supplied into Barra and Vatersay
20	Anaerobic digestion	Generation of biogas and electricity from food waste for use in local community

Impact Factors

In assessing the potential overall benefits of each option the following factors have been considered:

Electrical Grid Capacity – the influence of local grid network capacity on the viability of proposed supply schemes. Where large schemes are proposed these might need reinforcement works to be carried out in order to enable export of electricity into the wider grid network. For a smaller scheme it may not be possible to export all of the available energy from the system therefore reducing the value of this output to the local community.

Environmental designations – the influence that any proposed action might have in terms of designated areas such as Site of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC). This is both in terms of preventing use of land areas for energy development to avoid disturbing such sites and also landscape and visual impacts of any energy supply schemes.

Cultural heritage designations - the influence that any proposed action might have in terms of designations such as ancient monuments, burial grounds or archaeologically significant sites. This is both in terms of preventing use of land areas for energy development to avoid disturbing such sites and also landscape and visual impacts of any energy supply schemes.

Supply chain – The relative size of the supply chain for the technology and availability of relevant equipment. This includes consideration of whether required equipment is readily available at different scales or whether orders are bespoke to local requirements.

Technological maturity – Assessment of how well developed any technology is, and where there is risk associated with its operation. This includes how easily the technology could be used within the local area without need for significant modification.

Community ownership – The scope for community ownership and potential investment in the proposed solution.

Scale of development cost – Assessment of the relative scale of development costs involved in the proposed solution, capital cost requirements and initial view of investment return rates.

Lower energy costs – Estimate of impact on energy costs to end users

Local economic benefit – Assessment of potential local economic benefit. This is both in terms of whether any additional employment may arise from the proposed solution as well as additional benefit arising from the likes of lower fuel costs, enhanced community income via revenue generated from community owned assets

Carbon impacts – Estimate of impact of solutions in terms of net carbon emissions associated with energy supply and use.

Human health impacts – Any impacts of measures on local environment in terms of air quality and any other benefits from a change in energy supply or transport. This is predominantly focussed on reduced pollutants (e.g. particulates and oxides of nitrogen/sulphur from existing transport)

Increased mobility for vulnerable groups – Specifically for transport related projects, an assessment of whether the proposed solution will provide benefit for local mobility

Table A.9 List of options and estimated scale of potential impacts

#	Measure	Electrical Grid Capacity	Environmental designations	Cultural heritage designations	Supply chain	Technological maturity	Community ownership	Scale of development cost	Lower energy costs	Local economic benefit	Carbon impacts	Human health impacts	Increased mobility for vulnerable groups	**Total Rating**
1	Replacement of incandescent lightbulbs with LED equivalent	0	0	0	3	3	0	1	1	1	1	0	0	HIGH
2	Loft insulation top-up	0	0	0	3	3	0	1	1	1	1	0	0	HIGH
3	High efficiency storage heaters	0	0	0	1	3	0	-1	2	1	2	1	0	HIGH
4	Replacement of existing oil boilers	0	0	0	1	3	0	-1	2	1	2	1	0	MEDIUM
5	External wall insulation	0	0	0	1	3	0	-3	3	1	3	1	0	HIGH
6	Underfloor insulation	0	0	0	1	3	0	-1	1	1	1	1	0	HIGH
7	Replace entry doors with modern equivalent	0	0	0	2	3	0	-2	1	1	1	0	0	LOW
8	Install A-rated windows (uPVC frames)	0	0	0	0	3	0	-2	2	1	2	1	0	MEDIUM

#	Measure	Electrical Grid Capacity	Environmental designations	Cultural heritage designations	Supply chain	Technological maturity	Community ownership	Scale of development cost	Lower energy costs	Local economic benefit	Carbon impacts	Human health impacts	Increased mobility for vulnerable groups	**Total Rating**
9	Installation of Solar PV	0	0	0	3	3	2	-1	2	1	2	1	0	HIGH
10	Installation of small scale wind	0	0	0	3	3	2	-2	1	0	1	1	0	MEDIUM
11	Air source heat pump	0	-1	0	1	3	0	-1	2	1	2	1	0	HIGH
12	District heating scheme (Castlebay)	0	0	0	1	3	1	-2	2	1	2	0	0	HIGH
13	Hydrogen production from community wind turbine	1	0	0	1	2	3	-2	2	2	2	1	0	HIGH
14	Community minibus	0	0	0	1	3	2	-1	2	1	2	0	3	HIGH
15	Extend public electric vehicle charging points	0	0	0	3	3	2	-2	2	2	3	0	1	MEDIUM
16	Seek to increase amount of pavements and cycle paths	0	0	0	3	3	0	-2	1	1	1	1	1	LOW
17	Smart meters	0	0	0	1	3	-3	-1	2	1	2	0	0	HIGH

