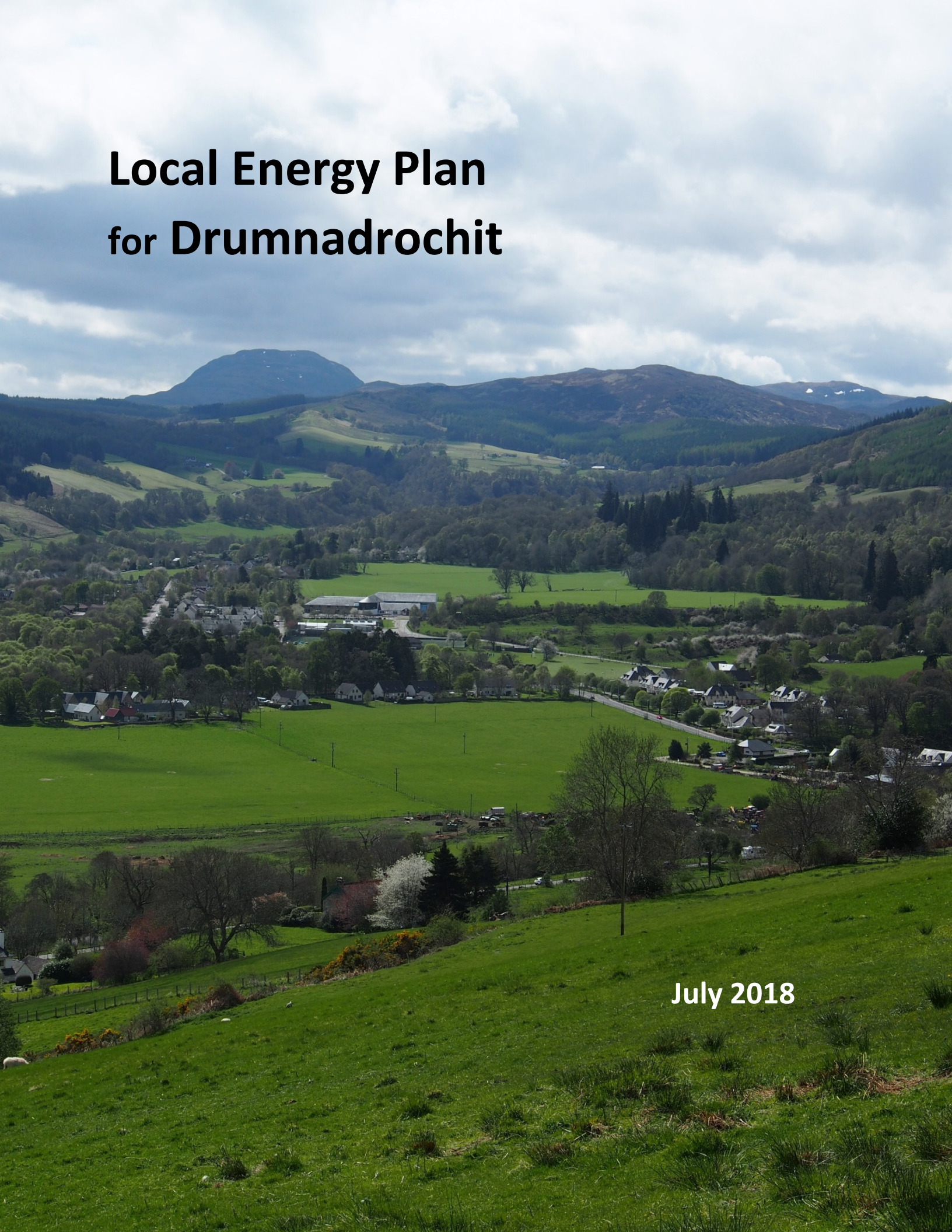
Local Energy Plan
for Drumnadrochit



July 2018

A Local Energy Plan for Drumnadrochit

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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 plan will be used to inform the development of the Drumnadrochit Community Action Plan.

The development of the plan has been led by a steering group including Soirbheas, Glen Urquhart Rural Community Association, the Chamber of Commerce and the Community Council.

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 Beyond Green Advisors Limited.

Contents

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.

LEPs involve a community themselves developing a greater understanding of current energy use and how they would like this to change in the future. It is developed by local communities rather than being developed for them by other bodies (e.g. local authorities or National Government). The LEP sets out key priorities and opportunities identified by the community, assisted by a range of other organisations who have an interest in how energy is produced and consumed in this community. These include local residents, businesses, community organisations, local authorities, distribution network operators, public and statutory authorities 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 Drumnadrochit 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 Drumnadrochit also play a direct 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 Drumnadrochit 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:

- Energy users in the community can better understand the amount of energy they consume (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, businesses, community and public sector buildings
- 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

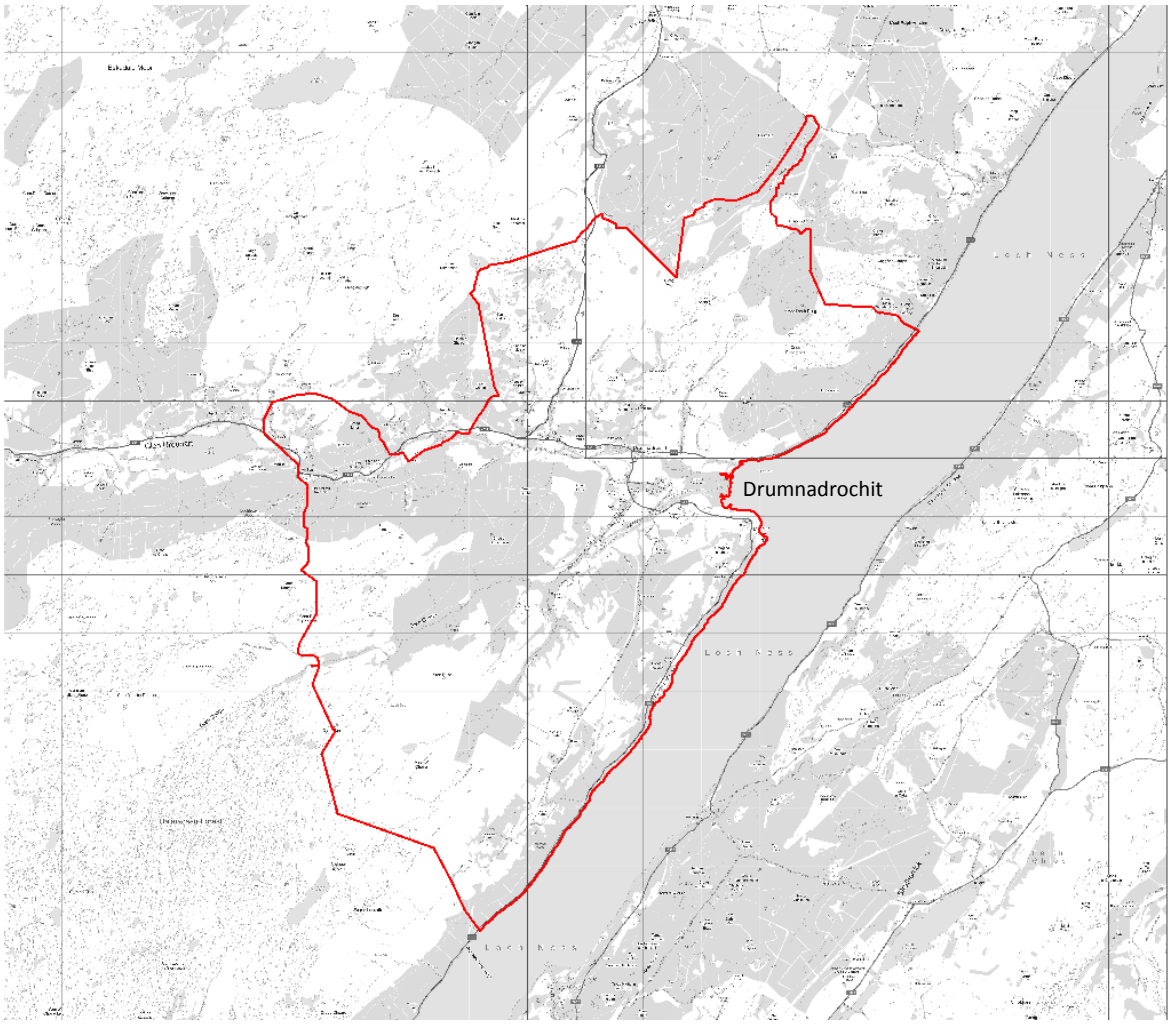
This LEP provides a summary of details collated from the community in Drumnadrochit through a number of engagement routes and events.

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 LEP 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 boundary (e.g. land available for energy generation). The LEP boundary selected for use in Drumnadrochit is shown in Figure 1.

Figure 1 Local Energy Plan Boundary (Drumnadrochit)



1.4 Aims and objectives

A community wide consultation programme was devised in order to help shape the aims and objectives of this LEP. As an outcome of this process the key issues that the community wished to see addressed were:

- Projects that reduced energy costs with minimal impact on the local environment
- Transport projects that prioritised the most vulnerable households with minimal impact on the local environment
- Projects that seek to use energy generated locally

Those that should benefit from any energy projects should be householders and community groups in the first instance.

Those that benefit from any transport projects should be householders and local-intra LEP area commuters as well as those travelling further afield.

2. Local Infrastructure

Local Infrastructure – Summary

- Existing capacity constraints on the local electricity grid restrict the scale of generation that can be implemented (without costly contributions to upgrade work)
- There is no mains gas supply to Drumnadrochit nor any existing district heating schemes
- Water supply is received from the Glenconvith works with wastewater treatment taking place within Drumnadrochit
- There are a number of bus services with routes to Inverness and Fort William; these are restrictive in terms of flexibility in commuting
- There are two small run-of-river hydro schemes operating close to the LEP boundary and some householders have installed solar PV, heat pumps or solar thermal

2.1 Electricity

The vast majority of Drumnadrochit's electricity is supplied via the UK national grid. This consists of a transmission network of high voltage cables that transports electricity generated at large centralised power plants, linked to a distribution network that consists of lower voltage cables that feeds electricity into our homes and businesses. Devices called transformers enable the changes in voltage ('step down' when taking electricity from the transmission into the distribution system). A number of factors, include the size of the transformers, as well as the size of electric current passing along the cables, limits the amount of power that can flow through the system in any local area.

Given UK and Scottish Government targets for the proportion of electricity supplies generated from renewable sources and the projected scale of generation the capacity of the historical transmission network in the Highlands (including west of the Drumnadrochit Local Area Plan boundary) was deemed inadequate to cope. Studies were undertaken in 2001 to identify how the existing network could best be reinforced to accommodate renewable generation. It was concluded that replacement of the existing
132 kV double circuit overhead transmission line between Beauly substation and Denny with a new 400 kV double circuit overhead transmission line would facilitate the required transmission capacity to accommodate renewable generation. The electricity industry regulator, Ofgem, also concluded that the new overhead transmission line was both required and justified.

Significant investment has been made in upgrading the transmission network. This has allowed the development of onshore wind energy in the highlands, with the community group Soirbheas supported by payment received by output of a local turbine.

Where there is local energy generation within Drumnadrochit (e.g. solar PV panels on a house roof) then if this electricity is not used within the building, it will be exported into the UK national grid. This means that there are potentially current flows running into Drumnadrochit, coming from power generation sources outside the geographic area, as well as current flows running out of Drumnadrochit from local energy generation.

There is a single primary substation in Drumnadrochit that acts as the local point on the distribution network. (The transformer is a 33 kV/11 kV step down with a rated capacity of 6 MVA)[1]. This sub-station is presently constrained for any generation with a load of 5 MVA (approximately equivalent

[1] https://www.ssepd.co.uk/GenerationAvailabilityMap/?mapareaid=2 (Accessed April 2018)

to 5 MW). The corresponding grid supply point (where the national transmission line is linked to the distribution network) is Ceannacroc. This grid supply point is also constrained in terms of the scale of generation that can be connected to it. Works on the Fort Augustus 400/275 kV high voltage line are proposed to be completed by October 2021. No planned works are in place at present on the distribution network.

In practice this makes connection of any larger scale renewable energy generation difficult to achieve within the Drumnadrochit area prior to any of the planned works being completed. There is, however, scope for the development of local micro energy systems such as hydro, solar and heat pump developments.

The present Distribution Network Operator (DNO) is Scottish & Southern Electricity Networks (SSEPD). The present Transmission System Operator (TSO) is Scottish & Southern Electricity Networks (SSEPD).

2.2 Heat

The UK national gas network operates in a similar way to the national electricity grid. High pressure underground pipes (the transmission network) enable the flow of gas from national sources (offshore gas fields, pipelines from Europe and liquefied natural gas) to be transported into the distribution network. The distribution network is the lower pressure gas supply that feeds homes and businesses.

Drumnadrochit is not on the UK national gas transmission network (operated by National Grid) nor its associated distribution network (operated in Scotland by SGN).

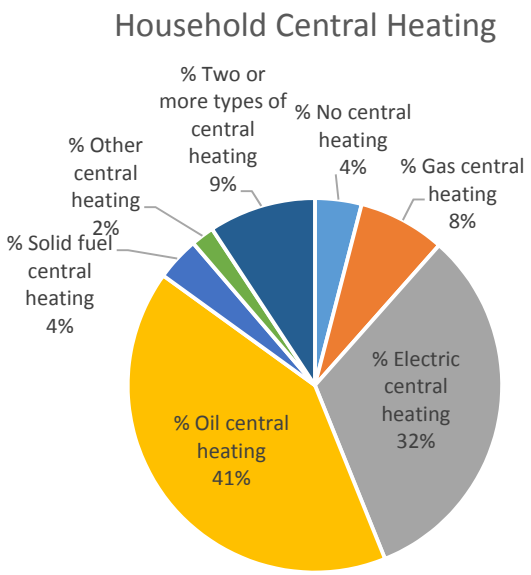
Oil and electric heating dominate heating fuel use in Drumnadrochit, heating 41% and 32% of properties respectively. This contrasts with Scotland as a whole (79% mains gas; 12% electricity; 7% oil).

Additionally, community energy research in 2014 identified that 35% of the 191 respondents had some form of wood heating. In older properties, wood heating is likely to be in an open fireplace. In newer properties there are likely to be wood burning stoves which are more fuel efficient in delivering heat.

There are currently two large biomass systems at the school and health centre.

There are no existing district heating networks in operation in Drumnadrochit at present.

Figure 2 Primary heating fuel use (Drumnadrochit)



2.3 Water

Drinking water used to be supplied from a local loch and river. A new treatment facility was constructed at Glenconvith in the mid-2000s with an enhanced supply capacity of up to 3.5 Ml/day. This facility also provides water supplies for neighbouring villages such as Beauly and also the west of Inverness.

In terms of wastewater treatment, the Drumnadrochit Waste Water Treatment facility was subject to expansion in 2008. This provided additional capacity to support the growth in the village's population between 2001 and 2011 as well as proposed new housing developments.

2.4 Transport

The main road running through Drumnadrochit is the A82. This is the main link road between Inverness and Skye (via A887/A87) and Fort William. There is a significant volume of traffic that passes through the village on route to these destinations. This makes it extremely challenging to identify road count data that specifically relates to activity and residents in Drumnadrochit. The majority of bus services running through the village also go onto service these larger areas.

Inverness Airport is 24 miles North East of the village following the A82 and A96 to B9039.

The A831 and A833 also run out of Drumnadrochit to the north and west of the village.

Many bus routes in the Highlands are operated commercially. This means that bus companies run these routes without financial support from Highland Council. However, the Council awards contracts for some additional services not provided commercially. Several bus services run through Drumnadrochit, these are highlighted in the following table.

The closest train station is Inverness Railway Station which can be reached on several of the bus routes.

Table 1 Bus service which run through Drumnadrochit

Bus Company	Services	Route	Daily Frequency (Weekdays)
Scottish City Link	119	Invermoriston - Inverness	Two services daily (Northbound); Three services daily (Southbound)
Scottish City Link	919	Fort William - Inverness	Four services daily (Northbound and Southbound)
Scottish City Link	917	Fort William - Inverness	Three services daily (Northbound and Southbound)
D&E Coaches	304	UHI/Raigmore - Tomich	Three services daily (Northbound); Four services (Southbound)
Shiel Buses	513	Fort William - Inverness	Two services daily (Northbound); Three services daily (Southbound)
Stagecoach North Scotland	17	Inverness – Cannich	Two services daily (Northbound and Southbound)

Note: Details summarised as available (May 2018)

Key challenges for the LEP area residents are reflected in national transport trends.

Nationally, bus passenger journey numbers almost halved between 1960 and 1975 and have roughly halved again since then. This will make it extremely challenging for new bus services in the LEP area. However, local anecdotal comment highlights a demand for local bus services from the village to Inverness.

Nationally, 31% of journeys to work were by public or active travel in 2016, the same as 2006. Based on 2011 Census data the figure for Drumnadrochit is around 11%. Public and active travel to work has remained at around 30% since 2006, with cycling retaining a low modal share but showing increases in share of work travel in the cities. The busy and exposed A82 is not a road that is conducive to commuting by bike.

Subsidised bus services form a large proportion of the region's local bus network. Many places are served by both local services and longer distance coach routes. However, limited frequencies away from all but the main routes severely limit opportunities for commuting and other time critical/sensitive trips, and can cause isolation and social exclusion for those without access to a vehicle. The requirements for Councils to provide free home to school transport means that buses and coaches, which are also used for public transport, are unavailable for some periods during the day. The bus network can be essential for those without access to a private car; gaps in that network can have a severe effect on social inclusion.

2.5 Renewable energy generation

In 2013, local community group Soirbheas undertook research into local energy issues. A number of respondents identified their engagement with solar energy – both PV and thermal for water heating as well as engagement with biomass and heat pumps. Since then, engagement with small micro and domestic renewable energy production has continued.

Data from Highland Council shows hydro and wind installations that have been granted planning permission and are operational in the local area. This can be accessed at:

Hydro:
http://highland.maps.arcgis.com/apps/webappviewer/index.html?id=fae522b61be440cba1edb1aba9b226f4

Wind:

http://highland.maps.arcgis.com/apps/webappviewer/index.html?id=5ec04b13a9b049f798cadbd5055f1787

In terms of specific hydro schemes operating close to the LEP Boundary, there are two existing schemes:

- Drumclune Farm
- River Coilte Hydro Scheme

Within the IV63 postcode area, including Drumnadrochit, there has been some uptake of small scale renewable energy generation. This can be summarised using data collected as part of the Feed in tariff (FiT) scheme. The data shows that there is an installed renewable energy capacity of 151.62 kW (photovoltaic) and 15 kW (wind).

Table 2 Overview of uptake of FiT eligible renewables in IV63 postcode area

Technology	Size of Installation	Declared Net Capacity (kW)	No. of installations	Domestic / Non-Domestic
Solar PV	Up to 4 kW	151.62	44	Domestic
Wind	4 – 15 kW	15	3	Domestic
Sub-total		166.62	47	

3. Characterisation of local area

Characterisation of local area – Summary

- The population of Drumnadrochit increased by 40% between 2001 and 2011
- Around 75% of the population are economically active, with 65% travelling to work by car. 20% work from home
- The combination of those that work from home and the 25% economically inactive mean that there will be energy demand during the day within a significant number of households

3.1 Overview

The village of Drumnadrochit is located at the end of Glen Urquhart, on the shore of Loch Ness. The main Inverness to Fort William/Skye road runs through the village, bringing a lot of transport to its centre. The village is also a popular tourist destination, being the first main population centre encountered by travellers from Inverness. The village has very dynamic and enthusiastic community leaders and businesses which help to encourage continual development of new facilities, housing

etc. As a consequence, Drumnadrochit has more facilities than would be expected for a village of its population size and closeness to the Highland capital.

The population of the village expanded significantly 40% between the 2001 and 2011 census. An upgraded waste water treatment facility and secondary school, the latter completed under a PPP in 2002, have helped support ongoing growth in the community. This is complemented with a range of new housing. The Inner Moray Firth Local Development Plan (published in July 2015) identified a number of areas for future housing and development.

The Plan recognises a key aspect of the community is the open fields that separate Drumnadrochit's settlements. These are noted as important to its character and their separation should be maintained where possible and safeguarded by green corridors accessible to wildlife and the wider community. Other constraints include woodland that should be protected and the flood risk areas associated with the Coiltie and Enrick rivers.

Application of these principles has resulted in the allocation of development land at the heart of the community, where longer road improvements are not required and where more people can walk or cycle to facilities. Developer requirements seek to ensure that the character of the village is maintained and even enhanced by the quality of the new buildings, their layout and their good connectivity.

3.2 Population of Drumnadrochit

The population of Drumnadrochit, based on Census figures from 2011, is 1,754 – an increase of 40% since 2001. In terms of demographics:

- Under-16 year olds form 18.4% of the population
- 16 – 59 year olds form 56.1% of the population
- Over 60 year olds form 25.5% of the population
- Just over 25% of the population are in the age range 45 – 59 years old

Further details can be found in Appendix A, Section 1.

3.2.1 Employment and economically active population

In terms of employment, around 75% of the population are economically active, with half of those in full time employment. A further 23% are self-employed.

Of the economically inactive, the dominant sector are those that are retired (56%); students are the second largest sector (15%).

Further details can be found in Appendix A, Section 1.1.

From an energy perspective this shows that there will be a significant number of empty houses during the day, where the occupants are out for work. There is also a significant proportion of the population made up by the economically inactive and who could be in their houses during the day, using premium rate electricity in appliances, heating etc. They also need to be considered in terms of support for efficient energy use.

3.2.2 Employment Sectors and Journey to Work

In terms of employment sectors the five most common, comprising around two thirds of total employment are summarised in Table 3.

Table 3 Employment by sector (Drumnadrochit)

Employment Sector	% of Total Economically Active Population
Human health and social work activities	13.7%
Wholesale and retail trade; repair of motor vehicles and motorcycles	13.4%
Accommodation and food service activities	13.2%
Construction	11.4%
Education	9.1%

In terms of those that are economically active, a typical journey to work is predominantly made by car (65%).It is useful to note that around 20% of those economically active work at home.

