The Shapinsay Community Wind Project

Environmental Statement – May 08

For The Shapinsay Development Trust

Highlands and Islands
Community Energy Company

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Foreword from HICEC

The Highland and Islands Community Energy Company (HICEC) supports and helps constituted, non-profit distributing community organisations in the Highlands & Islands of Scotland to install and develop both micro and larger-scale renewable energy projects to benefit their communities. An important part of our work is providing support to groups who wish to establish and manage community owned wind energy schemes ('community wind farms') for energy self-sufficiency and financial sustainability through the generation of local community income. Critically, to be eligible for our support, schemes must be majority owned and controlled by the constituted, non-profit distributing community organisations concerned. In Orkney, HICEC have been supporting six community organisations including Shapinsay Development Trust aiming to develop their own wind project.

Recently, Scottish and Southern Energy have announced Orkney area as a Regional Power Zone initiative under OFGEM approval, and Shapinsay Development Trust have already had positive correspondence with SSE on a potential grid connection. This creates a unique opportunity to connect projects with planning consent without having to wait for significant upgrades to the transmission system. However there is expected to be more demand from community groups and private developers than the predicted 15MW available capacity, and it has been crucial that this project is advanced as rapidly as possible to planning consent so they do not get left behind in the 'commercial race'.

We see this as a unrivalled window of opportunity for sustainable development of communities in Orkney and will continue to support the Shapinsay Development Trust in developing their project that would produce renewable energy locally, create a valuable source of revenue for their communities and assist greatly to the sustainability of geographically disadvantaged Orkney communities.

Sam Harcus
HICEC adviser for the Orkney area

Highlands and Islands
Community Energy Company

"Our aim is for all communities across the Highlands and Islands to be able to generate and use renewable energy for their long term and collective benefit"

Preface

This Environmental Statement has been prepared to accompany the application by the Shapinsay Development Trust, in consultation with the local community, to Orkney Islands Council, to construct and operate a community wind turbine on a site at Howe, Shapinsay, Orkney.

The Environmental Statement reports the findings of the Environmental Impact Assessment, undertaken on behalf of the Shapinsay Development Trust. It comprises three parts:

1. Non-technical summary- summarising the main findings of the environmental impact assessment in non-technical language;
2. Main volume text and figures; and
3. Appendices-reporting the findings of the Environmental Impact Assessment.

Printed copies of the Non-technical summary and the Environmental Statement may be obtained from Scotrenewables Ltd, Hillside Office, Stromness, Orkney, KW16 3HS. The non-technical Summary is available free of charge, and the Environmental Statement may be purchased for £200 per copy. Alternatively, these documents are available on CD, from the same address at £25 per copy.

Copies of the Environmental Statement may be consulted at the following locations, by arrangement:

- Kirkwall Public Library
- Orkney Islands Council Planning Department

In addition to the Environmental Statement, a number of stand-alone reports on specific technical issues have been prepared which provide further information on some of the surveys and research on which the environmental impact assessment has been based. These are:

- Shapinsay Community Wind Project: Bird Study
- Shapinsay Community Wind Project: Landscape and Visual Impact Assessment
- Shapinsay Community Wind Project: Noise Report
- Shapinsay Community Wind Project: Archaeological Assessment
- Shapinsay Community Wind Project: Habitat and Vegetation Assessment

Non-technical summary

1. Introduction

The Shapinsay Development Trust (the Trust) propose to install a single 900kW turbine at Howe on the South side of the island of Shapinsay, Orkney. The turbine will be accessed through the upgrading and extension of the existing track, with the underground cable to follow this route to join the electricity grid via the existing three phase network.

From the projected long term average wind speed for the site the annual electricity generation will be in the region of 2,739 MWh. Thus the proposed wind turbine would contribute to at least the following reduction in emissions;

- CO2 – 2,355 tonnes per annum, SO2 – 27.4 tonnes per annum, NOx – 8.22 tonnes per annum.

Over a 25 year lifetime it will displace over;

- CO2 – 58,875 tonnes, SO2 – 685 tonnes, NOx – 205.5 tonnes.

An Environmental Impact Assessment (EIA) has been carried out in accordance with the requirements of the Environmental Impact Assessment (Scotland) Regulations 1999 (the EIA Regulations). This document forms the non-technical summary of the Environmental Statement (ES) which reports this process.

2. Need and alternatives

The promotion of renewable sources of electricity generation is a key component of both UK and Scottish Climate Change Programmes, setting out the Governments proposals for meeting the UK's target under the UN Framework Convention on Climate Change and Kyoto protocol of achieving a 12.5% reduction in greenhouse gas emissions. Renewables energy reduction plays a key role in contributing to the Scottish Governments target of generating 18% of Scotland's electricity from renewables sources by 2010 and 40% by 2020 (quantified as 6 GW installed capacity). Scotland has already exceeded its 2010 target.

The Trust has spent two years developing the community wind turbine project into this planning application. The Trust has modified their plans after consultation to the current

proposal for a single 900kW wind turbine and has tried to accommodate the concerns as far as reasonably practical of neighbouring properties.

The site was selected after a feasibility assessment which took into account, wind resource, nature conservation particularly ornithological interests, areas vulnerable to landscape and visual impact and proximity to dwellings. Other aspects taken into account include access to site, impact on telecommunication interests and proximity to the electricity grid. The Howe site was selected as the preferred option on the basis that it presented the least risk to the community.

3. Existing environment

The proposed Howe site is located within an area of improved grassland surrounded by improved grassland/arable fields. The site is approximately 450m from the nearest dwellings at Barebrecks and Housebay Cottage and at present is used for grazing. There are no nature conservation designations on or in close proximity to the site.

As part of the EIA process the following studies were undertaken to assess the baseline conditions at the site:

- Habitat and vegetation survey and assessment
- Vantage point and breeding birds survey (2007)
- Archaeological and cultural heritage impact assessment
- Landscape and visual impact assessment
- Desk based assessment of the potential for otter activity; and
- Socio-economic assessment;

These studies are reported in the ES and included in full as Appendices.

4. The proposal

The proposed turbine is an Enercon E-44. The hub height is 45 m with a rotor diameter of 44 m, therefore the blade tip height of the turbine will be maximum of 67m. The generation capacity of the turbine will be 900kW.

The main aspects of the work are as follows:

- Approximately 65m of new access track
- Temporary construction compound

- Concrete pad (approx. 30 x 30m)
- Underground cable alongside the access track to three phase electricity network.

Construction

The construction period of should take approximately 4 weeks altogether depending on weather conditions. Many of the operations involved in the construction will be carried out concurrently therefore minimising site disturbance. A programme of site restoration will be carried out in a progressive manner to reinstate disturbed areas as soon as possible.

Operation

Once operational the site activities would be largely restricted to routine maintenance and emergency repairs to the turbines, with other occasional activities including track maintenance and snow clearing to maintain access to the turbines. During the first six months post installation a weekly check on each wind turbine will be required, in order to assess any abnormal stresses, unusual vibrations and the general condition. After the initial six months monthly checks will be conducted. Following this initial period annual maintenance, lasting approximately a week is required, in order to check the rotation and condition of the blades and the integrity of the bolts, an oil analysis is also required.

Decommissioning

The wind farm is designed with an operational life of 25 years. At the end of this period the developers may dismantle and remove the turbines, apply for an extension to the operating period using existing equipment, or apply for an extension to the operating period using new turbines.

5. Environmental Impact Assessment

This EIA has been prepared in compliance with the EIA regulations to accompany the planning application for the Shapinsay community wind turbine. The main objectives of the EIA are to:

- Identify the effects of the proposed development;
- Evaluate the extent and significance of these effects;
- Identify measures which can be taken to minimise these effects; and
- Identify opportunities to enhance or otherwise benefit the existing environment.

Consultation has played an important role in the final design of the project and consultations are ongoing with all statutory consultees and other interested parties. The aim of these has been to ensure that their views and knowledge have been sought and incorporated into the development and EIA process. Important issues that required addressed in the EIA were initially identified through consultation undertaken at the feasibility study stage.

The main issues that have been examined as part of the EIA are; landscape and visual effects, ecology and natural heritage, archaeology and cultural heritage, noise, socio-economic, telecommunications and aviation issues.

7. Mitigation and benefits

As a result of the ongoing consultation process and EIA several elements of the project have been amended to avoid or reduce potentially significant adverse effects. These include:

- Turbine moved to increase distance from sensitive bird nesting site
- Length of new access track required kept to a minimum

Community ownership of the turbine project will bring a number of benefits from the scheme both to the island of Shapinsay and Orkney as a whole. The income generated from the project will allow the pursuit of a number of grass roots community development projects on the island. The project will also provide full time employment opportunities for a number of local businesses during the construction and decommissioning phases and part-time employment during the operational phase. A number of service sector businesses are also likely to benefit from the development.

6. Significant effects

In evaluating the predicted effects from the project the proposed mitigation measures outlined in Section 8.2 of the document have been taken into account. The technical surveys undertaken have identified that the majority of environmental effects of the project can be mitigated to ensure that they are considered not significant. In addition consultation throughout the design process has allowed the flexibility to incorporate environmental concerns into the decision making process. Despite this there remain 3

main issues which have been predicted to result in significant adverse effects as a consequence of the proposed development. These residual effects area as follows:

Landscape and visual impacts (including visual impacts on cultural heritage)
This study concluded that the significance of the impact on the landscape character of the area would be 'high' largely because of its prominent location on a generally low-lying island, but that there would be negligible cumulative effects on the landscape character.

The viewpoint assessment concluded that the most significant visual impact, High, would be from viewpoints 2 (B9059 near Housebay), 3 (west of Quoymorhouse), 4 (Bonnyhill) and 6 (the Mor Stein). Moderate/ High impacts were identified at viewpoint 1(B9059 east of Hilton) and at viewpoint 7 (Mill Dam). The turbine would not, therefore, appear dominant from any viewpoint.

The Archaeological and Cultural Heritage impact assessment also considered the visual impact of the turbine on the setting of identified cultural heritage sites out to 30km. The visual impact of the development to the 15km distance has been defined as of Major significance due to the high number of important sites in the area

The landscape and visual impacts of the development are considered to be long-term as they will be present throughout the operation of the wind turbine. However on decommissioning of the scheme the turbine will be entirely removed and the negative effects on the landscape and visual resource will no longer be applicable.

Birds
A Vantage Point survey was undertaken which included a desk based assessment of all available breeding records and walkover survey conducted to collect further breeding data for 2007.

The main concern regarding the proposed turbine was in relation to one regularly used breeding site of red-throated divers in Shapinsay which is located 1km form the site. The other high sensitivity species known to breed within the area are the Northern pintail, Peregrine and Arctic Skua.

At the site-specific level, the impact of disturbance at this site would be of Very High magnitude and therefore of Very High significance. In the absence of flight activity data, the collision rate for red-throated divers could not be calculated. It remains unknown whether the red-throated divers' flight routes pass through the turbine site. The collision risk impact at the site-specific or regional levels could not be fully assessed due to the absence of flight activity data. However, the loss of one pair of red-throated divers would not present a significant impact at the national population level.

Noise

Noise predictions show that there is likely to be an exceedence of the ETSU-R-97 simplified noise criterion of 35 dB LA90 for 10 metre height wind speeds up to 10 m/s for the Enercon E44 turbine at the proposed location. The document does however allow for the noise limit to be increased based on an allowable margin of 5 dB above the 'prevailing' background, which could be determined by the undertaking of an onsite noise assessment if required. Other noise studies undertaken on Sanday indicate that when background noise levels are taken into consideration the necessary noise standards are likely to be met leading to little or no loss of amenity to the local Shapinsay residents.

8. Conclusions

The development of the Shapinsay community wind turbine will play an important role in securing the future sustainability of the island. By ensuring that the financial gain derived from the development is managed and re-invested locally a number of community initiatives can be pursued. The project will also support the government's climate change initiatives and displace 58,875 tonnes of CO_2 over the 25 year project lifespan.

The applicant has undertaken a thorough site selection process to minimise the effects of the works on the physical, biological and human environment. In particular careful attention has been given to ecological, archaeological and landscape and visual impacts in influencing project design. The technical reports undertaken to support this assessment are available in the Appendices to this Environmental Statement.

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Section 1 Introduction

Highlands and Islands
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Shapinsay Community Wind Energy Project

Environmental Statement

1 Introduction

This Environmental Statement (ES) forms part of the planning application for the Rousay Community Wind Turbine submitted by the Shapinsay Development Trust to Orkney Islands Council planning department under the Town and Country Planning (Scotland) Act 1997. Scotrenewables Limited has been contracted to undertake the technical and environmental works associated with submitting a planning application for this project.

The proposed project consists of the installation, operation and decommissioning of a single 900kW turbine which will be located at Howe on the South side of the island of Shapinsay, Orkney, see Figure 1.1. The development includes all associated infrastructure which will be required including foundations and hard standings, cabling to connect to the electricity grid and improvement and upgrading of an existing track to allow access to the site.

1.1 Background

The Shapinsay Community Wind Turbine is part of a project of development for the islands championed by the Shapinsay Development Trust (the Trust). The project is supported by the Highlands and Islands Energy Company (HICEC). HICEC is a non-profit making distributing company established in 2004 to support local communities in generating and using renewable energy for their long term and collective benefit. HICEC support constituted non-profit distributing community organisations in the Highlands and Islands of Scotland by providing advice, grant funding and financial support.

The Shapinsay Development Trust is one of six community organisations on Orkney aiming to develop their own wind projects being supported by HICEC in Orkney, see Figure 1.2. The other associated applications are:

- Rousay, Egilsay and Wyre, through the joint Development Trust;
- Hoy, through the Island of Hoy Development Trust;
- Eday, through the Eday Partnership;

- South Ronaldsay and Burray, through the South Ronaldsay and Burray Development Trust, and
- Stronsay, through the Stronsay Development Trust.

All of these projects are for identical turbines of equal generating capacity and will be submitted to the planning department at the same time as the applications for the Shapinsay turbine. Scotrenewables is undertaking the environmental and technical work associated with all of these projects. Scotrenewables is undertaking the environmental and technical work associated with the Environmental Statements all of these projects.

1.2 The need for the project

The need for this project is mainly found in the two fundamental but interlinked issues of climate change and sustainability and how the project will help to moderate future negative impacts of their future change on the community represented by the applicant.

1.2.1 Climate change

Climate change has been described as the greatest environmental challenge facing the world today (DEFRA, 2007). Predicted rises in global temperatures will bring changes in weather patterns, rising sea levels and increased frequency and intensity of extreme weather events. The effects will be felt both in the UK and globally, and the most severe problems are predicted to be encountered by communities in regions that are particularly vulnerable to sea and weather change.

The burning of fossil fuels to produce electricity is a major contributor to climate change through the release of atmospheric Carbon Dioxide (CO_2) and other harmful gases known collectively as greenhouse gases. Both the UK and Scottish Governments are committed to reducing greenhouse gas emissions and have entered into binding international agreements; namely the UN Framework Convention on Climate Change (UNFCC 1992) and the Kyoto Protocol (1997).

In order to meet these national and international obligations with regard to reducing greenhouse gas emissions the UK and Scottish Governments have set ambitious targets for increasing the amount of power generated from renewable energy sources through

the Renewables Obligation (and Renewables Obligation Scotland). The following targets for have been identified:

- UK: 10% of all electricity to be generated from renewable sources by 2010 increasing to 20% by 2020;
- Scotland: 18% of electricity to be generated from renewable sources by 2010 (includes hydro-electric power) increasing to 40% by 2020, quantified as 6 GW installed capacity. Scotland has already exceeded its 2010 target.

Onshore wind energy is recognised as one of the most viable and economic technologies available at the present time and Scotland, and furthermore Orkney, has been shown to have some of the best wind resources in Europe and the world.

Although, the effects of climate change are difficult to show and predict accurately. There is now a huge body of evidence to indicate that the natural variation in the earth's climate has been strongly influenced by manmade global warming over the last century; due to use of fossil fuels and the consequent net increase of carbon dioxide in the atmosphere In the next 50 years, it is conservatively predicted that average air temperatures in the area are expected to rise by 0.5-1.5° C, with 6-13% more rainfall, an increase in wind speeds, a rise in sea level and a disproportionate further increase in storm events.

The rise in sea level will not only affect areas adjacent to the sea, but also impact on low-lying regions well inland. In terms of our Natural Heritage, normally the species most likely to be affected by climate change are those close to the limits of their range, such as whimbrel and Scottish primrose. However, factors such as changes in sea temperature can have much more fundamental and widespread effects if they alter the breeding cycle and migration of fish such as herring and sandeel, on which many other aquatic and avian species and our fishermen depend.

Climate change is also predicted to have important effects on agriculture with wetter winters and milder summers. It is all these threats from global and local climate change that are giving a growing impetus towards energy efficiency and finding alternative sources of energy to fossil fuels in order to: combat man made climate change, redress the imbalance created historically by our activities, and sustain both a local and global climate conducive for environmental strength and richness into the future.

Government renewable energy targets are likely to have an influence in mitigating climate change and particularly in Orkney, which has the potential for wind, wave and tidal energy schemes.

In support of the government's commitment to renewable energy and its contribution to the climate change programme, more renewable energy developments are planned. Scottish Ministers wish to see the planning system play its full part in making positive provision for such developments. Planning policies such as National Planning Policy Guidance 6 (Revised 2000) – Renewable Energy Developments (NPPG6) guide applicants on the broad criteria they require to consider in developing renewable energy projects. SPP6 the Scottish Planning Policy Guidance Six has been in place in Scotland since March 2007. These policies include how the impacts can be minimised through careful consideration of scale, location, design and other measures. SPPG6 is based on the principle that renewable energy should be accommodated throughout Scotland where the technology can operate efficiently and environmental impacts can be addressed satisfactorily.

1.2.2 Sustainable development

The Scottish Government is also committed to creating sustainable communities and highlights this as one of four key objectives to creating sustainable development (Scottish Executive 2005). Choosing Our Future: Scotland's Sustainable Development Strategy (Scottish Executive 2005) sets out the national and international context that drives the Scottish Government's sustainable development agenda and starts to map out an action plan to achieve its four objectives:

1. Sustainable consumption and production; achieving more with les. This includes reducing inefficient use of resources, looking at the impact of products and materials across their whole lifecycle and encouraging people to think about the social and environmental consequences of their purchasing emissions.
2. Climate change and energy; securing a profound change in the way we generate and use energy, and reducing greenhouse gas emissions.
3. Natural resources protection and environmental enhancement; protecting our natural resources, building a better understanding of environmental limits and improving the quality of the environment.

4. Sustainable communities; creating communities that employ the principles of sustainable development locally.

The underlying principle for the Shapinsay Community Wind Turbine project is to secure the long term sustainability of the island communities which aligns nicely with the context of National Planning Policy Guidance 1 – The Planning System. The development is needed to maintain the viability of the island in the interest of the rural economy and environment as it will benefit the economy and social well-being of the island it supplies. The output of the turbine would not only help offset the carbon dioxide equivalent emissions produced on the island but it would also contribute significantly to the energy consumed on the island. The wind turbine provides an efficient local, sustainable source of energy that would carry environmental and social benefits that are material and should be considered in this planning application.

1.2.3 The applicant

The Shapinsay Development Trust was formed in 2004 from the Shapinsay Development Group and is a Company Limited by Guarantee and a registered charity. The Trust currently has three active sub groups looking at Renewables, Tourism, and the Play Park and has had a number of successes.

This Tourism Sub Group has worked towards enhancing one of the islands main visitor attractions, Burroughston Broch, putting new interpretation boards and signage in place to better explain the site. There is also ongoing work to build a drystone seal hide and provide interpretation of the nearby seal colony.

The main aim of the Play Park Sub Group is to refurbish the existing substandard play area providing new equipment, new surfaces and a part time Youth Development Worker to fully meet the needs of all the island children. The Group have been busy fund raising locally and are now looking to secure external funding for the project, which could be developed with other projects to provide a drop in centre and establish a children's council linked to the Trust.

Shapinsay held a very successful Renewable Day in 2006. Its aim was to encourage residents to move towards a sustainable renewable future. Together with other

Development Trusts across Orkney the Trust is now proposing a Community Owned Wind Turbine. The community wind turbine project is one of the strategic projects identified to provide a sustainable source of income, which would be used to benefit the Shapinsay community.

The Trust went through a rigorous process to gauge the communities view on this project, mailing information to all the adult population, inviting all residents to a public meeting where the proposed project was discussed in detail, followed by an opportunity to ask questions and air concerns regarding the Turbine. All residents over 16 were sent voting forms to indicate whether they were for or against the proposed project. To ensure impartiality the voting slips were returned directly to an independent body, Voluntary Action Orkney, who agreed to count the slips and announce the result through Radio Orkney on Wednesday 27th February 2008.

The Poll for the Community Owned Wind Turbine has returned in favour of the project with the following results:

Number of voting slips issued: 287
Number of voting slips returned: 217 (76%)
Number voting Yes: 167 (77%)
Number voting No: 49 (23%)
Spoiled slips: 1
Number returned after deadline: 20 (these are not included in the above figures).

This gave the Trust a clear mandate to proceed with the project as the returns far exceed these required by the Board, which needed 51% of the voting slips to be returned and a 'Yes' vote of 60% to proceed.

In May 2006 the Trust secured funding for an all age Music Group with tuition and advice given by local professional musician Jennifer Wrigley. This project has enabled us to give everyone the chance to take up a musical instrument and have expert advice and encouragement.

During 2007 the Trust were able to employ a Community Development Worker on a short term contract, which created a job opportunity within the island. One of the tasks undertaken was a Skills Survey, collecting information from residents with the aim of generating a database of people and skills, which would enable residents to source specific skills from within the island. Following this a workshop on drystone wall building was run by the Trust for island residents, which gave individuals a chance to learn a new skill. Further training workshops are proposed in other areas.

The Community Development Worker post proved a valuable asset to the Trust and further funding has been secured from Lloyds TSB for this post and the Trust have just appointed a worker.

The 2007 Development Plan builds upon the foundations set down in the 2006 Plan. The Trust aim is to carry forward substantive projects that will bring us closer to achieving the vision of Shapinsay as a place where:

- Our local environment is protected, enhanced and enjoyed by all;
- This island culture remains distinct from the Orkney mainland;
- Renewable energy sources and technologies enable us to become energy self sufficient;
- The population is balanced and economically active;
- We are well served by transport links;
- We enjoy the highest quality of essential services;
- Our archaeology, birds and wildlife are protected; and
- Children and adults thrive within the community.

The Development Plan is a strategic document, which outlines the key areas for project development over the coming year. It also gives a summary of the achievement of the Trust, and the methods by which the Trust will seek to monitor and evaluate projects.

In 2006/7 the Trust started a number of short and long term projects. As well as honouring commitments to current projects, the Trust plans to research and consult in the following areas;

Transport

At a recent consultation with Highlands and Islands Enterprise (HIE) the development trusts of Orkney stressed that transport was the number one factor for islands to be sustainable, dynamic and economically viable communities.

