Options Appraisal of Wind2Heat District Heating Scheme in Lochboisdale

Prepared for Lochboisdale Amenity Trust

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Executive Summary

Lochboisdale Amenity Trust (LAT), in partnership with Community Energy Scotland (CES), have commissioned this study to investigate the use of a renewable energy system to provide affordable heat for residents of Lochboisdale.

The study looks to identify a system that will address the following aims:

1. Reduce fuel poverty in Lochboisdale by providing lower cost energy to householders
2. Increase the sustainability of local businesses and amenities by lowering the running costs of their premises
3. Create an income for LAT to sustain the Trust's activities and to invest back into the community
4. Lower the carbon footprint of Lochboisdale by replacing fossil fuels with renewable energy

Community Energy Scotland has undertaken the following tasks with members of Lochboisdale Amenity Trust:

1. Wind Site Identification
2. Technical Studies
3. Grid Connection Analysis
4. Financial Modelling
5. Third Party Consultations
6. Community Consultation

Wind site Identification

The South Uist Scoping Study is not yet completed so we are not able to firmly identify a site. However, we believe the MOD restrictions will not apply in areas close to Lochboisdale and therefore it is likely that suitable sites for small and medium scale wind will be available. Further consultation with crofters and landowners will be required for the project to progress. This report will show the Technical and Financial Analysis for two options, determined based on calculating the demand for heating properties and matching the demand to the potential generation of wind sites close by.

- **Option 1: 5 x 5kW Turbines, District Heating Scheme in Lochboisdale Village**
- **Option 2: 100kW Turbine, District Heating Scheme in North Lochboisdale**

For the purpose of this report, Lochboisdale Village is property cluster situated after the cattle grid, circled in the map below.
For the purpose of this report, North Lochboisdale is as outlined in the following map.

Figure 1: North Lochboisdale area map (Lochboisdale Village circled)

Technical Studies

The technical study looked at matching the generation output of a renewable energy system, in this case small wind and/or hydro, to the energy requirements of an electric district heating system. An electric heating system was chosen as this was known to be the main source of heating in households. Three key factors influenced the shape of this project: the identification of Lochboisdale as one of the few suitable sites by the concurrent Uist Development Scoping Study, the changes to the UK subsidy (Feed-In Tariff) and the reduction of export capacity on the Distribution Network by Scottish and Southern Energy Power Distribution (SSEPD).

Feed-in Tariff (FiT) degressions

The UK Government are consulting on the reduction of FiT rates for all electricity-generating renewable technologies. The consultation for this closed on 19th October 2015. Community Energy Scotland have submitted a response to argue for favourable rates for community energy projects, but the results of this lobbying will likely not be known for a few months. The 'Preliminary-Accreditation' facility that was previously available to wind energy projects to fix the rate of FiT for one year whilst they developed the project further is no longer available as of 30th September 2015.

The implications of this uncertainty are that there are greater risks in the financial modelling of the project, as the level of FiT (rate paid for generation of renewable electricity) has not yet been confirmed. The financial modelling shows that there are three important factors in creating a viable system; a community feed in tariff rate, a grant towards the heating infrastructure and an increase in export to grid from 11kW to 50kW.

Grid Constraint

SSEPD in the Western Isles have reduced export connections from 17kW per phase to 3.68kW per phase (or from 50kW to 11kW in total where 3 phases are available). As shown below, 3 phase is widely available in Lochboisdale.