#	Measure	Electrical Grid Capacity	Environmental designations	Cultural heritage designations	Supply chain	Technological maturity	Community ownership	Scale of development cost	Lower energy costs	Local economic benefit	Carbon impacts	Human health impacts	Increased mobility for vulnerable groups	**Total Rating**
18	Tidal barrage	-3	-2	0	1	-1	-3	-3	3	2	3	0	0	LOW
19	Tidal array	-3	-2	0	1	-1	-3	-3	3	2	3	0	0	LOW
20	Anaerobic digestion	1	0	0	-3	-1	1	-3	1	0	2	0	0	LOW

Note:

Each impact factor is rated according to the following scale of impact:

Negative impacts, costs, constraints			No impact	Positive impacts, cost savings, revenues		
"-3"	"-2"	"-1"	"0"	"1"	"2"	"3"
high negative	medium negative	low negative	no impact/ neutral	low positive	medium positive	high positive

Each factor is also given a relative weighting in combining the scores. A summary of the scale of impact and relative weightings is provided here.

Table A.10 Summary of impact factors and relative weighting

Impact Factor	Negative impact	Positive impact	Weighting %
Electrical Grid Capacity	Grid capacity constraint limits or prevents full use of output electricity	Present grid capacity is enhanced by proposed scheme	10%
Environmental designations	Opportunity is limited or impossible to take forward due to impact on local environmental designations	Opportunity provides enhancement of local environment	10%
Cultural heritage designations	Opportunity is limited or impossible to take forward due to impact on cultural heritage designations	Opportunity provides indirect benefits to cultural heritage sites (e.g. sustainable power, alternative transport)	10%
Supply chain	Opportunity requires bespoke solution only available via a restricted number of suppliers/installers with a long lead time	Opportunity can be readily delivered via wide supply chain and installer base	3%
Technological maturity	Opportunity is an emerging technology with likelihood of high ongoing maintenance and insurance costs	Opportunity is well established with no significant difficulties to address in installation and well understood ongoing maintenance requirements	2%
Community ownership	Opportunity is entirely reliant on a private developer and would not offer direct community benefit	Opportunity offers a number of routes where the community could be involved as a developer/owner and deliver ongoing benefit	10%
Scale of development costs	Opportunity requires large capital investment which is difficult to obtain	Opportunity is deliverable with a moderate capital requirement that may be met in part via funding/loan schemes	15%

Impact Factor	Negative impact	Positive impact	Weighting %
Lower energy costs	Opportunity will not offer cheaper energy costs or potentially result in increased costs in order to achieve a cost-effective supply	Opportunity offers significant energy cost savings for end users	15%
Local economic benefit	Opportunity offers no additional local economic benefits	Opportunity offers additional local economic benefit in terms of lower fuel costs, enhanced community income, potential employment	5%
Carbon impacts	Opportunity offers no carbon reduction emissions benefit or potentially increases net emissions associated with energy use	Opportunity offers significant reduction in carbon emissions associated with energy use	10%
Human health impacts	Opportunity offers no benefit to local environment	Opportunity provides support for better health outcomes in terms of better heating in homes or improved air quality	5%
Increased mobility for vulnerable groups	Opportunity does not improve access to transport for the community	Opportunity offers more flexible transport that more closely meets needs of vulnerable groups	5%

The overall rating (combining the individual factors) then provides a HIGH/MEDIUM/LOW prioritisation score for taking forward the proposed theme. This is a combination of the weightings and the technology fit.

Evaluation Example

Measure 7 – Replace entry doors with modern equivalent

Electrical Grid Capacity – There is no impact from the local grid on this measure so the score in this category is 0

Environmental designations – There is no impact on this measure from local environmental designations so the score in this category is 0

Cultural heritage designations - There is no impact on this measure from cultural heritage designations so the score in this category is 0

Supply chain – The supply of entry doors is achievable via the local supply chain relying on sourcing from the wider Scottish market so the score in this category is 0

Technological maturity – Suitable door designs are available without extensive modification so this category score is +3

Community ownership – Door replacement will not be something that directly benefits a community trust or similar so the score in the category is 0

Scale of development costs – The costs of installing this programme to all relevant properties is very high and would require significant capital investment so the score in this category is -2

Lower energy costs – The benefit of the door replacement will mean reduced heating energy use and so a moderate reduction in associated heating energy bills so the score in this category is +1

Local economic benefit – There may be a small level of additional local employment associated with the replacement programme so the score in this category is +1

Carbon impacts – The improved insulation properties of the doors will reduce heating energy requirements and therefore offer a similar moderate scale of reduction in the related carbon emissions so the score in this category is +1

Human health impacts – Reduced heat losses from the property will offer a moderate improvement in the capacity to heat houses to a comfortable standard. It therefore offers a moderate potential to reduce under-heating of homes and associated issues of damp offering small positive health benefits. The category score is therefore +1

Increased mobility for vulnerable groups – The measure is not related to transport so does not have any impact in this area so the category score is 0