Project Ideas

- Develop a community transport strategy in conjunction with the Community Council;
- Undertake local transport audit;
- Work in partnership with the Community Council to lobby for better transport links to the mainland; and
- Work with the Community Association to investigate funding for a new Community minibus.

Young people

The young islanders policy stresses the need to develop projects that improve quality of life of our young islanders and create strategies that will increase their involvement in projects and activities within the community.

Current Projects

- Funding application to Children In Need and the National Lottery for a new Challenge, Adventure and Recreation Park, to include new equipment, play area surface, salary for a part time Youth Development Worker and the creation of a nature trail.

Project Ideas

- Establish a Children's Council linked to the Development Trust so that young people can make a direct contribution to community planning;
- Develop a Youth Drop-in Centre; and
- Investigate and provide training courses and work placements.

Housing

The island needs an adequate supply of affordable, high quality and green housing which will enable it to retain young people and encourage others who will develop the economy to relocate, whilst retaining and developing skills on the island. The Trust will be taking part in a Northern isles housing needs and land availability survey, in conjunction with OIC Housing Dept. The result of this survey will be analysed by Voluntary Action Orkney and made available to Orkney Housing Association Limited, with a view to obtaining more housing on Shapinsay. The survey will examine local needs and recommendations will be made on the basis of the information supplied.

Project Ideas

- Research skills training eco-building techniques in order to encourage and support more eco-friendly building; and
- Create a heritage skills training package as part of the Douche restoration scheme so that local builders have the opportunity to acquire skills in restoration and specialist building techniques.

Renewable and sustainable energy

Sustainable energy is a very important issue facing every community. In order to maintain and enhance the quality of our environment and to have sustainable future, the trust need to invest in environmentally friendly technology.

Current Projects

- Install a community owned wind turbine for Shapinsay that would enable the island to reduce energy bills, limit fossil fuel consumption and fund community programmes and projects.

Project Ideas

- Develop an island Renewable Energy Strategy that takes account of development in harnessing wave and tidal energy.

Enterprising community

The Trust has researched community owned subsidiary trading companies and how they can generate income. They have investigated the possibility of owning facilities and undertaken an audit of skills within the community. The aim is to make the Trust more sustainable and less reliant on grant funding, and to enable the community to develop expertise and strategies that will build on local enterprise initiatives.

Current Projects

- Organise a series of skills based workshops on Shapinsay, starting with a one day drystone dyke build and repair workshop in September; and
- Produce a marketing strategy to promote Shapinsay as an overnight destination for visitors to Orkney, as well as building awareness of the island as a weekend break alternative for Orkney mainland residents.

Project Ideas

- Undertake feasibility study into running a community pub/internet café to raise income to cover the ongoing administrative costs of the Trust; and
- Create an investment fund/vehicle for Shapinsay from the proceeds of the community owned wind turbine.

Recreation, Pastimes, Community Facilities and Local Services

A healthy community enjoys a high quality of life with a good balance between recreation and work. The Trust are committed to retaining and improving existing facilities and supporting the development of new ones.

Project Ideas

- Produce and island newspaper/newsletter;
- Work with Shapinsay Community Council, and local boat owners on the feasibility of a marina; and
- Support local sporting initiatives.

Education and learning

To create an enterprising community the trust will need to provide high quality training and life long learning that is easily accessible. The skills survey helped us to determine

local needs. The trust will build on existing facilities and encourage access through sourcing local expertise and encouraging the use of modern information technologies.

Project ideas

- Develop an ICT facility on the island for open access; and
- Investigate modern apprenticeships.

Elderly Care and Support

To create a balanced community the Trust want to care for the elderly and those with special needs on the island, thereby avoiding upheaval, and providing valuable local employment and training opportunities. Care and support for elderly members of the community is essential for maintaining quality of life on Shapinsay.

Project Ideas

- Investigate feasibility of a befriending/visiting service, for the elderly or infirm people who are unable to participate in the wider community; and
- Research care home, day centre and respite provision similar to Kalisgarth facility on Westray.

Culture, Heritage and Environment

The island culture and landscape are unique and need to be protected and conserved for enjoyment of future generations of islanders. The island welcomes visitors and recognise the value of sharing our heritage with others so that Shapinsay continues to be a vibrant Island culture.

Current Projects

- Promote island environmental education through the appointment of a Youth development worker. Establish working partnership with RSPB education officer;
- Enhance / interpret areas of wildlife significance. Using a team of volunteers, construct drystone seal hide close to Burroughston Broch seal colony, with information boards on breeding, habitat and life cycle;
- Develop footpath networks in partnership with OIC Environment department and local landowners;

- Work towards restoring the Douche in partnership with Community Council and Shapinsay Heritage Trust, to create new and enhanced visitor attraction, and to facilitate public access; and
- Create glossy visitor guide for Shapinsay based on existing black and white version currently in circulation.

Project Ideas

- Create field guides for visitors to enjoy the local wildlife and environment safely and without disruption; and
- Develop and island grapevine for wildlife spotting using website/phone texting.

It is evident from the development plan that the island of Shapinsay is a vibrant community with many projects under development. One of the most limiting factors in achieving success in these projects is the availability of finance both to employ staff and also to invest in the projects.

1.3 Policy context

1.3.1 EU, UK & Scottish policy

When the Scottish Climate Change Programme was published in November 2000, the Environment Minister, noted that the issue of climate change was moving up the political agenda. Now, 8 years later, it is safe to say that climate change is nearing the top of the political agenda – and rightly so. Given its global importance, climate change has been singled out as one of the key priorities for the UK's presidency of the EU and chairmanship of the G8.

Following Europe's first hand experience of the types of climate extremes we can come to expect with greater regularity over the coming decades – widespread flooding in central Europe in 2002, a record-breaking heat wave across Europe in 2003, and landslips and flash floods in Scotland and other parts of the UK in 2004, and summer of 2007 – climate change is at the forefront of people's minds. Scientific knowledge and public awareness of the problem continue to grow. More and more column inches are being devoted to the issue.

Recent developments on the international stage include the ratification of the Kyoto Protocol by Russia which meant it came into force on 16 February 2005. The targets set out in the Protocol represent an important first step in global efforts to curb emissions of the greenhouse gases which contribute to climate change. It is recognised by the Scottish Government, however, that much more substantial cuts will be required in the future to avert climate chaos.

The Scottish Government is committed to making an equitable contribution to the UK's Kyoto Protocol target and to working in partnership with the UK Government in moving towards the UK's more ambitious domestic goals. Through its action to date, the UK has established itself as a world leader in the fight against climate change and the Government is supporting these efforts by taking action in the same or similar areas as the UK Government, where it has the devolved powers to do so.

The Scottish Government's 2010 target for 18% of electricity requirements to be met from renewable energy has been met. The intention of planning policy is to facilitate successful achievement of the 2020 target, and beyond. In 2005, the Scottish Ministers re-confirmed the 2020 target, quantifying it as 6 GigaWatts (GW) of installed renewables capacity, and confirmed that this figure should not be regarded as a cap on development. The Government's expectation is that sufficient developments should be consented, at minimum, to enable achievement of the 2020 target several years ahead of schedule.

The Government's policy is that its 2020 target should be met by a range of renewable technologies. Hydro and onshore wind power is currently making the most significant contribution. This is expected to continue although these technologies will increasingly operate as part of a renewables mix as other technologies come on line. Biomass is also a proven technology which will contribute to current targets. Other technologies may have the potential to contribute more significantly to the overall generation mix in the longer term. This will include energy from waste and landfill gas and technologies not covered by the land-use planning system, such as offshore wind, wave and tidal. The Government will continue to support these renewable energy technologies, working through the Forum for Renewable Energy Development Scotland and in discussion with key stakeholder groups including our own Orkney Renewable Energy Forum.

The Scottish Ministers are also keen to see a major increase in the smaller-scale production of heat and electricity from renewable sources. While much of the forecasted activity in this sector may take place at a domestic level (through micro wind turbines, woodchip boilers, heat pumps and solar heating), there is also significant potential for decentralised energy supply systems and small, medium and large scale biomass heating plants for businesses, public buildings and community/housing schemes. Some of these issues will be considered in more detail in the Renewable Heat Strategy for Scotland. The income stream generated by community ownership of the wind turbine project in this application could be used to help increase the activity at the smaller scale in the local community.

The Intergovernmental Panel on Climate Change, made up of the world's leading scientists, observed in its Third Assessment Report that "there is now stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." Levels of carbon dioxide, the main greenhouse gas, have risen by more than a third since the industrial revolution and are now rising faster than ever before. Some examples of how our climate is already changing include:

- All of the ten warmest years since records began have occurred since 1990, including each year since 1997;
- Winter storms have doubled in the UK over the past 50 years;
- Spring plants are blooming earlier in Scotland (on average three weeks earlier since 1978).

Indicators of Climate Change in the UK, revised in January 2004, provides a list of 34 climate change indicators covering climate, socio-economic and environmental factors, e.g., temperature, precipitation, the Scottish skiing industry (number of snow days), health, and plant and animal phenology. This set of indicators is designed to raise awareness of how our climate is changing, at what pace it is changing and how it is altering the fabric of our natural and man-made world.

Climate change is a real global threat. The independent Stern Review, which was published in 2006, is the most comprehensive review ever carried out on the economics

of climate change. Stern states that if the world fails to stabilise emissions in a relatively short space of time, it 'could create risks of major disruption to economic and social activity, later in this century and in the next, on a scale similar
to those associated with the Great Wars and the economic depression of the first half of the 20th century'.

The UK's target under the Kyoto Protocol is to reduce its greenhouse gas emissions by 12.5% below 1990 levels by 2008-2012. The UK is comfortably on course to meet this target. In addition, the UK Government has a domestic goal to reduce its carbon dioxide emissions by 20% by 2010 (which it first set out in the UK Climate Change Programme, published in 2000) and has also pledged (in the 2003 Energy White Paper) to put the UK on a path to cut its carbon dioxide emissions by some 60% by about 2050, with real progress by 2020. The UK Climate Change Bill looks to strengthen this pledge by including it as a mandatory target in legislation.

In the Energy White Paper, published in February 2003, tackling climate change was identified as one of four key goals of UK energy policy to 2050, all of which were given the full support of Scottish Ministers:

- to put the UK on a path to cut its carbon dioxide emission by some 60% by about 2050, with real progress by 2020 (thereby accepting the recommendation of the Royal Commission on Environmental Pollution);
- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
- to ensure that every home is adequately and affordably heated.

The UK Government and the Devolved Administrations aim to deliver all four goals simultaneously. Measures to reduce emissions of greenhouse gases can impact on fuel poverty and competitiveness by impacting upon energy prices. Similarly, by influencing investment decisions and the energy mix, such measures can also impact
upon security of supply.

In delivering reductions in carbon dioxide emissions through energy policy, the White Paper makes clear that the UK Government's priority will be:

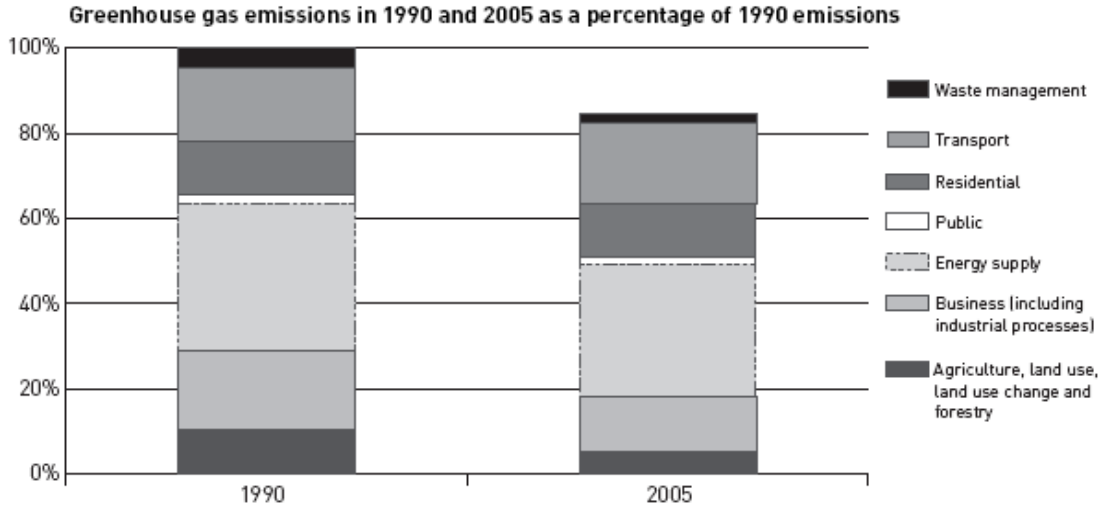
- Improvements in energy efficiency. As emissions from power stations (particularly fossil fuels) are directly linked to the demand for electricity, one of the most cost-effective ways of reducing emissions is to reduce the overall amount of electricity used. This also improves energy security and cuts costs for homes and businesses.
- Increasing the use of renewable forms of energy, which are 'carbon neutral' or produce very low emissions or no emissions at all. Again, increasing the amount of distributed renewable energy can contribute to security of supply.

Scotland's emissions are reported in the Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland. In measuring Scotland's emissions of greenhouse gases, a net figure is used which takes into account the amount of CO2e which is taken out of the atmosphere by land use and forestry. Scotland's net emissions of CO2e greenhouse gases in 2005 were over 54 million tonnes. This is approximately 0.2% of world CO2 emissions and 0.15% of all greenhouse gas emissions due to human activities. The Scottish Government recognises that this is virtually insignificant as a proportion of world emissions – if Scotland were to eliminate all of its emissions, the effect on global climate change would be negligible.

However, Scotland only has around 0.08% of the world's population – so we produce a much greater than average amount of emissions in proportion to our population. In addition to emissions which come from Scotland, consumption in Scotland has the effect of causing emissions to be released in other countries which produce products for the people of Scotland. Given the long-lived nature of greenhouse gases in the atmosphere it is also important to take account of past emissions. Levels of greenhouse gases in the atmosphere have been rising since the beginning of the industrial age in the 18th century. Industrialised countries such as Scotland have contributed the vast majority of greenhouse gases caused by man currently in the atmosphere. CO_2 accounts for roughly 80% of Scotland's greenhouse gas emissions.

Climate change is one of the most serious threats facing Scotland and the world. The most severe consequences include famine, drought and the extinction of species. Further action by all nations is needed urgently in order to avoid the most severe climate change. On 12 December 2007, at the United Nations Climate Change Conference in Bali, Indonesia, UN Secretary General Ban Ki-moon stated that 'the time for equivocation is over. The science is clear. Climate change is happening. The impact is real. The time to act is now.'

Figure 1.3 Sources of green house gas emissions in Scotland (1990 and 2005)



There are four key reasons why the Scottish Government is bringing forward legislation in 2008 to create mandatory climate change reduction targets of 80% by 2050:

- to drive decisions in government and business;
- to create and enable new means of reducing emissions and adapting to climate change;
- to play our part in global action on climate change; and
- to provide a strong example to other countries showing what can be done.

The UK Climate Change Bill will provide statutory targets at the UK level. But Scotland can, and should, go further. Scotland's emissions, and the potential to reduce emissions in Scotland, are different from the rest of the UK. We have massive potential in renewable energy, particularly in marine and wind energy. Studies have estimated

Scotland's potential renewable resource to be around 60 GigaWatts. This is equivalent to around 75% of the existing electricity generating capacity across the UK. The majority of the UK's forest area is in Scotland and we potentially have the space to increase its extent further, which would add to its ability to absorb CO_2. Orkney has large carbon sinks in her soils and particularly in the grass lands.

Orkney's economy has benefited enormously over the last 30 years from the development and exploitation of the offshore oilfields, firstly in the North Sea, and latterly, in the Atlantic Frontier to the west of the Islands. The Oil terminal at Flotta has provided significant direct employment for almost the whole of this period, although numbers have declined over the last ten years as the operation has been rationalised to handle the smaller volumes of oil coming through the terminal.

The current owners of the terminal, and majority shareholder of the linked North Sea assets, Talisman, see the operation at Flotta continuing to at least 2020. The company specialises in exploiting mature assets, and the current increase in the price of oil, which seems likely to persist, is a considerable help in achieving this. The company has an active exploration and development programme.

Recent activity in the building of large wind turbines at Burgar Hill, Sanday, Stronsay, Burray and approvals for further turbines at Flotta, Westray and Dounby show Orkney changing from fossil fuel development to renewable energy development. Further evidence of this can be seen in the considerable investment in the European Marine Energy Centre and also at the smaller scale with technologies such as solar panels, heat pumps, small scale wind energy and biogas plants appearing in houses, businesses and public buildings across the islands.

Deriving maximum community benefit from renewables development is as much a crucial aspect of development of the renewable industry as it was in the oil industry. Compared with the other industries, the direct employment benefits of the industry are limited. The Council has taken a great deal of time to establish an onshore wind energy planning policy with the aim of minimising negative impacts through locational guidance.

Maximising community benefit can help compensate for any adverse impacts. In addition, renewable resources such as wind and waves can be regarded as community resources, and it is proper therefore that the community should benefit from their development.

One way of doing this proposed is to require developers to pay part of the surplus from wind turbine developments into a community fund, the recently proposed payment of £5,000 per MW in the Merranblo development near Stromness provides an excellent example of a community fund. In the Highland Council area, this has been achieved with an average 'tariff' of £1,100 per MW per annum, although the aim is to reach a higher figure. There is no real mechanism for compelling developers to make these payments. Nevertheless, developers should be encouraged to make community payments.

The model proposed by this development and the five other community turbines, ensures that, after capital financing costs, **all** net revenue from the project is retained for local benefit within the local community. If the project is successful this is likely to be at least one order of magnitude greater than any other proposed scheme so far, with estimates varying between £20,000 and £200,000 per MW per annum depending on cost variables, financing and levels of capital granting available. However, to achieve this the local community is required to commit to considerable levels of work and organisation and potentially has to take on similar levels of project risk as would normally be expected of a commercial developer.

Community opportunities for Tidal sites? OIC could register interest in all potential offshore wind, wave and tidal site under the Land Reform Act and work towards gaining ownership of these sites, this way a community benefit can be applied by OIC as the land owners. This precedent can be instigated know in the OIC harbours area.

Another way of maximising community benefit is to enable local community groups to themselves own wind turbine projects, through a scheme of public sector investment in such projects. The Council is currently considering the establishment of such a scheme.

1.3.2 Renewable obligation

As part of its commitment to the Kyoto protocol and in accordance with the EU Renewables Directive, the UK has made a strong commitment to the development of renewable energy. The key policy mechanism by which the Scottish Government is encouraging growth in renewable energy is the Renewables Obligation Scotland (ROS), which was introduced in April 2002 as part of primary legislation and which is specified by such legislation to remain in place until 2027. The ROS provides strong financial incentives for all licensed electricity suppliers to secure a specified and increasing portion of their electricity from eligible renewable sources such as wind power. Suppliers must either meet their targets or pay a "buyout price" in relation to any shortfalls.

The European Union's Renewables Directive (RD), which came into force in October 2001, proposes that Member States adopt national targets for renewables that are consistent with reaching the overall EU target of 12 per cent of energy (22.1 per cent of electricity) from renewables by 2010.

The proposed UK "share" of this target is that renewable sources eligible under the RD should account for 10 per cent of UK electricity consumption by 2010.

The Scottish Programme indicated that in the energy sector, the Government had set a target to increase further the use of electricity from renewable sources in Scotland by 2010, taking the total to around 18% whilst also aiming for 40% by 2020. The target remains - and between 1990 and the publication of the Executive's Securing a Renewable Future: Scotland's Renewable Energy in 2003 a little over 200 MW of new renewable generating capacity had been developed and installed around Scotland (the figure of 200 MW represents an increase around 1-2% of the total capacity for generation in Scotland in 2003). However, the 18% target has now been achieved ahead of schedule and the far more ambitious aspiration to generate 50% of Scotland's electricity from renewable sources by 2020, has been set. There is also ministerial recognition that Scotland should achieve the EU target of securing 20% of energy from renewable sources by 2020, this is a huge step forward as this target will also include transport and heat in addition to electricity. Current thoughts are that 50% of electricity will be renewable, 10% of transport fuels and 6% of heat by 2020.

In previous years wastes have been added in with renewables as a convenient place to record this fuel source. However, the international definition of total renewables has been adopted and this excludes non-biodegradable wastes. Cofiring has also been included and this has led to many coal power stations including biomass in their fuel supply.

To date, the main instruments for pursuing the development of renewables capacity have been the Non Fossil Fuel Obligation (NFFO) Orders for England and Wales and for Northern Ireland (NI-NFFO), and Scottish Renewable Obligation (SRO) Orders; the term "NFFO Orders" is used is refer to these instruments collectively. These aimed to assist the renewables industry by allowing premium prices to be paid for electricity for a fixed period.

Ofgem has the responsibility for implementing the Government's Renewables Obligation, which started in April 2002. It requires suppliers to source a certain proportion of their total sales in Great Britain from electricity generated from renewable sources as follows:

Obligation period	Percentage of total supply
April 2002 - March 2003	3.0
April 2003 – March 2004	4.3
April 2004 – March 2005	4.9
April 2005 – March 2006	5.5
April 2006 – March 2007	6.7
April 2007 – March 2008	7.9
April 2008 – March 2009	9.1
April 2009 – March 2010	9.7
April 2010 – March 2011	10.4

Electricity generators can apply to Ofgem for accreditation to prove their generation comes from eligible renewable sources. Ofgem then issues generators with Renewables Obligation Certificates (ROCs) and Scottish Renewables Obligation Certificates (SROCs) for their qualifying output, with each ROC representing one megawatt hour of

renewable electricity generated. ROCs may be sold to suppliers (or third parties) either with or separately from the electricity generated.

In order to meet the targets, suppliers can present Ofgem with enough ROCs or use a buy-out clause to make up the shortfall. They can also use a combination of ROCs and buy-out to meet the obligation. Proceeds from the buy-out fund are paid back to suppliers in accordance with how many ROCs they have presented, compared to the total number of ROCs presented for the obligation period.

Ofgem is the Office of the Gas and Electricity Markets, which supports the Gas and Electricity Markets Authority, the regulator of the gas and electricity industries in Great Britain. The Authority's powers are provided for under the Gas Act 1986 and the Electricity Act 1989, as amended by the Utilities Act 2000 as well as under the Competition Act 1998 and the Enterprise Act 2002.

According to the ROC register maintained by Ofgem, approximately 55% of the renewable obligation was met for the period from April 2003 to March 2004, during which time the renewables target was 4.3% of total supply. The Government has to increase the renewables obligation target to 15.4% of total supply by 2015/16, thus ensuring there is a market for renewable energy at least until then. By being an embedded production proposal under the proposed Orkney RPZ scheme, this project best maximises existing grid structure and connection availability to help achieve these national renewables production targets within this ambitious time period.