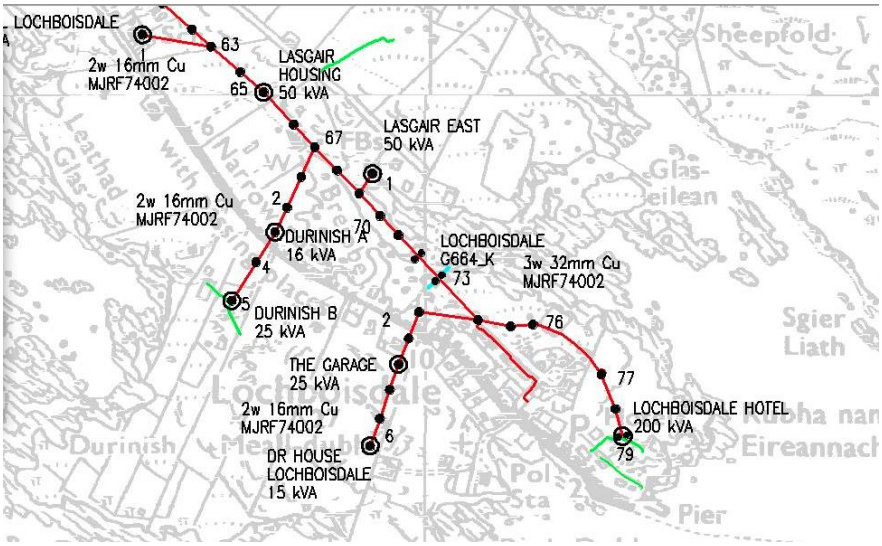

Figure 2: Area of 3 phase availability (in red)

The implication for this project is that a greater percentage of renewable energy generated will have to be used locally therefore sizing the system correctly is paramount.

Key next steps:

- Community decision on which option to take forward
- Consideration of an energy efficiency project as a first step, this will also allow the community to understand more fully the local use and gather data which will contribute to the design of a wind to heat system.

- Further analysis on the wind scheme including acquisition of historic wind data, detailed technical design, and budget costings
- Further community consultation
- Third party consultations on agreed option
- Detailed technical design and financial modelling for agreed option
- Consultation with potential business operators for the on-site use options

1. Introduction

Lochboisdale is a port in the South of the Island of South Uist in the Western Isles. Lochboisdale Amenity Trust (LAT) was founded in February 1998 with the aims of improving the quality of life and amenities in the Lochboisdale area. These aims include providing facilities for recreation and other leisure activities for the residents of Lochboisdale, promoting the heritage of the area, and encouraging training in many valuable skills.

LAT currently has eleven directors, of various ages, drawn from the local community. There is a wide range of professional skills and business experience within the group, from running local businesses, youth work, education and crofting to climate change campaigning on coastal protection.

To improve life for its residents, LAT has created a Play Area and Ball Court for local youth, carried out local tree planting and established a new path/walkway around the village. The Trust purchased the local village hall, which is used for local meetings and events.

Lochboisdale has a population of around 620. Lochboisdale has a fragile economy, suffering from depopulation, high unemployment, an aging population and a low population of working age residents. Businesses struggle to survive in this area, partly due to high energy costs, both for heating and transport. Lochboisdale has a negative economic trajectory due to these challenges, which affect local businesses.

Lochboisdale also has a high level of fuel poverty, which it is estimated affects more than 60% of the population. The village has many hard-to-treat houses meaning that it is difficult for LAT to combat fuel poverty through insulation due to the high costs of insulating Hard-to-heat Houses. According to a 2009 study by Flensburg University students household heating consumption accounts for 82% of energy consumption for homes in Lochboisdale.

In 2009 Flensburg University's International Class came to South Uist to do a research study for Storas Uibhist on the "Present Situation & Sustainable Energy Scenario for Lochboisdale up to 2014". The students surveyed households and businesses looking at energy consumption and provided recommendations including a wind2heat system (district heating) for the village.

Lochboisdale has a good wind resource and a potential for a hydro energy scheme in its proximity. The electricity and power station for the Uists is located to the north of South Uist and therefore Lochboisdale is at the end of a line.

Lochboisdale Amenity Trust had hoped to do a 'straight forward' wind turbine or solar photovoltaic (PV) project in order to generate a moderate income to sustain the Trust, however at the moment it seems unlikely that any new generation of over 3.68kW per phase can connect in Uist and at this size it is not possible to generate enough income to sustain LAT and its activities due to the level of FiT degression and loan repayments.

2. Project Background

The study examines the technical requirements for the generation and distribution of energy and the financial feasibility of using a grid-connected wind turbine, and potentially a hydro scheme, to provide grid-supported renewable power for household and commercial heating. The study will make recommendations on each of the areas outlined in the Outcomes and will highlight additional potential issues where these arise. The community will therefore benefit from sound technical and financial information, which can be used to help make a decision on whether or not to take forward this project.