3.3 Residential

3.3.1 Overview of property characteristics

Data for the domestic building stock is available via the Energy Saving Trust. This collates details from Energy Performance Certificates (EPC) calculated for individual dwellings as well as home inspections carried out via assessors from both local authorities and Home Energy Scotland.

For the present LEP a short summary is provided here.

Further details regarding the characteristics of the building stock can be found in Appendix A, Section 2.

Table 4 Drumnadrochit – residential property overview

Characteristic	Details
Tenure	Around 70% of domestic properties in the LEP area are owner occupied
Age	Around two thirds of domestic properties are at least 35 years old; one third of these were built prior to 1919.
Design archetype	55% of properties are detached houses; a further 15% semi-detached 11% of properties are flats
Wall construction type	Solid wall design predominates in pre-1919 properties Cavity wall design predominates among properties built between 1950 and 1983 Timber frame designs predominate in properties built since 1984
Primary fuel use	Around 75% of homes are fuelled using electricity (46%) or oil (33%) Oil has become the most common fuel source used in new build homes

Overall energy efficiency	The majority of houses with the lowest energy efficiency ratings (F-G) are older solid wall properties built pre-1949. The majority of post 2002 properties are energy efficiency rating C.

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. This includes aspects of heating and insulation as well as characteristics of buildings and overall rates of fuel poverty.

Under the current definition used in reporting[2], 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. The latest figures for 2014 – 2016 include the following details for the Highland Council area.

Table 5 Fuel Poverty Statistics (Highland Council – 2014 – 2016)

Characteristic	Parameter	Highland	Scotland
	% of LA	52%	31%
Age of Dwelling	Pre-1945	67%	36%
	Post-1945	47%	28%
House or Flat	House	54%	33%
	Flat	*	27%
Number of bedrooms	2 or fewer	49%	31%
	3	54%	31%
Tenure	Owner occupied	51%	29%
	Social Landlord	59%	35%
	Privately rented	*	31%
Household Type	Older	72%	45%
	Families	29%	17%
	Other	49%	29%

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

Table 6 Estimated Probability of Fuel Poverty (Drumnadrochit)

[2] 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

Probability of fuel poverty	Number of houses
Less than 40%	164
40-49%	154
50-59%	161
60-69%	89
70-79%	85
80-89%	94
90-100%	122
Unknown	60

3.3.3 Overall domestic archetypes

There are a mix of property types within Drumnadrochit with different challenges for householders in terms of improving the overall energy efficiency of their homes and reducing overall energy bills.

The predominant characteristics of the residential stock have been summarised here. This provides a guide to the type of works (in terms of insulation improvements) that would need to be carried out.

Table 7 Summary of residential archetypes (Drumnadrochit)

Age	Wall Type	Glazing	Loft Insulation	Build type	Primary fuel	EPC Rating	Floor area (m^2)
Pre-1919	Solid	Double / Triple	100 - 249 mm	Detached	Electricity / Oil	F - G	104 - 109
1919 – 1949	Cavity / Solid	Double / Triple	250 mm +	Detached	Oil	F - G	113 - 128
1950 – 1983	Cavity	Double / Triple	250 mm +	Detached	Electricity	E	83 - 118
1984 – 1991	Timber Frame	Double / Triple	100 - 249 mm	Detached	Electricity	C / D	96 - 128
1992 – 2002	Timber Frame	Double / Triple	100 - 249 mm	Detached	Electricity / Oil	C / D	88 - 118
Post 2002	Timber Frame	Double / Triple	250 mm +	Detached	Oil	C	120 - 130

3.4 Non-residential

Non-residential – Summary

- Large energy users in the LEP area are the Primary and High Schools, Health Centre and Loch Ness Exhibition Centre.
- Energy demand is mainly for electricity; heating systems in these buildings don't offer immediate potential to act as anchor loads for a district heating scheme
- Remaining energy demand is from smaller businesses (retail, food/drink, accommodation)

3.4.1 Local authority

The two main local authority buildings in Drumnadrochit are the High School and Primary School.

Glenurquhart Primary School, has existed as a separate entity since 1980, before then being collocated with the old secondary school. The building was constructed in 1975. The single storey building is divided into infant, middle and upper pupil areas. Each consists of classrooms, an open area, cloakrooms and toilets. During the 1992/93 session, an additional classroom, cloakroom area and toilets were built, extending from the present senior block. In 2005 the school was further extended to provide two classrooms, a staffroom and a resource area. There is a small hall which serves as a dining room and games hall. Following the completion of the new Glen Urquhart High School, the primary school playing field is now situated to the rear of the building.

The Primary School is heated by a biomass boiler, with an oil boiler back-up in the event that the biomass boiler is unavailable (e.g. during planned maintenance).

Total electricity consumption at the Primary School in 2016/17 was 83,039 kWh of electricity; 71,509 kWh of biomass and 47,722 kWh of heating oil.

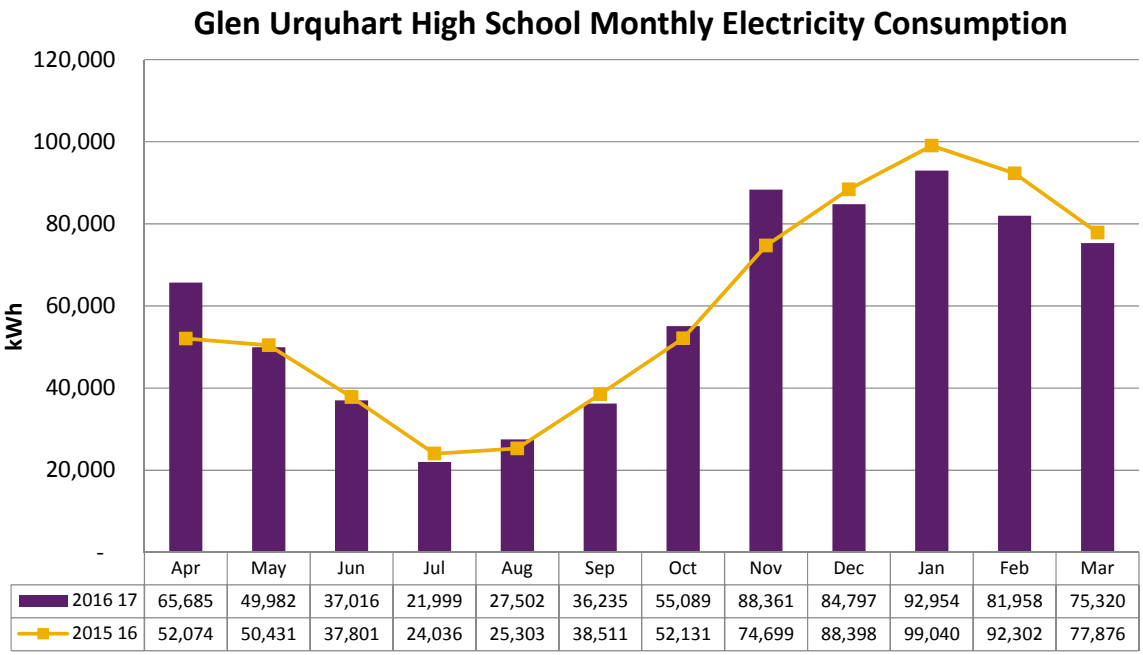
Opened in 2002, Glen Urquhart High School has 200 pupils, 25 teaching staff and 12 non teaching staff. The buildings also house the Craigmonie Community Centre, Glen Urquhart Child Care Centre and Community Library. The main source of energy used in the school is electricity. A summary of monthly energy use is shown here (Figure 11).

3.4.2 NHS Highland

In recent years, patient numbers in the village had grown steadily, reflecting demographic change and also the growth in the local population. This resulted in demand outstripping facilities at the previous local surgery.

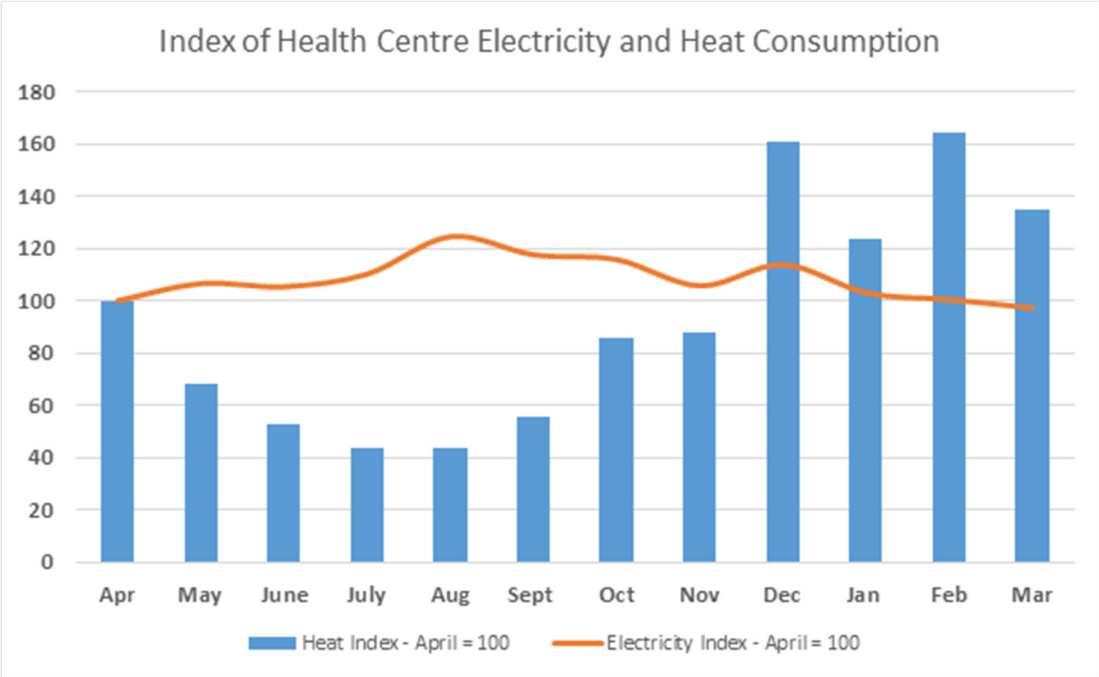
The new health centre was opened in late 2015. It uses electricity for powering lighting, computers etc while a containerised biomass heat cabin has been installed to meet heating requirements. This reflects the growing engagement with renewable energy technologies to meet heating requirements.

Figure 3 Monthly electricity consumption for High School



	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
2016 17	65,685	49,982	37,016	21,999	27,502	36,235	55,089	88,361	84,797	92,954	81,958	75,320
2015 16	52,074	50,431	37,801	24,036	25,303	38,511	52,131	74,699	88,398	99,040	92,302	77,876

Figure 4 Energy demand profile for Health Centre



3.4.3 Other businesses

The village has a vibrant business sector. The local Drumnadrochit Chamber of Commerce has over 40 members. Business activity ranges from large multi employee organisations such as Cobbs Bakery and the larger visitor attractions and hotels, through to small home based micro businesses; trades, business services, tourism etc. The following commentary summaries the potential energy use across the businesses located in the Local Energy Plan area.

Tourism (small and medium) – These smaller businesses can incorporate accommodation either as stand-alone self-catering properties or as part of a guest house or B&B. Energy use is likely to follow a more domestic energy consumption profile. Similarly, space and water heating is likely to be provided by onsite oil/LPG domestic type boilers. There is scope for these businesses to engage with micro renewables.

Tourism (large) – These are the larger visitor/tourist attractions in the village and have a higher energy requirement. The largest of these is the visitor centre and associated facilities at Urquhart Castle, managed by Historic Environment Scotland. The Loch Ness Exhibition Centre is a large complex which has a mix of older property. There is incentive to review energy use with increasingly considered options being an LED lighting refit or heat emitter upgrade, improving heater controls or replacing larger output boilers. These tend to be in older properties where there is a challenge with the heat loss and thermal integrity. An emerging issue is the challenge of insulation in hard to treat properties in a manner that does not affect the required permeability of walls.

Food and drink – There is a range of food and drink outlets producing a broad portfolio of food and drink products and dining experiences. These can be quite high energy use businesses, with higher demand for energy in the cooking and preparation of food as well as for chillers and cold stores. There is also a level of energy consumption for space and water heating throughout the year.

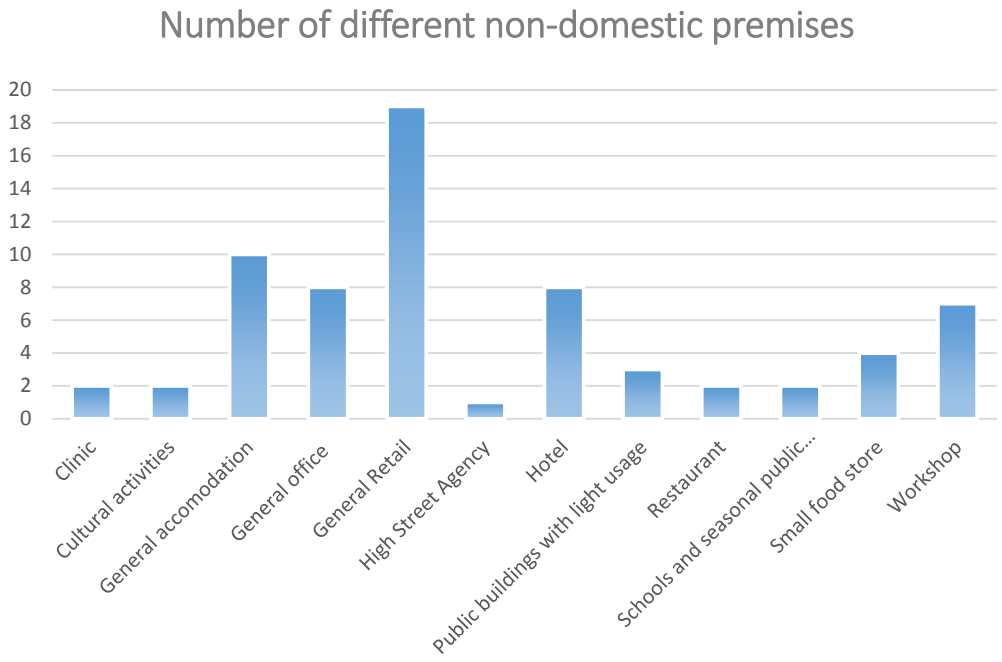
Retail and business services etc- These are tending to be smaller operations, some of which are home based businesses. As a result, energy consumption can be relatively low; resulting from lighting and space and water heating. A number will require large levels of illumination to provide attractive window or in-shop displays. There is engagement with new LED lighting technology in some premises to help minimise lighting costs.

There are a number of community buildings including for example a Day Care Centre, Blairbeg Hall and a Church as well as a Shinty clubhouse and a Fire Station.

A summary of the breadth of non-domestic premises within the LEP area is provided here.

An online business survey was used to collect quantitative business interaction with energy issues. A total of six responses were received. This was then complemented by a face to face or direct contact business survey. Summary details can be found in Appendix A, Section 3.

Figure 5 Overview of non-domestic premises (Drumnadrochit)



3.5 Transport

3.5.1 Annual Traffic Movements

Traffic count and flow data is collated by the UK Government Department for Transport (DfT) for three locations within the LEP area. This data provides a snapshot for a single 24-hour sampling period. It is not possible to determine the time of year when these counts were undertaken.

Average daily vehicle flow details are available for each of the count points. The data shows that:

- There are few cyclists passing through Drumnadrochit (a maximum of 1% of traffic flows are pedal cycles); this is not surprising given the nature of the A82 and the vehicles using this road
- Cars/taxis make up around 70% of the total traffic flows
- Light goods vehicles (LGV) account for a further 20 – 25% of traffic
- Heavy goods vehicles (HGV) make up around 3 - 9% of traffic
- Buses and coaches account for 1 – 2% of traffic. This reiterates the public transport challenges.

Further details are provided in Appendix A, Section 4.

While there is no data that has been available specifically for the volumes of traffic within Drumnadrochit it is possible to identify a seasonal impact by looking at accommodation occupancy rates in the region over a 12 month period (as an indirect measure of traffic volumes).

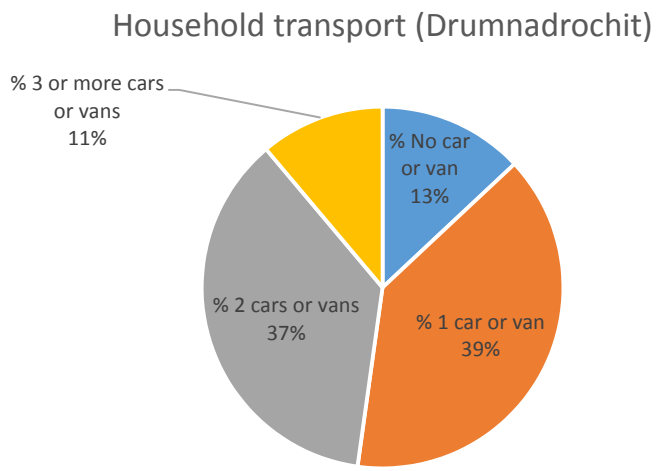
Visit Scotland publish the details for the Highlands & Islands [3] in terms of occupancy rates across hotels, guesthouses and B&B and self catering accommodation. Peaking numbers in the spring and summer months are noticeable for all three categories of accommodation, but particularly in the case of guest houses, B&B and self-catering accommodation. This provides an indirect indication of the seasonal nature of traffic that might be anticipated within Drumnadrochit.

Further details are provided in Appendix A, Section 4.

3.5.2 Domestic vehicle ownership

The estimated total domestic vehicle ownership within Drumnadrochit is 1,087 with the percentage breakdown of number of cars or vans per household (based on Census data) shown here.

Figure 6 Household transport (Drumnadrochit)



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. This, combined with statistics from Transport Scotland, provides a means of estimating vehicle fuel use.

This provides an average travel distance of 9,700 miles per year (17,300 km) per vehicle equating to annual fuel use of somewhere in the range of 1,000 – 1,100 litres of fuel at a cost of £1,240 - £1,360 per year.

Transport Scotland data for journeys by foot suggests that around 50% of residents in rural communities such as Drumnadrochit do not walk (as a means of transport) in a given week. Around one third don't walk for pleasure or to keep fit.

Further details are provided in Appendix A, Section 4.

[3] http://www.visitscotland.org/pdf/Tourism_in_Scotland_Regions_2016.pdf (Accessed April 2018)

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 and large scale wind projects
- Solar resource in the LEP area is moderate
- Hydro resource close to the LEP area offers some potential for small-scale run-of-river hydro
- Forest Enterprise Scotland seek to manage local forestry to support local users of wood fuel

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.

3.6.1 Summary of environmental designations and other relevant heritage items

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 are six SSSIs within 3 km of the LEP area.

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 are two SACs within 3 km of the LEP area.

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 are two areas covered by the North Inverness Lochs SPA within the LEP area, which is designated for its population of Slavonian grebe (Podiceps auritus).

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 within 3 km of the LEP area.

Semi Natural Ancient Woodland - There are 255 areas of Semi-natural and planted woodland within the LEP area, and tree type and coverage is as follows:

- Broadleaf – 1,482 Ha
- Conifer – 1,397 Ha
- Mixed Broadleaf / Conifer – 71 Ha
- Scrub – 10 Ha
- Total (all woodland) – 2,960 Ha

Schedule Monuments – There are 11 scheduled monuments within the LEP area.

Listed buildings – there are 49 category A, B and C listing buildings within 3 km of the LEP area.

Garden and Designed Landscape – The Inventory of Gardens and Designed Landscapes in Scotland is a listing of gardens and designed landscapes of national artistic and/or historical significance. There are no listings within 3 km radius of the LEP boundary.

Further details are provided in Appendix A, Section 5.

3.6.2 Estimated solar resource

Solar irradiance is a measure of the power available from the sun for a given area. Drumnadrochit can have annual solar irradiance of up to 837 kWh/m^2 (see Appendix A, Section 5). This is lower than areas to the South of the UK, but is sufficient to offer useful electricity generation potential for householders and small businesses.

Historically, surplus output of any small-scale PV array was assumed to be exported to the grid which would generate an export payment. As that export payment can be about a third of the purchase price of day rate electricity, there is more interest now in using all the output on site, reducing the need to purchase expensive electricity.

3.6.3 Estimated wind resource

The wind resource in the area is very good with an available average wind speed of around 5.5 m/s at 10 m a.g.l. (See Appendix A, Section 5). However, near settlements within the valleys the wind speed ranges from 3 – 4 m/s. Key considerations can be summarised as:

- A number of environmental designations;
- Certain areas have a poor resource at lower heights due to likely shielding from hills in the surrounding area, which corresponds to areas where most of the population resides.
- Resource on the surrounding hills is good.
- Cumulative impact of larger wind developments already within the wider area.

This means that medium or large-scale wind development will have limited feasibility across large areas of the LEP area. Smaller wind turbines, below 30 m to tip, are more likely to be less constrained; however, careful consideration would need to be made in terms of available resource.