1.3.3 Why wind energy?

The Trust Directors believe that onshore wind technology is presently one of the most cost-effective renewable technologies for the energy resources available to the community. Although there are tremendous potential marine resources surrounding and between the island group, Orkney has one of the best wind resources in Europe and the marine energy conversion technologies have not been shown to be mature enough to provide acceptable levels of project risk at present. The highest risk to this single turbine project for the community is the risk of a private developer from within or outwith the island group, using up the most promising sites before a community project can be developed. The development trust are working urgently to ensure that their project is

considered before any others as it believes the project maximises material benefit to the community, is sensitively scaled within the environment and can best utilise existing infrastructure capacity available under the active management scheme..

A small wind project typically takes 18 months to 3 years to develop from the initial concept stage through to Full Consent. The developer makes an initial assessment of the suitability of the site using the national wind database and identifies any special area designations or civil aviation and military interests. A land option or lease is then normally agreed before significant further costs are incurred in developing the project. The land on which a wind project is constructed is typically leased for 25 years with a renewal option for a further 25 years. Prior to submitting a planning application, the developer carries out on-site wind assessment to prove the viability of the site and has an environmental impact assessment or environmental appraisal prepared to support the planning application. During this period, the developer also applies for a grid connection with the local electricity distribution.

When the proposed project secures Full Consent, including agreement of planning conditions and grid connection, it moves into the construction phase, which includes the process of tendering for contractors and suppliers, with this phase normally taking between 6 and 9 months. The turbine time from placing the order to delivery could be as long as 24 months. Typically, the developer will have entered into a long-term Power Purchase Agreement through which the electricity generated by the turbines will be sold to an electricity supply company. The useful mechanical life of a wind project is up to 25 years, at the end of which the life of the project can often be extended by re-powering the site with new wind turbines subject to a new planning permission.

1.3.4 The issue of grid access

Currently the grid system connecting Orkney to the national grid is near capacity. After successful lobbying by the members of the Orkney Renewable Energy Forum, Scottish and Southern Energy (SSE) and Ofgem have agreed operational and contractual changes to squeeze extra capacity out of the Orkney grid by offering initially ‘non-firm’ connections as well as firm connections. A ‘non-firm’ connection means a generator can be taken off the grid when it is at capacity, these connections included EMEC, Westray, Flotta, Burray and the previous Burgar Hill development. Not content with this OREF

were successful once again in lobbying SSE to apply for the Registered Power Zone concept and Orkney was designated to be the first zone in Scotland. This permitted S&SE additional funding and they have been working with the University of Strathclyde on a study of active grid management which indicates that additional non-firm connection offers could be made – initially 15MW but perhaps as much as 40 MW in time. Obviously a non-firm connection could potentially constrain the rate of return to an investor. Potentially this could make investment in generating capacity less attractive. The projects in the public domain at the moment include the Hammars Hill 4.5MW development, the Holodyke development of 900kW, the Stromness Development of 2.7MW and the 4.5MW of community developments in Hoy, South Ronaldsay, Stronsay, Shapinsay, and Rousay. These publicly known projects alone would account for the available 15MW capacity, and there are strong indications that proposals requiring 3-4 times this capacity are seriously under investigation (at feasibility/baseline environmental study stages).

Clearly it is better to be in a position to have sufficient capacity to be able to offer firm connections but this requires significant investment in additional infrastructure and sites to accommodate the 100MW+ of development required to secure the connection. The most likely extension of capacity in Orkney would be a new 132 kV cable, capable of handling some 100-130 MW of new installed capacity. There is a proposed Orkney located multi-site 140MW on-shore wind proposal by Fairwind Statkraft Orkney Ltd (FSOL) which has been in the “national grid queue” for a number of years and has more recently been reported publicly as being at the scoping stage. This proposal has triggered early 132kV cable route selection and environmental assessment studies for the Caithness-Orkney Grid reinforcement process by the grid providers. However, this project is at an early stage of development and, by the nature of its scale, is likely to be locally and possibly national contentious, will be subject to examination centrally by the Scottish Government, and may require a public enquiry and/or appeals to any consenting decision that is made. In this context, likelihood of success of the proposal cannot be predicted at this stage.

Apart from this project and the RPZ capacity, there is currently insufficient evidence that other new generating capacity will materialise in Orkney to trigger grid reinforcement and create further export capacity in time to help contribute to the Scottish Governments

present targets. Ofgem have previously undertaken a consultation on new transmission capacity for renewable energy. Prior to the present FSOL proposal, their consultation paper placed all three island groups (Orkney, Shetland and Western Isles) into a third category of possible projects, 'additional' projects, which it stated had insufficient justification to proceed even with the necessary feasibility studies. They would only allow a go-ahead if developers underwrote the costs (i.e. committed themselves to paying for the studies, and for the cable). FSOL have initially given this undertaking for their proposed project, however, any smaller developers are not able to do this. There are no other equivalent larger scaled developers attempting to work within an equivalent timescale.

New arrangements for managing access to the national grid are being phased in under BETTA (British Electricity Trading and Transmission Arrangements) which came firmly into force on 1 April 2005, and established a GB – wide transmission system. Access and charging is managed by National Grid Transco (NGT). The basic charging principle for generators using the transmission grid is 'cost reflective' and this means that those generators using the transmission system in Orkney would pay a charge, which reflected the costs of providing a new cable to Orkney. This would impose a substantial cost penalty on generation in Orkney, which would probably make it unprofitable, and would certainly encourage developers to go elsewhere or connect at the distribution level 33kV and below.

1.4 Planning context

1.4.1 Planning permission

All windfarms require planning permission; but consent procedures vary for those above and below 50MW in size. Windfarms below 50MW are subject to the usual planning procedures with the application being determined by the Local Planning Authority (Orkney Islands Council). Windfarm developments above 50MW require authorisation from the Secretary of State for Scotland in under Section 36 of the Electricity Act 1989, who would usually issue the deemed planning consent at the same time.

1.4.2 National policy context

As outlined above the Scottish Climate Change Programme commits Scotland to generating 18% of its electricity from renewable sources by 2010. However, the Scottish Government has recently agreed that Scotland should aim for 40% of its electricity from renewable sources by 2020 and have announced a series of measures to help reach this target.

One of the main measures to increase Scotland's renewable energy output is the Renewables Obligation Scotland (ROS) Order 2002. The ROS places a legal obligation on every licensed electricity supplier in Scotland to supply a percentage of electricity from renewable sources. It works in tandem with the Renewables Obligation in England and Wales.

Both of these obligations are reflected in planning policy and guidance. Scottish Planning Policy 6: Renewable Energy (SPP6) sets out the national planning policy for renewable energy development that planning authorities should consider when preparing development plans and considering planning applications.

1.4.3 Local planning context

Since devolution recent national planning frameworks in Scotland have been informed by the local authority statutory development plan system, which sets out the planning policies for any given area against which planning applications will be assessed. At present the Development Plan for Orkney is made up of the Orkney Structure Plan (approved December 2001) and the Orkney Local Plan (adopted December 2004). The Sturcture Plan sets out the strategic framework for the development of land in Orkney to 2011. This includes an overall long term development strategy and a context for the Local Plan. The Planning ETC. (Scotland) Act 2006 establishes a new system of development planning which abolishes the statutory requirement for Orkney Islands Council to prepare a Structure Plan. In future, the statutory development plan for Orkney will comprise a single Plan, a Local Development Plan which will include a strategic vision and spatial strategy for the area. Orkney Islands Council has commenced its review of the current Local Plan and intends that this review will follow the new development plan arrangements set out in the 2006 Act. In the meantime, the Orkney Structure Plan 2001 remains the relevant strategic planning document which includes

coverage for the outer isles. The combination of these two plans provides general support from the Orkney islands Council (OIC) for all types of renewables energy development, provided that such schemes can be developed in an environmental acceptable manner. The framework for wind energy developments are set out in more detail through the following policies:

The Orkney Structure Plan

- Policy SP/U6 Renewable Energy: generally supportive of renewable energy development provided that it acne be undertaken in an environmentally acceptable manner.
- Policy SP/U7 Wind Energy: establishes siting and design criteria whiall all proposals must respond to in ensuring all environmental considerations are acceptable.

The Orkney Local Plan

- Policy LP/U7 Wind Power: established the criteria that planning applications have to satisfy to be granted planning permission in terms of wind power development:

In addition to these plans and policies the Council has also produced further guidance on Wind Energy development in Orkney to support the policies set out in the Structure and Local Plans. Currently there is approved guidance in the form of a *Wind Power and Wind Turbine Policy Framework* (OIC October 1998) and *Supplementary Planning Guidance on Onshore Wind Energy Projects in Orkney* (September 2006), although further amendments to the latter document have recently gone out to public consultation and prior to going to Council for approval

The 2006 Supplementary Planning Guidance (SPG) sets out detailed policy guidance covering 11 specific areas. The guidelines provide:

- The objective for individual policy guidelines
- Detailed guidance on the interpretation of the guidelines
- An indication of how proposals will be evaluated against the guidelines; and
- The design measures which would help mitigate the impact of development.

The following table (Table 1.1) summarises the development guidelines set out in the SPG and highlights where these are addressed in this document.

The Trust are fully in support of Orkney Island Councils Community Plan that commits to ensuring renewable developments in Orkney are well designed and sited. They are in total agreement that renewable energy developments should be designed wherever possible to minimise environmental impact.

This application has been prepared in accordance with both the Draft Planning Framework reported to the Environmental Planning and Protective Services Committee on the 26th January, 2005 and the Local Plan policy LP/U7 approved in December 2004.

This environmental statement accompanying the application aims to fulfil all Statutory Environmental Impact Assessment regulations by providing sufficient information on the Social, Economic and Environmental impacts of the proposed development to allow the Orkney Islands Council to make its planning consent approval decision on the application.

Table 1.1 Summary of supplementary OIC planning guidance

Development guideline	Objective	Project response
1 Natural Heritage and Biodiversity	To avoid significant negative effects on all aspects of the natural environment and biodiversity and in particular those sites and species identified and being of international, national and local importance.	Location chosen to avoid protected areas Full Environmental Impact Assessment undertaken to assess impacts Consultation undertaken with SNH
2 Landscape impacts	To avoid significant negative impacts on the landscape character of Orkney	Sites chosen in consultation with local community and SNH Full Landscape and Visual Impact Assessment undertaken to SNH current best practise
3 Visual Impacts	To avoid significant impacts on houses or settlements, locally prominent or valued landscape features, and locally prominent and important buildings, archaeological sites or scheduled ancient monuments.	Sites chosen in consultation with local community and SNH Full Landscape and Visual Impact Assessment undertaken to SNH current best practise
4 Operational Impacts	To avoid significant negative effects on residential amenity and impact on neighbouring activities, in terms of noise, shadow flicker, construction traffic, and electromagnetic interference from renewable energy developments.	Location chosen to comply with DTI guidance and OIC planning guidelines Full Environmental Impact Assessment undertaken including assessment of quality of life issues

Development guideline	Objective	Project response
		Results of assessments incorporated into project decision making process where possible
5 Impact on the Historic Environment	To avoid significant negative effects on all aspects of the Historic Environment which are considered important internationally, nationally or locally.	Archaeological and cultural heritage impact assessment including assessment of cumulative impacts undertaken as part of EIA
6 Water resources	To avoid significant negative effects on all water resources including ground, surface and drinking water.	Effects on hydrology and hydrogeology not considered to be significant Secondary impacts on habitats and vegetation discussed in Habitat and Vegetation assessment
7 Aviation interests	To ensure the safe use of aerodromes and airspace and to protect aviation interests.	Full consultation undertaken and reported in Environmental Statement
8 Ancillary developments	To avoid significant negative effects ib any aspect if the environment or those using it from the impacts of ancillary development associated with onshore wind developments.	Table of environmental commitments provided in Environmental Statement
9 Decommissioning and site reinstatement	To ensure satisfactory reinstatement of the site after the permanent cessation of generation from the site.	Table of environmental commitments provided in Environmental Statement
10 Partnership working	To maximise the benefit accrued by both local communities and their environment as a result of the generation of renewable energy within their	Socio-economic assessment undertaken as part of EIA

Development guideline	Objective	Project response
	area.	Table of environmental commitments provided in Environmental Statement
11 Community and Environmental Benefit	To maximise the benefit accrued by local communities and their environment as a result of the generation of renewable energy within their area.	Proposed non profit distributing wholly-local trust ownership maximises local community benefit Socio-economic assessment undertaken as part of EIA

1.5 Introduction to the Environmental Impact Assessment

Environmental Impact Assessment (EIA) can be defined as "a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects" (IEMA, 2004). The main objectives of the EIA are as follows:

- Improve the environmental design of the project;
- Check the environmental acceptability of the proposal / capacity of the site and the receiving environment;
- Ensure that resources are used efficiently and appropriately; and
- Facilitate informed decision making.

By initiating the environmental assessment at an early stage the above objectives can be integrated into the project design process which should allow the maximisation of positive impacts and the reduction / elimination of negative impacts where possible. The EIA process consists of the following main steps:

- **Scoping and consultation:** scoping of main environmental interactions and discussions with stakeholders to ensure their interests are covered adequately;
- **Baseline studies:** undertake baseline environmental assessments where existing data is inadequate, highlighted by scoping;
- **Description of baseline conditions:** description of the existing environment;
- **Description of proposed project:** including all aspects of construction, operation and decommissioning;
- **Environmental impact assessment:** a systematic identification of where interactions both positive and negative are likely to occur including allocating a measure of significance;
- **Discussion of significant impacts:** including mitigation, monitoring proposals and environmental management;
- **Presentation of findings in the Environmental Statement**; to be submitted with the planning application; and where necessary
- **Monitoring:** undertake proposed monitoring if applicable.

In undertaking this work it is important to consider the long term environmental consequences if no attempt is made to lessen the effects of climate change in order to place the assessment of the project environmental impacts into context.

1.5.1 Requirement for an EIA

An EIA is not an automatic requirement of the planning application process. Under the Environmental Impact Assessment (Scotland) Regulations 1999 (EIA Regulations) a developer is required to produce and submit an Environmental Statement under Schedule II if the proposal is likely to have a significant effect on the environment by virtue of factors such as its nature, size or location. Circular 15/99 (EIA Regulations) advises a threshold of five or more wind turbines or over 5MW generating capacity. Planning Advice Note 45: Renewable Energy Technologies (PAN45) sets out the following indicative criteria and thresholds above which an EIA might be required:

- The development is in or is likely to affect a sensitive location (e.g. NSA, SSSI);
- The development is in or is likely to affect as area valued for its landscape character;
- The development consists of more than 10 turbines;
- The development has a total installed capacity exceeding 5MW.

Various factors can be judged to trigger this conclusion during screening, however all the proposed community wind turbine projects clearly do constitute EIA developments by virtue of exceeding the 15m hub height threshold defined in column 2 of schedule 2 of the regulations. This matter was queried and confirmed with the local authority during formal screening for this proposal. Irrespective of the applicability of the EIA regulations, both the Trust and HICEC stated at the outset that they wanted environmental assessment completed to the standard of formal EIA as they wanted to demonstrate their commitment to protecting and enhancing the natural environment of Shapinsay by undertaking this project and ensuring that as little environmental disturbance was caused by the project as possible.

1.5.2 Scope of the EIA

The scope of this EIA can be identified as including:

- all works associated with the transport to site of the wind turbine from Hatston pier, Kirkwall, Orkney;
- the installation, commissioning and operation of the turbine including access road, cabling and substation (if required); and
- decommissioning of the project, including removal of materials from site and site reinstatement.

The off-site construction of the wind turbine will not be included in the scope of this assessment.

As discussed in Section 1.1 above this application is one of six community projects supported by HICEC submitted to the planning department at the same time. This EIA includes consideration of the cumulative issues associated with the Shapinsay development and any other wind farm developments which currently have planning applications under consideration. Unusually it also includes consideration of the five other associated HICEC supported projects which will also be submitted to planning at the same time. Other planned projects, e.g. at the scoping stage, have not been included in this assessment. A full list of all projects considered is given in Appendix 1.

1.5.3 Structure

To satisfy the objectives of the EIA Regulations, comply with the most recent planning guidance and concur with current UK best practise, the following structure was adopted.

Non-technical summary	Summary of the results of the ES in a form which can be readily understood by the layperson.
Section 1	**Introduction** Introduction to the project including project background, development context, energy and planning policy context and introduction to the Environmental Impact Assessment process
Section 2	**Scoping and consultation** Description of this issues raised during the scoping process
Section 3	**Site selection** Description of site selection process including quality of life issues
Section 4	**Project description:** Description of the proposed project, including alternatives considered, installation, operation and decommissioning.
Section 5	**Environmental description:** Description focussing on the environmental factors likely to be affected by the project.

Section 6	**Environmental impact assessment:** Methodology and potential environmental impacts matrix
Section 7	**Discussion of potentially significant impacts:** Detailed individual reports on potentially significant impacts.
Section 8	**Conclusions** Including table of environmental commitments and summary of data gaps and uncertainties
Section 9	**References**

Section 2 Scoping and Consultation

Highlands and Islands
Community Energy Company

Scotrenewables®
WIND POWER

2 Scoping and consultation

2.1 Introduction

Scoping is the process of identifying those aspects of the environment and the issues that need to be considered when assessing the effects of a particular development. This recognises that there maybe some environmental elements where there will be no significant impacts or effects resulting from the development, and hence where there is no need for further investigation to be undertaken.

Scoping is undertaken through the professional judgement of the EIA team, as well as through consulting organisations and individuals with an interest in and knowledge of the site. It takes account of published guidance, the effects of the kind of development under construction and the environmental resources that could be affected.

There is a formal requirement to consult as part of any Environmental Impact Assessment (EIA), but eliciting a formal response may be time consuming, and the response is not binding, i.e. the consultees can amend their recommendations on the scope in the light of further information or in response to views expressed by third parties. It is, therefore, essential to engage in an informal scoping process in parallel with the formal process, so that work can proceed without undue delay to the progress of a development, accepting that there maybe a need to revisit certain aspects, and to consider some not previously assessed. The scope, therefore, evolves during the EIA process.

2.2 Scoping undertaken

During the feasibility study extensive informal scoping was undertaken with the Trust members, SNH, RSPB and Orkney Islands Council (OIC). Due to the level of consultation that had already taken place OIC Planning Department felt that a formal scoping opinion in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 would not be required. They did however request that an informal pre-planning opinion be sought from the following organisation, which included a wide range

of telecommunications and television service providers, as well as organisations responsible for air safety:

Airwave MM02	Mono Consultants Ltd
BBC	National Air Traffic Services
BritishTelecom	National Grid Wireless-
Cable and Wireless	OAT
Civil Aviation Authority	Ofcom
County Archaeologist Julie Gibson	OIC airfield superintendent (John Tulloch)
CSS Spectrum Management Services Ltd	OIC harbours
HIAL (C/o Kirkwall Airport)	OIC planning
Historic Scotland	Orange PLC
Hutchinson 3G	RSPB
JRC	SEPA
MCGA	SNH
MLL Telecom Ltd	Thus PLC
Mobile Operators Association	T Mobile
MOD – defence Estate organisation	Vodaphone Ltd

The initial round of consultation took place in October 2007 and was repeated again in early 2008 as the site had changed from NGR ND30012: 93410 to ND 30012: 93401.

No formal response was received from OIC Planning, SNH or RSPB as they were consulted throughout the process regarding the siting of the turbine. In addition, as OAT were undertaking the archaeological assessment no formal response was received from them either.

Hutchinson 3G and T Mobile responded to the 2007 consultation and had no objections to the proposal, but did not respond to the second round in 2008. Organisations who did not respond to either round of consultation were MLL Telecom Ltd, Mono Consultants Ltd, Thus PLC, CAA, NATS, HIAL, OIC airfield superintendent, MCGA and OIC Harbours.

Table 2.1 below provides a summary of the issues raised during the informal scoping process and provides information on the action taken.

Table 2.1 Summary of issues identified during consultation

Aspect	Specific issue	Organisation	Action
Designated areas	Effects on designated areas are likely to be minimal.	Scottish Natural Heritage (SNH) / Royal Society for the Protection of Birds (RSPB) SNH / RSPB	There were no designated areas in the vicinity of the proposed project so no further action was necessary (see Section 5.3).
Protected species	Shapinsay's only nesting site for Red-throated diver is located just outside the proposed located, approximately 800m to the north-east of the site. Pintail duck may also nest in the vicinity. Otter activity in the area to be assessed.		Discussions with RSPB/SNH held regarding implications for protected species (see Section 4.1). Bird VP survey and desk based assessment undertaken (see Appendix 6) Local recorder consulted who confirmed that there was unlikely to be disturbance to otters (see Section 5.2.2).
Habitats and biodiversity	Basic habitat assessment should be undertaken.	SNH	Following a site visit by an experienced ecologist it was decided that the quality and sensitivities of the site were not significant a brief survey and assessment only were carried out (see Section 5.2.1).
Landscape resource	Turbine would not be seen from the World Heritage site or the National Scenic Area Site lies 3-4km away from Balfour castle and is therefore	SNH	Full Landscape and Visual Impact Assessment undertaken see Appendix 3.

	unlikely to affect the setting of these woods and grounds Turbine would introduce a large structure into an area with few existing focal points or features The site does not lie adjacent to any significant landscape features		
Visual amenity	The turbine is unlikely to be visible from Balfour village but would be clearly seen from the eastern part of the island especially from the scattered housing surrounding the site The turbine would be visible from most of the islands roads and from ferries to the Mainland and to a lesser extent ferries to the North Isles. The turbine would not interrupt any popular or valued views on the island. The standing stone Mor Stein lies approximately 1km to the east of the possible site, the most popular views of the stone are from the west. • the turbine is unlikely to be seen from the Balfour village conservation area or from Balfour Castle itself. • the turbine would present a clear, simple image and the access track should be able to be sensitively sited. It is important that the final micrositing does not result in any partial views of rotors from Balfour village. • cumulative effects with existing windfarms should be low,	SNH	Full Landscape and Visual Impact Assessment undertaken see Appendix 3.

	but consideration will need to be given to any other projects which are in the planning process. It is understood that a three turbine commercial development is currently being planned on the west of the island and this could introduce more serious cumulative effects.		
Pollution prevention and control	All aspects of site work that could impact on the environment should be systematically addressed and pollution prevention and control measures identified. Basic hydrology and hydrogeology information to be supplied.	Scottish Environment Protection Agency (SEPA)	Pollution prevention and control measures addressed in Section 4.8. Hydrology and geology discussed in Section 5.1. A copy of the complete response received from SEPA is available in Appendix 5.
Historic environment	An assessment should be made of the potential impact on scheduled monuments, designed landscapes, listed buildings and include unscheduled archaeological sites and archaeological landscapes. Impact on setting - the scheduled monuments, Hillock of Howe broch and Mor Stein should be assessed.	Historic Scotland (HS)	Full Archaeological and Cultural Heritage Impact Assessment undertaken, see Appendix 7. Full Landscape and Visual Impact Assessment undertaken see Appendix 3. A copy of the complete response received from HS is available in Appendix 5.
Noise	Distance from local dwellings (see 4.1.2) should preclude noise disturbance.	OIC	Desk based noise assessment undertaken (see Section 7.2.4).
Shadow flicker	Distance from local dwellings (4.1.2) should preclude shadow flicker disturbance.	OIC	Shadow flicker discussion (see Section 3.2.2).
Roads and transport	The site is good in terms of access with possibility to upgrade existing tracks around the site and options to approach the	OIC	Access assessed and optimum route identified (see Section 4.5.1)

	site from many directions.		
Technical issues	The site is close to the three phase 11kV line. Potential for interference to telecommunications links.	Ofcom / OIC	Telecommunication providers consulted. Airwave MM02, Arquiva, BritishTelecom, Cable and Wireless, CSS Spectrum Management Services Ltd, JRC,Orange, Scottish and Southern Energy and Vodaphone Ltd had no objection to the proposal. Information from the BBC Windfarms tool indicated that no dwellings would have interference with the television signal. For further discussion of technical issues see Section 3.2.3.
Aviation interests	Turbines can interfere with aviation operators by way of: The physical obstruction caused by a tall structure; and The effects that the supporting structure and rotating turbine blades on communications, navigation and surveillance systems including radar, and other equipment.	Civil Aviation Authority (CAA)	Consultation undertaken with CAA and Highlands and Islands Airports Limited, see Section 3.2.5.