The project aims to match distributed energy generation to demand at a local level for space heating requirement for households and businesses who wish to join the scheme in Lochboisdale. Providing local renewable energy to heat the homes in Lochboisdale should give residents greater energy security and will shield them against the rising prices of fossil fuels. Any remaining margin as a result of the sale of electricity will go back into LAT to be used in development projects around the community, providing a benefit to the wider community too.

The project would be managed as a social enterprise with the objective of alleviating fuel poverty while demonstrating how renewable energy can be applied to small scale district heating projects.

More than 70% of households that responded to the SESAM surveys, 2009, said they were interested in using renewable energy sources. As costs are prohibitive for most residents to install their own renewable energy devices and access to land or roof space is not available to all, this district heating project is a good way to maximise the generation of renewable energy in Lochboisdale with access to as many of the residents as possible.

In general the distribution network in Uist can only accept up to a maximum of 11kW of generation where there is 3 phase. This potential barrier to generation will be overcome by using the available 11kW of grid access when necessary, but prioritising local supply thereby maximizing the local benefits of the renewable energy potential in Lochboisdale.

Several ways of reducing energy use were outlined in the SESAM study. It is hoped that this project will encourage residents to think about their energy use and how they can reduce it, and encourage them to think of taking forward their own energy efficiency and smaller scale renewables projects where possible.

The MOD is a barrier to wind generation in large parts of the Uists. This project could lead to the progression one of the few remaining wind energy projects which could be permitted in the Uists.

Small wind projects struggle to get access to debt finance as the FiT has degressed to such a degree. We are hoping to be able to offer a more financially viable option, which could make the project financeable, through receiving a higher price per kWh than for a project selling all generated electricity to the grid.

Other barriers to renewable energy which will be addressed include overcoming the technical requirements of limited export grid connection, the technical challenge of balancing two sources of generation with multiple loads, and financial risks associated with the uncertainty of the FiT.

3. Technical Analysis

This section will review the wind site, grid connection and the options for using the energy generated locally for heating and other uses.

Wind Site Investigation

Several wind turbine planning applications in Uist have recently been blocked by the MOD. These were not in the Lochboisdale area; a previous feasibility study suggests that there is still potential for wind turbines near Lochboisdale. The Uist Development Scoping Study, commissioned by Comhairle nan Eilean Siar and working with the MOD and other stakeholders, has informed the suitable areas for wind turbines.

The outcome of the Scoping Study is not yet known but it is likely that Lochboisdale is one of the very few areas which will be suitable for a new wind site.

The draft of the Uist Development Scoping Study highlights the potential options for siting turbines close to Lochboisdale. The different size options have been determined through an estimation of energy demand for electric heating and matched to the generation of two potential sizes of turbines.

Grid Connection Analysis

Since May 2015 SSEPD have reduced the maximum export on the distribution grid in the Western Isles from 50kW for a three phase line to 11kW for a three phase line. This will significantly reduce the total size of installation possible.

In order to install renewable generation of over 11kW an export limiter will be required to control the amount of energy being used locally and to limit the export to the distribution grid to 11kW.

The energy used locally could be used on a private wire network to distribute electric heat throughout North Lochboisdale and/or Lochboisdale Village. If the demand was not as great as the energy generated the turbine would have to be curtailed (switched off or curtailed). This would be a high risk as it would impact on the income and therefore the financial viability of the turbine.

Local Energy Use Options

The following section will describe two options for using the energy generated locally. This is necessary due to the export restrictions. Using the energy locally also provides energy at a locally controlled price and can help to protect local residents from fluctuating fossil fuel prices. More local benefit is realised through local use of electricity which is bought at a cheaper rate than electricity from the grid. This is an option for providing affordable heat to Lochboisdale.

Due to the grid export restrictions and distances between properties Community Energy Scotland would currently recommend that Option 1 is the favourable option. Option 2 is more financially attractive however, the project would require significantly more load than is currently available. This would negatively affect the financial viability.

Option 1: Small Scale Wind Turbines + District Heating in Lochboisdale Village

This option will include up to five small-scale wind turbines installed within 2km of the cluster of housing in Lochboisdale Village (see Figure 1).

Energy Demand for Lochboisdale Village	Est. 53MWh per annum
Turbine Generation 25kW	Est. 77MWh per annum

Assumption

35% Capacity Factor

Capital costs

The capital cost for 5 x 5kW turbines is currently in the region of £135k for development and installation. This does not include the infrastructure needed to use the energy locally.