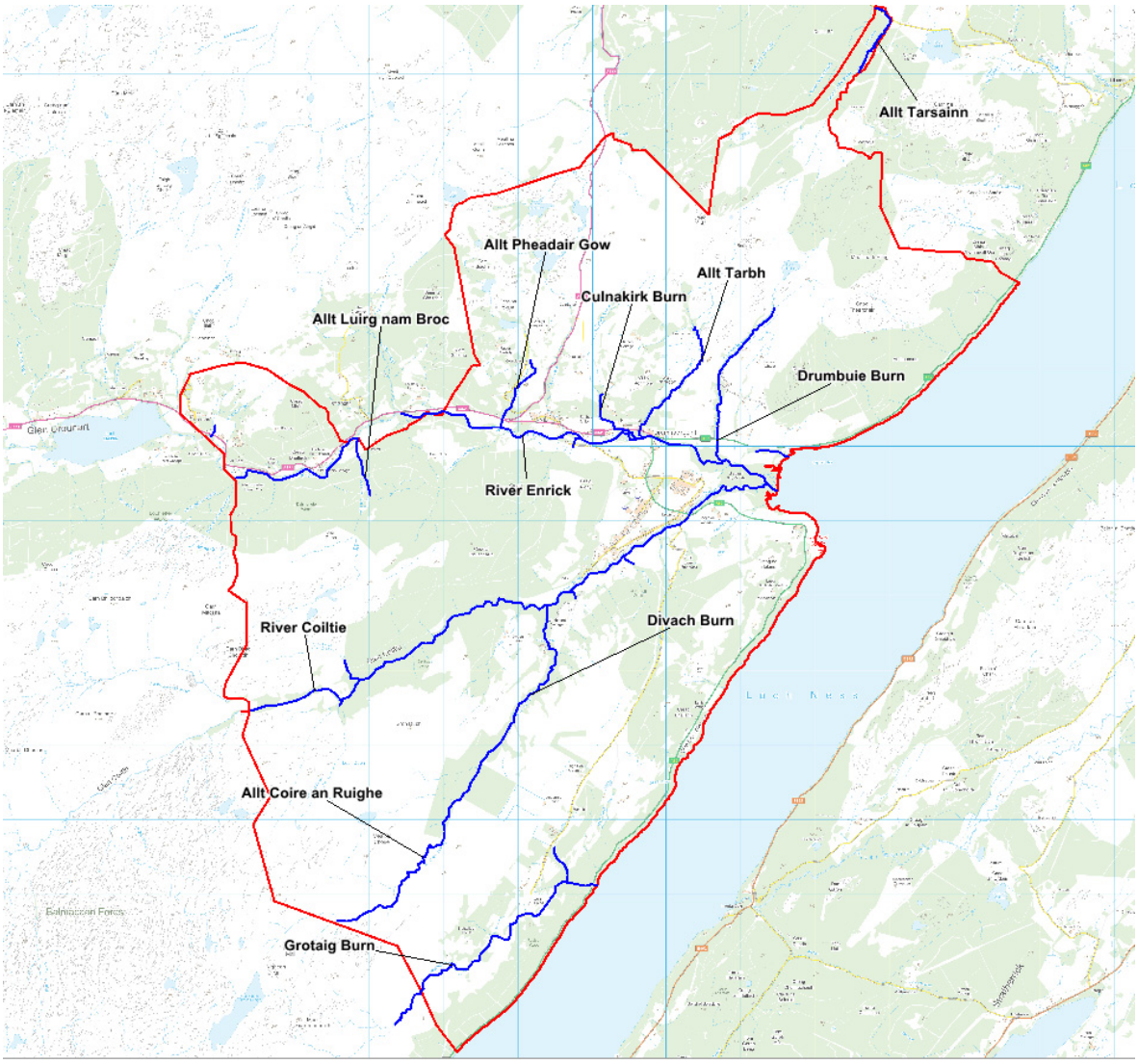
Information regarding the status of planning applications for medium and large scale wind developments in the area is available via Highland Council[4].

3.6.4 Estimated hydro resource

There are a number of watercourses, burns and rivers within the Drumnadrochit LEP area, as shown in Figure 7. Details of these rivers can be found in Appendix A, Section 5.

[4] http://highland.maps.arcgis.com/apps/webappviewer/index.html?id=5ec04b13a9b049f798cadbd5055f1787

Figure 7 Key Rivers and Burns around Drumnadrochit



3.6.5 Estimated biomass resource

Forest Enterprise Scotland is the agency responsible for managing the National Forest Estate on behalf of Scottish Government Ministers. There are ten Forest Districts; Drumnadrochit lies within the Inverness, Ross & Skye District.

The management priorities and objectives within each District is set out in a Strategic Plan.[5]

In the area including Drumnadrochit there is a commitment to prioritise timber production where there are no major biodiversity interests (e.g. SAC/SSSI). In terms of volume this amounts to at least 200,000 m^3 of softwood timber each year.

The Strategy recognises the key role that the District provides in supplying major timber processors in the wider region, but also the need to supply to small-scale local users. Support to the local

[5] https://scotland.forestry.gov.uk/managing/who-manages (Accessed June 2018)

woodfuel and firewood markets is a specific aim, through the management of broadleaf woodland (mostly birch).

4. Energy Baseline

In framing the energy needs of the community in Drumnadrochit it is useful to understand the present scale of energy consumption and how energy is consumed and utilised by residents in homes or staff and occupants in public buildings and business premises. This then supports an understanding of how energy can be managed, where largest uses of energy can be identified and informs how changes to demand and supply of energy can have an impact in the local area.

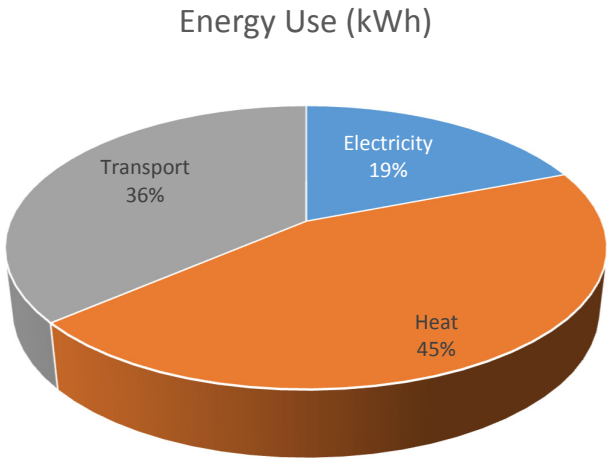
Energy use fluctuates throughout an average day, week, month and year in response to a range of factors; weather, hours of daylight, level of tourism and business activity etc. It is helpful to think about the total energy use over a 12-month period, since this then captures some of these fluctuations in monthly demand.

The review of energy use prepared for this LEP document has involved collating information from a variety of data sources in order to develop the overall figures. These include direct billing information from some organisations as well as data on household energy use modelled using SAP (Standard Assessment Protocol – the formal software used in producing EPC details and evidencing compliance with Building Regulations in the case of new build properties). Where energy bill data is not available, estimates of energy use have been derived using nationally published benchmarks. Transport data has been derived using information available from Scotland's Census and nationally published data from Transport Scotland.

4.1 Overall energy demand

This array of energy information and data has facilitated the production of a summary of total energy use in the LEP area.

Figure 8 Total annual energy use (Drumnadrochit LEP area)



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

Table 8 Breakdown of energy use (Drumnadrochit)

Source	Annual Energy Use (GWh/yr)	Annual Carbon Emissions (tCO_{2e}/yr)
Residential, *of which:*	28.4	1,975
Electricity	5.1	4,066
Heating	11.9	3,444
Transport	11.4	9,485
Non-Domestic, *of which:*	3.0	1,005
Electricity	0.9	346
Heating	2.1	659
Total (All Sources)	31.4	2,980

4.2 Future changes

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 can typically be managed within the context of existing supply and generation systems. 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.

In the case of Drumnadrochit there are two significant areas of new housing that are allocated within the Local Development Plan (see Section 5 for further details). Taking forward both sites would add an additional 130 housing units to the energy requirements of Drumnadrochit.

While the precise details of the housing proposed will only become available as phases of development take place, it is possible to provide an initial estimate of the scale of demand and compare this with the overall figures for existing demand. If all 130 units of housing are developed then this will require somewhere in the region of 0.3 – 0.35 GWh/yr of heating (around 3% of total existing residential heating energy use) and 0.4 – 0.45 GWh/yr of electricity (around 8% of existing residential electricity use).

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[6]. 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 between now and 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.

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

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

Strategies (LHEES) will provide prospectus for local area in terms of investment in energy efficiency, district heating and other heat decarbonisation opportunities.

Further details can be found in Appendix A, Section 6.

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.

5.1.1 Financial tariff support for renewables

For smaller scale renewable generation (of a size up to 5 MW) the UK Government has put in place two support schemes – the Feed in tariff (for electricity generation) and Renewable Heat Incentive (for heat generation). Eligible technologies in each case are able to receive a payment related to the energy that they produce. These payments are received over the operational lifetime of the technology (typically 20 years).

In its Autumn Budget of 2017[7] the UK Government announced a review of the Levy Control Framework (LCF) that ultimately sets outs how much money is committed from UK Government funds to pay for feed-in tariffs, and schemes relevant for large scale generation (over 5 MW capacity). In the near term this means that no new carbon electricity levies will be put in place until 2025.

This means that there will not be access to feed-in tariffs for electricity generators until 2025. The scheme will effectively close to new generation in April 2019.

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
- The Local Development Plan allocates a number of sites for development in Drumnadrochit, including some that are already underway
- Ongoing initiatives by Highland Council and other agencies are seeking to reduce overall fuel poverty levels and offer increasingly sustainable energy supply systems

There are a number of organisations that will have an interest in and influence over achievement of the Local Energy Plan outcomes. These organisations can be categorised as statutory/public sector and voluntary/local community.

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/661480/autumn_budget_2017_web.pdf (Accessed April 2018)

5.2.1 Statutory/Public Sector

Highland Council

The Highland Council is the local authority covering the Drumnadrochit area and is responsible for services such as education, social care, waste management, cultural services and planning.

Energy efficiency in its own operations: As a public sector organisation it is legally obliged to measure and report its annual energy use and greenhouse gas emissions and as a result of this is also continually reviewing how to reduce emissions. The organisation's current Carbon management Plan 2013 – 2020[8] identifies a range of energy and emission reduction activity the Council will be undertaking in its estate. One of the major initiatives within this plan is a £16 million capital programme to change the majority of the Council's street lighting stock to energy efficient LEDs by 2020/21.

Supporting communities: The overall priorities for the Council in how it plans services and supports communities are set out in its 'Local Voices, Highland Choices' document[9]. This provides five themes for the period 2017 – 2022.

Planning requirements for renewable energy: The Highland Renewable Energy Strategy was published in 2006, which helped to inform requirements and expectations around renewable energy developments. In August 2016 the Planning, Development and Infrastructure Committee agreed that this will no longer be used as a material consideration in respect of wind. The Onshore Wind Energy Supplementary Guidance, November 2016 (with addendum, December 2017) provides the latest guidance for any wind turbine installation in the LEP Area.

Planning and local development: The 2015 Local Development Plan which covers Drumnadrochit is the guide for development and investment in the Inner Moray Firth area over the next twenty years[10]. This Plan sits alongside the Highland-wide Local Development Plan to provide the framework for delivery of new homes, jobs and services, and supporting infrastructure.

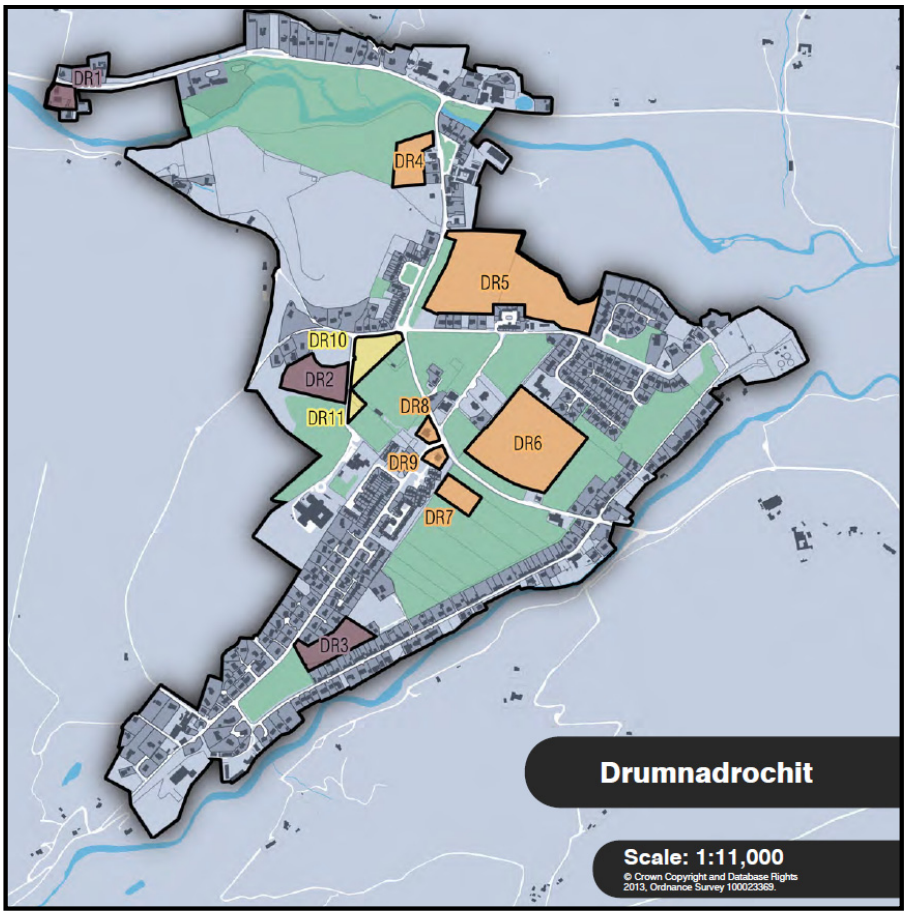
There are 11 allocated sites within Drumnadrochit as shown below. The largest two sites are:

- Up to 55 homes, Business, Retail, Community facilities (DR6)
- Up to 75 homes, Business, Retail, Community facilities (DR7)

Further details are provided in Appendix A, Section 6.2.

[8] https://www.highland.gov.uk/info/1210/environment/321/climate_change/4 (Accessed April 2018)
[9] https://www.highland.gov.uk/info/695/council_information_performance_and_statistics/381/our_priorities (Accessed April 2018)
[10] https://www.highland.gov.uk/downloads/file/15008/adopted_inner_moray_firth_local_development_plan (Accessed April 2018)

Figure 9 Drumnadrochit Development Allocation in the Local Plan



NHS Highland

NHS Highland is the public funded healthcare provider providing services in Drumnadrochit. The organisation manages a recently constructed medical practice in the village. The organisation is also recognised as a "main player" and reports annual energy and emissions use data as required by the Scottish Government. Its Carbon Management Plan is helping staff to engage with energy efficiency and emissions reduction projects. One relevant initiative within the Carbon Management Plan is a continued review of vehicle use to seek opportunities for expansion of the use of electric vehicles. The organisation is also one of the leaders in the area in terms of assessing climate related risks to healthcare. This is helping to identify where there will be emerging healthcare requirements and threats and where infrastructure will need to be climate proofed.

Scottish Natural Heritage

Scottish Natural Heritage is the Scottish public body responsible for the country's natural heritage, especially its natural, genetic and scenic diversity. It advises the Scottish Government and acts as a government agent in the delivery of conservation designations including the Special Area of Conversation and Special Site of Scientific Interest which form much of the eastern boundary of the village.

Community Planning Partnership

The Community Planning Partnership brings together all three of the organisations noted here, third sector organisations and other key community groups. The Highland Outcomes Improvement Plan

(HOIP)[11] sets out the vision, purpose and focus for the Highland CPP from 2017-2027 in order to reduce inequalities in Highland.

Further details are provided in Appendix A, Section 6.2.

5.2.2 Voluntary/local community

GURCA - Glen Urquhart Rural Community Association.

The group's purposes are to benefit the community of Glen Urquhart which comprises the Glen Urquhart Community Council area with the following objectives:

- The advancement of community development (including the advancement of rural regeneration) within the Community;
- The advancement of education
- The advancement of citizenship
- The advancement of environmental protection or improvement

Glenurquhart Community Council

The Community Council is part of the Aird and Loch Ness Ward of Highland Council which has 4 elected members of Highland Council. The Community Council is entitled to a total of nine members based on the size of the population in its area. Glen Urquhart Community Council covers around 230 sq.km, with a population of about 2,077, approximately 1,500 households. The area runs alongside Loch Ness, from Brackla Burn on the north to Alltsigh Burn on the south, going as far as Corrimony and Millness up the Glen. The Community Council area is larger than the LEP boundary, by including a significant area to the west towards Cannich.

Drumnadrochit Chamber of Commerce

The Chamber looks to promote and enhance business opportunities for all its members. It is actively involved with a large number of tourist and public bodies, working with them when possible. It also strives to bring more tourists to Drumnadrochit and the surrounding area, giving them a warm welcome through a wide range of accommodation, restaurants, visitor attractions and shopping opportunities. The Chamber has played an essential role in the Drumnadrochit LEP preparation by helping to promote the survey to members and also identifying a representative sample of businesses for further interview.

Glenurquhart Care Project

The Glenurquhart Centre is a community-owned business run by the Glenurquhart Care Project (GCP) Charity. It was established in response to a need for local care provision for the elderly and vulnerable in the communities in and around Glen Urquhart and Upper Strathglass.

Soirbheas

Soirbheas is a registered charity, whose objectives are to strengthen and support the communities of Glen Urquhart and Strathglass. The charity distributes funding derived from community benefit and investment from local renewable energy schemes. There are four key objectives Soirbheas works towards:

1. Improving the energy efficiency of the housing within local communities

2. Strengthening the local economy by encouraging new businesses to set up

[11] http://www.highlandcpp.org.uk/uploads/9/5/2/0/95206114/hoip_v6_cpp_board_final__no_photo-ilovepdf-compressed.pdf (Accessed April 2018)

3. Protecting our environment for future generations

4. Providing services that enable elderly people to live longer in their own homes

One of Soirbheas' main sources of income is its interest in the Corrimony wind farm. Soirbheas is a partner in the five turbine windfarm at Corrimony, having raised money from grant applications and a loan from SIS, to invest in one of the turbines.

5.3 Community commentary on areas of action

Community commentary - summary

- The views of the community have been sought via a combination of work with the local steering group, workshop sessions with volunteer local ambassadors and via an online survey
- The community sees the LEP as interlinked with health and wellbeing and the quality of the local environment.
- Aims and objectives for the LEP have been distilled and set out in Section 1.4
- The top five priorities arising from community survey work seeks to use solar, hydro and wastewater to generate useful energy for the local community. Further work in improving insulation in homes (reducing heating bills) was also prioritised. Development of a community bus service using an electric vehicle was the final priority

A programme of community engagement was devised to assist in the development of this LEP. In broad terms an 'Ambassador' programme was used, where volunteers from within the community were asked to attend a series of workshops to discuss issues relevant to the development of the plan. In doing so they were then asked to reflect on wider views through everyday conversation among other community members.

The first workshop session provided an introduction to the development of the LEP and asked for some general thoughts around potential ideas that Ambassadors would like to see within the Plan.

In terms of types of projects there was interest in:

- Solar PV
- Hydro
- Biomass
- District heating

There was no interest in the development of wind turbines.

Potential project ideas included:

Transport

- Public transport that meets community needs (timing, frequency, capacity for locals)
- More charging points for electric vehicles (powered by local renewables?)
- Car sharing scheme

Energy

- Energy from waste water
- Reduce heat loss / energy use in community buildings (sensors, zoning, door closers etc)
- Street lights and other public lighting: solar power, use timers

Barriers to implementation of the LEP were seen as:

- Behaviour Change
- Lack of knowledge
- Support from community
- Finance
- Time commitments

The LEP was seen as interlinked with health and wellbeing and the quality of the local environment.

Two follow up surveys were then issued. The first looked at where priorities lay in terms of what the LEP could address. These have been distilled into the priorities set out in Section 1.

The second looked at specific types of projects that people would be keen to see addressed.

A summary of overall responses is provided here. The five highest scoring initiatives are highlighted within the Table.

Table 9 Community Survey Responses (Project Ideas)

Project	1	2	3	4	5	Average Score
Community biomass heating system	9.3%	3.7%	24.3%	31.8%	30.8%	3.7
Solar energy to heat and power community buildings	0%	0.9%	9.3%	21.5%	68.2%	4.6
Wastewater to heat homes	0.9%	0.9%	13.1%	29.0%	56.1%	4.4
Air to heat community buildings	4.7%	5.6%	25.2%	24.3%	40.2%	3.9
Water to generate electricity	0.9%	1.9%	8.4%	22.4%	66.4%	4.5
Demand management	4.7%	5.6%	20.6%	24.3%	44.9%	4.0
Energy storage	1.9%	2.8%	25.2%	28%	42.1%	4.1
Installing insulation to reduce heating bills	0.9%	1.9%	3.7%	27.1%	66.4%	4.6
Installing technology that allows real time monitoring of energy use	5.7%	5.7%	25.7%	17.1%	45.7%	3.9
Learning how to reduce bills and travel costs	4.7%	10.3%	20.6%	32.7%	31.8%	3.8
Electric community bus	3.8%	1.9%	7.6%	24.8%	61.9%	4.4
Electric cars						3.4
Car sharing / car club						3.1
EV charging points						3.6

Note: 5 is most appealing; 1 least appealing. Percentage of respondents is included in each score

Other Comments

1. Biomass - I have seen problems (in Sweden) where biomass projects have overused the "plentiful" local supply to the extent of causing damage to soil (not enough waste left to rot-down and replenish).
2. I was involved in the installation of a pv system at an outdoor centre. Partially grant aided, approved supplier. Panels went on fire before we had recovered our investment. Installers gone, insurers difficult (apparently this has been a fairly wide-spread issue in Germany). In favour of pv, but I think needs care.
3. There is a national shortage of biomass log pellets and the cost has increased dramatically in the last year, I would strongly recommend avoiding any biomass scheme. Our own biomass pellet boiler has been a huge disappointment and a major headache this last winter
4. My ratings are affected by likelihood of idea being feasible for the study area eg carsharing nice idea but I can't see Drum having adequate 'scale'
5. I wish we could have all the projects!
6. Many thanks for your continued support of local community organisations. Happy to take part in energy surveys.
7. Anything that benefits the environment around Drumnadrochit while responsibly providing energy for the community is a good thing.

8 Need something that will be quiet as dont want to disturb the community and it also will have to be trust worth in the equipment used without destroying the local area like the hydro scheme on the river coiltie.
9 Community bus would also be well used if there was a mid afternoon service from Inverness
10 More diverse waste collection and disposal systems.
11 All good ideas/projects-but getting full community engagement is the big challenge…
12 This is a useful stimulus for the community, but some concrete proposals with real evidence of government backing, for Drumnadrochit to act as a rallying point for an unfurling of new ways of producing or conserving energy would be a very sound next step. The community requires I feel something which will convince them that this is not merely a means of suggesting possibilities, but ultimately of achieving realities. At present the community sees this as nice notions, but where's the beef?