Section 3 Site Selection

3 Site selection

3.1 Feasibility study

A number of possible sites and turbines were considered by the Trust when initially investigating the potential for a community development. As part of the HICEC project a feasibility study was undertaken during 2006 and early 2007 to progress proposals for a community owned wind energy scheme in the Shapinsay Development Trust area (Cris Energy, 2007).

Initial screening was undertaken in consultation with Scottish Natural Heritage (SNH), the local Planning Authority (Orkney Islands Council) and the Royal Society for the Protection of Birds (RSPB). Areas of search were identified during a map based exercise which determined those areas free from major constraints, see Figure 3.1 below. The major constraints were identified as:

- Wind resource;
- Designated conservation areas;
- Areas of high bird activity;
- Areas vulnerable to landscape and visual impact; and
- Proximity to dwellings.

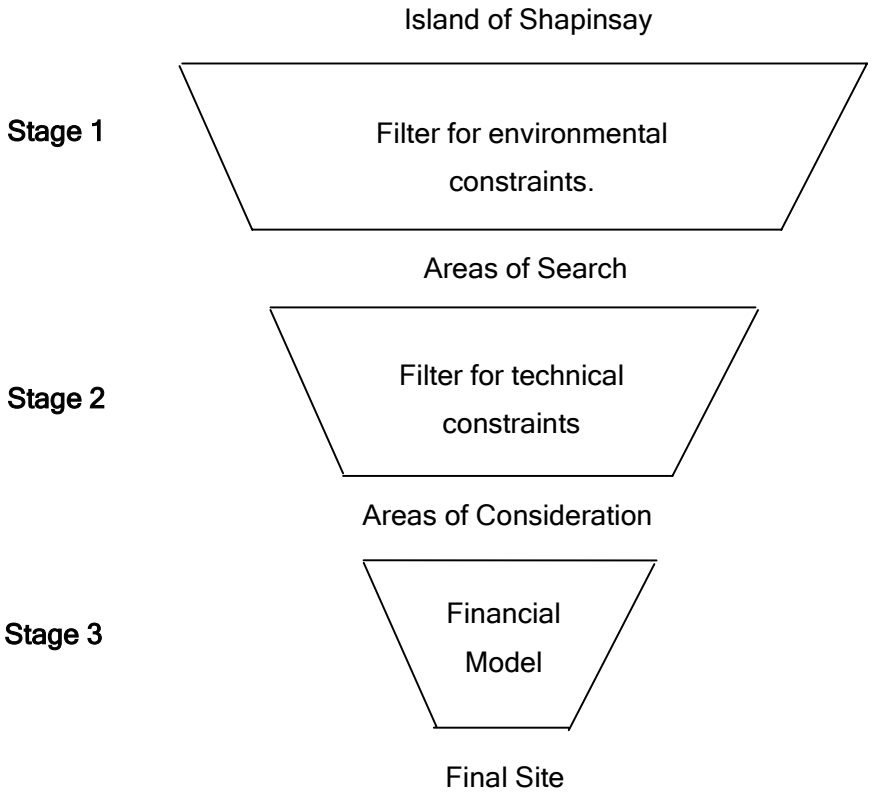
This process identified a total of ten potential areas for further detailed investigation. A number of technical issues were then considered which further narrowed the search area these were identified as:

- Access to site;
- Impact on telecommunication interests;
- Proximity to the electricity grid; and
- Exclusion zones around dwellings.

Finally the last remaining areas were scored according to a risk profile to identify the most favourable sites. At this stage financial modelling was employed to estimate the likely level of profitability for the community at each site.

The feasibility study identified two potential sites on Shapinsay which provided the best conditions and presented the least risks to the Trust in terms of barriers to development.

Figure 3.1 Filter process for determining final location of wind turbine



The details of each site are summarised in the following table.

Table 3.1 Sites identified by Feasibility Studies

	Site 1 Howe	Site 2 Balfour
Approximate location	Easting 351468 Northing 1016876	Easting 347650 Northing 1017650
Altitude	40m	24m
Distance from nearest dwelling	545m	550m

Distance to 11kV cable	250m	900m
Distance from new access track	550m	550m
Predicted Gross energy yield	3.127 GWh/yr	2.95 GWh/yr
Predicted net energy yield	2.739 GWh/yr	2.57 GWh/yr

The Trust then selected the site they preferred at local meeting by vote based on the information presented in the feasibility study.

The Trust has spent two years developing the community wind turbine project into this planning application. The Trust has modified their plans after consultation to the current proposal for a single 900kW wind turbine and has tried to accommodate the concerns as far as reasonably practical of neighbouring properties.

The currently favoured machine is the Enercon E44 which is a wind turbine with a power output of 900kW, a tower height of 44m and a blade diameter of 44m. The final turbine chosen will be dependant on tender responses but will have a tower height no greater than 44m and a blade diameter no larger than 52m. The proposed turbine location is shown later in the report along with wire frames, photomontage, and zones of theoretical visual influence. The Development Trust has also been working hard to secure a grid connection capacity of 900kW and are nearing an agreement with Scottish and Southern Energy to utilise spare capacity on the proposed active management system. The project shall be known as the Shapinsay Community Wind Project.

The project has developed through many stages and the initial feasibility study entered into detailed dialogue with the landowner, the community and Scottish and Southern Energy plc to identify the existing network capacity for generation on Shapinsay and looked at the level of wind turbine capacity which may be feasible. The outcome of these discussions pointed to a 900kW turbine on the east side of the island. This was chosen by the community and stakeholders as being the most feasible option compared to the other sites identified in the feasibility report, unfortunately it remains unpopular with two of the neighbouring properties who are concerned about the visual disturbance. The Development Trust have strived to ensure that any affect was minimised.

During site selection the most important issue was to explore in detail the site which would pose least risk to the community in developing a wind turbine project. The first stage involved a map-based exercise to determine those areas on the island free from major constraints such as areas with important environmental and natural heritage issues, landscape character, other areas of high bird activity, and proximity to dwellings. This work included collaboration with SNH, OIC, telecommunication providers, and RSPB. This formal screening process identified various areas of search generally suitable for wind turbine siting, and these are identified by maps in the report. The second stage looked in more detail at the areas of search and in particular at the technical issues of access, telecommunication impact and proximity to the electrical network which filtered the areas down further to areas of consideration.

These areas of consideration were then scored independently according to a risk profile to identify the most favourable site which included for the first time the economic impact.

A formal grid application was applied for in January 2007 and the Trust decided to press on with negotiations with S&SE with the final cost to be revised upon securing planning permission.

The Shapinsay Development Trust are concluding negotiations to reach an agreement with the landowner of the site.

The feasibility study also investigated a number of potential wind turbines suitable for each site and the associated issues of supply, transport to Orkney, transport to site, access track requirements, installation requirements etc. A number of turbines were initially identified as being suitable for the community project however the ENERCON E-44 turbine was chosen as it has smaller blades and would be to transport to site from the ferry pier has no gear box and has a higher cut out wind speed therefore allowing generation during a broader spectrum of conditions (Cris Energy, 2007).

3.2 Quality of life

The following section describes aspects of the environment which are considered to influence the quality of life enjoyed by the local residents which could potentially be affected by the development. The following topics are included in this category:

- Visual amenity
- Noise
- Shadow flicker
- Electro-magnetic interference
- Roads and transport
- Aviation interests.

Visual amenity is discussed in full in the Landscape and Visual Impact Assessment (LVIA) was commissioned as part of this EIA. Further discussion of the significant issues is included in Section 7 with the full LVIA available in Appendix 3.

Guidance

Orkney Islands Council Supplementary Planning Guidance (Final Draft, 2008) recommends the following guidance for quality of life and amenity:

"On-shore wind energy development and/or associated infrastructure will not be permitted in locations where there will be significant negative impact on quality of life or amenity at sensitive locations including residential properties, work places, core paths and recognised visitor sites. Planning applications must be accompanied by evidence of assessment in terms of factors including noise, shadow flicker, electromagnetic interference and construction/decommissioning phasing, to the satisfaction of Orkney Islands Council. Cumulative impact of developments must also be assessed".

3.2.1 Noise

Noise is a complicated issue which can influence quality of life through being a nuisance to surrounding receivers and in extreme cases by causing physical harm. Physically sound is a pressure variation which can be detected by the ear. The relative strength of this pressure variation depends on the source and the medium through which it travels the speed of sound us approximately 340m/s in atmospheric air (BERR, 2007). It should

also be noted that there is a difference between sound power level and sound pressure level. Sound power level is a property of the source of the sound, whereas sound pressure level is a property of the sound at a given observer location. The most important factors affecting noise are:

- type of noise source;
- distance from source;
- wind speed;
- temperature;
- humidity;
- precipitation; and
- presence of barriers and buildings.

The factors with the most influence on noise propagation are the distance the observer is from the source and the type of noise source.

Noise assessment methodology

Developers are obliged to carry out noise predictions to evaluate the likely perception of noise from wind turbines on local residents and those working in the vicinity. They compare the predicted noise levels of turbines with the existing background level. The assessment should be able to demonstrate compliance with national noise regulations. The results of noise assessments are generally presented as contour maps, with contours joining locations of equal noise level.

Because there is no relevant British Standard, the method generally used by developers to predict the noise from wind turbines is described in the Statutory Order from the Ministry of the Environment No 304 of May 14, 1991, on Noise from Windmills (translation by LK, 1991, Denmark).

The method of assessing the impact of the wind farm locally is described in 'The assessment and rating of noise from wind farms', ETSU-R-97, by the Working Group on Noise from Wind Turbines (Final Report, September 1996). Since its publication, this report has been used to evaluate the noise from wind farms in the UK.

When considering wind turbine noise, developers give consideration to wind speeds both at noise-sensitive locations and at the wind turbine site. When the wind speed is low, the turbines will not be generating and will therefore produce negligible noise. In medium to high wind speeds at nearby properties, the background noise level due to the wind itself will generally be louder than the noise from the turbines.

The most noise-sensitive periods occur when turbines are generating in low or medium winds and a noise-sensitive location is experiencing low wind-induced background noise. It is in these conditions that developers make their noise predictions.

The models used to calculate noise assume a flat, hard ground with no buildings or other structures. This assumption produces 'worst case' noise assessments as structures such as buildings, soft ground, trees and intervening hills would further reduce the actual noise from that predicted.

When developers select turbines for a consented scheme, manufacturers are usually required to guarantee that the noise produced by their machines will not exceed the predicted levels, and to bear the financial cost of remedying any noise issues, should these arise.

Noise level limits

In the assessment report, noise levels are set to safeguard the amenity at all dwellings. For quiet rural areas such as those around the proposed wind farm site, these levels are described as follows: 'In low noise environments the daytime level of the LA90, 10 min of the wind farm noise should be limited to an absolute level within the range of 35–40dBA'.

A differentiation is made between those dwellings associated with a project, for example a landowner, and those with no associations to the project. For dwellings associated with a project, the assessment report recommends 'that lower fixed limits can be increased to 45dBA and that consideration should be given to increasing the permissible margin above background where the occupier of the property has some financial involvement in the wind farm'.

Therefore, most proposals are usually assessed using the lower limits of 35-40dBA at the nearest dwellings and up to 45dBA at properties where the owners have an interest in the project, although noise levels in the UK are kept to well below this recommended level.

It is important to note that these limits apply to noise levels outside the dwellings, as the assessment report is aimed to protect the amenity of areas used for relaxation and where a quiet environment is highly desirable. Noise levels inside a property will be approximately 10dBA less than those outside, even when a window is open.

Noise concerns voiced at the planning stage rarely continue following the commissioning of turbines, and are generally thoroughly regulated through the use of appropriate planning conditions.

Noise from wind turbines consists of the sound produced by the turning blades and from the gearbox, generator and hydraulic systems within the nacelle. In modern turbines, however, this mechanical noise has been reduced so that it is almost non-existent.

As with other impacts of wind energy, perception of the noise depends on local features (for example rural or urban area, topography), the number of residents and the distance they are from the site, and the type of community affected (residential, industrial, tourist). The interaction of these factors can both lessen or enhance the perception of sound from wind turbines.

DTI Guidance

Recommended Good Practice on Controlling Noise from Wind Turbines from "*The Assessment and Rating of Noise from Wind Farms*" (ETSU for DTI 1996) states that:

- The current practice on controlling wind farm noise by the application of noise limits at the nearest noise-sensitive properties is the most appropriate approach;
- Noise limits should be applied to external locations and should apply only to those areas frequently used for relaxation or activities for which a quiet environment is highly desirable;
- Noise limits set relative to the background noise are more appropriate in the majority of cases;

- Generally, the noise limits should be set relative to the existing background noise at the nearest noise-sensitive properties and that the limits should reflect the variation in both turbine source noise and background noise with wind speed;
- It is not necessary to use a margin above background noise levels in particularly quiet areas. This would unduly restrict developments which are recognised as having wider national and global benefits. Such low limits are, in any event, not necessary in order to offer a reasonable degree of protection to wind farm neighbours.
- Separate noise limits should apply for day-time and for night-time as during the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance.
- Absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area contributing to the noise received at the properties in question. Any existing turbines should not be considered as part of the prevailing background noise.
- Noise from the wind farm should be limited to 5dB(A) above background for both day- and night-time, remembering that the background level of each period may be different.
- The LA90,10min descriptor should be used for both the background noise and the wind farm noise, and that when setting limits it should be borne in mind that the LA90,10min of the wind farm is likely to be about 1.5-2.5dB(A) less than the LAeq measured over the same period. The use of the LA90,10min descriptor for wind farm noise allows reliable measurements to be made without corruption from relatively loud, transitory noise events from other sources.
- A fixed limit of 43dB(A) is recommended for night-time. This is based on a sleep disturbance criteria of 35dB(A) with an allowance of 10dB(A) for attenuation through an open window (free field to internal) and 2dB(A) subtracted to account for the use of LA90,10min rather than LAeq,10min.
- Both day- and night-time lower fixed limits can be increased to 45dB(A) to increase the permissible margin above background where the occupier of the property has some financial interest in the wind farm.
- In low noise environments the day-time level of the LA90,10min of the wind farm noise should be limited to an absolute level within the range of 35-40dB(A). The actual value chosen within this range should depend upon; the number of

dwellings in the neighbourhood of the wind farm; the effect of noise limits on the number of kWh generated; and the duration of the level of exposure.

- For single turbines or wind farms with very large separation distances between the turbines and the nearest properties, a simplified noise condition may be suitable. If the noise is limited to an LA90,10min of 35dB(A) up to wind speeds of 10m/s at 10m height, then this condition alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary.

Orkney Island Council Guidance

The Supplementary Planning Guidance for the Development of Onshore Wind Energy Projects in Orkney September (OIC 2006) states that:

"For the purpose of the assessment, and unless demonstrated to be otherwise, background noise levels in rural areas are assumed to be as shown in the table 3.2 below:

Table 3.2: Background noise levels taken from the Supplementary Planning Guidance for the development of on shore wind energy projects in Orkney, September 2006.

Wind Speed (m/s)	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Background dBA	*24*	*25*	*27*	*29*	*31*	*33*	*35*

The loss of amenity from noise will be assessed on the following basis:

- *A difference of 3dB of less – insignificant*
- *A difference of 4-9 dB – marginal loss of amenity*
- *A difference of 10dB of more – significant loss of amenity"*

Orkney Islands Council Supplementary Guidance Onshore Wind Energy Development - Final Draft May 2008.

This states that:

The noise generated from a proposed wind turbine/wind farm must be assessed to ensure compliance with the Department of Trade and Industry publication "The

Assessment and Rating of Noise from Wind Farms", September 1996 or subsequent amendments/publication and to the satisfaction of the Planning Authority. (OIC 2008)

An independent consultant was contracted to undertake a desk based noise assessment of the site, the results of which are discussed in section 7.2.4.

3.2.2 Shadow flicker

Shadow flicker occurs when the sun passes behind the hub of a wind turbine and casts a shadow through the rotating blades of the turbine causing a flicker effect. A similar effect can also occur when the gloss blades of a rotating turbine reflect the sun causing a flashing light. Shadow flicker only happens when a certain combination of conditions coincide at particular times of the day and year mainly in the winter months when the sun is low in the sky (BERR, 2007).

Although often discussed, shadow flicker only occurs in relative proximity to sites, is highly predictable and hence relatively straight forward to avoid. In reality significant shadow flicker effects have only been recorded occasionally at one site in the UK (BERR, 2007).

Any shadow flicker effect is strongly related to distance from the wind turbine. Shadows cast close to a turbine will be more intense, distinct and 'focused'. This is because a greater proportion of the sun's disc is intermittently blocked. Similarly, flickering is more intense if created by the area of a blade closer to the root and further from the tip. At a distance of 10 rotor diameters a person should not perceive a wind turbine to be chopping through sunlight, but rather as an object with the sun behind it (BERR, 2007). This is the premise on which the national guidance is set.

Scientists agree that the shadow flicker frequencies that produce significant disturbance and nuisance to people lie above 2.5 hertz. This is true both of the general population and of the 2% who suffer from epilepsy, 5% of whom have exhibited an adverse reaction to flicker effects above 2.5 to 3 hertz. This is well above the maximum frequency effect from turbines, which is usually under 1 hertz, and is therefore well below that considered to be the cause of nuisance (BERR, 2007).

The seasonal timing and location of potential shadow flicker effects given the worst case scenario of permanent sunshine throughout datlight hours can also be accurately predicted using the geometry of the wind turbine, its orientation relative to neighbouring properties and the latitude of the site.

Guidance

Orkney Islands Council Supplementary Planning Guidance (Final Draft, 2008) recommends the following limits for shadow flicker based on the limit set out in PAN45:

"As per Planning Advice Note 45 – 2002 Renewable Energy Technologies, as a general rule there should be at least a separation of 10 times the wind turbine's rotor blade diameter from a dwelling house or work place to the proposed location of a wind turbine. Additional technical information may be requested from the applicant on the potential shadow flicker and shadow casting effects from other locations out with this set distance that are judged to be sensitive in the opinion of the Planning Authority".

As this project complies with above guidance no detailed assessment was undertaken.

3.2.3 Electro-Magnetic interference

Onshore wind turbines can cause electro-magnetic interference (EMI) in two ways:

- Physical interference 'scattering' signals can lead to a phenomenon called 'ghosting' on television screens; and
- Electrical interference, caused by signals generated within wind turbines, can cause interference to communications equipment.

Guidance

Orkney Islands Council Supplementary Planning Guidance (Final Draft, 2008) recommends the following guidance for electro-magnetic interference:

"All efforts should be made to minimise electromagnetic interference with radio/television signals by paying regard to the siting of the proposed wind turbines in relation to telecoms systems, technical solutions and the provision of alternative services. Full consultation should take place with the relevant agencies including Ofcom. Planning

conditions may require the Developer to correct any electromagnetic interference at their own expense".

Consultation

Ofcom was contacted early in the projects development as regards the potential impact of the proposal on the telecommunications infrastructure in the area. In addition, the following service providers contacted, Airwave MM02, BritishTelecom, Cable and Wireless, CSS Spectrum Management Services Ltd, JRC, Orange and Vodaphone Ltd had no objection to the proposal. No response was received from MLL Telecom Ltd, Mono Consultants Ltd and Thus PLC.

Information from the BBC Windfarms tool indicated that no dwellings would have interference with the television signal.

Future Telecommunications Traffic

In relation to the potential impacts on future links for the telecommunication industry, the proposed wind farm, given permission, will become an established element within the area. It will not be possible to establish a new link through the site with the wind turbine in situ. It should be noted, however, that it would not prove an insurmountable problem to find alternative routes around the proposed wind turbine due to its relatively small size.

3.2.4 Roads and transport

The turbine components will arrive via the Hatston ferry terminal and be transported to the Shapinsay ferry terminal where it will be transported onwards to the Shapinsay pier and the B9059. The route through the village requires great care as the corner at the pier and the corner at the entrance to Balfour Castle are both very tight in terms of allowing the transportation vehicles through. The intersection for access is the next junction east of Housebay cottage where some modification work will be required (see Section 4.5.1).

Guidance

Orkney Islands Council Supplementary Planning Guidance (Final Draft, 2008) recommends the following guidance for traffic:

"*All efforts should be made to minimise the effect of construction on the surrounding users. An application for a wind turbine will have to include a Method Statement. This Statement will provide information on the routing/timing of construction movements, possible road infrastructure improvements and construction phases and timescales. Cumulative impacts within each individual criterion in the bullet points above will also have to be addressed by applicants, for example the cumulative noise impact of a proposed wind turbine in close proximity to other existing wind turbines".*

3.2.5 Aviation interests

The effective utilisation of an aerodrome may be considerably influenced by natural features and man-made constructions inside and outside its boundary. These may result in limitations on the distance available for take-off and landing and on the range of meteorological conditions in which take-off and landing can be undertaken. For these reasons certain areas of the local air space must be regarded as integral parts of the aerodrome environment. The degree of freedom from obstacles in these areas is as important in the granting and retention of an aerodrome licence as the more obvious physical requirements of the runways and their associated runway strips, and is determined by survey in accordance with CAP 232 – Aerodrome Survey Requirements.

This impact is of particular relevance to wind energy production, with the construction of a wind turbine or wind farm impacting on aviation operators by way of:

- The physical obstruction caused by a tall structure; and
- The effects that the supporting structure and rotating turbine blades on communications, navigation and surveillance systems including radar, and other equipment.

It is therefore necessary to safeguard aviation interests against developments which could impact on the safe use of airports and airfields across the county.