The equipment needed to use the energy locally would cost in the region of £150k plus legal costs to set up local supply agreements.

What are the next steps?

The next step would be to acquire existing wind speed data for the area, monitor the site for wind speeds, consult with crofters and Storas Uibhist to secure use of a site, consult statutory planning bodies and identify how to maximise the use of excess generation.

Outcomes

The potential outcomes would be income generation, affordable heating costs, affordable energy costs for new and existing businesses, 1 job created to maintain and administer the system.

Timescales

The timescales for this option would be 2-3 years of development. The project would have a lifetime of 20 years.

Option 2: Medium Scale Wind Turbine + District Heating in North Lochboisdale

This option will include a 100kW turbine sited close to Lochboisdale.

Energy Demand in North Lochboisdale	Est. 106MWh per annum
Turbine Generation for 100kW	Est. 302MWh per annum

Assumption

35% Capacity Factor

Capital costs

The capital cost for a 100kW turbine is currently in the region of £300k for development and installation. This does not include the infrastructure needed to use the energy locally.

This equipment needed to use the energy locally would cost in the region of £300k plus legal costs to set up local supply agreements.

What are the next steps?

Due to the decrease in export capacity this option is not currently viable because not enough of the energy generated will be used and therefore the annual income will be insufficient to cover debt and maintenance

costs. In future if the export capacity increases to 50kW or more this option would be more viable. The next step would be to acquire existing wind speed data for the area, monitor a site for wind speeds, secure use of the site, submit a screening application bodies and identify a system of use for the electricity above 50kW.

Outcomes

The potential outcomes would be income generation, affordable heating costs, affordable energy costs for new and existing businesses, 1 job created to maintain and administer the system.

Timescales

The timescales for this option would be 3-4 years of development. The project would have a lifetime of 20 years.

4. Financial Analysis

In this section a comparison of total cost of the two options is provided. Assumptions are as follows (and are detailed at the bottom of this section): A Community Feed In Tariff rate of 14.45 p/kWh, a grant for 80% of the capital cost of the infrastructure required for the heating system and a grid export limit of 50kW.

	Option 1: 25kW	**Option 2: 100kW**
Capital costs	£285, 000	£600, 000
Operating Costs	£5, 000 per annum	£17, 000 per annum
Annual Income	£20, 120	£50, 280
Average retained profit Y1 – Y6	-£2, 000	-£10, 000
Average retained profit Y7 – Y15	-£2, 000	£5, 000
Range of retained profit Y16 - 21	£6 – 20, 000	£5 – 25, 000

Assumptions:

	Option 1: 25kW	**Option 2: 100kW**
Loan rate, 15 years	5%	5%
Heat rate	8 p/kWh	8 p/kWh
Export rate	4.5 p/kWh	4.5 p/kWh
Feed In Tariff rate	14.45 p/kWh	14.45 p/kWh
% use of generation in total, including export + local use	100%	67%

There are three significant external issues which will affect long term financial viability of the project:

1. **A Community Feed In Tariff**

The availability of a community rate, or continuation of a higher rate, for the UK Government's Feed In Tariff will be vital to the viability of either option. The Feed In Tariff is a subsidy paid for each unit of electricity generated by a renewable source. This is currently under review by the UK Government and there is a high likelihood that it will be significantly reduced. Community Energy Scotland together with other representative bodies put forward the case for a community rate and a ring fenced budget for community projects. It is likely that the result of the UK Government consultation will be available in early 2016.

2. **A grant for the 'heating infrastructure'**

Currently the Big Lottery Fund is reviewing their Investing in Communities fund. Community Energy Scotland are inputting into this review with a view to the inclusion of Local Energy projects. The new scheme is likely to be launched in early 2016. The infrastructure costs of a district heating scheme would be eligible for grant support and would not create an issue with 'State Aid' as the heating infrastructure is not part of the 'generating equipment'. Other grants may be available also.