5.4 High level technology review

In thinking about the potential options for further work in terms of energy generation and supply in the Drumnadrochit area it is helpful to consider a range of different technologies and how useful or well matched they are in terms of the energy needs within Drumnadrochit. An overview is provided here.

Further details can be found in Appendix A, Section 6.3.

Table 10 Technology overview (Drumnadrochit)

Overall Technology suitability for Drumnadrochit	Technology	Commentary
HIGH	Biomass	Potential cost effective alternative to oil fired systems. Not a direct alternative for electrically heated properties (requires wet heating system)
	Heat Pumps	Air-source heat pumps offer potential alternative to electric heating. Ground source and water source heat pumps are more expensive options (more civil works are required during their installation). Fitting to existing properties needs to be linked with building fabric improvements.
	Hydro	There are a number of local water courses offering potential for small scale hydro schemes.
MEDIUM	Wind	Wind resource is good in the LEP area. However, existing planning guidance will restrict the scale of any development
	Solar PV	Rooftop solar PV offers potential for householders. There is limited immediate land area available within the LEP for larger ground-based systems
	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
	Energy storage	Household scale storage systems (often linked to solar PV) are expensive. The benefit of storage would be limited for

Overall Technology suitability for Drumnadrochit	Technology	Commentary
		individual THTC users given a lower tariff for electricity overnight.
LOW	Gas CHP	No mains gas supply to the LEP area makes this option expensive. Alternative gas supplies would need to be 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.
	Fuel Cells	Given existing heating assets operated by larger users in the LEP area these systems would be unable to operate cost effectively.
	Biomass CHP	This is an expensive option and could not operate effectively at the scale of heat demand within the LEP area
	Geothermal	The LEP area is not within a recognised priority area for geothermal resource. 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
	District Heating	The size and distribution of heat demand in the LEP area is not well suited to a district heating scheme. A larger baseload of heat would need to include one of the schools, which isn't feasible given their own existing heating systems
	Electrolysers	This technology would be expensive to install and need to operate at a community-scale

6. Review of local options

The earlier sections of the LEP outline the baseline energy consumption profile for Drumnadrochit as well as aspirations of the local community and Steering Group for the outcomes of the Plan.

A key theme as part of the data gathering and consultation was to raise awareness of energy saving measures and to provide an education framework around energy issues. This will help to sustain existing momentum around energy awareness and also a growing understanding of domestic, commercial and public sector energy interventions and projects in Drumnadrochit.

The following sections identify a range of possible energy options that the Drumnadrochit LEP area residents can consider.

6.1 Energy Saving Measures and Educational Framework

6.1.1 Energy Efficiency Awareness and Support

Support is already available to the community of Drumnadrochit via a number of agencies including Highland Council, Home Energy Scotland, Resource Efficient Scotland and Energy Saving Trust.

- Highland Council can apply for funding (via the Scottish Government Home Energy Efficiency Programmes Scotland – Area Based Scheme) available to install energy efficient measures in eligible properties. Residential properties owned by Highland Council and local Housing Associations 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, including travel. HES Specialists have developed a wealth of knowledge about domestic energy efficiency and heating. Over the last nine years, the team have visited almost 6,000 households across the Highlands and Islands and heard the concerns of many householders, including many struggling to heat their home. They are fully trained and know what advice to provide and understand the barriers that can stop people taking action. There remains opportunity to take advantage of their in-depth knowledge when developing potential community projects on domestic energy efficiency. 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
    - 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 Drumnadrochit on what is available to them. They can:
    - Work with local business facing organisations and advisors to disseminate information on the support available including grant and loan funding
    - 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 Drumnadrochit.

Proposed Action Point #1

Deliver community energy awareness event, showcasing the emerging Local Energy Plan and the work of the above agencies in supporting ongoing efforts to use energy efficiently and further develop renewable energy opportunities. This could include trial opportunities to use electric vehicles and/or electric bikes.

6.1.2 Energy tariffs and market switching

Given the extent of use of electricity as a primary heating fuel it is useful to include information and education to the community and businesses on the different tariffs available. It is understood a large proportion of householders use the Total Heat Total Control (THTC) tariff and awareness needs to be provided to show there could be the potential to switch to a more competitive tariff which could save money.

Home Energy Scotland and Changeworks Affordable Warmth Service have an in-depth understanding about switching from THTC. Many people including some electricians and many electricity suppliers, do not understand THTC, nor other north of Scotland restricted meters, and many householders would benefit from remaining on the THTC tariff if they understood it properly.

Home Energy Scotland and Changeworks staff advise householders on restricted meter types and tariffs including THTC. If need be, advisors will visit a householder in their home to explain how the restricted meter works and how to use it properly. (There are currently 11 restricted meter types in north of Scotland).

Proposed Action Point #2

Community to work with Highland Council and Home Energy 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 join the existing heating oil club in Drumnadrochit[12]. 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.

Proposed Action Point #3

Post local notice to residents using heating oil to provide further details regarding the heating oil club.

6.1.3 Promotion of energy efficiency

There is an opportunity to provide educational information to both Drumnadrochit High School and Primary School so the younger generation can benefit from the advice from the agencies listed above. Home Energy Scotland, for example, offers a range of support for promoting energy efficiency. The organisation uses social media; press editorial; adverts; posters; direct mail; third party mailings; targeted emails; support for private sector landlords to help contact their tenants; attendance at local events to provide energy advice; delivery of local events with external speakers;

[12] https://www.oil-club.co.uk/heating_oil_clubs/the_drumnadrochit_village_heating_oil_club.html (Accessed April 2018)

delivery of Billbusters and Top Tips energy saving sessions; and deliver home energy visits to those who need them.

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

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

The larger and more disruptive works would be the delivery of both internal and external wall insulation programmes 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.

Table 11 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)	Estimated No. of Properties relevant for measure
1	Replacement of incandescent lightbulbs with LED equivalent	£15,800	£16,340	240,100	81	860
2	Loft insulation top-up	£93,600	£13,100	192,530	65	340
3	Room in roof wall and sloping areas insulation	£168,700	£27,160	398,990	134	105
4	Internal wall insulation	£1,625,920	£93,830	1,378,490	464	225
5	External wall insulation	£543,280	£15,800	231,830	78	48

6	Cavity wall insulation	£34,120	£18,980	278,895	94	80
7	Underfloor insulation works	£1,291,107	£86,360	1,268,750	427	780
8	High efficiency storage heaters	£2,398,000	£96,900	1,423,100	479	428
9	Replacement of existing oil boilers	£956,120	£44,740	657,360	221	305
10	Replace entry doors with modern insulated uPVC equivalent	£551,700	£17,330	254,600	86	725
11	Install A-rated windows (uPVC frames)	£2,910,000	£53,520	786,310	265	745

Different dwellings will benefit to a larger or greater extent depending upon individual circumstances. Measures with longer payback periods can be used in a targeted way for particular households, where finances can be made available.

Alongside the existing funding schemes and programmes described in Section 6.1 the Scottish Government is currently developing its EES (Energy Efficient Scotland 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.

There is potential to develop a community project to help householders install domestic energy efficiency measures. This might entail exploring development of a Community Installer Management Service in dialogue with the community and their needs. This initiative may be of benefit because there are a significant number of energy efficiency installers cold-calling householders across the Highlands and promoting inappropriate energy efficiency and heating solutions. They can sweep through an area. There is also the situation that when a householder does want to undertake energy efficiency work, they find it difficult to find an accredited installer who will come to their area. Many installers, found on postcode searches, say they cover Drumnadrochit but may not actually come. Exploring a Community Installer Management service would potentially help householders and many businesses, to access a range of installers; ensure they install the most suitable energy efficiency measures; and be assured of a quality job. Home Energy Scotland can facilitate this support.

For owner occupiers interested in improving their hard to treat homes and renewables, Home Energy Scotland offers a specialist service including a home visit, survey of the respective property and provide bespoke recommendations. This has benefits beyond the Energy Performance Certificate as the recommendations are tailored to take account of

- Practical opportunities and limitations of the house
- Actual energy usage and actual energy costs

- Preferences of the householder

In addition, the home energy specialist can provide scenarios to include different recommendations, which can cover different scale of works and can compare different heating options. We will help direct the householder to installers. If the householder can get quotes, we can review the quotes.

The benefit to community buildings is harder to estimate without a specific review of the individual buildings. However, as with the residential stock, there is an opportunity to help the users of community buildings including for example church, shinty and sports clubs, understand how they can reduce energy consumption and spend. There may also be scope to engage with renewable energy for onsite power generation. This type of intervention can be of interest some public funders who may provide financial support.

Awareness raising efforts can be included as part of the wider action point on Energy Efficiency Awareness. Opportunities for energy saving and any subsequent energy generation opportunities can be included within the Community Action Plan.

6.2 Energy generation and supply

There are a number of potential electricity generation schemes that are reviewed here.

#12	Community Solar panel and energy storage system
Location	The Glenurquhart Care centre already has operational solar panels on its roof. One potential option is to install a battery storage system so that energy generated during the day not used on site can be stored and released for use in other properties. The system could be linked via a private wire supply to the first phase of 10 properties proposed for development within the adjacent site.
Rationale	Using more of the energy generated by the solar panels either within the Care Centre or in neighbouring buildings offers a higher cost saving (displacing need to buy grid supplied electricity) than it loses in terms of an export tariff for electricity exported directly to the national grid. A battery system could also be used in a wider smart grid (see later option). The village is one of the main tourist attractions for tourists visiting Loch Ness. Numbers will peak during the summer, coinciding with the main levels of electricity output from any future solar PV installation. The installation of these PV arrays would therefore match energy production with a significant level of demand. There is scope for the community to be an investor or delivery partner in this scheme, potentially assisting wider uptake of Solar PV in the area. The cost of installation of the battery system will be similar to the cost of installation of the original solar panels. The greatest benefit of the electricity produced will be if it can be used and reduce grid-supplied import. This may require a private wire arrangement with neighbouring buildings.
Benefits	Helping to offset daytime electricity production which is the highest cost electricity that businesses and domestic customers will purchase.
Steps to develop	1 – Carry out feasibility study with Glenurquhart Care Project and housing developer to determine options for supply of energy from the Solar PV system into local buildings.

#13	Community ground based solar array
Location	A ground mounted solar PV array can accommodate a larger number of panels and therefore produce more output than typical roof-mounted systems. There are fields and land in the village where ground mounted solar PV panels could be installed if this does not conflict with development potential or requirements for maintaining the green fields that separate developments (Section 3.1) While the village itself is relatively low lying and shaded from trees and hills, there is a south facing hillside on the left hand side of the main Drumnadrochit to Inverness road as it leaves the village. A 100 kW array, for example, would need a land area of around 650 m^2. The estimated energy output would be around 75,000 kWh/yr with an installation cost of £100,000 - £120,000.
Rationale	A large-scale array could produce electricity sold on to local buildings displacing grid supplied requirements and reducing consumer costs.
Benefits	Villagers, business and building owners benefiting from the financial support made available to encourage the establishment of micro renewable energy production. Helping to offset daytime electricity production which can be the highest cost electricity that businesses and domestic customers will purchase. Scope for community involvement as a direct investor and owner of an array therefore offering a revenue stream to support ongoing local energy requirements.
Steps to develop	1 – Seek to carry out an initial feasibility study to identify potential sites for a ground-based array. 2 – Work with stakeholders such as Highland Council, Local Energy Scotland, Resource Efficient Scotland to scope out support and resources that could help identify and deliver a solar array. 3 – Explore community benefit models that could be developed to enhance role of wider community in developing any potential scheme

#14	Rooftop Solar PV installation
Location	There are a number of buildings with roof space that would accommodate solar panels.
Rationale	A wider programme of solar PV installation would offer scope for a community-led investment opportunity that could offer a means of distributing output electricity to local consumers. Initial assessment from the Home Analytics database suggests that there are adequate roof spaces in residential properties to install around 1,750 kept of capacity capable of delivering around 1.2 GWh of electricity per year. The installation cost would be of the order of £1,000/kWp; the output electricity would attract up to the average local electricity tariff price (ca. 15p/kWh).
Benefits	Villagers, business and building owners benefiting from the financial support made available to encourage the establishment of micro renewable energy production. Helping to offset daytime electricity production which can be the highest cost electricity that businesses and domestic customers will purchase.
Steps to develop	1 – Use initial details from Home Analytics to determine scale of potential for Solar PV installation across residential stock. 2 – Work with stakeholders such as Highland Council, Local Energy Scotland, GURCA and Soirbheas to scope out potential scale of projects.

	3 – Work with stakeholders to identify how output from this project would create financial and environmental benefits for the community

#24	Rooftop Solar Thermal
Location	Domestic and community building rooftops
Rationale	Solar thermal panels capture energy from the sun and use this to provide water heating in properties. This is a form of renewable and low carbon energy which displaces the need for the use of grid supplied electricity or oil/LPG for water heating. The sun produces most energy during the summer when there are the greatest number of tourist visitors to the LEP area. Solar thermal panels will therefore help to meet hot water requirements during the busiest time of the year.
Benefits	Solar thermal panels will offset the need to purchase and consume grid supplied electricity and also fossil fuels such as LPG or heating oil. The panels will capture the sun's energy and convert this to heat. Solar thermal can meet around 50% of domestic hot water demand; this may be higher during summer periods when the largest amount of solar energy is available. This means that existing domestic hot water systems need to be retained to ensure that total requirements are met. Sufficient space for hot water storage tanks are therefore required to make solar thermal systems viable. A key challenge, therefore, is to identify the purchase and install costs and likely output of the solar thermal panels and compare this with the cost of heating from the existing systems. It also means using potential roof space that could accommodate solar PV to generate electricity instead.
Steps to develop	1 – Use initial details from Home Analytics to determine scale of potential for solar thermal across residential stock. 2 – Review community buildings to identify scope for solar thermal (for example to produce hot water for showers in the shinty team building). 3 – Work with stakeholders such as Highland Council, Local Energy Scotland, GURCA and Soirbheas to scope out potential demand for a domestic install programme.

#19	Use of heat pumps (air and ground source) and other renewable options
Location	New build development
Rationale	Air source and ground source heat pumps could be a potential source of space heating for individual buildings. Ground source heat pumps need more physical space around the property to enable installation of a borehole or horizontal trench. The heat output from these systems is lower than a conventional radiator (or storage heater) so they are best suited for use with underfloor heating in order to provide a larger surface area for heat emitting. The alternative is a larger radiator. This makes them difficult to use as a retrofit installation method, particularly if replacing electric heaters. It also means less savings for properties where there has not been considerable work to improve overall insulation and reduce heat demand. Heat pumps are therefore ideal in new build properties. It is possible to develop small scale supply networks to buildings, where hot water is fed from a ground source heat pump system to provide space heating and domestic hot water. These would be most suited to new build developments, given the need for a whole new distribution system in the case of fitting in existing properties with electric heating. An emerging area of heat pump technology is water source heat pumps. These could collect heat from the Coilte/Endrik or indeed Loch Ness, using this to provide space and water heating

	to properties. However, a challenge with this technology is making them spate proof for rivers like the Coilte which can be very turbulent after heavy rainfall.
Benefits	Heat pumps on new build properties will displace the need for LPG or other forms of fossil fuel powered heating. Using heat pump technology creates the opportunity for small scale district heating on new development where shared infrastructure (e.g. ground water loop) can be installed. There will be scope to link the electricity required for heat pump technology, to local electricity production from solar PV or hydro systems.
Steps to develop	1 Support negotiations with developers of new housing to encourage uptake of heat pumps or other renewable technology (as appropriate). 2 Support existing building owners in looking at the feasibility of using heat pumps or other renewable options where this is achievable. 3 Develop and agree a clear statement on behalf of the community regarding on-site renewables that can be taken into consideration by Highland Council when assessing planning applications.

#20	Local Anaerobic Digestion
Location	New facility within local area
Rationale	At present there are no direct food waste collections within Drumnadrochit. This means that there is biodegradable waste available in the local area that could be used in a suitable digester to generate biogas that could be used as a fuel. There are also a number of neighbouring farms that would provide a further source of animal manure. An anaerobic digestion facility would use sealed digester tanks to breakdown the waste and through control of temperature and chemical conditions generate a biogas that could be cleaned and used as a fuel for electricity generation or simply heat output. Estimated household biodegradable waste in Drumnadrochit is estimated, based on Highland Council waste arisings figures, to be around 150 ktpa. This is a modest amount of waste and would offer a small capacity for energy generation. This would not greatly improve with the addition of farm waste, since its energy content is very low. The costs of setting up a facility would be heavily impacted by the cost of waste collection. The process of biogas generation also produces a solid residual output that can be used a soil improver.
Benefits	Potential benefit of biogas for community use Generation of soil improver for use in local gardens, recreational areas and wider farmland
Steps to develop	1 Discuss with Highland Council estimates of relevant waste streams arising in the area and future plans for waste collections. 2 Carry out initial feasibility study to assess local scale of waste arising and collection models relevant to anaerobic digestion.

#21	Local hydro projects
Location	A number of water courses in the Drumnadrochit LEP area
Rationale	The steep sided hills around the LEP area lend themselves to small hydro developments that are less intrusive than larger schemes established post war in the surrounding area. There are an increasing number of small and micro hydro schemes in the immediate area.

	Smaller, micro hydro schemes could provide a more continual supply of electricity, especially over the winter where there is a reduction in energy produced by solar PV arrays and still weather may impact on wind turbine electricity output. There is also an increasing range of hydro generation technologies that can be used in different catchment areas.
Benefits	Small and micro hydro schemes will produce a more regular supply of electricity than other renewable energy technologies, especially over the winter. This would make them an ideal source of energy to use in, for example, the heat pump systems identified in the previous intervention. Where the schemes are able to operate and produce electricity during the summer, this can help meet the requirements of some electric vehicle and bike interventions identified in earlier projects. While hydro will deliver these benefits, a significant analysis is required to be undertaken on any scheme that will have an impact on a river/stream that is used by migratory salmon. This could be an issue for the Endrik.
Steps to develop	1 Review existing Highland Council produced online map resource that identifies where micro hydro schemes have been established. Identify initial river sections for further feasibility work looking at micro hydro schemes. 2 Where any development may have an impact on migratory Atlantic salmon, greater assessment and planning will be required. It would be prudent to identify additional requirements and how these could be addressed. Typically, this would involve using an Archimedes screw turbine with associated fish protection measure rather than other forms of design. 3 Explore community based funding options for any proposed hydro development

#22	Use of heat from wastewater for community buildings
Location	Use heat source from wastewater arising at wastewater treatment works
Rationale	Wastewater at a temperature of 7 °C would provide a potential heat supply of 100 kW, given existing flow rates across the wastewater treatment works. A heat pump would then be used to exchange heat from the wastewater in order to deliver a low temperature hot water supply. This LTHW supply would be distributed via pre-insulated buried pipework to serve individual buildings, specifically: • Blairbeg Hall • Glen Urquhart Care Centre
Benefits	The proposed solution would replace electric storage heating as currently used in the Glen Urquhart Care Centre and Blairbeg Hall. It therefore offers potential cost savings in terms of the end-user bills for space heating and hot water.
Steps to develop	1 Further feasibility work to carry out trial pits for proposed pipework routes, as well as developing better understanding of civil works requirements and how proposed scheme will interface with individual buildings. 2 Further system design work to provide basis for more accurate cost estimate for delivery of the project. 3 Liaison with Scottish Water Horizons and Highland Council to obtain relevant planning permission for works

6.3 Transport and Travel

A number of transport and travel related opportunities are reviewed here.

#15	An electric vehicle and bike charge point and provision of an electric car
Location	The village currently has two public funded electric vehicle charge points in the main car park. Analysis of the charge data has shown how the use of this resource corresponds to main tourist visitor periods. There may be scope to increase facilities at this existing resources. The Care Centre has a mini bus and car for collecting day care clients they will both need to be replaced in the future. This may provide a location for charge facilities. The new Health Centre may provide a suitable location for further charge facilities. It is difficult to generate revenue directly from any additional charging points. Each vehicle has the ability to search for public charging points and will show those that are free to use as well as those that charge. Given the existing charging points in the village this means there may not be demand for use of additional charging points if priced per charge. The cost of installation of a charging point will be in the region of £1,000 - £1,500 depending upon the design. Promoting the use of ULEV vehicles through the purchase of an electric mini-bus and car by the Care Centre would be positive from a community perspective. While the capital cost of these vehicles would be ~ 40 – 50% higher than a conventional vehicle this would be offset by operational cost savings (lower ongoing maintenance and fuel costs). Promoting the use of ULEVs and electric bikes to community members and the availability of grant and loan funding will help householders, businesses and visitors make the switch to electric vehicles and bikes.
Rationale	Data provided by Highland Council identified use of the existing charging facilities. There is increased use of the facilities in months where there are greater number of tourists in the village. This suggests there is an increase in the number of electric vehicles visiting the area. As people become more aware of electric car travel, there may be scope to engage with electric bike travel around Drumnadrochit while cars are recharging. Concerns about the emissions from internal combustion continue to gain momentum, there will be an increasing range of hybrid and pure electric transmission vehicles being made available by manufacturers and bought by residents in the Drumnadrochit Local Energy Plan area. So there will be an increasing profile of hybrid and electric vehicles in the village. Electric transmission vehicles will become an increasingly adopted mode of travel in the area. The provision of electric bikes will present an alternative method for tourists visiting the village to explore peripheral areas, travel to the Castle, Divack Falls etc. This will also provide a less polluting and congesting way to move about the village which can become congested by tourists during busy periods.
Benefits	The community may be able to generate income from the sale of electricity for charging vehicles in the future. There is a range of funding being made available to incentivise the purchase of greener hybrid and electric vehicles. This may be complemented with project specific funding from for example Climate Challenge Funding. The rental of electric bikes may become a new income generating activity for the community. Scope to engage with public sector initiatives aimed at helping the transition towards electric transmission vehicles to help raise the profile of this technology in the village

Steps to develop	1 – Engage with HITRANS who are about to publish their Electric Vehicle Strategy for the Highlands. Identify key objectives in the strategy and how they could link to relevant projects in Drumnadrochit. 2 – Engage with funders and support stakeholders such as the Energy Saving Trust to identify possible funding and support for the installation of additional charging facilities. 3 – Establish regular monitoring of the existing facilities and look to install additional capacity when the existing facilities reach a specific threshold. 4 – Undertake community awareness raising activity to help generate increased knowledge of the different forms of electric vehicle and bike transport. Consult with Home Energy Scotland regarding potentially organising community engagement events focusing on the benefits of electric vehicles and the funding support available.