<u>Guidance</u>

Orkney Islands Council Supplementary Planning Guidance (Final Draft, 2008) recommends the following for safeguarding aviation interest:

"At the earliest opportunity, applicants must consult with the Department of Trade and Industry sponsored document "Wind Energy and Aviation Interest – Interim Guidance" when designing and siting their proposal and fully consult with the Civil Aviation Authority, Highland and Islands Airports Limited, the Ministry of Defence, the National Air Traffic Services, Her Majesty's Coast Guard and the Airport Superintendent, Orkney Islands Council."

The Civil Aviation Authority, Highland and Islands Airports Limited, the Ministry of Defence, the National Air Traffic Services, Her Majesty's Coast Guard and the Airport Superintendent, Orkney Islands Council were all consulted as part of the consultation execise (see Section 2.2). The only response received was from the Civil Aviation Authority (CAA) who requested that the Highlands and Islands Airports Limited (HIAL) were consulted however no response was received prior to submission of the planning application.

As the proposed turbine is over 15km south of Kirkwall airport it is not considered to be an obstacle. This will be confirmed during the planning application when the potential impact on communications, navigation and surveillance systems will also be assessed.

Section 4 Project Description

4 Project description

The proposed project consists of the installation, operation and decommissioning of one single 900kW ENERCON E-44 wind turbine at Howe, Shapinsay, Orkney. The turbine model and location were selected after an extensive feasibility study and technical assessment process as outlined in Section 3 above. Further micro-siting was undertaken by Scotrenewables to establish the precise location, detailed in section 4.1 below. The lifetime of the project will be 25 years.

4.1 Alternatives considered

As part of the EIA process Scotrenewables consulted a number of statutory and non-statutory organisations (see section 2). Concern was expressed by the RSPB over the location identified in the feasibility study due to the proximity to a sensitive breeding site for red throated diver located to the north west of the site. The RSPB recommended that the site should be over 1000m from the sensitive nest site. This land not available to the Trust, so a site approximately 800m from the nest site which was still 440m+ from the nearest occupied dwellings was finally chosen in agreement with the RSPB.

4.2 Site location and layout

The location and layout of the site including cabling and access track are shown in figure 4.1. The turbine base will be located at a position of 59º 2' 10.8"N 2º 51' 03.85"W. The nearest properties to the proposed development are:

- Barebrecks c450m from proposed turbine
- Housebay Cottage c450m from proposed turbine
- Howe c500m from proposed turbine

4.3 Wind resource assessment

A wind resource assessment was undertaken using the NOABL wind speed estimator database which identified the most promising areas in terms of wind energy yield. The assessment took account of wind speed and direction distributions and also terrain topography. For the Howe site the predicted gross energy yield @ NOABL is 8.7m/s annual average wind speed: 3.127GWh/yr.

4.4 Turbine details

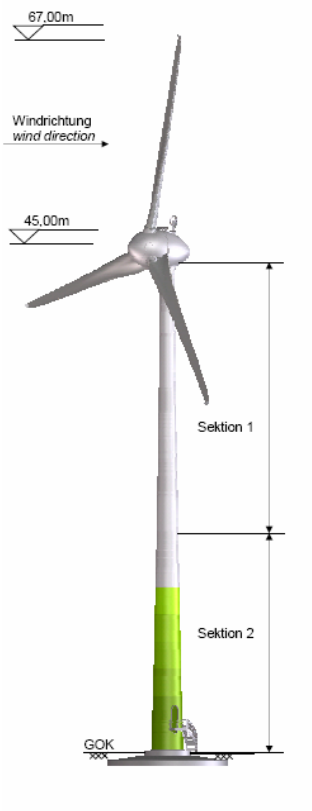
The ENERCON E-44 is a typical 3-bladed horizontal axis wind turbine. Wind turbines convert the kinetic energy of the wind into electric energy. Air passing over the blades of a turbine causes them to rotate. This low speed rotational motion is then converted into electric energy at a voltage of 690V by a generator located inside the nacelle, which is then converted to a high voltage by a unit transformer, located either at the base of the turbine or within the nacelle. A high voltage underground transmission line will connect the turbine to the existing 11kV infrastructure. The power produced by the wind farm will go directly into the local distribution network.

The ENERCON E-44 wind turbine (pictured below) is especially suitable for sites with high wind speeds and is designed to ensure maximum yield in the upper power range. The table below gives a detailed specification for the turbine.

Table 4.1 Turbine specifications

Component	Details
Tower	
Hub height	45m
Colour / finish	steel
Number of sections	2
Rotor	
Type	E-44
Nominal power	900kW
Rotor diameter	44m – with an overall tip height of 67m
Power regulation	Pitch
RPM	Variable: 12 to 34 rpm
Cut-in wind speed	2.5 m/s
Cut-out wind speed	28 – 34 m/s (ENERCON Storm control)
Blades	

Component	Details
Blade length	18.9m
Total swept area	1521m^2
Material	GRP (Glass Reinforced Plastic - Epoxy)
Generator	
Type (model)	Synchronous, direct drive ring generator
Yaw system	
Type	4 electrical motors
Control of orientation	Active (based on wind vane signal)
Controller	
Type	Microprocessor
Grid connection	Via ENERCON inverter
Remote communication system	ENERCON remote monitoring system
Braking system	
Aerodynamic brake	Three independent pitch systems with individual emergency supply
Aerodynamic activation	By controller via electric motors
Time to stop rotor from maximum rpm	Approximately 1 revolution



Wind turbines start to generate electricity at a windspeed of about 3m/s, their output increasing up to their maximum rated power at a windspeed of about 13m/s. As the windspeed increases further, the output is limited to the maximum until the windspeed reaches 25m/s, when the wind turbine shuts down automatically. The proportion of time that the turbines will be generating electricity is, therefore, dependent on the time that the windspeed is between 3 and 25 m/s. Generation from a wind turbine is also seasonally dependent, such that approximately two thirds of the total annual energy yield from the wind turbine is expected to be delivered in the six months between October and March, with the remaining six months delivering the other third.

4.5 Site construction and installation

The on site construction and installation operations can be split into the following basic stages:

- Prepare construction areas;
- Upgrade existing access track;
- Excavate and prepare foundations;
- Excavate and install cabling and grid connection infrastructure;
- Delivery and installation of turbine; and
- Remove construction areas and reinstate site.

It is anticipated that without weather delays this whole process could take as little as 4 weeks altogether minimising disruption.

4.5.1 Site access

The turbine components will arrive via the Hatston ferry terminal and be transported to the Shapinsay ferry terminal where it will be transported onwards to the Shapinsay pier and the B9059. The route through the village requires great care as the corner at the pier and the corner at the entrance to Balfour Castle are both very tight in terms of allowing the transportation vehicles through. An initial site investigation confirms that it would be possible; however there is little room for error. The haulage contractor will need to perform his own site investigation and transportation plan for approval from the Orkney Islands Council before there is any movement of components. Exemption from the weight restrictions on the island roads will also need to be secured.

As we progress up towards the site the intersection for access is the next junction east of Housebay cottage. Some modification work will be required at this intersection to create a new access onto the existing farm track heading north up the hill. In order to reduce the number of land owners to negotiate with in terms of access the Trust decided that the new corner would require the transport vehicles to reverse up the access track.

A new track will be created at this intersection from upgrading the existing track which heads northwards up the hill to the reservoir (see Figure 4.6). The hatched lines in the figure 4.3 are clearance areas where obstructions should be cleared from.

The new track will be constructed to comply with Enercon (see Figure 4.3), the turbine manufacturer, requirements. The geometry of the access track has been designed to take account of the guidelines supplied by Enercon. These recommend a maximum longitudinal slope of 7% on a loose surface and 12% on a fixed surface. A minimum road clearance width of 5.0m is required on the straight road section.

Figure 4.3: New access corner shown in red from the B9059 onto the existing farm track.

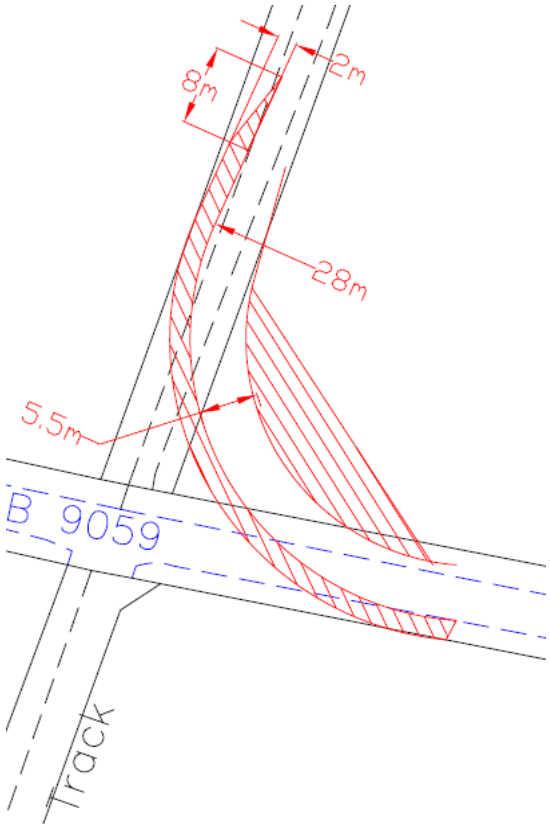
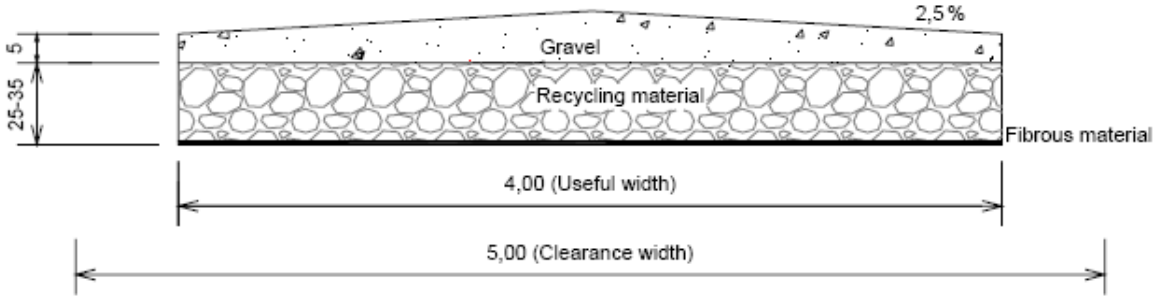


Figure 4.3: Minimum requirements for access roads as stipulated by Enercon

Useful width of carriageway	4m
Clearance width	5m
Clearance height	4.6m
Radius of curve	28m
Incline with loose surface	7%
Incline with paved surface	12%
Ground clearance for transport vehicles	0.15m

It is a basic principle that transport vehicles should not exceed the maximum axle load of 10t. Thus, a transport vehicle with an actual overall weight of 100t has to have at least 10 axles. Lowloader trailers, drop base vehicles, semi trailers and adapter vehicles are used on Enercon construction sites. The vehicles vary to some extent in terms of length and width and can be shortened (pushed in) by several metres once they have been unloaded.

The new track will require an overall minimum thickness of 300mm Type 1 material as a combined sub-base, road-base and 50mm wearing course of gravel. This material is to be placed in well rolled and compacted layers not exceeding 150mm thick.



An estimate of the equivalent cumulative number of standard axles has been determined based on the anticipated levels of construction traffic and the available Enercon data for tower delivery which requires the roadway to be designed for a maximum 12 tonne axle loading. The Shapinsay Development Trust will need to liaise with the landowner to secure the land for the track. The area of the new track to the turbine is 2,170 m^2. To create a new track of 350mm average depth this will require in the region of 760 m^3 of infill material for the track alone.

Minor modifications may be required on route where fencing, sign posts and other obstructions may require to be temporarily removed but this would be finalised by the haulage contractor during the transport survey before delivery of the turbine. Consideration may also be required to relocating overhead line poles at the intersection road into the site to reduce the amount of road works but this will depend on the cost.

The Shapinsay Development Trust should secure access to the full width of the existing farm track from the B9059 to the new turbine site. This strip will be wide enough to make

provision for the cable tracks, access track and drainage. It is envisaged that the contractor will need to erect temporary fences to allow enough working room during the construction but this will depend on working methods. Liaison will, nonetheless, be required with the landowner.

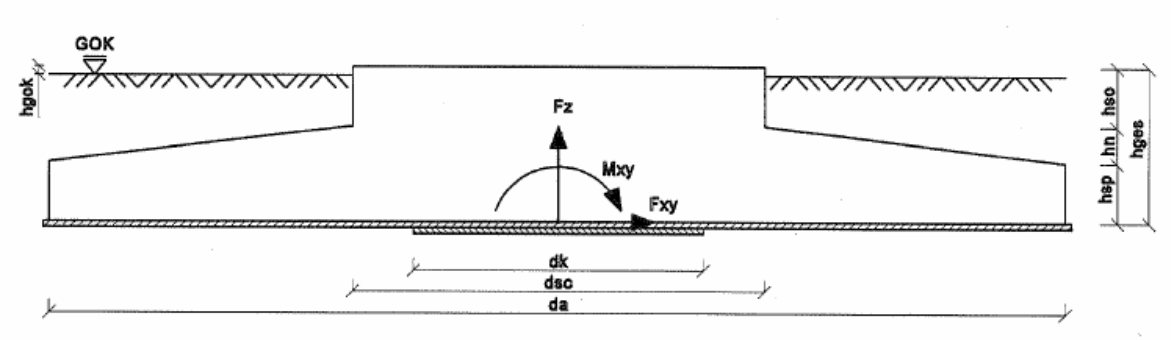
The permanent fences will then be erected on the boundary of the land leased by the Trust. Any existing openings to the fence line will require to be reinstated to existing dimensions and further fences that join at right angles will need to be altered to suit.

4.5.2 Foundations

A basic site investigation concluded that the ground conditions are appropriate for a mass concrete spread foundation but this would need to be confirmed before construction with an excavation of test pits.

The standard Enercon foundation scheme is shown Figure 4.4 below. It is anticipated that the concrete for the foundation will be provided by site batching. The contractor shall supply method statements for the sourcing and transportation to site of materials for concreting, site storage, concrete manufacture and testing regime for approval at tender stage.

Figure 4.4: Standard Enercon foundation scheme



Geometry of foundation		
Outer diameter	da	12.5 m
Base diameter	dso	5.0 m

Geometry of foundation		
Foundation height	hges	1.6m
Base height	hso	0.6 m
Inclination of plinth	hn	0.4 m
Height outside diameter	hsp	0.6 m
Difference top of foundation to top ground surface	hgok	0.15 m
Diameter of soft compression layer	dk	2.9 m
Concrete class and volume	C25/30	111 m3
Reinforcement steel and weight	BSt 420 S (A)	13.5 t
Reinforcement steel and weight	BSt 500 S (A)	12.9 t

4.5.3 Hardstanding

The requirements for positioning the plant and equipment containers required during the tower delivery and erection have been determined in consultation with Enercon documentation. This has resulted in a compound area of approximately 1316m^2 with a perimeter of 190.5m (see Figure 4.5). Working on an average 350mm depth this equates to a further 461 m^3 of infill material.

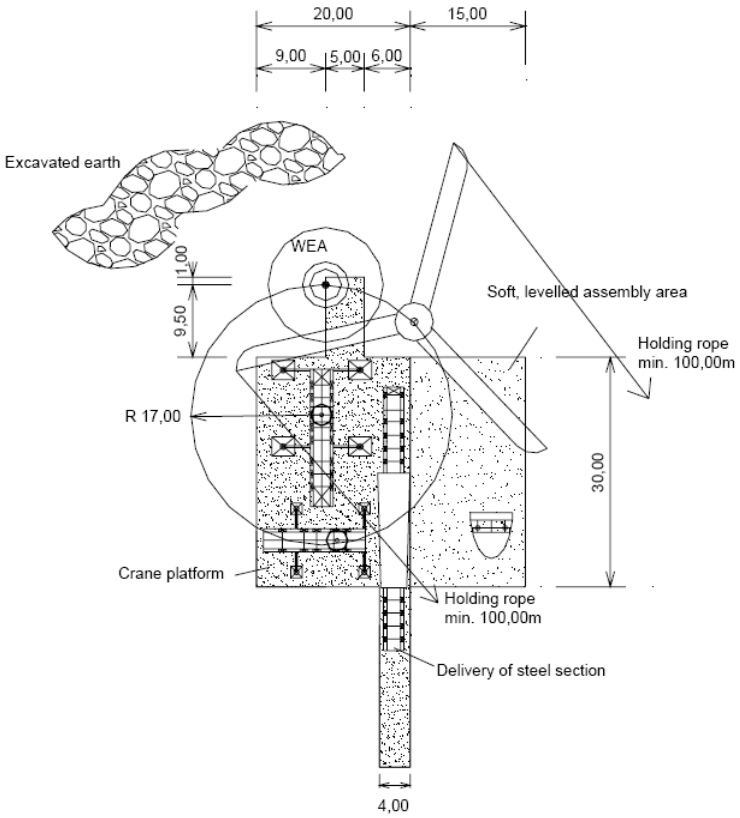
The crane platform is the key to ensuring that everything runs smoothly and safely during the construction phase. It should take the form of a coarse, level surface with a top surface made from recycled materials or mixed minerals with a grain size of 0 – 32 mm.

The crane platform should be located above ground level to ensure that surface water is properly dispersed. During construction, plate load bearing tests should be carried out to ensure that the necessary bearing capacity is achieved.

Any cranes used have a maximum support pressure of 200t and are supported on the crane platform by means of load distribution plates. Pressures of up to 18.5t/m² may act on the platform as a result of this and the maximum surface pressure is therefore 185kN/m^2.

The dimensions of the crane platform should be calculated so that all the work necessary for installing the wind energy converter (including tower) can be carried out in the optimum manner. The example above provides a basic standard. The soft, levelled assembly area can be located either to the left or to the right of the crane platform.

Figure 4.5: Compound hardstanding area for delivery and erection of turbine



To ensure that any components inside the tower can subsequently be replaced and to protect the wind energy converter against ingress of dirt, a 5 m wide and stable access road has to be constructed between the crane platform and the tower once the foundation has been backfilled.

During foundation construction, the crane platform also serves as a storage area for material (e.g. reinforced steel) and machinery. Any excess earth excavated during the construction phase should always be stored behind the foundation.

The ground conditions have been established in this area as part of the site investigation. The natural soils encountered at shallow depth are firm clays which will form a good formation for the compound hardstanding. The hardstanding area will comprise a minimum thickness of 300mm well rolled Type 1 material placed in layers not exceeding 150mm thick. It is envisaged that the hardstanding area will also be used during the construction of the turbine foundation to accommodate the concrete batching plant and temporary storage of materials.

4.5.4 Electrical infrastructure

The E-44 offers the possibility to locate the transformer and medium-voltage switchgear inside of the tower (see Figure 4.7). This eliminates the need of an external housing. ENERCON calls this tower integrated transformer station "Standard 1". Most of ENERCON's customers prefer this Standard 1 option for their wind turbines (WEC) and this is the preferred choice of the Shapinsay Development Trust.

The entrance to the tower is located approx. 2.5m above the ground level and can be reached via an external stairway. The control and power cabinets are located on the first (entrance) floor.

The complete transformer station is integrated in the cellar of the turbine. The access to the transformer station is provided by means of a tower ladder through a locked hatch in the first floor. Only authorised persons are allowed to access the cellar.

The Trust have yet to finalise the electrical design of the project to confirm what additional equipment will be required for the active management grid connection, where possible however all electrical switchgear will be housed in the bottom of the tower.

The cable tracks will follow the line of the access track to minimise any disturbance and a cross section of the track is provided in Figure 4.8 below.

Figure 4.7: Single Line Diagram of the wind turbine supplier electrical infrastructure

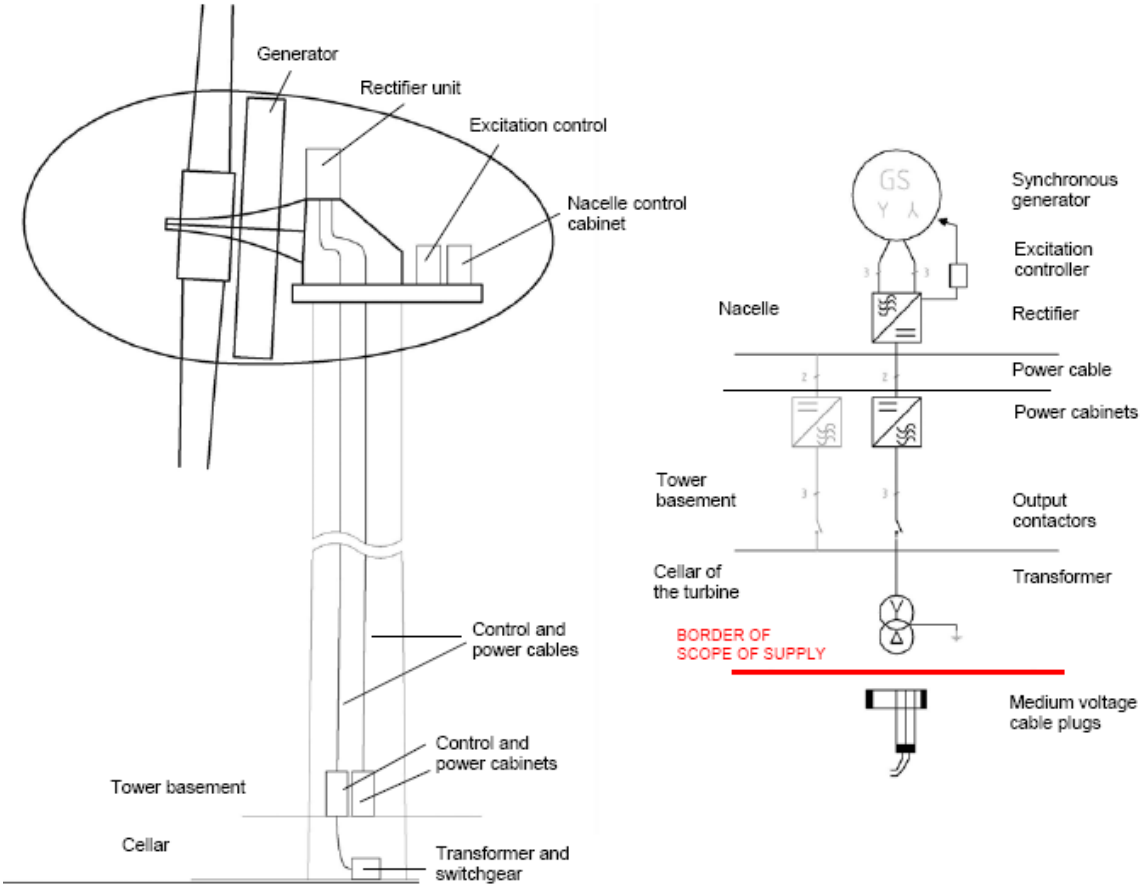
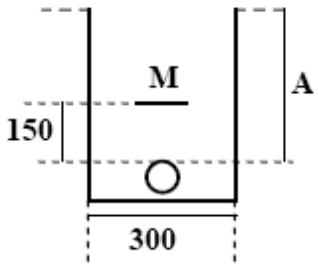


Figure 4.8: LV Service cable trench



M is the location of the marker tape and distance A depends on the type of ground; 450mm for unmade ground, grassland or footway; 800mm roadway depth or 1000mm for agricultural land. It is recommended that the cables are laid in the unmade ground after

excavating the access track at depth of 450mm on the Trust side of the fencing on neighbouring agricultural land. The existing overhead line runs alongside the existing track so it will mean a short cable run to the turbine. Cables should be laid in accordance with the specification for electricity service and distribution cables for use during the installation of new connection written by Scottish & Southern Energy Power Distribution Company.