3. **An increase in export limit to 50kW**

Scottish and Southern Energy Power Distribution have recently reduced the amount of electricity a generator can export to the grid system. This means that energy generated by this scheme would have to be used locally, stored or the generator switched off when generating in excess of 11kW. This significantly increases the risk of loss of earning to the generator. The financial viability requires the maximum generation possible and therefore it would be recommended to work further with SSEPD to understand how the system proposed might work, when generation would be at a maximum and how that could be used locally. Without the ability to generate at times of high wind speeds the financial viability is at high risk.

5. Community Consultation

Community Energy Scotland and Lochboisdale Amenity Trust hosted a community consultation drop in session to discuss the project with local residents. Around 12 residents attended, along with 2 members of CES and 8 members of the LAT board. CES informed the residents of the projects and the findings of the study, and discussed with them whether or not they would be in support of the project. All residents who attended the session were in favour of the idea. Fuel poverty and energy efficiency was also discussed. Questions asked as part of the consultation are addressed in this final report.

Next steps

- LAT to look into short term ways of helping residents, perhaps accessing support and advice from Tighean Innse Gall
- LAT to publicise this report and the project through their website and Facebook page, inviting responses from local residents
- LAT to look into a dedicated energy advice officer for the area
- CES to assist and support LAT where possible

6. Summary and Recommendations

This report has outlined two potential options which could be progressed. The table below summarises each option, the percentage use of energy generated(for more info see section 4), its main capital costs, its yearly income and the preference ranking within Lochboisdale Amenity Trust members (taken from community consultation event on 19/10/15)

Options	Percentage use of system	Main Capital Costs (£,000)	Average Yearly Income (£,000)	Comments
1. 25kW	100%	285	20	This would be the recommended option.
2. 100kW	67%	600	51	This option would require significant partnership to create the demand required.

Table 1 Options summary

Based on the results obtained, Community Energy Scotland suggests that under the following set of circumstances option 1 would be worth exploring further. Please refer for section 4 for a full description of the following 3 points.

1. A Community Feed In Tariff
2. Availability of grant funding for the 'heating infrastructure'
3. An increase in export limit to 50kW or more

These external factors are likely to become clearer in early 2016 and Community Energy Scotland will stay in touch with LAT regarding any significant change.

Community Energy Scotland recommends the following next steps for Option 1:

- Acquire detailed wind data
- Consult and agree with landowners / crofters locally
- Detailed design and outline budget of wind scheme by specialist consultants, including evaluation of turbine size options in light of grid constraint and FiT levels
- Door to door detailed survey of heating systems, consumer units and metering in potential district heating properties and collection of historic billing data for residents with 12 month records
- Installation of data loggers in sample of properties to record detailed energy usage for benchmarking demand
- Detailed technical design and outline budget of District Heating scheme by specialist consultants
- Financial modelling of Wind and District Heating following design work
- Further community consultation when results are available

Due to the external factors above and after the community consultation event feedback Community Energy Scotland would also make the following recommendations for a smaller scale energy efficiency project.

1. Working with Tighean Innse Gall on tariff-switching, energy efficiency measures and best use of current heating systems.
2. Working with Hebridean Housing Partnership on an energy monitoring and education project.
3. Recruiting a dedicated energy efficiency project officer for Lochboisdale.

References

a. A group of post graduate students studying Sustainable Energy Systems and Management (SESAM) at the University of Flensburg in Germany, undertook an study called the *Present Situation and Sustainable Energy Scenario for Lochboisdale up to 2014*.
b. South Uist, Eriskay and Benbecula Wind Energy Feasibility Study, 2006
c. WI renewables study 2002 Part 1: Resource Investigations
d. WI renewables study 2002 Part 2: Development Consideration
e. Western Isles Hydro Power Feasibility Study, Faber Maunsell
f. Provision of technical assistance to Community Hydro Electric Projects in the Western Isles, Fairhurst
g. Western Isles Energy Audit, Element Energy 2004
h. Western Isles Energy Audit 2014
i. Isle Pact Energy Audit for Uist, Sustainable Uist
j. Island Sustainable Energy Action Plan, 2011
k. Hard to Treat Housing Studies, Sustainable Uist

Appendices

A1: Detailed Financial model for Option 1

A2: Detailed Financial model for Option 2

A3: Poster to advertise Community Consultation

A4: Poster with information used at Community Consultation

A5: Feedback form used at Community Consultation