#16	Electronic real time public transport information for visitors
Location	There are a number of bus stops located in the centre of the village. These are used by buses passing through the village on their way to and from Inverness, Fort William and Skye. These services can drop off tourists in the village who will then catch a later service. There is also a tailored service which will collect passengers from a number of local stops outwith the village centre, transporting these people to Inverness and back.
Rationale	A key challenge for potential passengers and also for the service providers to increase use of these services is the lack of real time journey information. Due to weather, reliability, road conditions etc buses may not be running to schedule, especially over the winter or if there is an accident on the road. Increasing the provision of real time information for specific buses travelling to and through the village would help users plan their travel and have more confidence in the service. This would potentially reduce the need for car transport etc. This is also a key challenge for a community that has a significant number of tourist visitors that will be using public transport to get to and from Drumnadrochit. While there are comprehensive online facilities such as Traveline Scotland, poor internet and phone connectivity in the village challenges the ability to access these online resources. They also do not provide real time journey information that can update waiting passengers. In the first instance the enhanced wi-fi access in Drumnadrochit will help access to national travel data services. Using Traveline Scotland in the first instance would be a route to getting information live. LED display boards suitable for public transport information cost anywhere in the region of £1,000 - £4,000 each. The key value of such boards would be how to integrate these with a computer system to enable updated information.
Benefits	This would provide more real time information on public transport in and to and from the village. This could increase levels of confidence in public transport and increasing number of users. This would provide operators the confidence that services could be retained and possibly increased. Increasing the use of public transport would help to reduce the number of cars travelling to and about the village. This would help reduce vehicle fuel use, costs and emissions.
Steps to develop	1 – Engage with Traveline Scotland to confirm that all local providers and relevant services to Drumnadrochit are on the system

	2 - Engage with Stagecoach and other main bus service providers to establish how they are able to provide updates on specific bus journeys and transmission of this information via the Traveline Scotland web –based service 3 – Engage with Highland Council, HITRANS, bus service operators to identify suitable information displays and how this could be established in the village.

#17	Information as you travel
Location	Scope to provide more information for travellers as they are making their journey to Drumnadrochit on a community shuttle bus that would have taken commuters to Inverness and is transporting tourists on the return journey.
Rationale	There are a significant number of people commuting from the Local Energy Plan area to Inverness in the morning for work. Limited bus timetabling discourages commuters from using public transport. Operating a hybrid or electric commuter shuttle bus would be able to provide more appropriate timetabling as well as take tourists to Drumnadrochit on the return journey from Inverness. Providing real time tourist information about attractions, etc, on the bus would help to maximise the potential to encourage tourists to spend longer in the village and increase their spend per head. If the service proved popular then a larger fleet of vehicles would enable smarter travel routes to collect passengers potentially enhancing the flexibility of the timetable.
Benefits	Potential to increase tourism numbers visiting the village, improving the occupancy and financial viability of a new commuter shuttle bus service and helping to address a potential void in tourism information that will be left with the imminent closure of the TIC.
Steps to develop	1 Engage with relevant organisations; HITRANS, Community Planning Partnership, Energy Saving Trust, Climate Challenge Funding to identify the possible support for a community run hybrid or electric vehicle that would help displace Drumnadrochit commuters taking their cars to Inverness 2 Review the type of “in-bus” information displays etc that would be suitable to provide updated and real time information 3 Undertake community engagement to determine the potential uptake of this resource should it become available
#18	Electric shuttle bus and/or electric bike hire from the village to Urquhart Castle and other sites or landmarks
Location	Based in the village car park, this service would help tourists to access more peripheral areas of the village, for example Divach Falls, Abriachan or viewpoints at Bunloit.
Rationale	The use of electric transmission is likely to be expanded into mini buses by late 2019, early 2020. This will provide a low carbon form of travel around the village. This new service would help to distribute tourist numbers around the attractions in the wider area. If linked into a park and ride, this would reduce some of the car parking pressure at the Urquhart Castle car park. This in turn could free up space for coach parking which removes the need for coaches to park in the village. This would displace the need for tourists, visitors etc to use their car to travel around the immediate Local Energy Plan area for sightseeing. Electric mini-buses are likely to cost in the range of £50,000 - £70,000 to purchase and at present there are limited opportunities to rent these vehicles. Members of the Community

	Planning Partnership may be able to contribute to vehicle costs if the vehicle was used for wider community services outwith the tourist season.
Benefits	Providing a local mobility solution for people that would like to experience/explore the wider Drumnadrochit area. transport would be provided on electric bikes or a minibus that could be charged on increased provision of electric charging facilities. These would increasingly incorporate electricity produced from renewable energy facilities. The provision of electric bikes would help displace the need for some car journeys in and around the village. The ability for these bikes to assist cyclists on uphill journeys are likely to open up areas like Bunloit, Divach Falls for visitors to experience. This resource would also help to reduce the number of vehicles requiring parking space at the Urquhart Castle visitor centre. The increasing popularity of this attraction is leading to periods of car parking congestion that is having to be managed by new car parking attendants etc.
Steps to develop	1 Engage with relevant organisations; Drumnadrochit Chamber of Commerce, Historic Environment Scotland, Highland Council, Energy Saving Trust and HITRANS to explore initial support and potential for this proposal 2 Determine initial scope of scheme and associates outline costs and discuss with relevant organisations to explore potential funding options including any potential community ownership model 3 Explore potential to develop pool of e-bikes for hire in local area. Identify possible popular routes and attractions for visitors to access using electric bikes and produce online maps and information. This could promote, for example, access to the Glen Affric to Kintail Way.

#25	Electric Vehicle Car Club
Location	Based in the village car park, this service would help residents access Inverness and other areas. There would be scope to manage bookings etc via an online portal. This would allow both residents and tourists to access the Car Club (and potentially co-ordinate car share opportunities).
Rationale	The use of electric transmission is increasingly being incorporated into cars and vans and is likely to be expanded into mini buses by late 2019, early 2020. Running a car club will allow residents to access electric hire vehicles.
Benefits	This will provide an affordable and low emission transport solution that can be used by residents and visitors.
Steps to develop	1 Engage with relevant organisations; Drumnadrochit Chamber of Commerce, Climate Challenge funders, Energy Saving Trust, Highland Council and HITRANS to explore initial support and potential for this proposal 2 Determine initial scope of scheme and associates outline costs and discuss with relevant organisations to explore potential funding options including any potential community ownership model

6.4 Local Energy Management

#23	Community Smart Meter Initiative
Location	Across the Local Energy Plan area
Rationale	Every home and business in the UK is being offered a smart meter installation over the coming years. Smart meters provide greater detail on how energy is being consumed in a property. However, the greater value is in enabling smarter communication within local electricity grids to more accurately match demand and generation supply. So called 'smart' communication would enable the receipt and transfer of information between individual consumers and energy suppliers. This would enable time of use charging and greater ability for sharing of community energy generation to the benefit of local users. Unfortunately there is no single specification for smart meters, and earlier specifications don't enable two-way communication.
Benefits	Part of the rationale behind installing smart meters is that with access to greater information about energy use and costs, consumers will be more aware of why they are using energy and how consumption can be reduced. As awareness of how, why and when we use energy increases, there is potential for energy suppliers to offer different tariffs during the day. There will be scope to target energy consumption at periods where the lowest tariffs are being charged. This principle currently exists with the economy 7 tariff which results in a cheaper electricity charge overnight. In future we are likely to see more frequent opportunities throughout the day, to access cheaper electricity. There is also greater capacity to develop a smarter local grid that can match generation with demand. This means more effective use of local generation and avoids import of grid electricity where it is not needed.
Steps to develop	1 Explore with SSEN what options there are for smart meter uptake in Drumnadrochit and whether this will facilitate future smart grid in the area 2 Deliver a community smart meter awareness event, working with relevant stakeholders to highlight the technology and the potential benefits. 3 Develop an ongoing Smart Meter community engagement programme that will maintain the supply of supporting information case studies etc so that residents and business can maximise the benefits achievable from this technology.

6.5 Initial Options Appraisal

A summary of the opportunities reviewed in the previous section is provided here.

Table 12 Description of measures summary

#	Measure	Description of measure
1	Replacement of incandescent lightbulbs with LED equivalent	Replacement of older style bulbs with LED equivalent
2	Loft insulation top-up	Upgrade and top-up of existing loft insulation to at least 250 mm thickness
3	Room in roof wall and sloping areas insulation	Upgrade and top up of room in roof insulation to at least 100 mm thickness
4	Internal wall insulation	Installation of internal wall insulation (partition walls or battened)
5	External wall insulation	Installation of external wall insulation as rendered surface
6	Cavity wall insulation	In-fill or replacement of cavity wall insulation
7	Underfloor insulation works	Installation of insulation material beneath existing suspended floorboards
8	High efficiency storage heaters	Replacement of existing electric heaters with modern equivalent and additional controls
9	Replacement of existing oil boilers	Replacement of existing oil boilers with condensing, high efficiency equivalent
10	Replace entry doors with modern insulated uPVC equivalent	Replacement of main entry doors with uPVC insulated equivalent
11	Install A-rated windows (uPVC frames)	Replacement of existing glazing with double glazing (uPVC frames)
12	Use of Solar PV and battery storage at Day Care Centre	Development of supply system from Day Care Centre solar array to battery storage and/or private wire arrangement with adjacent new build housing
13	Development of a ground-based solar array	Development of a ground based solar array on a suitable site in the local area to use for community supply
14	Wider uptake of rooftop Solar PV	Wider programme of installation of solar PV on suitable rooftop areas
15	Community electric vehicle charging point and e-bike facilities and vehicle	Installation of an additional electric vehicle charging point and provision of a community ULEV vehicle and electric bikes
16	Development of real time public transport information displays	Use of LED display boards within main car park and/or bus stops to provide real time public transport information

#	Measure	Description of measure
17	ULEV Shuttle bus to Inverness	Development of shuttle bus service to/from Inverness within working week
18	ULEV Shuttle bus for local tourism	Development of shuttle bus service to operate in peak season to support movement of tourists and visitors
19	Promotion of use of heat pumps (air or ground source) and other renewable options in new build properties	Promote use of heat pumps and other renewable options within new build development properties in the community
20	Anaerobic digestion facility	Investigate use of biodegradable waste to generate biogas, to be used as local fuel
21	Small hydro scheme	Development of a small hydro scheme for electricity generation
22	Use of heat from wastewater for community buildings	Use of heat within wastewater as source of heating for community buildings close to local wastewater treatment works
23	Uptake of smart meters and development of local smart grid	Roll out of smart meters and capacity to develop a local smart grid
24	Wider uptake of rooftop solar thermal	Wider programme of installation of solar thermal systems on suitable rooftop areas
25	Local Car Club	Development of an electric vehicle car club

Table 13 List of options and initial overall assessment rating

#	Measure	Total Rating
1	Replacement of incandescent lightbulbs with LED equivalent	HIGH
2	Loft insulation top-up	HIGH
3	Room in roof wall and sloping areas insulation	HIGH
4	Internal wall insulation	MEDIUM
5	External wall insulation	MEDIUM
6	Cavity wall insulation	HIGH
7	Underfloor insulation works	MEDIUM
8	High efficiency storage heaters	MEDIUM
9	Replacement of existing oil boilers	LOW
10	Replace entry doors with modern insulated uPVC equivalent	LOW
11	Install A-rated windows (uPVC frames)	LOW
12	Use of Solar PV and battery storage at Day Care Centre	MEDIUM
13	Development of a ground-based solar array	HIGH
14	Wider uptake of rooftop Solar PV	HIGH
15	Community electric vehicle charging point and e-bike facilities and vehicle	MEDIUM
16	Development of real time public transport information displays	HIGH
17	ULEV Shuttle bus to Inverness	HIGH
18	ULEV Shuttle bus for local tourism	MEDIUM
19	Promotion of use of heat pumps (air or ground source) and other renewable options in new build properties	HIGH
20	Anaerobic digestion facility	LOW
21	Small hydro scheme	HIGH
22	Use of heat from wastewater as primary heating for community buildings	HIGH
23	Uptake of smart meters and development of local smart grid	HIGH
24	Wider uptake of rooftop solar thermal	LOW
25	Local Car Club	MEDIUM

This overall rating is a combination of the weightings and the technology fit as described in more detail in Appendix A, Section 6.4.

7. Summary of proposed actions

A summary of proposed actions is provided here.

Table 14 Summary of action points

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
1	Promote energy efficiency and opportunities for support in demand management and resource efficiency	Raise awareness among community in Drumnadrochit of existing support services available to homes and businesses Potentially use community day as a forum for this	Local Energy Scotland Home Energy Scotland Resource Efficient Scotland Energy Saving Trust Soirbheas GURCA Drumnadrochit Chamber of Commerce	Short
2	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	Home Energy Scotland Highland Council Soirbheas GURCA	Short
3	Heating oil club	Promote existing heating oil club within Drumnadrochit	Glen Urquhart Community Council Soirbheas GURCA	Short
4	Continue programmes of fabric improvements and insulation within residential property	Seek support, advice and funding (where available) for ongoing improvement works to insulation and building fabric	Highland Council Home Energy Scotland Warmworks Scotland	Medium

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
			Soirbheas GURCA Drumnadrochit Chamber of Commerce	
5	Use of Solar PV (photovoltaic) and battery storage at Day Care Centre	Conduct feasibility study to look at options for supply into battery storage system or adjacent new build property	Glenurquhart Care Project Soirbheas Local Energy Scotland	Short
6	Develop a solar PV and/or solar thermal array	Conduct feasibility study to look at potential for development of a community owned and operated ground mounted solar array and promote the uptake of building mounted PV and solar thermal arrays in suitable locations	Soirbheas GURCA Highland Council	Short
7	Small scale hydro scheme	Carry out feasibility study to assess scope for further micro hydro scheme in local area	Soirbheas GURCA Highland Council	Short / Medium
8	Promotion of use of heat pumps (air or ground source) and other renewable options in new build properties	Seek designs for new build dwellings that use heat pumps (air or ground source) and other renewable options where appropriate as the primary heat source alongside high levels of insulation and fabric	Highland Council Private Developers GURCA Glen Urquhart Community Council Soirbheas	Short / Medium
9	Use heat from wastewater	Seek to use heat from wastewater as primary heat source for	Scottish Water SHARC	Short / Medium

#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
		community buildings. Follow up initial feasibility study	Soirbheas GURCA Highland Council Local Energy Scotland	
10	Real time transport information	Seek to provide enhanced transport information in Drumnadrochit	Soirbheas GURCA Highland Council HITRANS Drumnadrochit Chamber of Commerce	Short
11	ULEV shuttle bus to Inverness and Community use	Conduct feasibility study to look at development of a ULEV shuttle bus service to Inverness timetabled to suit travel needs from Drumnadrochit. Explore options to use the bus by the community outside peak tourist periods (June – August peak)	Soirbheas GURCA Highland Council HITRANS Home Energy Scotland Energy Saving Trust	Short / Medium
12	Electric vehicle development	Explore local opportunities to extend the charging point network and promote community investment in vehicles	Soirbheas GURCA Highland Council HITRANS Home Energy Scotland Energy Saving Trust	Short / Medium

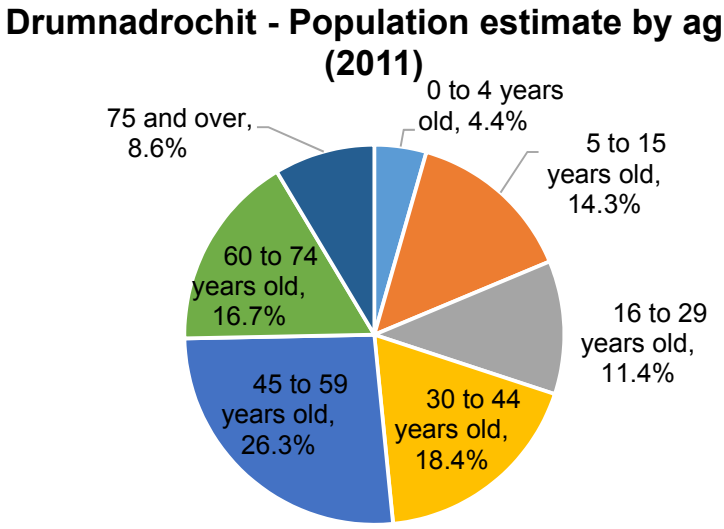
#	Action	Description	Relevant parties to be consulted	Timeframe (Short / Medium / Long)
13	Smart grid development	Seek understanding of potential development of localised grid management system. Initial exploratory talks with Scottish & Southern Electricity Networks (SSEN) regarding appropriate smart meter designs to be rolled out	SSEN Highland Council Soirbheas GURCA Glen Urquhart Community Council Drumnadrochit Chamber of Commerce	Medium

Appendix A Supporting Information

A.1 Population of Drumnadrochit

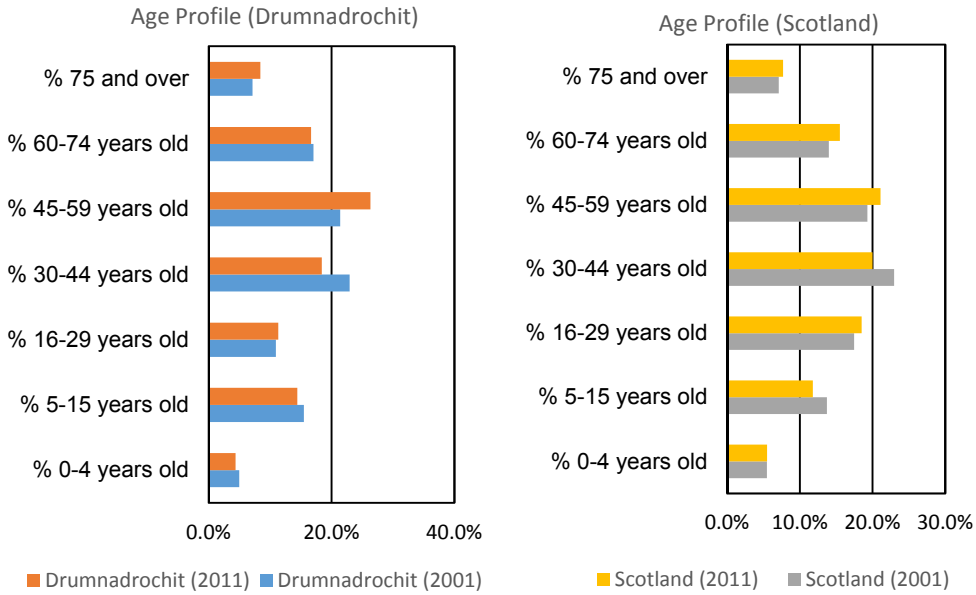
The population of Drumnadrochit, based on Census figures from 2011, is 1,754 – an increase of 40% since 2001. A summary of the population by age is shown here (Figure A.1).

Figure A.1 Population by age (Drumnadrochit)



The change in demographics between 2001 and 2011, and a comparison with Scotland's population as a whole is shown here (Figure A.2).

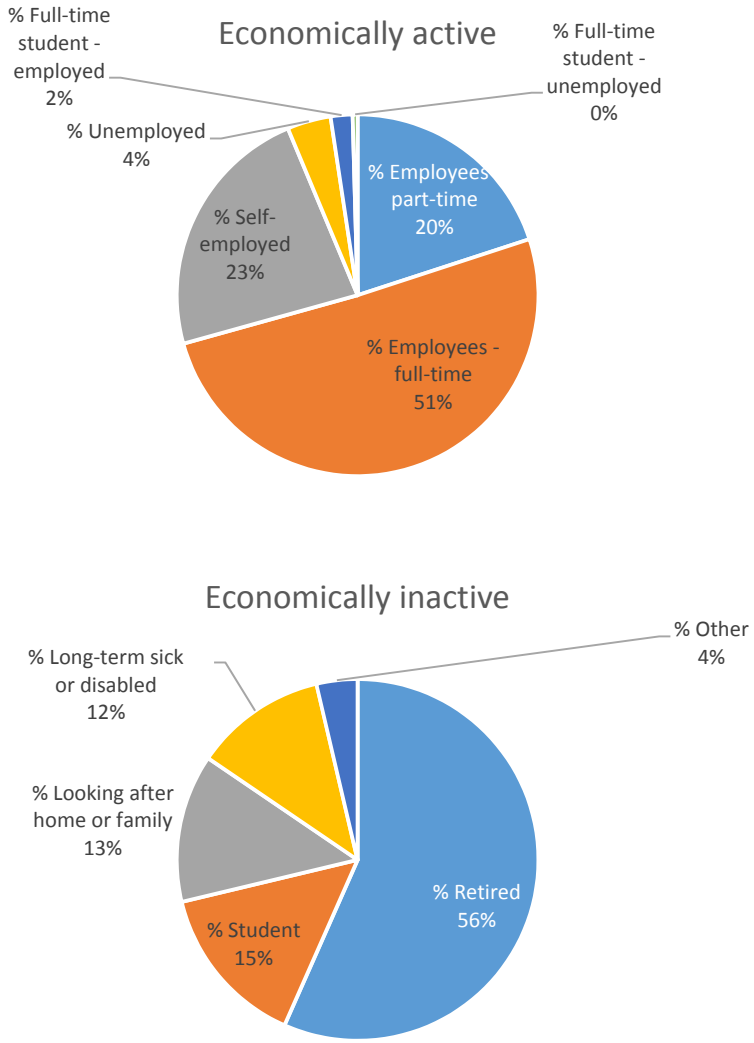
Figure A.2 Demographic profile by age (Drumnadrochit)



A.1.1 Employment and economically active population

In terms of employment, around 75% of the population are economically active, with half of those in full time employment. A summary is provided here.