4.5.5 Delivery and installation of turbine

It is recommended upon signature of the final contract that a general inspection is made by Enercon, the Carrier and the Client together of the access and site road is essential. It is also recommended that this be done well in advance of any delivery to ensure maximum efficiency of plant hire. It should also be noted by Enercon that the orientation of the tower parts on the delivery vehicles should suit the crane positions as designed.

The islands in Orkney generally have a maximum vehicle length restriction and a maximum weight restriction although and exemption can be applied for where necessary and the turbine supplier should liase closely with Orkney Islands Council before delivery.

The tower will be delivered in two parts, each on a separate vehicle, utilising the timetabled ferry. The regular Shapinsay ferry will not be suitable for transporting the required loads and the Thorsvoe vessel should be hired to accommodate longer loads.

The nacelle, weighing 21t, including the rotor and hub will be delivered on one load. There will be two further vehicles with the 3 rotor blades that are 20.8m long and the generator at 16t. In addition to the above there will be a parts container and a tools container. These are not considered abnormal loads. Therefore, in the worst case, there will be 2 loads for the tower and one each for the rotors, nacelle, generator, parts container and tools container making a total of 6 loads delivering the turbine. Enercon stipulate that maximum axle loads, based on 4 axle trailers, are in the order of 12t with an overall maximum vehicle load of 120t.

Orkney Islands Council also wishes to have details of the vehicle movements delivering any fill. The successful contractor should be made aware of this and instructed to liaise with the council.

Cranes

In addition to the turbine components, cranes will need to be transported to site to erect the structure. In the past Hugh Simpson Contractors of Wick have been used for this purpose as local firm Heddle Construction do not have a large enough crane. For this type of job they would use a 350t crane that will be broken down into parts that will comply with the ferry linkspan weight restrictions.

They also require two smaller cranes to reconstruct the main crane on site and to assist with the erection. These cranes will be delivered to site using the same method as for the main crane and can be sourced from Heddle Construction in Kirkwall. The compound hardstanding area should have sufficient space to allow the assembly of the main crane on delivery.

4.5.6 Duration of works

A temporary construction compound will be located within the area of hard standing avoiding any areas of environmental sensitivity identified during the EIA process. The construction compound will be fenced off and locked when not in use. The entrance to the access track will have double gates which will be closed at all times outside of working hours.

The actual erection of the wind turbines can be completed relatively quickly, within around 6-10 days. The month during which this happens will be dependant on the result of the planning process, and it is therefore, not possible to give exact dates. The start and finish dates will be confirmed on approval of the project, but will avoid periods of known adverse weather conditions, and, where appropriate, heavy periods of bird activity.

4.5.7 Site reinstatement

The spoil material from the removal of ground cover at construction site will be placed in two separate areas. The topsoil and vegetation layer will be stored in the working area where it will be re-used once construction activities are complete for the formation of embankments. The majority of the spoil material will go towards the reinstatement and landscaping of areas along existing tracks and newly created margins of widened track where appropriate, as well as for infill.

Once construction is complete the permanent hard-standing will remain. It is anticipated that grasses and mosses will start to colonise the area helping to 'soften' their appearance relatively quickly

4.6 Operation and maintenance

4.6.1 Routine servicing and emergency repairs

During the first six months post installation a weekly check on the wind turbine will be required to assess any abnormal stresses, unusual vibrations and the general condition. After the first six months of operation, monthly checks will be conducted.

Routine maintenance or servicing turbines is carried out twice a year, with a main service at twelve monthly intervals and a minor service at six months. This annual maintenance, lasting approximately one week, is required to check rotation and condition of the blades, as well as the integrity of all the bolts.

4.6.2 Extended services

At regular periods through the project life, oils and components will require changing which will increase the service time on site per machine.

Oil changes are required approximately every 18 months. Changing the oil and worn out components will extend each turbine service by one day.

Blade inspections will occur as required (somewhere between every 2 and 5 years) employing wind smiths utilising a "Cherry Picker" or similar. Repairs to the blades would utilise the same equipment but minor damage on every blade (not expected) would more than double the duration of the inspection period.

Blade inspections and repair work is especially weather dependent. Light winds and warm, dry conditions are required for blade repairs. Hence mid-summer (June, July, and August) is the most appropriate period for this work.

Turbine repair times will depend on the part required, sourcing, delivery and maintenance personnel availability at the time, however, it is anticipated that most repairs will be undertaken within 14 working days.

Hard standing areas such as the crane pads will serve as parking areas for maintenance vehicles.

4.6.3 Meteorological effects

Although wind turbines require wind for electricity generation, at high wind speeds (> 25m/s) they shut themselves down to avoid excessive wear on the components, and the rotor is both aerodynamically, and mechanically braked. However, modern wind turbines are designed to withstand much greater wind speeds, and are normally warranted against structural failure for wind speeds up to 150mph. Lightning generally has no effect on turbines, though as with all structures, there is a risk of damage if hit directly by lightning. Enercon turbines are fitted with a lightning protection system as part of their design.

Snow does not generally cause problems other than with access to the site. Occasionally very heavy snow and ice may affect the anemometer or aerodynamics of the turbine blades. This results in temporary automatic shutdown. In these circumstances the turbine would restart automatically after accumulations have thawed.

The operation of the wind turbine would comply with relevant health and safety regulations. Appropriate warning signs would be installed concerning restricted areas such as transformers, switchgear and metering systems. Wind turbines installed at the site would comply with BS EN 61400-1: 1995 “Wind turbine generator systems – safety requirements”.

4.7 Decommissioning and site reinstatement

The wind turbines will be designed with an operational life of 25 years. At the end of this period the applicants have a number of options:

- To dismantle and remove the turbines;
- To apply for an extension to the operating period using the existing equipment; or
- To apply for an extension to the operating period using new turbines.

If it were decided to dismantle and remove the turbines then it is considered that the base of the turbines should be below ground level and all cables cut at a depth of 1m below ground level and left in the ground. The access track would be left for use by the landowner. This approach is considered to be less environmentally damaging than seeking to remove foundations and cables entirely.

If the decommissioning option is chosen, a Decommissioning Method Statement will be prepared and agreed with the Planning Authority six months prior to the commencement of work.

A Section 75 Agreement, which covers the restoration of ground works, shall be in place before construction commences. This includes the lodging of sufficient funds, such as a bank bond, to ensure the decommissioning of the site is provided for.

4.8 Environmental management

The developer will ensure that all contractors are well controlled and exercise the appropriate environmental precautions with regard to the local conditions on site, working to ISO 14001 standards.

The contract between the applicants and the civil engineers involved in construction of the wind turbine will specify the measures to be taken to reduce or mitigate the environmental impact of the construction process. These measures will consist of three main types:

- conditions to be adhered to under the planning consent;
- the requirements imposed through consultation with any statutory body; and
- any other relevant mitigation measures identified in this Environmental Statement.

A copy of any conditions associated with the planning consent will be incorporated into the contract with the company constructing the wind turbines, and the company will be required to adhere to these. The construction contractor will be required to provide

evidence that it has incorporated all environmental requirements into its method statements, as well as its staffing and budgetary provisions.

Local environmental specialists will be available during the construction period to provide specialist advice if required.

Site Specific Method Statements and Environmental Management Plans will be a requirement of the construction contractors contracts, and will be submitted to Orkney Islands Council, SEPA and other relevant authorities, to ensure procedures and mitigation are adhered to and with particular regard to the following.

4.8.1 Waste management

Many activities involving waste materials are exempt from licensing if they meet the requirements detailed in Waste Management Licensing Regulations 1994, as amended. Although an activity may be exempt from licensing it still requires to be registered by SEPA and is subject to statutory controls to prevent environmental pollution or endangering human health.

The proposed development will not affect any “controlled waters”, will not require any discharges to the public sewer and all wastes will be removed from site and disposed of at authorised local authority sites.

4.8.2 Pollution prevention

SEPA Pollution and Prevention Guidelines (PPG6 working at construction and demolition sites) will be adhered to.

The following paragraphs detail the potentially polluting activities of the proposed development and the measures that will be put place to eliminate or significantly reduce any deleterious effects.

Access track

The proposed site access track follows the course of the existing track, and so would have a negligible impact on water quality. There are no proposed crossings of watercourses.

Electric cable laying

Cable laying has the potential to damage soils and introduce new drainage pathways which could generate silty runoff. To minimise disturbance impacts cables will be layed in small trenches along the side of the access track. Trenches will be dug during drier periods and the electric cables will be quickly placed within the trenches and soils replaced to minimise the ingress of water. Temporary silt traps will be provided in the longer trench runs, if necessary, these can take the form of straw bales.

Wind turbine and crane pad construction

The turbine foundation design minimises excavation requirements. Crane pads (areas of hard standing) will be built adjacent to the foundations and will be left in place for the lifetime of the development. The main potential impacts arising from construction are the generation of silt-laden water from exposed ground and the leaking of concrete residues into the water environment.

During the design phase the potential for water pollution during turbine construction was considered, and as a result the turbines have been located away from water features. This will ensure that any accidental spillage of concrete during concrete pouring will not pose a direct risk to surface water. Furthermore the consistency of the concrete will also be such that there is no potential for the concrete to enter the soil water environment and be transported through the soils and unsaturated zone either to groundwater (if present) or to surface water features. Spill response measures will be put in place to ensure that any accidental spillages at the surface can be contained and quickly removed from the site.

In accordance with BS6031: 1981 Code of Practice for Earth Works land disturbance will be kept to a minimum and disturbed areas will be stabilised as soon as possible after construction. Essential mitigation measures relevant to controlling erosion and runoff

from turbine base/crane pad construction are described in SEPA's pollution prevention guidance, and special requirements include:

- Scheduling construction activities to minimise the area and period of time that soil will be exposed, particularly during winter periods;
- Installation of cut-off drains around the working areas to intercept uncontaminated surface runoff and divert it around the works;
- Minimising the stockpiling of materials and locating essential stockpiles as far away as possible from watercourses; and
- Revegetation of foundations and crane pad workings areas as soon as possible after construction.

Construction compound

The construction compound will be on crane pad which will restrict any potential pollution.

Site working practices

During the tendering process the expected level of environmental control will be included in the tender documents, so the contractors can allow for mitigation measures in their costs. SEPA's special requirements for water pollution prevention from civil engineering contracts contains a definitive list of clauses for incorporation into civil engineering contractual documents.

The site induction for contractors will include a specific session on good practice to control water pollution from construction activities. Contractors will be made aware of their statutory responsibilities not to "cause or knowingly permit" water pollution.

As with all similar construction operations there will be heavy plant and machinery on site. All fuels will be stored in bunded areas with 110% capacity of volume stored. This greatly reduces the risk of any accidental leaks into the water environment.

Plant and machinery used during the construction phase will be well maintained to minimise the risks of oil leaks or similar. Maintenance and refuelling of machinery will be undertaken off-site or within designated areas of temporary hardstanding. In these designated areas contingency plans will be implemented to ensure that the risks of

spillages is minimised. Placing a drip tray beneath plant and machinery during refuelling and maintenance will contain small spillages.

No chemicals will be used as a part of the construction process.

For the turbine foundation a ready mixed concrete will be transported to the site from a concrete facility, so that no mixing will be required at the turbine location. The transportation of the concrete will be weather dependent, with no concrete laying being undertaken during periods of heavy rain. Any excess concrete not utilised on site, will be transported off site, back to the plant where it came from for appropriate disposal.

No washing of the vehicles carrying the concrete will be undertaken on site. Thus ensuring that no cement washings can escape into the surrounding soil, where it may percolate further into the ground. Any materials used during the creation of the foundations i.e. shuttering, will be removed from the area and disposed of in an appropriate manner, and will form part of a contractors obligation.

Throughout the construction phase best working practices will be adopted, and measures to protect the water environment will be undertaken, through adopting the recommendations set out in the SEPA's Pollution Prevention Guidance Note PPG6.

Throughout the construction process, and around the construction site, temporary silt traps shall be utilised to prevent sediment entering downstream watercourses. The implementation of these traps shall negate the possibility of watercourses exceeding the suspended solids threshold of 25mg/l, thereby preventing any danger to the local water environment.

Apart from the operation and general maintenance of the turbines, there will be few on-site activities during the operational phase. However, the development site has some potential to affect the water environment beyond the construction phase, resulting in the need to develop a longer-term sustainable mitigation strategy.

Access tracks – operational phase

The proposed mitigation for the construction of the access tracks will continue to function throughout the operational phase of the site. Methods incorporated into the scheme are designed to be sustainable and to cope with storm events. Therefore only routine maintenance is envisaged to be necessary for the road network within the site during the operational phase. Except in emergencies, such maintenance will generally be carried out in the summer months when the track is dry, thus further reducing the potential impact on the water environment.

Maintenance regime– operational phase

The maintenance regime will involve monitoring the surface water drainage effectiveness, and resolving any problem areas as soon as they develop to minimise erosion of the track or sedimentation of the drainage system. As the track is used as part of farm operations, this will be a routine process, with the silt trap being cleaned as part of the ongoing farm operations.

Electric cable tracks– operational phase

Once the electric cables have been installed, and the soil profile restored, the cable runs will return to close to their natural, pre-construction condition. Consequently no mitigation measures regarding electric cable tracks will be required during the operational phase of the development.

Wind turbine and crane pad– operational phase

No continuing impact from turbine and crane pad construction is envisaged once they are complete and the soils and vegetation have been restored.

Site working practices– operational phase

There will be very little in the way of on-site activities during the operation of the wind farm. However, there will be the need to carry out regular maintenance or emergency repair of the wind turbines, and this will require access by maintenance crews. During such activities there will be the need to bring oils, greases and other substances, bringing with it the potential for accidental spillages. Such spillages are likely to be very small, with negligible risk of pollution to watercourses and groundwater elsewhere on the site.

Throughout the site operation, however, best working practices will be adopted, and measures to protect the water environment will be taken through the adopting of the recommendations set out in the SEPA PPG Notes.

Decommissioning

The potential impacts on the water environment during decommissioning are likely to be broadly similar to those during the construction phase, and similar mitigation measures are likely to be required. The degree to which the site is returned to its natural state will determine the extent to which mitigation would be needed. For example, turbine removal alone would require little mitigation specific to the water environment. Other activities, however, such as the removal of electric cables, would require measures equivalent to those used in construction. Any new legislation or guidelines published prior to decommissioning will be adhered to and incorporated into mitigation design prior to decommissioning taking place.

4.8.3 Residual impacts

Electric cable laying

The cable trenches are small, temporary features and as such their potential impact on the water environment is low. Their actual impact in terms of creation of new drainage pathways or damage to the soil profile is likely to be negligible, due to the incorporation of suitable mitigation measures.

Turbine/Crane pad construction

With any large construction operation the potential exists for unforeseen, accidental events to cause minor surface water pollution, even with mitigation in place. This is most likely to involve silty runoff from exposed ground; the likelihood of concrete residues actually reaching a watercourse is very low. However the mitigation described will ensure that any incident that does occur is both small in magnitude and quickly ameliorated. Changes in runoff characteristics will be limited in duration and will not change flood risk or cause channel erosion.

Site working practices

With any site operations there exists the potential for accidental unforeseen releases. The likelihood and magnitude of these effects, however, are likely to be small given the best practice measures adopted, and that negligible or minor impacts on surface waters are anticipated.

Access track – operational phase

There is not likely to be any negative impacts on the water environment as a result of the access track during the operational stage. As mentioned previously, the upgrading of the existing access track would have a positive effect, through regulating the flow into the existing drainage ditch, and reducing the current erosion of the existing track. This would also result in a decrease in the amount of sediment entering the drainage system.

Site working practices– operational phase

During routine maintenance and emergency repair activities there will be the need to bring oils, greases and other substances to site, bringing with it the potential for accidental spillages. Such spillages are likely to be very small and readily contained, so the risk to downstream watercourses is very low.

Decommissioning impacts

Potential impacts during decommissioning are likely to be similar to those during the construction phase, but would depend on the exact nature of the decommissioning activities that take place. It seems unlikely that the ground would require to be disturbed on the same scale as during the construction phase, and many of the construction activities would not be required. The most likely impacts are from spillages and leaks associated with plant and machinery. Mitigation similar to that implemented during the construction phase (updated to reflect changes in legislation/guidance) would ensure that the significance of such impacts is very low.

Cumulative impacts and effects

No cumulative impacts or effects on hydrology as a result of the proposed development are anticipated. A cumulative effect would only occur from a development immediately above the proposed site, and no such developments (existing or proposed) are known about.

4.9 Health and Safety

A Planning Supervisor will need to be appointed for the contract. A civil engineering designer will need to provide Risk Assessments for the civil works including forming the access roads and foundation construction and these will need to be provided for incorporation within the Pre-Tender Health & Safety Plan to accompany the invitation to tender documentation

The Balance of Plant (BoP), Engineer Procure and Construct (EPC) Contractor will be required to develop a Construction Phase Health & Safety Plan (CPH&SP) to ensure the safe management of the works on and off site. This plan should incorporate site specific risk assessments and method statements for all construction works including transportation and storage of materials. The CPH&SP should include a risk assessment and method statement for the eventual restoration of the site to the requirements of local authority and SEPA.

Enercon will be responsible for the delivery of the turbine, erection, testing and commissioning and will have to comply with the BoP EPCs CPH&SP.

Regulations that must be adhered to thereby ensuring workplaces meet health, safety and welfare needs are:

- Health and Safety (First Aid) Regulations 1981
- The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- The Workplace (Health, Safety and Welfare) Regulations 1992
- Personal Protective Equipment at Work (PPE) Regulations 1992
- The Manual Handling Operations Regulations 1992
- The Provision and Use of Work Equipment Regulations 1998 (PUWER)
- Lifting Operations & Lifting Equipment Regulations 1998 (LOLER)
- Control of Substances Hazardous to Health Regulations 1999 (COSHH)
- The Noise at Work Regulations 1988
- Electricity at Work Regulations 1989
- The Electricity (Overhead Line) Regulations 1970
- Health and Safety (Display Screen Equipment) Regulations 1992

- Construction (Health, Safety and Welfare) Regulations 1996
- The Construction (Head Protection) Regulations 1989
- Confined Spaces Regulations 1997
- Fire Precautions (Workplace) Regulations 1997
- Fire Precautions Act 1971
- The Safety Signs Regulations 1980
- The Pressure Systems and Transportable Gas Containers Regulations 1989
- The Safety Representatives and Safety Committee's Regulations 1997
- The Safety, Quality and Continuity Regulations 2001
- Supply of Machinery (Safety) Regulations 1992

Section 5 Environmental Description

5 Environmental description

5.1 Physical environment

The Orkney Islands are located approximately 20km off the north-east tip of mainland Scotland. Orkney is an archipelago of over 70 islands and skerries, of which 17 are currently inhabited. The islands are approximately 85km from north to south and 37km from east to west.

The island of Shapinsay is the closest of the North Isles to Kirkwall, lying less than 7 km off the eastern coast of Mainland Orkney. It is separated from the Mainland by Shapinsay Sound and The String. Between Shapinsay and the Mainland lies the small uninhabited Helliar Holm. The island measures approximately 7 km north to south and east to west, and is roughly boot shaped. Shapinsay is relatively low-lying with the highest point being Ward Hill at a height of 64m above sea level.

Howe, where the proposed turbine site is located towards the South East end of Shapinsay is at a height of approximately 35m above sea level.

5.1.1 Meteorology and air quality

The Orkney Islands are subject to a high frequency of gales (>34 knots / 17 m/s) and strong winds (>18 knots / 9 m/s), particularly from October to March. Winds through the year are predominantly from the west to south-southeast direction. Both gales and strong winds blow mainly from the southwest to west; gales occur for 1% of the year and strong winds for 31.5% of the year. Periods of calm are experienced for only 0.2% of the time. Extreme gales, where wind speeds exceed 90 mph, are relatively frequent although usually short (MET office, unpublished data).

The Gulf Stream flows northeast across the Atlantic Ocean and makes Orkney's climate milder than expected at this latitude. There is less than 10°C difference between the average summer and winter temperatures with milder winters averaging temperatures of approximately 5°C, and summer temperatures averaging 15°C reaching maximum temperatures of approximately 19°C (MET office, unpublished data)..

The average annual rainfall in Orkney varies from 850 mm (33 in.) to 940 mm (37 in.) (MET office, unpublished data).

Air quality in Orkney is reported as generally very good. This can be attributed to the lack of significant industrial processes in the islands and the low volumes of road traffic. The risk of the air quality objectives for most pollutants being exceeded are considered negligible. However, two air pollutants that have been identified as a having a risk of exceeding the regulatory standards locally are sulphur dioxide and particulate matter; both are associated with domestic solid fuel burning under certain weather conditions (Watson, 2003).

5.1.2 Visibility and daylight hours

On the longest day, there are approximately 18 hours of daylight and proper darkness is absent; on the shortest day only 6 hours of daylight is experienced (MET office, unpublished).

Damp sea fog (Haar) can occur all year round, but is more frequent in the warmer summer and early autumn months when the winds are less forceful. The eastern coasts of Orkney are more prone to fog than the west, again this can be attributed to wind direction and strength.

5.1.3 Geology and Geomorphology

The solid geology of Shapinsay is mainly Rousay Flagstone, but the relatively high plateau in the south east is composed of sandstones and volcanic rocks. Fault lines that run North-South through the western part of the island determine the presence of the pronounced valley at Balaclava and the adjacent ridge that is surmounted by a straight road running due north (Land Use Consultants, 1998).

Shapinsay has a generous mantle of boulder clay over its surface, which forms the basis for productive soils. These are mainly non-calcareous gleys, brown forest soils with peaty podzols, peaty gleys and rankers on thinner drifts (Land Use Consultants, 1998).

5.1.4 Hydrology

Water is an important feature in the landscape of Orkney which continues to influence the physical form of the land and the biological communities it can support. Since the last glacial period the land mass of Orkney has continued to submerge which is marked by the absence of raised beaches and the presence of peat bed at or below sea level. The submersion of Orkney is such that the river systems have been severely truncated with only small streams now remaining (Land Use Consultants, 1998).

The Shapinsay site is located within an area of farmland at the South east end of the island with planned access along an existing farm track. There are no burns or large drains in the immediate area of the proposed development and some small areas of standing water to the North and South East some distance away. It is not anticipated that these areas would be affected by the development. Measures to minimise the impact on water quality are detailed in section 4.8.2.

5.1.5 Landscape resource

From the high point of Ward Hill, high ground extends as a ridge to the north east and as a plateau to the east. Most of Shapinsay's coastline is formed by rock platforms and low cliffs; however, the west coast has long beaches.

Shapinsay is intensively farmed and over 80% of the island is under cultivated grass and arable crops. Shapinsay is characterised by the rigid geometry of its fields and roads and the intensity of cultivation. The remainder is rough grazing and moorland, most of which is on the south east plateau (Land Use Consultants, 1998).

Two landscape character types have been identified on the island: Ridgeline Island Landscape and Plateau Heaths and Pasture (Land Use Consultants, 1998). A summary of these landscape character types is provided in Table 5.1 below.

Table 5.1 Summary landscape character types found on Shapinsay

Landscape character type	Key characteristics	Landscape sensitivities
Ridgeline Island Landscape	▪ Elongated narrow islands with a single ridgeline along their length; ▪ Gentle and consistent slopes down to the coast; ▪ Main roads following the ridgeline in straight sections; ▪ 19th Century rectilinear pattern of fields and minor roads; ▪ Shallow bays, shingle beaches and wave-cut platforms; ▪ Rich archaeology along the coast.	▪ Maintenance of agricultural features; ▪ Impact of large scale modern farm developments; ▪ Skylining of new development on ridge line; ▪ Potential impacts of fish farm related developments in bays/at the end of local access roads.
Plateau Heaths and Pasture	▪ Locally high ground 50-100m AOD forming fairly extensive plateau; ▪ Mixture of pastures and heathland; ▪ Large scale field pattern with occasional unenclosed areas; ▪ Scattered farmsteads; ▪ Elevated topography denies views to coast except from plateau edge; ▪ Generally open and exposed character despite relatively low altitude.	▪ Open plateau character sensitive to changes in land cover; ▪ Open plateau makes built structures highly visible from within the landscape.

Reference (Land Use Consultants, 1998)

5.2 Biological environment

5.2.1 Habitats and vegetation

This site is a field of improved grassland surrounded on all sides by improved grassland/arable fields. A possible area of sensitivity was part of the access track, which has remnant semi-natural grassland along it and is potentially significant as a wildlife corridor and footpath. In this case it was decided that some features of the site could be significant at a local level and to carry out an abbreviated assessment appropriate to the small scale of the sensitive feature (Crossley, 2008).

As part of this assessment an experienced ecologist undertook a site visit to assess the quality of the habitats in the area and whether further investigation was required. In this case it was decided that the quality and sensitivities of the site were not significant and to carry out a brief survey and assessment only the results of which are presented below (Crossley, 2008). A full copy of the report including methodology and decision making process is included in Appendix 4.

Results of Shapinsay site visit and assessment

A site visit was made on 4th February 2008. The proposed turbine position is in a field of improved grassland at HY5125516900, and the planned access via or alongside an existing farm track. No significant habitat/vegetation community is present at or close to the turbine position in the field. The access track has some habitat of ecological value and has social value as a footpath. A brief assessment without habitat mapping is sufficient for this site.

Habitats and vegetation types

The grass field is characterised by improved grassland species of fertile, neutral, clay soil used for livestock grazing. They include mainly ryegrass *Lolium perenne*, bent *Agrostis* species, Yorkshire fog *Holcus lanatus*, creeping buttercup *Ranunculus repens* and daisy *Bellis perennis* (MG7 *Lolium perenne* grassland in NVC).

The field is approached from the south by a rutted track approximately 500 m long with a ditch on the west side. The width of the track corridor is 6 – 8 m. It includes margins of rough, grassy vegetation.

For most of its length the quality of this grassland is semi-improved, characterised by grasses including creeping red fescue *Festuca rubra*, Yorkshire fog, bent species, with common flowering plants including dandelion *Taraxacum* species, spearwort plantain *Plantago lanceolata* and meadow vetchling *Lathyrus pratensis* (MG6 *Lolium perenne-Cynosurus cristatus* grassland in NVC).

The northernmost section of the track, nearest the proposed wind turbine position, between HY5113216761 and HY5115216814, has a wider margin of unimproved and relatively species-rich acid grassland, with species including tormentil *Potentilla erecta*, devil's-bit *scabious Succisa pratensis*, cat's-ear *Hypochaeris radicata* and bird's-foot trefoil Lotus *corniculatus*, in places mixed with plants of dry heath including heather *Calluna vulgaris*, bell heather *Erica cinerea* and creeping willow *Salix repens* (U4 Festuca *ovina-Agrostis capillaris-Galium* saxatile grassland in the NVC). Bits of this vegetation extend further north past the turbine position, where the track corridor narrows.

Construction of the turbine access track would displace and disturb most of the existing access track vegetation.

Value of habitats and assessment of impacts

The improved grassland in the turbine field has negligible ecological value. The loss and disturbance of this habitat is therefore considered insignificant.

The semi-improved MG6 grassland and unimproved U4 acid grassland along the track have negligible value as habitat types on the geographical scale used in this assessment but the grassy track feature in which they occur is listed as a 'Locally Important' habitat in the LBAP under the heading 'Miscellaneous Field Boundaries'. Such corridors in an agricultural landscape, especially where native vegetation survives from pre-enclosure times, are valuable for a variety of farmland biodiversity. The track also has social value as a footpath. The loss and disturbance of these habitats is considered significant at the scale of the development site only.

Possible mitigation

The character of the grassy track should be retained as far as possible. The U4 acid grassland should be restored by careful lifting, storing and replacement of the turf. Other semi-improved

grassland should recover spontaneously without special treatment.

John Crossley 2008.

5.2.2 Mammals

European otter

The European otter, *Lutra lutra*, is known to be well distributed throughout Orkney, habituating holts by the coast with freshwater sources nearby. Three national otter surveys of Scotland have been undertaken in which Orkney was included. The results of these surveys prove Orkney to be among the most important areas in Europe for otter activity (Conroy, 2005).

Otters are largely solitary, nocturnal animals. Radio tracking has shown that individuals ranges can stretch over 40 km for males and 21 km for females (Kruuk, 1995). Otters are highly specialised carnivores, they can tale poultry and eat seabirds such as Shags and Fulmars however there main food is fish (Berry, 2000). Observations of otters in Shetland have shown that there main food consists of small bottom-living species such as Eelpout, Roaklings and Butterfish which during the day hide under stones and rocks. This means that otters can hunt readily during the day and is the reason why in Orkney otters are often active during the day (Berry, 2000). Freshwater sources are also important as they have to wash the salt from their fur to retain insulation from the cold.

Otter females live in group ranges of up to five individuals, each with a core area within a larger range. Males have much larger ranges which often overlap with female ranges (Berry, 2000). Otters can breed at any time of the year although there is strong evidence to suggest that in Orkney most cubs are born in winter and spring (Conroy and Bacon 2005). Litters can be up to four and natal holts are often located far fro the shore but always close to freshwater.

A local expert was consulted regarding the potential for disturbance of otters at the site. It was concluded that due to the sites distance from the coast and any significant burns it was unlikely that there would be any disturbance to otters from the development (Booth, 2007).

The European otter has been subject to increasing national and international conservation legislation which makes it an offence to disturb, trap, kill or harm the species as well as damaging and/or disturbing its resting, feeding and breeding sites. The European otter is listed on Appendix 1 of CITES, Appendix II of the Bern Convention and Annexes II and IV of the Habitats Directive. It is protected under Schedule 5 of the WCA 1981 and Schedule 2 of the Conservation (Natural Habitats, etc.) Regulations, 1994 (Regulation 38). The European sub-species is also listed as globally threatened on the IUCN/WCMC Red list (UKBAP, 2007).

5.2.3 Birds

The Orkney Islands have richness of bird life which has been studied for over 150 years. This richness is largely a result of the presence of several different semi-natural habitats found within a relatively small land area. The importance of Orkney for breeding birds is reflected in the fact that the Royal Society for the Protection of Birds (RSPB) has 11 reserves in the islands constituting some 8 percent of the total land area (Berry, 2000). The variety of habitat and the richness of the farmland, heather moorland, and coastal waters provides ideal breeding territory for a host of bird species many of which are of high conservation importance and thus protected by national and international legislation.

SNH have produced extensive guidance on assessing the impacts of onshore windfarms on birds including producing a list of bird species considered to be most vulnerable to potential impacts (SNH, 2006). The table below provides a list of birds species present on Shapinsay, from the 2006 Orkney bird report, which are included on the SNH list. It also provides broad information on their present conservation status. A full explanation of the conservation terminology is given below. The full SNH list is reproduced in Appendix 2.

Table 5.2 Summary of bird species present on Shapinsay and conservation status

	Orkney bird report	Conservation status		
Species	**Breeding**	**Annex 1 EU Birds Directive[1]**	**Wildlife and Countryside Act 1981 Schedule[2]**	**Birds of conservation concern[3]**
Curlew *Numenius arquata*	×	×		Amber
Dunlin *Calidris alpina*	×	×		Amber
Golden plover *Pluvialis apricaria*	×	×		Green
Greenland white-fronted goose *Anser alibifrons flavirostris*	×	×		Amber
Greylag goose *Anser anser*	✓	×	1 part II	Amber
Peregrine falcon *Falco peregrinus*	✓	✓	1 4	Amber
Red throated diver *Gavia stellata*	✓	✓		Amber
Slavonian grebe *Podiceps auritus*	×	×	4	Amber
Whooper swan *Cygnis cygnus*	✓	×	1	Amber

Reference: Orkney Bird Report 2006

Further information on conservation status:

Note [1]: Birds listed under Annex I of the EU Birds Directive are protected under The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Habitats Regulations) and can form part of a Special Protected Area designation.

Note [2]: The Act makes it an offence to intentionally kill, injure, or take any wild bird or their eggs or nests (with exception to species listed in Schedule 2). Special penalties are available for offences related to birds listed on Schedule 1, for which there are additional offences of disturbing these birds at their nests, or their dependent young. Under Schedule 4 the Act prohibits certain methods of killing, injuring, or taking birds, restricts

the sale and possession of captive bred birds, and sets standards for keeping birds in captivity.

Note [3]: Birds of Conservation Concern list updated every 5 years based on the following criteria.

Red list species:

- Globally Threatened
- Historical population decline in UK during 1800-1995
- Rapid (>50%) decline in UK breeding population over last 25 years
- Rapid (>50%) contraction of UK breeding range over last 25 years

Amber list species:

- Moderate (25-49%) decline in UK breeding population over last 25 years
- Moderate (25-49%) contraction of UK breeding range over last 25 years
- 2 or 3 Species with unfavourable conservation status in Europe
- Five-year mean of 1-300 breeding pairs in UK
- >50% of UK breeding population in 10 or fewer sites, but not rare breeders
- >50% of UK non-breeding population in 10 or fewer sites
- >20% of European breeding population in UK
- >20% of NW European (wildfowl), East Atlantic Flyway (waders) or European (others) non-breeding populations in UK

Green list species

- Species that fulfil none of the criteria are green-listed.

During the feasibility study stage in-formal consultation was undertaken with both SNH and the RSPB regarding the possible Howe location and any possible issues regarding the local ornithology. At this time the main concern raised by both groups was regarding a small lochan located less than 1km for the proposed site which was used as a breeding site by red-throated divers. Red throated divers are protected by Annex 1 of the EU Birds Directive see Table 5.2 below.

Red-throated divers are thought to be particularly sensitive to disturbance at their breeding sites and are also vulnerable to collisions incidents due to several aspects of

their biology (Aquatera, 2007d). They nest inland on small lochans and make many flights each day from their nest sites to and from feeding sites at sea. Problems may occur if nests are located within the proposed development or if the development is located on a flight path to a feeding area. A survey of the site was therefore commissioned to establish the potential collision risk for divers from the proposed development. An assessment of habitat loss and displacement due to disturbance was also undertaken. A copy of the full report is available in Appendix 6.

5.3 Nature conservation

There are no internationally designated conservation sites on the island of Shapinsay. The only nationally designated conservation area on Shapinsay is the Balfour Castle Gardens and Designed Landscapes (GDL) site: one of only three such designations in Orkney (SNH, 2005).

At present there is no primary legislation in place that gives protection to gardens and designed landscapes. The only legislative protection is the Town and Country Planning (General Development Procedure) (Scotland) Order 1992 (the GDPO), which requires planning authorities, prior to granting planning permission, to consult Scottish Ministers on 'development which may affect a historic garden or designed landscape'. Any planning proposal that would affect a site included in the GDL Inventory must be referred to Scottish Ministers (through Historic Scotland) and to Scottish Natural Heritage via the local planning authority.

There is no requirement for the local planning authority to notify Scottish Ministers where consent will be granted for a proposal that may affect a GDL site and where objections have been voiced from the statutory consultees under the terms of the Notifications Direction. This puts Inventory sites in a less advantageous position than category A-listed buildings and scheduled monuments – similarly nationally-important heritage assets – for which planning authorities have to notify Scottish Ministers when Historic Scotland objects to a development that affects their setting.

As stated in the Orkney Local Plan (2005), the character and features of historic gardens or designed landscapes will be preserved and enhanced. Within these areas

developments that would adversely affect their historic character or appearance will not be permitted (OIC 2005).

The table below gives details of the GDL site and its qualifying criteria.

Table 5.3 National designated areas on Shapinsay

Balfour castle Garden and Designed Landscape (GDL) site **Designated under the Town and Country Planning (General Development Procedure) (Scotland) Order 1992**
A large mid-19th century designed landscape comprised of formal gardens and Orkney's largest woodland which together form the integral setting of Balfour Castle. One of the architect David Bryce's (1803-76) first large commissions, who also remodelled the grounds incorporating earlier features, in collaboration with garden designer Craigie Inglis Halett. **Specific Values** **Work of Art: Outstanding** The Balfour Castle designed landscape is skilfully contrived so as to provide an ornamental landscape, despite the harsh climate. It is of outstanding value as a Work of Art. **Historical: High** This site has high Historical value being the focus of the 19th century economic improvements on Shapinsay, as well as incorporating features from the earlier gardens belonging to the House of Sound and Cliffdale. **Horticultural: High** Balfour Castle's gardens and woodlands are exceptional, in Orkney, for their scale and diversity. They give the site high Horticultural value. **Architectural: Outstanding** Balfour Castle and designed landscape are of outstanding Architectural interest as an important and early example of Bryce's work. The gardens and designed landscape provide an integral setting for the Castle, a Category A listed building. **Scenic: Outstanding** Balfour Castle with its designed landscape forms an important landmark on arrival at Shapinsay, and is an important component of the island's landscape character. It is prominent in views from Mainland Orkney and from ferries to the Northern Isles. This gives the site outstanding Scenic value. **Nature Conservation: High**

The varied habitats of extensive woodland, grassland and coastal habitats, within the Balfour Castle policies, give the site high Nature Conservation value. **Size:** The current extent of the designed landscape of 29ha (72 acres) laid out 1846-50 remains unchanged in extent to the present day.

There are in addition a number of areas highlighted in the Orkney Islands Council Local Plan as being of local conservation significance. These are outlined in Table 5.4 below.

Table 5.4 Local designated areas on Shapinsay

Site	Designation	Interest
Swart Helligeo, East Hill	Scottish Wildlife Trust (SWT) reserve (part): OIC Policy LP/N1	Marginal Moorland, Coastal heath and marsh
Lairo Water and the Ouse	Site of local ornithological interest: OIC Policy LP/N1	Intertidal sand and mud, saltmarsh and coastal grassland
The Galt	Site of local ornithological interest: OIC Policy LP/N1	Area of degraded maritime heath
Vasa Loch, Shapinsay	Site of local ornithological interest: OIC Policy LP/N1	Loch s with wet grassland
Mill Dam	RSPB reserve: OIC Policy LP/N1	Marshland
Ayre of Vasa	Site of local geological interest: OIC Policy LP/N1	Complex cuspate foreland
Veantrow Bay	Site of local geological interest: OIC Policy LP/N1	Complex of shingle depositional landforms

The OIC Local Plan also classifies the coastline of Shapinsay as undeveloped coast (Policy LP/C1). This policy also places some restriction on the type and scope of development permitted in these areas.

5.4 Human environment

5.4.1 Population and development

Balfour village at the South west corner of the island is the main centre of population on Shapinsay. Here there is a small group of houses and the only shop and post office on the island. With only limited facilities the residents are heavily dependent on the daily ferry service and once weekly air service to Kirkwall on the Mainland of Orkney.

In common with many of the more remote islands in the Orkney Archipelago Shapinsay faces the problem of depopulation. The 2001 census recorded a permanent population of 300 people on Shapinsay a decline of 6.83% since 1991 (322). This is augmented by seasonal influxes of visitors to the island accommodated by the many self-catering properties and several hotels on the island. The main employment opportunities are in farming, fishing or fish-farming; there are also craft businesses and some seasonal tourism-related work.

5.4.2 Cultural heritage

As part of the EIA an Archaeological and Cultural Heritage Impact Assessment was commissioned the full report is included in Appendix 7. The assessment included consideration of both recorded and potential unrecorded sites which could be directly affected by the development and the potential for visual impact of the turbine on recorded sites within the zones of visual influence.

Baseline conditions at the development site

There are no Scheduled Ancient Monuments, listed buildings, designated designed landscapes within the immediate area of the proposed development. Four sites in relative proximity to the site are listed on the National Monument Record of Scotland (NMRS) (ORCA 2008d). The location of the sites identified adjacent to the development area are shown in Figure 5.1 and summarised in Table 5.5.

Figure 5.1 Shapinsay development area with archaeological sites identified

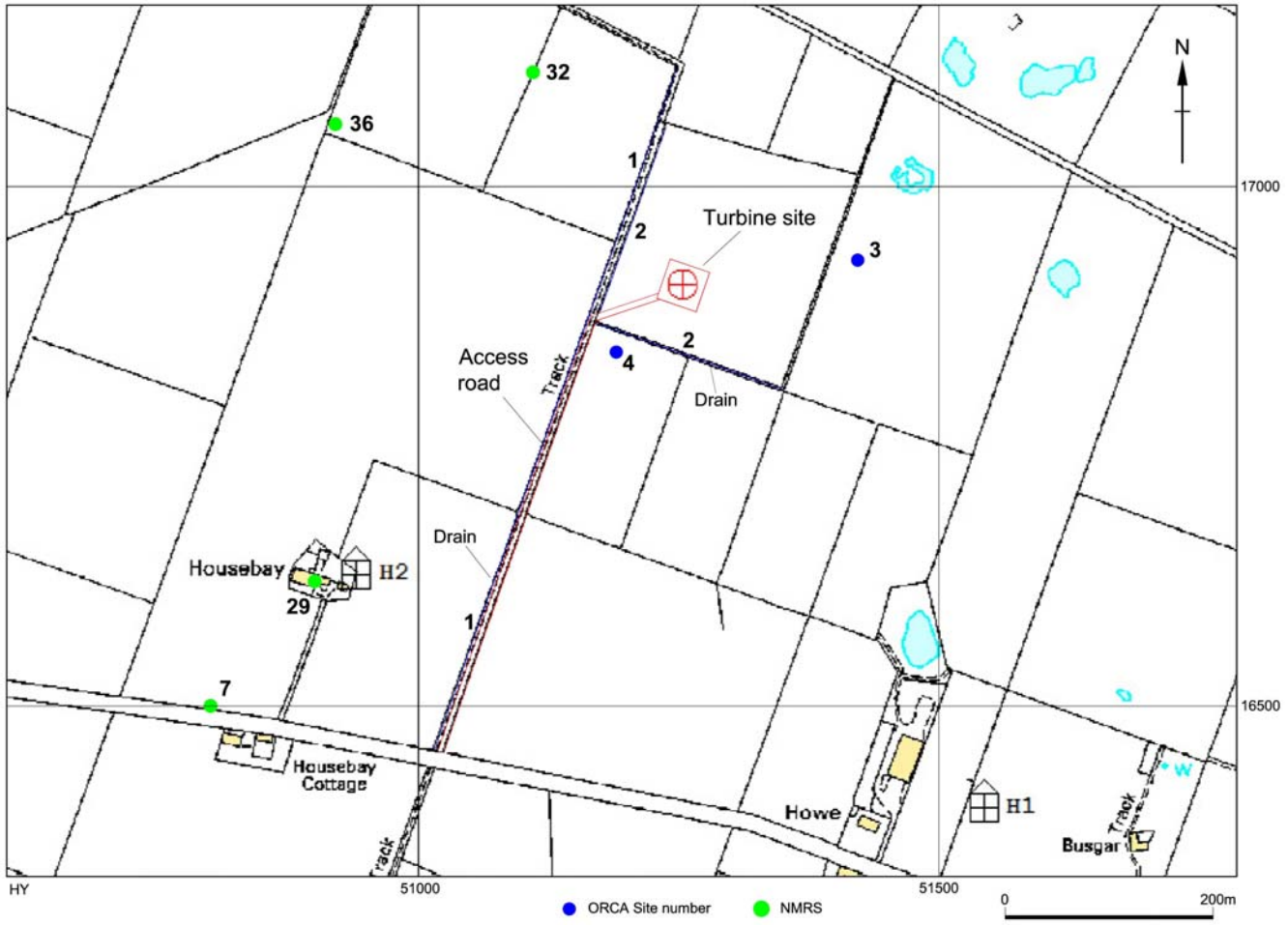


Table 5.5 Summary of sites identified at Howe and results of physical impact assessment

Site #	Description	NGR (HY)	Importance[1]	Potential Impact	Significance of impact
1	Drain	51166/ 16860	Low	Medium	Minor
2	Field Boundaries	51168/ 16858	Low	Low	Minor
3	Earthworks	51422/ 16929	Low	Negligible	None
4	Building	51190/ 16840	Low	Negligible	None

Note [1] Full explanation of ORCA significance criteria given in Appendix 7.

All of the sites identified were accorded low archaeological importance and the potential for impact from the development assessed as Minor or Negligible therefore no further discussion is included here. A full description of the all the sites including methodology, impact assessment and proposed mitigation measures is included in Appendix 7.

Zone of visual influence

A large number of sites fall within the Zone of Visual Influence (ZVI) of the proposed turbine. Within 2km of the turbine site at Howe there are a total of 44 sites excluding the sites identified by the walkover survey (Table 5.5). These include three Scheduled Ancient Monuments, the Mor Stein standing stone (approx. 1km to the E), the chambered cairn at Castle Bloody (approx. 2km to the ESE) and the Hill of Howe broch (approx. 0.8km to the S). There is one Grade B listed building, the Balfour family burial mausoleum within the South Church Yard. There are no designated gardens or landscapes within 2km of Howe (ORCA, 2008d). It should be noted that not all of these sites will be directly visible from the proposed turbine site. A map depicting all the recorded archaeological sites which fall within the 15km ZVI of the proposed Shapinsay turbine is included in Section 7, Figure 7.1.

An assessment of the impact of this visual influence has been undertaken as part of the Archaeological and Cultural Heritage Impact Assessment, see Appendix 7. A number of these sites have also been assessed as part of the wider Landscape and Visual Impact Assessment undertaken to support the EIA which is available in full in Appendix 3.