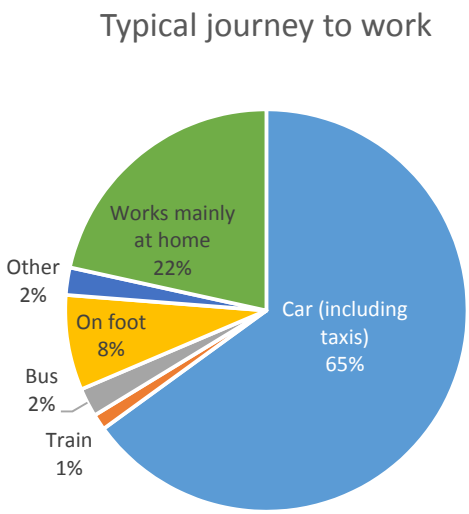
Figure A.3 Economic activity and economically inactive (Drumnadrochit)



A.1.2 Typical Journey to Work

In terms of those that are economically active, a typical journey to work is predominantly made by car.

Figure A.4 Typical journey to work



It is useful to note that around 20% of those economically active work at home.

A.2 Residential

Data for the domestic building stock is available via the Energy Saving Trust. This collates details from Energy Performance Certificates (EPC) calculated for individual dwellings as well as home inspections carried out via assessors from both local authorities and Home Energy Scotland.

For the present LEP area further details are provided here in terms of the characteristics of the building stock.

A.2.1 Property Tenure

There are a total of 929 domestic properties within the LEP area. Of these, around 70% are owner occupied.

Table A.1 Housing tenure – Drumnadrochit

Tenure	Number of properties
Owner occupied	630
Privately rented	133
Local Authority	77
Housing Association	29
Unknown	60

A.2.2 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 (Drumnadrochit)

Property Type	Pre-1919	1919 - 1949	1950 - 1983	1984-1991	1992-2002	Post 2002	Sub Total
Detached	208	18	72	60	67	86	511
Semi-detached	33	2	24	15	19	47	140
End-terraced	12	0	39	9	2	2	64
Mid terrace	4	1	40	6	1	2	54
Small block of flats / flats in converted dwelling	28	0	16	8	4	2	58
Flat in mixed use	15	0	0	6	20	1	42
Unknown							60
Sub total							929

Around two thirds of domestic properties are at least 35 years old; one third of these were built prior to 1919. In terms of the typical archetype then the predominant form is detached dwellings, with flats making up around 11% of the total stock.

A.2.3 Construction type and age

The way in which housing is constructed determines what form of insulation can be used to enhance overall energy efficiency and reduce energy consumption for heating. 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 (Drumnadrochit)

Property Type	Cavity	Solid	Timber Frame	System Built	Unknown	Sub Total
Detached	76	226	202	7		511
Semi-detached	23	33	84	0		140
End-terraced	41	11	12	0		64
Mid terrace	45	4	5	0		54
Small block of flats/ flats in converted dwelling	16	22	18	2		58
Flat in mixed use	6	17	18	1		42
Unknown						60
Sub total	207	313	339	10	60	929

Table A.4 Wall construction type and age (Drumnadrochit)

Wall Construction	Pre-1919	1919 - 1949	1950 - 1983	1984-1991	1992-2002	Post 2002	Sub Total
Cavity wall	23	13	144	11	15	1	207
Solid wall	263	8	20	6	12	4	313
Timber frame	14	0	26	84	85	130	339
System Built	0	0	1	3	1	5	10
Unknown							60
Sub total							929

A.2.4 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 in Drumnadrochit varies greatly depending on building type and age. The majority of houses with the lowest energy efficiency ratings (F-G) are older solid wall properties built pre-1949. The majority of properties built post 2002 have an energy efficiency rating of C.

Figure A.5 Energy Efficiency of property by age (Drumnadrochit)

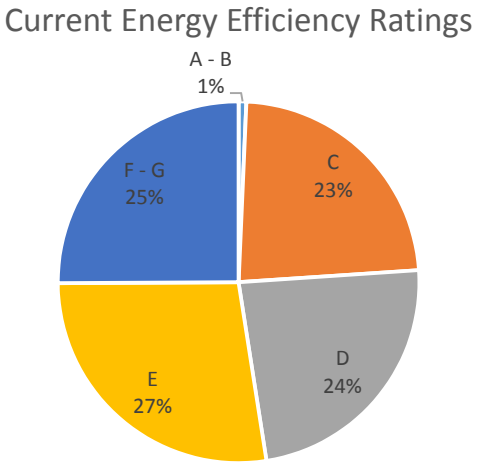
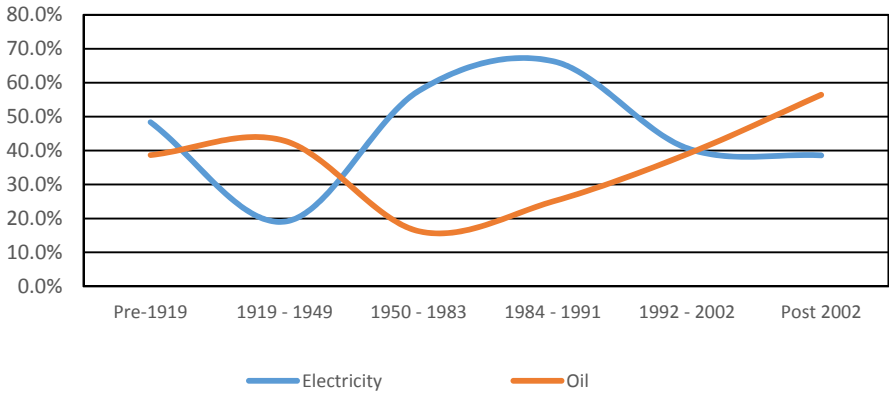


Table A.5 Primary fuel and property age (Drumnadrochit)

Primary fuel	Pre-1919	1919 - 1949	1950 - 1983	1984 - 1991	1992 - 2002	Post 2002	Sub Total
Biomass/solid	16	6	15	1	4	2	44
Electricity	145	4	110	69	46	54	428
LPG	22	2	33	8	19	5	89
Oil	116	9	31	26	44	79	305
No heating system	1	0	2	0	0	0	3
Unknown							60
Sub total							929

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.6 Predominant primary fuel by age of property (Drumnadrochit)



A.3 Non-residential

An online business survey was used to collect quantitative business interaction with energy issues. A total of six responses were received. This was then complemented by a face to face or direct contact business survey. A summary of the online survey details is provided here.

Table A.6 Energy survey (Drumnadrochit)

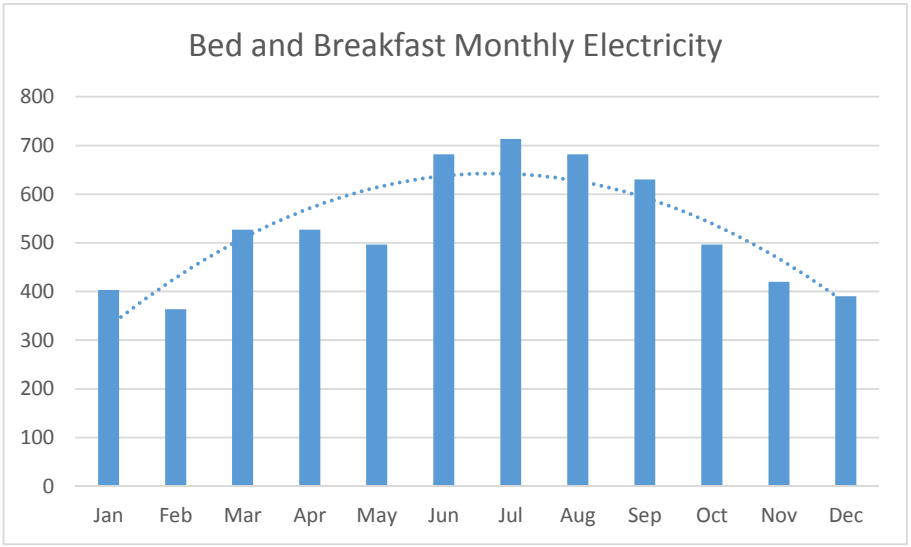
Question	Responses
Sector	Accommodation and food services (2)
	Small retail (2)
	Professional services office (2)
Main fuel used for heating	Oil (4)
	LPG (1)
	LPG + Economy 7 (1)
How is hot water supplied?	Combi boiler (1)
	Tank linked to central heating (3)
	Tank with immersion heater (2)
Annual electricity consumption	Range 4,150 – 9,000 kWh/yr

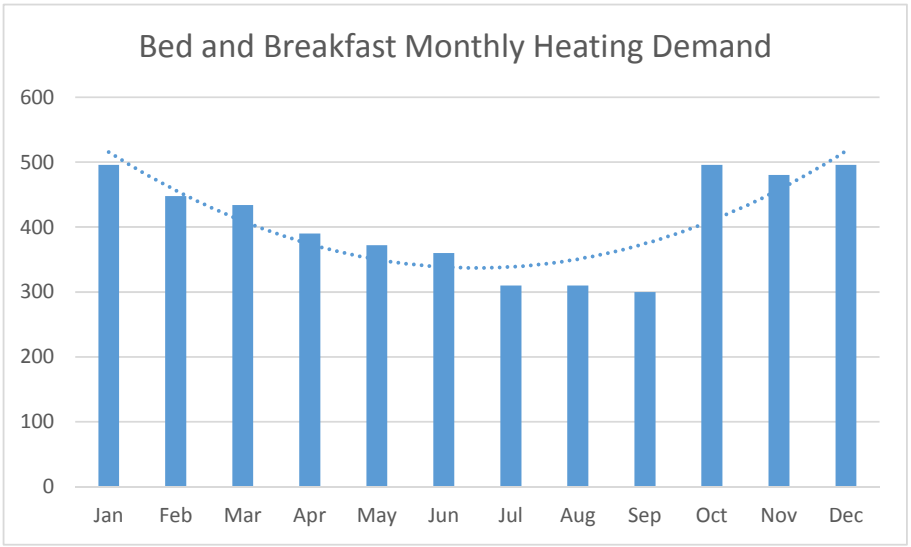
The heating demand profile for one of the Bed & Breakfast respondents is shown in the following figures.

While heating energy demand is largely in line with anticipated demand linked to typical weather patterns, there is a seasonal spike in October that looks to be related to additional visitors.

The electricity demand profile also shows the impact of seasonal tourism with much higher demand during peak periods July – September.

Figure A.7 Energy demand profile (B&B Accommodation)





To complement this quantitative data, a small direct contact survey was undertaken with a sample of businesses to identify key energy and resource issues. The following boxes articulate results from some of this face to face business engagement.

Drumnadrochit Business Engagement – Tourism

One of the local hotels has been very active with energy efficiency activity. LED lighting has been fitted as well as lighting sensors to ensure lighting is only activated when required. More insulation has been fitted to reduce heat loss and more efficient oil boilers will be installed. Long returns on solar PV have provided a disincentive though heat pump technology is becoming more attractive and could make a contribution in the future.

Across the tourism businesses surveyed there was recognition that customers are expecting greener and more sustainable accommodation, but without any compromise in service delivery or customer experience. This drives continual review of how the businesses can be more energy and resource efficient and they are all looking for ways to achieve this

Drumnadrochit Business Engagement – customer services

Owners are keeping an eye on energy use in their businesses. The main energy use is electricity consumed for lighting. There is limited scope for renewable and low carbon energy in these businesses which often operate from very limited area footprints. However, there is scope for the owners to reduce consumption and bills through more energy efficiency. For example in one business more energy efficient LED luminaries have been fitted to replace the highest energy use lighting.

Drumnadrochit Business Engagement – Food and Drink

Energy costs are a significant consideration for this sector and there was evidence of increasing monitoring and management of energy use. Businesses are interested in more energy saving and the opportunity to reduce fossil fuel use. Common interventions include LED lighting refits and engagement with different renewable energy technologies where appropriate. A key challenge was trying to identify pertinent information as this is a very dynamic field with continual change, An example was the current interest in removing single use plastics such as straws and single use cups.

Drumnadrochit Business Engagement – Small retail outlets

In these premises, electricity use for lighting and space heating is very much the main resource use. A key challenge for these businesses is to maintain an attractive and well-lit space which will create an attractive environment. There is growing awareness of the LED technology and the savings that can help deliver. Indeed there were examples of LED luminaries replacing fluorescent tube lighting to help reduce lighting costs

A.4 Transport

A.4.1 Annual Traffic Movements

While there is no data that has been available specifically for the volumes of traffic within Drumnadrochit it is possible to identify a seasonal impact by looking at accommodation occupancy rates in the region over a 12 month period.

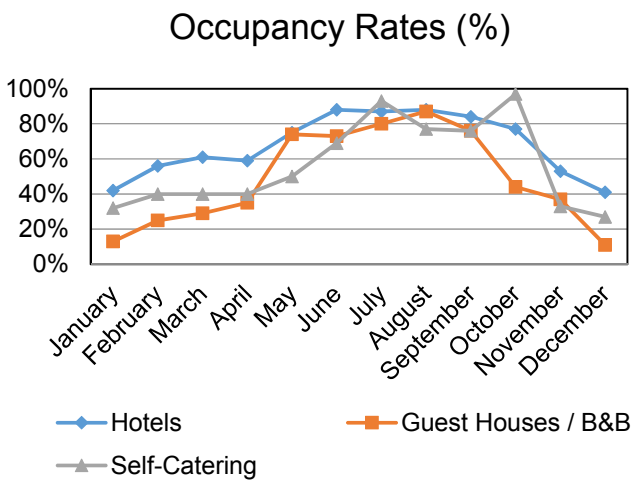
Visit Scotland publish the details for the Highlands & Islands [13] in terms of occupancy rates, which are summarised here. These are an indirect measure of anticipated traffic flows associated with tourism.

[13] http://www.visitscotland.org/pdf/Tourism_in_Scotland_Regions_2016.pdf (Accessed April 2018)

The peaking numbers in the spring and summer months are noticeable for all three categories of accommodation, but particularly in the case of guest houses, B&B and self-catering accommodation.

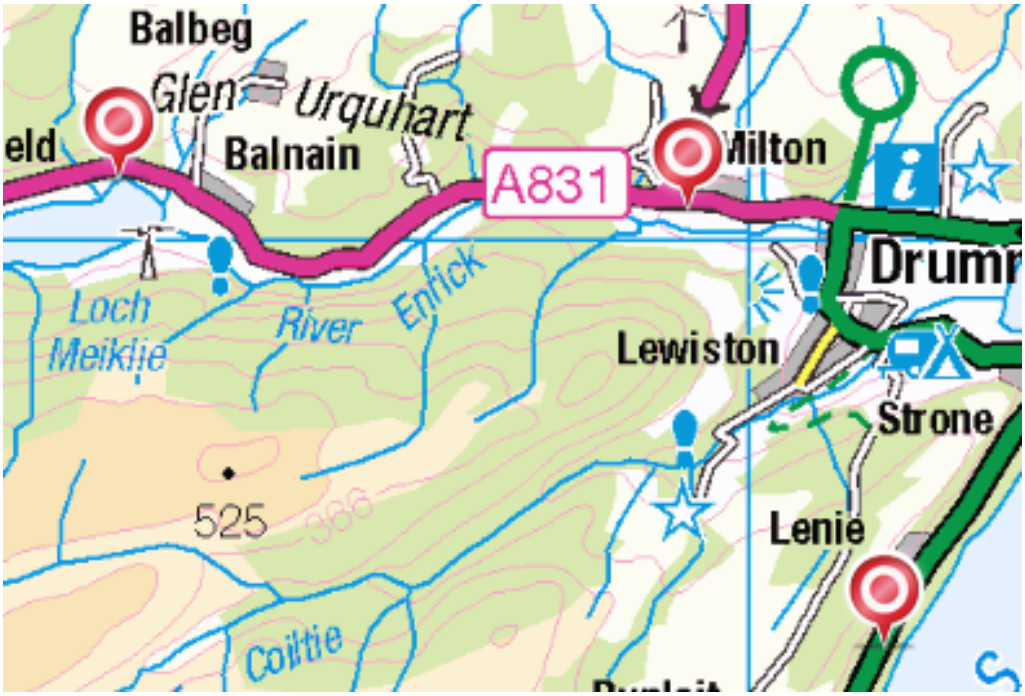
Table A.7 Net Room Occupancy (%) – Highlands & Islands

	Hotels	Guest Houses & B&B	Self-Catering
January	42%	13%	32%
February	56%	25%	40%
March	61%	29%	40%
April	59%	35%	40%
May	75%	74%	50%
June	88%	73%	69%
July	87%	80%	93%
August	88%	87%	77%
September	84%	76%	76%
October	77%	44%	97%
November	53%	37%	33%
December	41%	11%	27%
Average	67%	49%	56%



Traffic count and flow data is collated by the UK Government Department for Transport (DfT) for three locations within the LEP area as shown here.

Figure A.8 Traffic Count Data Points

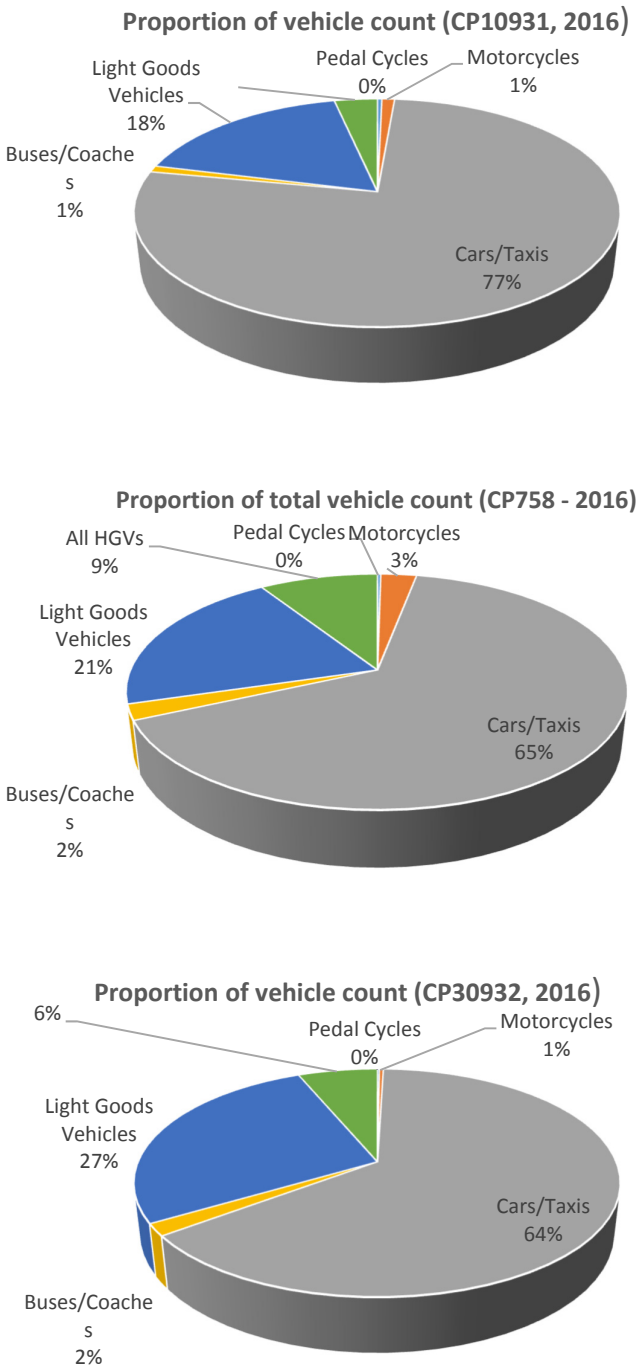


Average daily vehicle flow details are available for each of the count points. These are summarised here.

The data shows that:

- There are few cyclists passing through Drumnadrochit (a maximum of 1% of traffic flows are pedal cycles) this is not surprising given the nature of the A82 and the vehicles using this road.
- Cars/taxis make up around 70% of the total traffic flows
- Light goods vehicles (LGV) account for a further 20 – 25% of traffic
- Heavy goods vehicles (HGV) make up around 3 - 9% of traffic
- Buses and coaches account for 1 – 2% of traffic. This reiterates the public transport challenges.

Figure A.9 Traffic Count Data



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. On this basis the mix of fuel types is as shown here.

Table A.8 Estimated fuel type of household vehicles (Drumnadrochit)

Fuel Type	Estimated number of vehicles
Diesel	502
Petrol	517
EV/Hybrid	6
Other	1

Statistics from Transport Scotland provide an estimate of the number of days in the previous seven days on which a person made a trip of more than a quarter of a mile by foot. This is available per urban/rural classification (Drumnadrochit is categorised as Remote Rural) and summarised here.

Table A.9 Data on journeys by foot (Remote Rural Communities Scotland) - % of respondents

Number of days	As means of transport	Just for pleasure or to keep fit
None	49.5%	33.6 %
1 – 2 days	15.1%	20.5%
3 – 5 days	18.6%	18.2%
5 – 7 days	16.8%	27.8%
1+	50.5%	66.4%

A.5 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.

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.

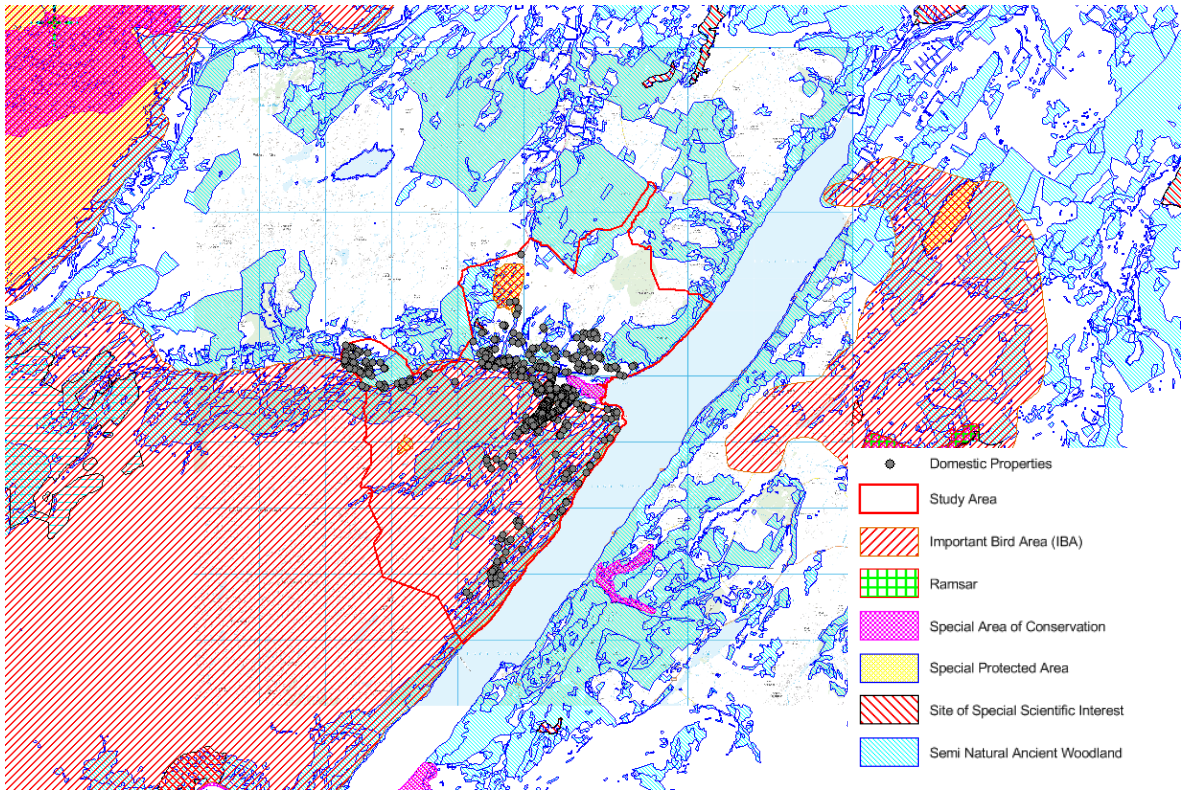
A.5.1 Summary of environmental designations and other relevant heritage items

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 are six SSSIs within the LEP area and within 3 km. They are:

- Balnagrantach – it is designated due to its biological interest; is a breeding site for a schedule I bird; nationally rare sedge and provides habitat for 8 species of dragonfly.
- Urquhart Bay Wood – it is designated due to its biological interest, which is primarily due to it being one of the few remaining floodplain woodlands in the UK.
- Dubh Lochs - it is designated due to its biological interest; it provides breeding and feeding habitat for a number of protected bird species including Slavonian Grebes.

- Gartally Limestone Quarries - it is designated due to its geological interest, which is primarily due to metamorphic minerals in Lewisian limestone.
- Inverfarigaig - it is designated due to its biological interest; which is primarily due to its upland mixed ash woodland.
- Loch Battan - it is designated due to its biological interest; the key feature of interest is its wetlands which includes examples of open water transition fen; springs (including flushes); and valley fen.

Figure A.10 Drumnadrochit Environmental Designations



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 are two SACs within the LEP area and within 3 km:

- Ness Woods - This complex of sites includes one of the best and most extensive examples of a ravine woodland in Scotland at Glen Tarff; further examples occur along the north-facing shores of Loch Ness
- Urquhart Bay Wood – designated due to its Alder woodland on floodplains

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 are two areas covered by the North Inverness Lochs SPA within the LEP area, which is designated for its population of Slavonian grebe (Podiceps auritus).

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

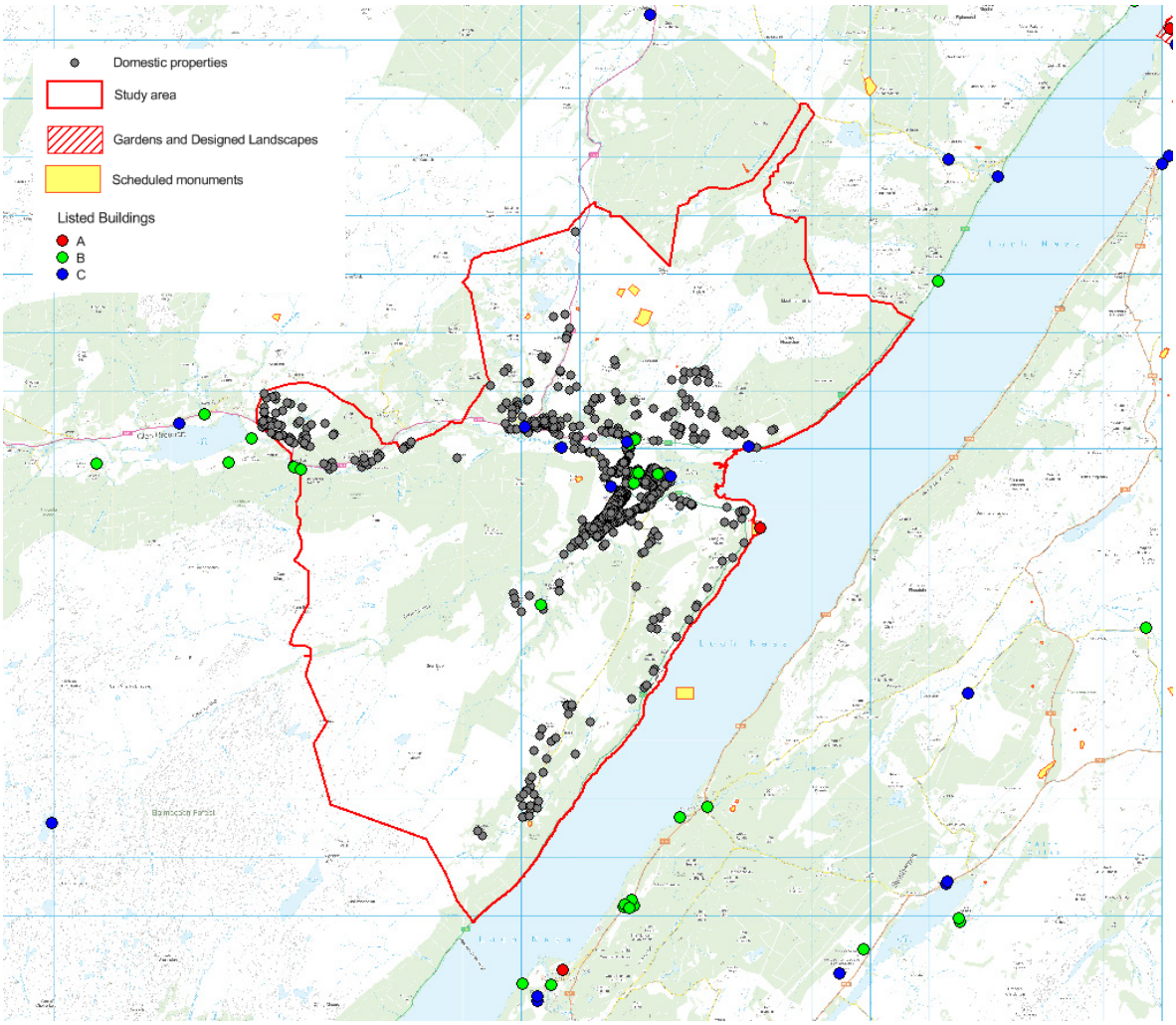
populations. IBA was developed and sites are identified by BirdLife International. Currently there are over 12,000 IBAs worldwide. There is one IBA within 3 km of the LEP area:

- Central Highland Hills and Glens - This is an important area for raptors and other specialist montane and forest birds. The IBA is also nationally important for breeding Black-throated loon (Gavia arctica).

Semi Natural Ancient Woodland - There are 255 areas of Semi-natural and planted woodland within the LEP area, and tree type and coverage is as follows:

- Broadleaf – 1,482 Ha
- Conifer – 1,397 Ha
- Mixed Broadleaf / Conifer – 71 Ha
- Scrub – 10 Ha
- Total (all woodland) – 2,960 Ha

Figure A.11 Drumnadrochit Cultural Heritage Designations



Schedule Monuments – There are 11 scheduled monuments within the LEP area –

- Dun Scriben, fort
- Craig Mony, fort
- Garbeg, settlement 1160 m NNW of Garbeg Cottage
- Garbeg Cottage, settlement 1250 m N of
- Culnakirk Burn, burnt mounds 540 m NNW of Garbeg Cottage
- Garbeg Cottage, burial mounds 920 m NNE of
- Clachmhor, cup-marked stone
- Loch nam Faoileag, hut circles 730 m NNW of Wester Balnagrantach
- Upper Drumbuie, burnt mound 230 m NNE of
- Loch nam Bat, still 1790 m N of Wester Balnagrantach
- Urquhart Castle

Listed buildings – there are 49 category A, B and C listing buildings within 3 km of the LEP area:

- Category A
    - Foyers, British Aluminium Factory
    - Urquhart Castle
- Category B

Boleskine House	Drumnadrochit, Glenurquhart Secondary School	Inverfarigaig Bridge
Boleskine House, Gate Lodge	Drumnadrochit, Glenurquhart Secondary School, East Schoolhouse	Inverfarigaig Pier
Boleskine House, Stables	Drumnadrochit, Glenurquhart Secondary School, West Schoolhouse	Kilmartin Hall
Boleskine, Old Boleskine Church, Burial Ground	Drumnadrochit, Greenlea	Lochletter Bridge
Boleskine, Old Boleskine Church, Watch House	Drumnadrochit, Kilmore Parish Church of Scotland	Lochletter Farm, Garden Pavilion
Boleskine, Old Boleskine Parish Church	Farraline House	Mains of Gorthleck
Brachla, Aa Sentry Box (No 631)	Farraline House, Walled Garden	Mill of Tore, Corn Mill and Kiln
Drumnadrochit, Benleva Hotel	Foyers Cemetery, Jane Fraser Memorial Obelisk	Mill of Tore, Mill Cottage and Byre
Drumnadrochit, Dhivach Lodge	Foyers, Lower Foyers Bridge	
Drumnadrochit, Drumnadrochit Hotel	Glenurquhart, Shewglie	

- Category C

Abriachan, Balbeg Mill	Drumnadrochit, Temple Cottages	Glen Urquhart, St Ninian's Church
Convinth, Old Parish Church, Burial Ground	Errogie, Corrugated-Iron Cottage	Glenurquhart, Free Church
Drumnadrochit, Allanmore	Errogie, Former United Free Church	Gorthleck House

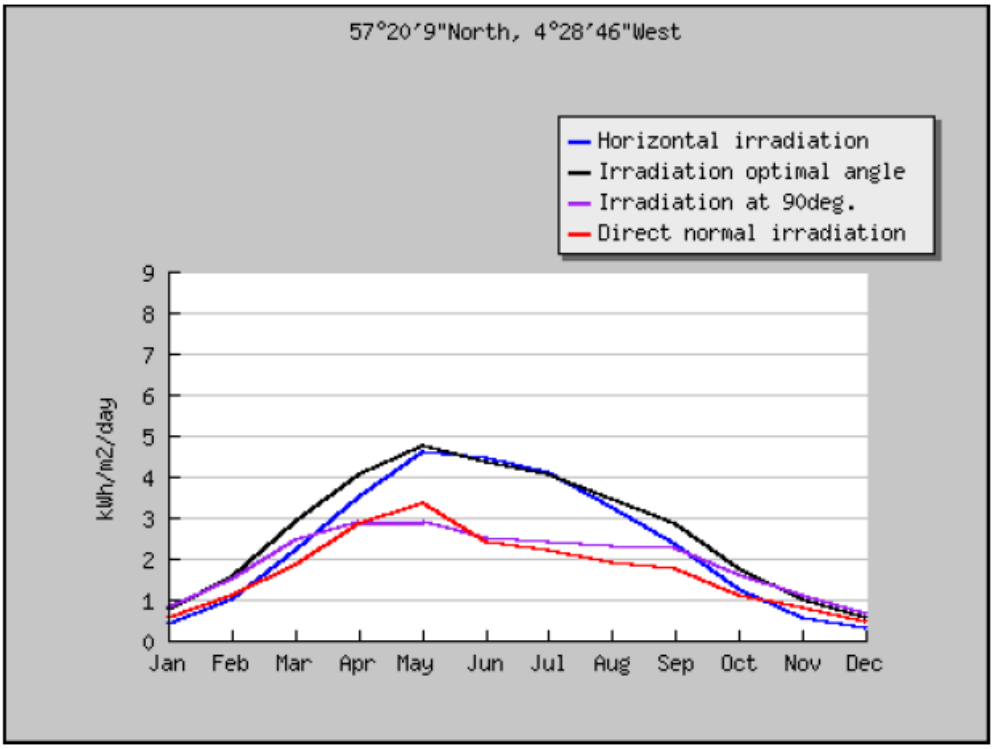
Drumnadrochit, Bridge	Errogie, Former United Free Church, Boundary Walls	Killianan Burial Ground
Drumnadrochit, Cnocan Burra Burial Ground	Foyers Mains Steading	Leadclune
Drumnadrochit, Old Kilmore Burial Ground	Foyers Mains Steading, Dovecot and Hen House	Loch Ashlaich, Shooting Box and Bothy

Garden and Designed Landscape – The Inventory of Gardens and Designed Landscapes in Scotland is a listing of gardens and designed landscapes of national artistic and/or historical significance. There are no listings within 3 km radius of the LEP boundary.

A.5.2 Estimated solar resource

Drumnadrochit can have annual solar irradiance of up to 837 kWh/m^2. The potential annual irradiation for the Drumnadrochit LEP area is shown here.

Figure A.12 Estimated annual solar irradiation[14] for Drumnadrochit



A.5.3 Estimated wind resource

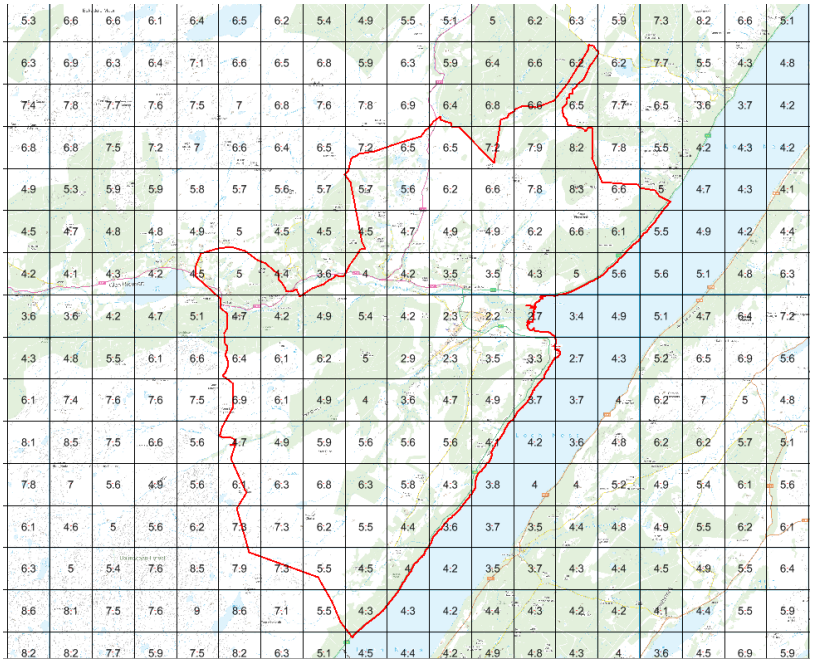
The wind resource in the area is very good with an available average wind speed of around 5.5 m/s at 10 m a.g.l. (Figure A.13). However, near settlements within the valleys the wind speed ranges from 3 – 4 m/s. Key considerations can be summarised as:

- A number of environmental designations;

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

- Certain areas have a poor resource at lower heights due to likely shielding from hills in the surrounding area, which corresponds to areas where most of the population resides.
- Resource on the surrounding hills is good.
- Cumulative impact of larger wind developments already within the wider area.

Figure A.13 NOABL[15] Wind Speed at 10 m above ground level



A.5.4 Estimated hydro resource

There are a number of watercourses, burns and rivers within the Drumnadrochit LEP area.

Table A.10 Watercourses within Drumnadrochit LEP area

Name of Burn / River	Length (m)	Height Max (m)	Height Min (m)
Allt Luirg nam Broc	835	219	80
Allt Pheadair Gow	1,140	200	53
Allt Tarbh	1,860	240	34
Culnakirk Burn	940	150	35
Divach Burn, Allt Coire an Ruighe, River Coiltie	9,398	414	15
Drumbuie Burn	2,817	331	25
Grotaig Burn	3,816	301	15
River Coiltie	8,150	286	15
River Enrick	9,725	124	15

[15] 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

A.6 Options Appraisal

A.6.1 Scottish context

Scotland's Energy Strategy was published in December 2017[16]. 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 between now and 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.

These in turn are built on six priorities:

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

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 as our energy transition takes place.
 **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 – collaboratively addressing the challenges of today and preparing the sector and its workforce for a positive role in Scotland's future energy system

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.6.2 Local context

There are a number of organisations that will have an interest in and influence over achievement of the Local Energy Plan outcomes. These organisations can be categorised as statutory/public sector and voluntary/local community.

Statutory/Public Sector

Highland Council

The Highland Council is the local authority covering the Drumnadrochit area and is responsible for services such as education, social care, waste management, cultural services and planning. The organisation is recognised as one of the "main players" providing annual updates under the Public Sector Climate Change Reporting requirements. The organisation has therefore to measure and report its annual energy use and greenhouse gas emissions and as a result of this is also continually reviewing how to reduce emissions. The organisation's current Carbon Management Plan 2013 – 2020[17] identifies a range of energy and emission reduction activity the Council will be undertaking in its estate. One of the major initiatives within this plan is a £16 million capital programme to change the majority of the Council's street lighting stock to energy efficient LEDs by 2020/21. It is estimated that by the end of the project, approximately £1 million will be saved per year in reduced energy costs, halving the Council's energy costs for street lighting.

The overall priorities for the Council are set out in its 'Local Voices, Highland Choices' document[18]. This provides five themes for the period 2017 – 2022:

[17] https://www.highland.gov.uk/info/1210/environment/321/climate_change/4 (Accessed April 2018)
[18] https://www.highland.gov.uk/info/695/council_information_performance_and_statistics/381/our_priorities (Accessed April 2018)

- A place to live – Continuing to support and develop attractive and sustainable communities. This means an aim to deliver 500 affordable homes per year as well as ongoing work to improve the quality and condition of the housing stock and minimise fuel poverty.
- A place to learn – Supporting schools and early years learning to ensure that young people's potential can be realised.
- A place to thrive – This seeks to deliver continued economic opportunities for businesses in Highland. It includes role out of improved broadband services and investment in transport infrastructure. Of direct relevance to Drumnadrochit is a commitment to work with partners to ensure fewer people experience transport as a barrier to accessing opportunities, including working with communities on community transport schemes.
- A welcoming place – Encouraging ongoing economic growth to retain younger people within the local economy. Promoting the Highlands as a tourist destination and investing in supporting services and infrastructure to support the tourism sector is also a priority.
- A redesigned council – The Council seeks to work more closely with communities in delivering services. It notes that communities across the Highlands are increasingly ambitious to control more assets and land with increasing interest in local service delivery.

The Highland Renewable Energy Strategy was published in 2006, which helped to inform requirements and expectations around renewable energy developments. In August 2016 the Planning, Development and Infrastructure Committee agreed that this will no longer be used as a material consideration in respect of onshore wind. The Onshore Wind Energy Supplementary Guidance, November 2016 (with addendum, December 2017) document provides the following landscape and visual guidance on the potential for wind turbine installation in the LEP Area:

- No scope for Large or Medium turbines, singly or in groups.
- Scope for:
- Micro and small scale turbines strongly associated with existing buildings/land use, therefore avoiding higher ground
- typical appropriate group size:- up to 3

The Council has also established a comprehensive online renewable energy information resource for onshore wind and hydro.

The 2015 Inner Moray Firth (IMF) Local Development Plan which covers Drumnadrochit is the guide for development and investment in the Inner Moray Firth area over the next twenty years[19]. This Plan sits alongside the Highland-wide Local Development Plan (HwLDP) to provide the framework for delivery of new homes, jobs and services, and supporting infrastructure. The HwLDP contains general planning policies for the whole of the Highland region, which guide and provide a basis for assessing proposals for development e.g. Renewable Energy Developments, the consideration of Sustainable Design, etc. There is Supplementary Guidance providing more detailed explanation of some of those key policy areas.

Within the IMF Local Development Plan growth is mainly focused on larger settlements in two growth areas – Inverness to Nairn and Ross-shire – with organic growth of smaller settlements to help strengthen those communities. The Plan also provides greater certainty to local communities and the development industry on how development sites should be delivered.

[19] https://www.highland.gov.uk/downloads/file/15008/adopted_inner_moray_firth_local_development_plan (Accessed April 2018)

Relevant details for Drumnadrochit are provided here.

Housing

Site: DR1 Easter Milton - Requirements: Pedestrian connection improvements including land safeguarded through the site for access to the river to allow for pedestrian bridge opportunity; Flood Risk Assessment which should also address any potential erosion issues.

Housing Capacity: 4

Site: DR2 North of Cnocan Burra Burial Ground - Requirements: Setback from school access road; safeguarding of pedestrian access and improved footpath to the Mausoleum; minimisation of any woodland loss.

Housing Capacity: 5

Site: DR3 Land at West Lewiston Requirements: Maximum capacity of 2 houses; provision of visually continuous and permanent green corridor through the site and adjoining land.

Housing Capacity: 2

Mixed Use

Site: DR4 Land west of Post Office Uses: Tourism, Business, Retail, Community

Site: DR5 Drum Farm Requirements: Developer to prepare masterplan / development brief to be agreed with the Council who may adopt this as Supplementary Guidance. This should address: phasing of a maximum of 10 housing units per annum; any application must include a non-housing element which must be provided within an initial phase of development; high quality of architectural design respecting the site's prominent tourist route location; landscaped set back from A82 including stone dyke feature and remote footpath / cycle way; publicly accessible green corridor retention to retain and frame public vistas and to maintain a degree of visual separation between settlements; connection to wider village path network; Flood Risk Assessment (may affect developable area).

Uses: 55 homes, Business, Retail, Community.

Note: The developer undertook a community consultation in December 2017 to obtain views on the construction of 55 homes as well as business and retail space on this site.

Site: DR6 Land south west of Coiltie Crescent Requirements: Developer to prepare masterplan / development brief to be agreed with the Council who may adopt this as Supplementary Guidance. This should address: phasing of a maximum of 10 housing units per annum; initial phase of development must include a non housing element; high quality of architectural design respecting the site's prominent tourist route location; landscaped set back from A82 including stone dyke feature and remote foot / cycle way; publicly accessible green corridor retention to retain and frame public vistas and to maintain a degree of visual separation between settlements; path links to Benleva through the wood and to wider village network; speed limit reduction and signage relocation; A82 junction to be compatible with access to site DR7 opposite.

Uses: 75 homes, Business, Community, Retail.

Note: This site is now being developed with the initial phase of construction involving the completion of 20 homes for Albyn housing and 12 houses for the Glenurquhart Care Project designed for the elderly & vulnerable.

Site: DR7 Land south of Medical Practice Requirements: Safeguarded for development of an expanded health centre and pharmacy only; high quality of architectural design respecting the site's prominent tourist route location; landscaped set back from A82 including stone dyke feature and remote foot / cycle way; speed limit reduction and signage relocation; A82 junction to be compatible with access to site DR6 opposite.

Site: DR8 Retail Units on A82/Balmacaan Road Requirements: Redevelopment of current building; high quality of architectural design respecting the site's prominent tourist route location; rationalisation of current access and parking arrangements.

Note: Warrants have been prepared for the redevelopment of these retail units and were submitted to Highland Council in April 2018.

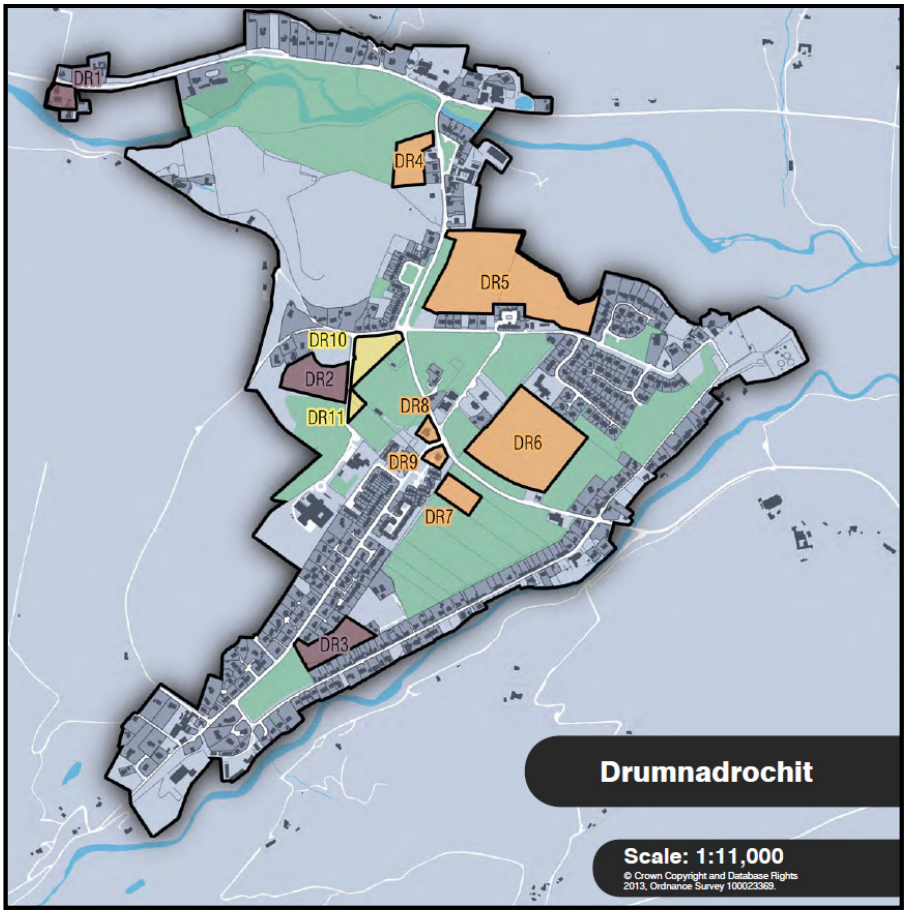
Site: DR9 Medical Practice Requirements: Redevelopment of current building; high quality of architectural design respecting the site's prominent tourist route location; rationalisation of current access and parking arrangements; woodland retention.

Community

Site: DR10 North of Shinty Pitch Requirements: Safeguarded for the above use(s) only

Site: DR11 West of Shinty Pitch Requirements: Safeguarded for the above use(s) only

Figure A.14 Drumnadrochit Development Allocation in the Local Plan



The Highland Council are developing a range of local area plans as part of the emerging Scottish Government requirements for Local Heat & Energy Efficiency Strategy (LHEES). The Council have been an early adopter of energy masterplanning and under the Highland Energy & Renewables Opportunities initiative (HERO) and Spatial Planning Renewable energy Assessment Concept tool (SPRAC) which look at the options to develop a coherent plan for energy in an area. These actions are developed over the Scottish Government Heat Map and update the resource to provide a greater energy and heat assessment opportunity and allows a quicker strategic assessment.

The Council has also initiated assessment of District Heating (DH) opportunities within the larger settlements in the Highlands (and in the West Highland and Islands area this has already informed the Proposed Local Development Plan). Using the District Heat Partnership toolkit for DH, the Council have established locations where this may be included or promoted in suitable areas.

These initiatives will lead to a formal Local Heat and Energy Efficiency Strategy that will be adopted through Council to promote and enable transition to a low carbon energy landscape.

NHS Highland

NHS Highland is the public funded healthcare provider providing services in Drumnadrochit. The organisation manages a recently constructed medical practice in the village. The organisation is also recognised as a "main player" and reports annual energy and emissions use data. Its Carbon Management Plan is helping staff to engage with energy efficiency and emissions reduction projects. One relevant initiative within the Carbon Management Plan is a continued review of vehicle use to seek opportunities for expansion of the use of electric vehicles. The organisation is also one of the leaders in the area in terms of assessing climate related risks to healthcare. This is helping to identify where there will be emerging healthcare requirements and threats and where infrastructure will need to be climate proofed.

Scottish Natural Heritage

Scottish Natural Heritage is the Scottish public body responsible for the country's natural heritage, especially its natural, genetic and scenic diversity. It advises the Scottish Government and acts as a government agent in the delivery of conservation designations including the Special Area of Conservation and Special Site of Scientific Interest which form much of the eastern boundary of the village.

Community Planning Partnership

These organisations are all part of the Community Planning Partnership which brings together public agencies, third sector organisations and other key community groups. The Highland Outcomes Improvement Plan (HOIP)[20] sets out the vision, purpose and focus for the Highland CPP from 2017-2027 in order to reduce inequalities in Highland. There are five main priority areas for action:

Poverty Reduction - More people in Highland will live a life free from the experience of poverty. The CPP recognises the need to tackle a range of issues to lessen the extent of poverty, this includes living wage & seasonal employment, financial education and advice, affordable childcare and reducing fuel poverty.

Community Participation and Dialogue - People in Highland will be more involved in decisions that affect their lives. This is predominantly a commitment to try and engage more effectively with local

[20] http://www.highlandcpp.org.uk/uploads/9/5/2/0/95206114/hoip_v6_cpp_board_final__no_photo-ilovepdf-compressed.pdf (Accessed April 2018)

communities and listen to their needs and aspirations when delivering services so as to reflect local circumstances.

Infrastructure - Fewer people in Highland experience transport and digital connectivity as a barrier to accessing opportunities. This includes work to improve awareness and co-ordination of public transport, as well as providing investment and support for community-led transport schemes to extend and improve existing schemes. There is also a focus on ensuring access to high speed broadband and affordable and accessible housing.

Community Safety & Resilience - People in Highland will benefit from living in stronger, safer and more resilient communities. This is centred on support for resilience within communities and recognition of vulnerabilities within communities at an earlier stage. The other concern is digital safety and awareness.

Mental Health & Mental Wellbeing - People in Highland will benefit from good mental health and wellbeing. Suicide rates for both men and women are higher in Highland than the Scottish average and suicide in Scotland is three times more likely in those from the most deprived areas when compared to those in the least deprived areas. Poverty is the single biggest driver of poor mental health according to the Scottish Government Mental Health Strategy 2017-21.

A.6.3 High level technology review

In thinking about the potential options for further work in terms of energy generation and supply in the Drumnadrochit area it is helpful to consider a range of different technologies and how useful or well matched they are in terms of the energy needs within Drumnadrochit. An overview is provided here.

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 Drumnadrochit
Gas Fired Combined Heat and Power	A gas fired gas turbine (or engine) where electricity is generated and heat is recovered for use from engine cooling systems and exhaust.	Output is available at all times.	No mains gas supply to provide primary fuel source. 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 to provide primary fuel source. 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 5-10% with a payback of 5-6 years.	**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 will require a backup via grid or energy storage system to meet the demand. However, a wind turbine can be coupled with other systems (which are not wind dependent) to cover the user needs e.g. solar PV.	Unlikely to receive any grant funding or incentives via FiT or CFD	Local wind resource is good. Wind energy is a mature renewable energy system but local planning issues are likely to restrict the scale of development.	Well established technology with range of turbines to suit client requirements. Many providers of technology mean that it is competitively priced. Maintenance contracts are typically carried out	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.	**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 Drumnadrochit
						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 be withdrawn in April 2019.	Solar resource in local area is moderate. Solar PV technology is well established and therefore relatively low risk.	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.	It is typical for a solar thermal installation to operate in conjunction with a conventional means of raising thermal energy such as a gas boiler. Solar thermal can also be combined with other renewable energy systems. i.e. Heat	It is possible that solar thermal will be removed from the list of eligible technologies that qualify for RHI support. Unlikely to attract any grant funding. Enhanced capital allowances can be claimed for eligible products.	Solar resource in local area is moderate. Any system would only displace a maximum of 50% of annual domestic hot water requirements. Solar thermal technology is mature and would be considered as relatively low risk.	There are many providers of technology which means that it is competitively priced. Maintenance contracts can be placed with either equipment suppliers or specialist contractors.	The technology would displace around 500 kWh of heat per m^2 per annum worth around £10 per annum without RHI. A 100 m^2 system would cost around £70,000 and save around £1,000 per annum without RHI. It cannot be considered an attractive investment with an ROI of less than 2%. RHI is	**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 Drumnadrochit
			pumps for COP improvement.				available for systems below 200 kWth and 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. Due to the cost of the installation, the use of the fuel cells will have to be maximised to justify this type of investment. 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. Also used in transport applications where hydrogen is used as a fuel.	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 (as a stand-alone source of heat and power). Transport applications may be more viable.	Emerging technology with 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).	**LOW**
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 require sizing so as not to clash with other LZC technologies. For example, if a biomass fed system has been sized for heat baseload, an energy from waste	Depending on the system, Feed in Tariff could be available for electricity generated and RHI for heat.	Relatively mature technology with a number of potential planning issues which make it a technology involving moderate risks.	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	**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 Drumnadrochit
			system would need to avoid heat rejection to atmosphere.		Potential odour issues would require mitigation. Main issue is no present consolidated waste feedstock collection.		£1,500 to £2,000 per kW thermal output. On £ per kWe basis, AD CHP systems range 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% to 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	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.	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	There is only a limited number of commercially viable electricity storage systems but ongoing maintenance is understood to be minimal.	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.	

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 Drumnadrochit
	wind and solar PV which are not always available to meet the user demand.	The system would then supply a site during periods of higher electricity charges. The system could also mitigate the electricity supply outages and disruptions that may occur.			systems that have been installed for an extended period of time.		A domestic battery system linked to a Solar PV array in Drumnadrochit might provide 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.	**MEDIUM**
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.	Any biomass system will need to be sized consistently with the complimentary 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.	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.	Project economics will be sensitive to sourcing biomass fuel at a competitive price and access to RHI for the new installation ROI would be expected to be 8% to 10%.	**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 Drumnadrochit
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 such as gas fired burners and grid electricity will be required to 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. It is possible that the scheme could bid for a Contract for Difference (CfD) for electricity generated. Grant funding 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. The typical scale of these systems is larger than would be required to meet the needs of any proposed district heating scheme in Drumnadrochit.	Many providers of technology mean that a scheme can be competitively tendered. Maintenance contracts can be carried out under contract by the suppliers of boiler and turbine.	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. Project economics will be sensitive to the price of biomass fuel and access to CfD 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.	**LOW**
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	Output is available at all times only the efficiency (COP) of the heat pump will vary depending on	It would be unusual for a large heat pump to operate in conjunction with a CHP or biomass	RHI range per kWh generated depending on the type of heat pump (air, water, ground	Heat pumps are a mature technology with relatively low risk. There are some	Many providers of technology mean that it is competitively priced.	Costs increase significantly with ground and water source systems due to the need for civils.	

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 Drumnadrochit
	cooling or heating mode depending on the requirements. This analysis is based on an air source system for the office area.	the source temperatures.	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.	source) with no limit in capacity. Very unlikely that a heat pump based office heating system would be considered innovative so unlikely to qualify for any grant funding.	risks in sizing which can be mitigated by using reputable suppliers. Ground or air source heat pumps 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	Maintenance contracts are typically carried out by a specialist contractor.	Typical costs for larger systems are in the region of £500 per kW heat output so a 1MW heat output system would be £500k compared to a 1 MW heating gas boiler at £30k. 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)**
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	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	RHI available for deep geothermal.	Still considered as an emerging technology in the UK and would be considered as high risk.	The geothermal energy industry is not well established and there are few companies supplying this technology. The	The developing nature of this technology in the UK means that it is not possible to provide estimated costs or ROI.	**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 Drumnadrochit
	as a means of energy transfer.		pumps, CHP or biomass			same can be said of after sales support. Surveys to date have not identified Glen Urquhart as an area of high geothermal energy potential	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.	
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 renewable heat energy to a group of end users.	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 interface unit (HIU). The HIU normally features a heat exchanger and a heat meter for measuring energy supplied and to bill the end user.	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 supplied by an innovative technology such a large scale heat pump.	Medium risk – Reasonably established technology with many successful commercial applications in Scotland although there have been examples of poor design that have led to the DH scheme being oversized and operating at a loss.	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 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	**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 Drumnadrochit
					Large scale DH schemes would be costly to implement since the largest single source of heat is at the Primary School and sized for its needs. Small scale networks feeding new housing development would be easiest to implement.		schemes normally work on a project lifecycle basis of 40 years.	
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 to generate electricity. The reservoir is topped up by	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)	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 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.	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 Drumnadrochit
	pumping water back up from the discharge point							
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 can be stored as hydrogen and used either to generate electricity (using a fuel cell) or as a fuel for a boiler of vehicle	There are no incentive schemes for use of electrolysers	The technology is mature, though a number of more recent designs are emerging. Use of an electrolyser in conjunction with the turbine owned by Soirbheas would reduce revenue from power sales. Uncertain where market for hydrogen would be at this stage	The supply chain is limited	Prices range from £2,000 - £3,000 / kW of capacity.	**LOW**

Note: Each information category is scored Green/Amber/Red according to the scale of fit (or relative difficulty in development) associated with the technology. These individual scores are combined to provide an overall fit (HIGH/MEDIUM/LOW)

A.6.4 Initial Options Appraisal

A summary of the opportunities reviewed in the previous section is provided here

Table A.11 Description of measures summary

#	Measure	Description of measure
1	Replacement of incandescent lightbulbs with LED equivalent	Replacement of older style bulbs with LED equivalent
2	Loft insulation top-up	Upgrade and top-up of existing loft insulation to at least 250 mm thickness
3	Room in roof wall and sloping areas insulation	Upgrade and top up of room in roof insulation to at least 100 mm thickness
4	Internal wall insulation	Installation of internal wall insulation (partition walls or battened)
5	External wall insulation	Installation of external wall insulation as rendered surface
6	Cavity wall insulation	In-fill or replacement of cavity wall insulation
7	Underfloor insulation works	Installation of insulation material beneath existing suspended floorboards
8	High efficiency storage heaters	Replacement of existing electric heaters with modern equivalent and additional controls
9	Replacement of existing oil boilers	Replacement of existing oil boilers with condensing, high efficiency equivalent
10	Replace entry doors with modern insulated uPVC equivalent	Replacement of main entry doors with uPVC insulated equivalent
11	Install A-rated windows (uPVC frames)	Replacement of existing glazing with double glazing (uPVC frames)
12	Use of Day Care Centre Solar PV and battery storage	Development of supply system from Day Care Centre solar array to battery storage and/or private wire arrangement with adjacent new build housing
13	Development of a ground-based solar array	Development of a ground based solar array on a suitable site in the local area to use for community supply
14	Wider uptake of rooftop Solar PV	Wider programme of installation of solar PV on suitable rooftop areas

#	Measure	Description of measure
15	Community electric vehicle charging point and e-bike facilities and vehicle	Installation of an additional electric vehicle charging point and provision of a community ULEV vehicle and electric bikes
16	Development of real time public transport information displays	Use of LED display boards within main car park and/or bus stops to provide real time public transport information
17	ULEV Shuttle bus to Inverness	Development of shuttle bus service to/from Inverness within working week
18	ULEV Shuttle bus for local tourism	Development of shuttle bus service to operate in peak season to support movement of tourists and visitors
19	Promotion of use of heat pumps (air or ground source) and other renewable options in new build properties	Promote use of heat pumps and other renewable technology that is appropriate within new build development properties in the community
20	Anaerobic digestion facility	Investigate use of biodegradable waste to generate biogas, to be used as local fuel
21	Small hydro scheme	Development of a small hydro scheme for electricity generation
22	Use of heat from wastewater for community buildings	Use of heat within wastewater as source of heating for community buildings close to local wastewater treatment works
23	Uptake of smart meters and development of local smart grid	Roll out of smart meters and capacity to develop a local smart grid
24	Wider uptake of rooftop solar thermal	Wider programme of installation of solar thermal systems on suitable rooftop areas
25	Local Car Club	Development of an electric vehicle car club

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 adding to the development costs.

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 benefit of local energy supply in reducing energy costs for households and businesses

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

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.12 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	3	1	1	1	0	0	HIGH
2	Loft insulation top-up	0	0	0	3	3	0	3	1	1	1	0	0	HIGH
3	Room in roof wall and sloping areas insulation	0	0	0	3	3	0	3	1	1	1	0	0	HIGH
4	Internal wall insulation	0	0	0	3	3	0	1	2	2	2	1	0	MEDIUM
5	External wall insulation	0	0	0	2	3	0	1	2	2	2	1	0	MEDIUM
6	Cavity wall insulation	0	0	0	3	3	0	3	1	1	2	1	0	HIGH
7	Underfloor insulation works	0	0	0	3	3	0	2	1	1	2	1	0	MEDIUM
8	High efficiency storage heaters	0	0	0	3	3	0	-3	2	2	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	Replacement of existing oil boilers	0	0	0	3	3	0	-1	2	1	2	0	0	LOW
10	Replace entry doors with modern insulated uPVC equivalent	0	0	0	3	3	0	-3	1	2	1	0	0	LOW
11	Install A-rated windows (uPVC frames)	0	0	0	3	3	0	-3	1	2	1	1	0	LOW
12	Use of Day Care Centre Solar PV and battery storage	-1	0	0	2	2	2	-2	1	2	2	0	0	MEDIUM
13	Development of a ground-based solar array	-1	0	0	3	3	3	-3	2	2	2	0	0	HIGH
14	Wider uptake of rooftop Solar PV	0	0	0	3	3	2	-2	2	2	2	0	0	HIGH
15	Community electric vehicle charging	0	0	0	3	2	3	-2	1	1	1	0	1	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**
	point and e-bike facilities and vehicle													
16	Development of real time public transport information displays	0	0	0	2	3	1	-1	0	0	0	1	1	HIGH
17	ULEV Shuttle bus to Inverness	0	0	0	3	2	3	-3	2	2	1	1	1	HIGH
18	ULEV Shuttle bus for local tourism	0	0	0	3	2	3	-3	0	2	1		0	MEDIUM
19	Promotion of use of heat pumps (air or ground source) and other renewables in new build properties	0	0	0	3	3	0	0	2	1	1		0	HIGH
20	Anaerobic digestion facility	0	0	0	2	2	1	-3	1	2	2	1	0	LOW
21	Small hydro scheme	0	0	0	3	3	3	-1	2	2	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**
22	Use of heat from wastewater as primary heating for community buildings	0	0	0	1	-1	-3	-2	2	1	2	0	0	HIGH
23	Uptake of smart meters and development of local smart grid	-1	0	0	1	-1	1	-1	0	1	0	0	0	HIGH
24	Wider uptake of rooftop solar thermal	0	0	0	1	3	0	-2	1	0	1	0	0	LOW
25	Local Car Club	0	0	0	1	3	1	-2	2	0	2	2	1	MEDIUM

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 in Table A.13.

Table A.13 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 offers a number of routes where the community could be involved as a developer/owner and deliver ongoing benefit	Opportunity is entirely reliant on a private developer and would not offer direct community benefit	10%
Scale of development costs	Opportunity is deliverable with a moderate capital requirement that may be	Opportunity requires large capital investment which is difficult to obtain	15%

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