5.5 Socio economic impact assessment

This section presents information on the expected socio economic benefits of the Shapinsay Community Wind Turbine project. These benefits will accrue not only to people in Shapinsay itself but also to people elsewhere in Orkney and in broader terms the global environment.

5.5.1 Ownership options and local content

Community investment in wind farms is common in Germany, Sweden and Denmark but, with limited exceptions, has not flourished in the United Kingdom. It is evident that in those countries there have been different planning regimes and government funding arrangements which have permitted greater opportunities for community ownership particularly of wind farms. This community ownership has run alongside larger wind farm schemes which would be much more common in the United Kingdom.

There is an interest, shared by the Council and the wider community groups in Orkney, in ensuring that local benefits from the development of renewables in the islands are maximised. There are a number of ways in which this can be achieved, and there are some examples of these in Orkney and elsewhere in the Highlands and Islands, which could be used to help shape policy guidelines for the development of the industry in the islands. The principal options for deriving community benefit are:

Community-owned wind turbines

This is the development of one or more turbines by a non profit distributing community group with an open constitution, usually via a wholly owned trading subsidiary, with all surpluses being made available to the community group for other community projects in the locality. Westray Development Trust has the most advanced project of this kind in Orkney. The Council and HICEC have provided substantial assistance to the early stages of this project.

This process has become less risky over the last few years thanks to the efforts of communities such as Westray and Gigha who have been pioneers in establishing the processes required to develop community owned wind turbine projects. These communities have been instrumental in helping the Highlands & Islands Community Energy Company (HICEC) succeed. The HICEC is part of the Highlands & Islands Enterprise Network and their interest is twofold; they administer two funding schemes; the first is the community side of the Scottish Community and Householder Renewables Initiative which funds small community renewable energy projects (<£100k in assistance) and is generously added to by Orkney Islands Council in the Orkney area.

The second grant scheme they administer is the Growing Community Assets (GCA) funding scheme from the National Lottery. The GCA scheme allows HICEC to assist much larger developments and recent funding awards have included £900k each to Westray and Harris to develop community wind energy projects. HICEC also can provide enabling equity to help attract bank finance to a project but to date this is still to be put into practice. The HICEC are currently in discussions to break away from HIE to become a company limited by guarantee with its members actually made up from the communities it helps.

An alternative way of community involvement is for the community to invest itself. The Energy Technology Support Unit in AEA Technology Plc has sought to help communities understand community investment through their publications on Community Involvement in Renewable Energy Projects published by the DTI in 1994, 1995 and 2000.

Baywind Energy Co-operative Limited in Cumbria has developed using one of the methods set out in that report and early success has led to the formation of Energy 4 All Ltd. Baywind has raised a total of £1.9 million of equity investment and now owns six turbines across two wind farms.

There are a number of points about Baywind which are worth recording. The Swedish developer, The Wind Company, helped the community establish the Co-operative. This was an additional expense for the Developer. The Developer took the risk in building the first wind farm and provided its expertise in assisting Baywind to find shareholders so that it could purchase two out of the five wind turbines on the first farm which it built, and

one from the second. The community invested after much of the risk had passed. The risk which the investors had was essentially limited to machinery breakdown, which to some extent was covered by regular maintenance, insurance and guarantees, and whether the wind blew at predicated speeds. Investors were invited to become shareholders by Baywind making a public offer of shares in the co-operative which gave preference to local shareholders. The total size of the investment required that it was necessary for Baywind to go beyond the immediate region in which the investment took place to find investors as each individual investment limit was capped at £20,000 because the company was an Industrial and Provident Society.

By the time of close of the second offer, 60% of the investors were from the North West Region with an average investment of £2,000. At the start of the offer for the third turbine the existing investors indicated that they were interested in investing one third of the new offer. The new offer closed in less than three months as against the six month time period required for the first two offers.

Baywind has now purchased the remaining three turbines on the original Harlock Hill wind farm Site and owns the whole wind farm. The sixth turbine is part of the Haverigg II wind farm. Baywind, again, owns the turbine outright but it sells its electricity to the wind farm owner who, in turn, has a Power Purchase Agreement with the Non-Fossil Purchasing Agency.

Local private investor-owned wind turbines

This is development undertaken by a group of local investors – an investors club – with profits being distributed as dividends to members of the club or company. The Burray wind turbine developed by Orkney Renewable Energy Limited is the first project of this kind in Orkney. In Denmark, local individual participation in renewables projects has been combined with the availability of bank loans to individuals, secured on the project, to ensure that less well-off members of the community can participate.

This model has its attractions; however a lot of the value in the project is lost to the community as it relies in taking the risk in actually developing the project. The Baywind model had to work with a developer partner as it was based upon a ‘community of interest’ as opposed to a ‘geographical community’. This has always been one of

Shapinsay's strengths in the fact it they are recognisable as a geographical community with a clear boundary formed by the causeways which link the islands to the Orkney mainland. Early on the development trust identified that it would be far more valuable if they developed their own project rather than working with a developer partner as it could be scaled to take advantage of existing grid capacity rather then the pressure to maximise the size of the development. Other lessons however can be learned from the Baywind and Burray community models in terms of the level of investment attainable and whether further funds could be raised from within the community.

Community benefit paid by private developer

These are annual payments made to community bodies or projects, which are now common, and which have been adopted as a matter of policy by some Local Authorities. Several privately-owned developments in Orkney are making such payments with more information provided below. It should be noted that councils have no power to compel a private developer to make such payments, but nevertheless such payments are common, as a means of ensuring local support, rather than opposition, to a project. One issue which has arisen on mainland Orkney is whether the immediate community should receive all such benefit (which can be contentious where more than one community is impacted), or whether benefits should be collected and held in a special fund for all communities – or some combination of these two. It should also be noted that payments based on installed capacity are less attractive to developers, and perhaps less fair, than payments based on actual electricity generated, which can vary from year to year.

The diversified energy market has led and continues to lead to the redundancy of large centrally sited generating facilities which concentrates visual intrusion and pollution in large sites. It has led to a renewal of more local facilities of generation not only gas but also smaller hydro schemes or other renewable technology.

Developers are aware of the importance of seeking community support for a wind farm development. That support can come from not objecting to a proposed wind farm to writing in support of the Development to the local Planning Authority. Developers have found it difficult to involve communities in the benefits of a wind farm. At the very least developers may involve communities by establishing some type of Community Grant

Fund which is derived from the annual income received by the Developers of the wind farm.

Typically, annual amounts vary between the recent agreement at Burgar Hill of an initial payment of £30,000 followed by annual payments of £1,250 per MW. At the Scottish & Southern Energy development in Sanday, the community can realise up to £24,000 per annum from the 8.25MW development. More recently Scotrenewables increased the level of community payments further with an offer to the Stromness community of £5,000 per MW but this depends on the outcome of the Scottish Government inquiry. This would be an example where the developer and landowner may establish a local committee comprised of representatives from Parish Councils or Voluntary Organisations to decide on how the money should be spent. Orkney Renewable Energy Limited, owners of the Burray project also provide a community fund although the amounts and recipients vary year to year.

Council equity participation in wind turbine projects

The Council could participate with private developers, or with community groups or local investors' clubs, which are developing wind turbine projects. The Council would not be the developer, and would not participate prior to planning consent being granted, to avoid conflicts. The Council established an investment fund of £2m for this purpose in 2007 although to date the terms offered have not proved attractive in comparison to other funds available to community groups. Funds would come from the Strategic Reserve Fund, and dividends would go back into that Fund.

Council-owned wind turbine project

It would be possible for the Council to itself act as sole developer of a renewable project, providing the equity for all of the project cost (or some combination of equity and loan). One possible project, at the Flotta oil terminal, is under investigation. The investment fund of £2m would probably be insufficient for this purpose, and therefore it would mean putting more Council funds at risk, although the rewards would potentially be greater. All of these mechanisms could potentially be deployed, in some cases in combination, depending on circumstances of individual projects. Shetland lead the way in this type of development with the huge 100MW+ Viking Wind Farm under consideration with the

Shetland Islands Council as the main developer through its subsidiary Viking Wind Power.

So in conclusion a community ownership model with the community being the developer offers the greatest value in terms of socio economic benefits, some of these include;

- Controls over a capital spend in the region of £1,250,000.
- Increase in community confidence.
- Increase in the intellectual capital on the island.
- Training opportunities for local people.
- Local and regional employment through development and construction.
- Further long term employment opportunities through operation & maintenance.
- Other benefits to local business through visiting professional tourists and purchase of goods and services.
- A reliable net profit for the Trust in excess of £120,000 per annum.
- A financial return for local people and businesses providing investment.
- Income for the ferry operators who would be contracted to transport infrastructure.
- Opportunity to improve access to the hill above the site.
- An educational resource for the school.
- An additional tourist attraction on the island.
- A major research opportunity in integrating marine and wind energy.
- A major contribution towards the island becoming 100% renewable.

5.5.2 Finance

The Trust need to decide upon a preference in terms of funding priorities for the project first will come grant finance and the Trust feel that in order for it to be worthwhile to take on the risk in developing the project the maximum permissible EU state aid limit on grant funding would require to be sourced.

The next priority could be local finance from islanders either in debt or equity dependant on the terms and conditions on the grant finances. Using local finance in this manner vastly increases the socio-economic benefit by the multiplier effect of retaining the income generated by the turbine on the islands.

The next priority could be towards local or agency equity finance in terms of Orkney Islands Council, Highlands & Islands Enterprise or local companies. Again this has a higher socio economic benefit by retaining incomes in Orkney or the wider Highlands & Islands.

The next priority in terms of finance could be from Community Finance Development Initiatives or CDFI's. These are social lenders who provide debt finance to community groups to develop projects where the mainstream banks do not lend.

The final choice of funding would be from mainstream high street lenders although it is highly unlikely whether the cost of performing the due diligence on such a small scale project would make it attractive to these lenders.

5.5.3 Construction

Nearly £400,000 of the capital works could be required locally in developing and constructing the project with the potential for the following contracts to be awarded;

- Civil Engineering design and construction companies.
- Electrical Service companies, including design, installation and maintenance.
- Quarries and concrete suppliers.
- Steel reinforcing suppliers and fixers.
- Road Haulage companies.
- Plant Hire companies.
- Ancillary Workers.
- Accommodation and catering.

5.5.4 Post construction operation and maintenance

After completion, the operation and maintenance of the wind farm will likely provide part time employment for an engineer/fitter on the island although this is dependant on the turbine supplier. The trading subsidiary will also require and administrative post to be created.

5.5.5 Reduction of emissions

Each unit of wind generated electricity will displace a unit of conventionally generated electricity and thus saves the emissions associated with that form of generation.

From the projected long term average wind speed for the site the annual electricity generation will be in the region of 2,739 MWh. Thus the proposed wind turbine would contribute to at least the following reduction in emissions;

- CO_2 – 2,355 tonnes per annum, SO_2 – 27.4 tonnes per annum, NO_x – 8.22 tonnes per annum.

Over a 25 year lifetime it will displace over;

- CO_2 – 58,875 tonnes, SO_2 – 685 tonnes, NO_x – 205.5 tonnes.

These figures are based on the BWEA figures of 860kg/MWh for carbon dioxide, 10kg/MWh for sulphur dioxide and 3kg/MWh for nitrogen oxides.

The benefit of displacement of emissions may also be described in terms of the number of equivalent homes to be supplied on an annual equivalence basis. Utilising the DTI Digest of UK Energy Statistics 2000 and the latest data from the Office of National Statistics, it is possible to make this calculation. Based on the data from 1998 the average domestic consumption is 4.35MWh per annum.

This means this project would provide the equivalent annual electricity of 629 households, more than that on Shapinsay as a whole. If we also add the heating requirements of the house at approximately 20MWh per property then the wind turbine would produce the energy for 112 households which nearly makes the island self sufficient in its electrical and heating requirements.

Section 6 Environmental Impact Assessment

6 Environmental Impact Assessment

6.1 Methodology

A range of activities associated with the proposed development may affect the receiving environment. This section identifies and ranks all the potential environmental and socio-economic impacts which could arise directly or indirectly from the development based on the project description given in Section 4. These include issues raised during the feasibility studies and by stakeholders during informal consultation. The outcomes are presented as a table (Table 6.2) which identifies all the potential environmental impacts associated with the project.

For each environmental impact, the significance was assessed in terms of regulatory requirements (R), stakeholder concerns/conflicts (S) and environmental sensitivity (E). The precautionary principle was applied when assessing environmental sensitivity. An overall significance rank was then given for each project activity or action; this was based on the significance of the impact on the individual environmental receptors by applying the following rules:

- Any project activity assigned a High significance ranking for any environmental receptor was given an overall ranking High; and
- Any project activity assigned a ranking Significant for 2 or more environmental receptors was given an overall ranking of Significant.

6.1.1 Terminology

In the assessment of environmental impacts there are a number of terms applied which can lead to confusion. For the purposes of this assessment the following terminology has been employed:

Environmental receptor: feature of the environment upon which a change may occur due to a specified project activity, e.g. air quality.
Effects: a change from the normal status of an environmental receptor resulting from a project activity, e.g. increased CO_2 emissions.

Impacts: the observable change which occurs to an environmental receptor because of the effects of a project activity, e.g. reduction in air quality. This may also lead to secondary impacts, such as detrimental impacts on human health.
Ranking: the assessment of identified impacts to determine significance.
Residual: the overall significance of an activity taking into account any mitigation measures applied.

6.1.2 Assessment criteria

The following criteria, Table 6.1, were used to assess the potential impacts of the project. These assessment criteria were based on the Institute of Environmental Management and Assessment published guidance (IEMA, 2004).

6.2 Assessment of potential impacts

The following table (Table 6.2) demonstrates the systematic approach taken in impact prediction. It considers the likely impacts of the proposed project for all environmental components. The process also attempts to consider changes in baseline conditions which may occur if the project did not go ahead, the no-change situation. The impact prediction process also includes consideration of:

- Direct / primary impacts: a direct result of the development;
- Indirect / secondary impacts: may be knock-on effects of direct impacts often produced in other locations; and
- Cumulative impacts: attempts an assessment of the cumulative impacts of the development by taking into account other planned projects in the planning process (planning applications submitted) and the other HICEC community wind energy projects.

Table 6.1 Assessment criteria

High significance	
▪ Substantial environmental or socio-economic negative impacts which cannot be reduced with the resources available to the project ▪ Major gaps and uncertainties in the data ▪ Serious stakeholder concerns which cannot be resolved ▪ Non-compliance with environmental legislation ▪ Impact on habitat and/or species of (national / international) conservation importance	
Significant	
▪ Discernable environmental and socio-economic negative impacts which are well understood and can be mitigated within the scope of the project ▪ No major gaps or uncertainties in the data ▪ Concerns expressed by stakeholders which can be resolved ▪ Compliance with environmental legislation ▪ No interaction with habitat and/or species of (national / international) conservation importance	
Low significance	
▪ Potentially minor environmental or socio-economic negative impact within the scope of natural variability e.g. a highly localised / short term impact which does not require further mitigation ▪ No major gaps or uncertainties in the data ▪ No concerns expressed by stakeholders ▪ Compliance with environmental legislation ▪ No interaction with habitat and/or species of (national / international) conservation importance	
Negligible	
▪ Any potential effect arising which is unlikely to be detectable or measurable	
No impact	
▪ Activity will not interact with an environmental receptor	
Positive	
▪ Overall effect of development to enhance or improve environmental or socio-economic receptor	

Table 6.2 Ranking of potential environmental impacts

Significance rating				Receptor	
High significance		Negligible		Environmental	E
Significant		Not-applicable		Stakeholder	S
Low significance		Positive effect		Regulation	R

Project activity or action	Air quality	Geology/Geomorphology/soils	Hydrology	Landscape character	Habitats and vegetation	Mammals	Birds	Cultural heritage: direct	Cultural heritage; visual	Neighbouring properties	Local community	Tourism and recreation	Roads and local amenities	Visual amenity	Local economy	Aviation/technical interests
Site construction and installation																
Construction vehicles and plant	E				E	E	E			S	S		S	S		
Dust pollution from site clearance	E				E	E	E			S						
Noise pollution						E	E			S/R						
Light pollution						E	E			S				S		
Workforce presence						E	E			S	S		S		S	
Removal of groundcover for site		E	E	E	E	E	E							S		
Spoil disposal from site clearance		E	E	E	E	E	E							S		
Creation of foundations		E			E											

Project activity or action	Air quality	Geology/Geomorphology/soils	Hydrology	Landscape character	Habitats and vegetation	Mammals	Birds	Cultural heritage: direct	Cultural heritage; visual	Neighbouring properties	Local community	Tourism and recreation	Roads and local amenities	Visual amenity	Local economy	Aviation/technical interests
Removal of groundcover for access track		E	E	E	E	E	E	S/R						S		
Spoil disposal for access track		E	E	E	E	E	E							S		
Introduction of aggregate for access track		E	E	E	E	E	E									
Change in rainwater run-off / standing water		E	E	E	E	E	E									
Change in sediment budget		E	E		E											
Operation and maintenance																
Introduction of new development / industrial feature				E/S					S/R	S	S	S		E/S /R	S	
Clean energy generation	E/S										S				S	
Physical presence of turbine and site				E	E/S	E/S	E/S		S/R	S	S	S		S/R		
Physical presence of access track			E	E						S	S	S		S/R		
Noise pollution					E	E	E/S			S/R	S	S				
Shadow flicker					E	E	E			S/R						
Electromagnetic interference										S	S					S
Workforce presence					E	E	E			S	S				S	
Maintenance vehicles and plant	E				E	E	E			S			S			

Project activity or action	Air quality	Geology/Geomorphology/soils	Hydrology	Landscape character	Habitats and vegetation	Mammals	Birds	Cultural heritage: direct	Cultural heritage; visual	Neighbouring properties	Local community	Tourism and recreation	Roads and local amenities	Visual amenity	Local economy	Aviation/technical interests
Decommissioning and site reinstatement																
Decommissioning vehicles and plant	E				E	E	E			S	S		S	S		
Site reinstatement		E	E	E	E	E	E		S/R	S				S		
Workforce presence					E	E	E			S	S		S		S	
Noise pollution					E	E	E			S/R						
Cumulative issues																
Cumulative issues associated with other developments in Orkney				E	E	E	E	E	E		E			E	E	
Cumulative issues with HICEC projects				E	E	E	E	E	E		E			E	E	

6.3 Further discussion of impacts

Table 6.3 below shows the distribution of rankings from the project activities / actions. Activities which have been given a ranking of Low or Negligible will not be discussed further as defined in the assessment criteria (Table 6.1) these effects although discernible are well understood and can be mitigated within the scope of the project.

Table 6.3 clearly illustrates that the majority of activities associated with the project have little or no negative environmental impact and have accordingly been ranked as of Low or Negligible significance (see Table 6.1). The majority of the Significant environmental impacts occur through the operational phase of the development. Environmental impacts which were given a ranking of Significant or greater are discussed further in Section 7 below.

Table 6.3 Summary of environmental effects

Overall significance ranking		Number of interactions given this ranking			
		Construction phase	Operation phase	Decommissioning phase	TOTAL (incl. cumulative)
High		0	7	0	11
Significant		0	2	0	5
Low		26	8	19	52
Negligible		44	24	8	84
Positive		2	9	1	16

Section 7 Discussion of Potentially Significant Impacts

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7 Discussion of potentially significant impacts

The following section provides a more detailed discussion of the potential issues identified in Section 6, Table 6.2 above which have been given a ranking of Significant or above. The issues are divided into activities associated with the construction, operation and maintenance and decommissioning stages of the project in line with the project description provided in Section 4.

7.1 Impacts associated with the construction phase

There are no impacts associated with the construction phase which have been ranked as Significant or higher. A full description of all construction activities is included in Section 4.

7.2 Impacts associated with the operational phase

7.2.1 Landscape character

The landscape of the island of Shapinsay is gently rolling, low-lying and agricultural with geometrically shaped fields and road layout. Balfour Castle and its associated woods are key features in the landscape. It is a domesticated, rather than a wild landscape, but contains very little intrusive development of any sort.

The site itself lies on rising farmland (an area defined as 'Ridgeline Island Landscapes' in the Orkney Landscape Character Assessment) and the turbine would therefore introduce a large structure into a generally low-lying landscape, which currently contains few obvious focal points. It would be located within the working landscape of the island.

The turbine would not be sited within, nor can it be seen from, the World Heritage Site or the Hoy and West Mainland National Scenic Area. It may be visible from the southern parkland of the grounds of Balfour Castle which are listed in the 'Inventory of Gardens and Designed Landscapes', but would not be visible from any of the other main elements of these grounds as identified in the inventory.

The turbine would not be seen from Shapinsay's Burroughston Broch, but would be visible from the Mor Stein (viewpoint 6), from where the visual effects have been assessed as 'High.'

The turbine would be seen from the Balfour Village Conservation Area from where viewpoint 5 has assessed the impact as 'Moderate/High'

This study concludes that the significance of the impact on the landscape character of the area would be 'high' largely because of its prominent location on a generally low-lying island, but that there would be negligible cumulative effects on the landscape character.

7.2.2 Birds

There are three main possible impacts of the wind turbine on birds these are considered to be:

1. Displacement to breeding, roosting or foraging birds due to avoidance of turbines;
2. Disturbance during the construction and decommissioning phase; and
3. Mortality due to collisions.

The potential for habitat loss has also been considered.

A Vantage Point survey was undertaken which included a desk based assessment of all available breeding records and walkover survey conducted to collect further breeding data for 2007. The main concern regarding the proposed turbine was in relation to one regularly used breeding site of red-throated divers in Shapinsay which is located 1km form the site. The only other high sensitivity species known to breed within the area are the Northern pintail, Peregrine and Arctic Skua. A full description of the methodology used in defining the magnitude and significance of potential impacts is provided in Appendix 6 (Aquatera, 2007d).

The following presents a summary of the findings of the VP assessment and desk based work undertaken by Aquatera in 2007. The full report is available in Appendix 6.

Disturbance

The maximum disturbance distances for red-throated divers are thought to be in the range 500–750m (SNH, unpublished). The breeding lochan in Shapinsay is within this range at a distance of approximately 600m from the proposed turbine site. It is therefore possible that the breeding site would be subject to disturbance from the presence and operation of the turbine. An increase in human presence in the area could potentially have a negative effect on the breeding success of the breeding pair if they were to remain at the site. Alternatively, they may be displaced elsewhere if there is sufficient suitable breeding habitat available.

The divers may be displaced from the breeding site if they avoid the wind turbine and surrounding area due to disturbance as a result of the construction or operation of the turbine. Disturbance may potentially arise from increased human activity in the vicinity of wind turbines, for example, during construction, maintenance visits and through facilitation of visitor access via newly constructed access roads. A decline in breeding numbers of red-throated divers very close to a three-turbine wind farm site at Burgar Hill in Orkney was attributed to human disturbance during the construction phase rather than the operation of the turbines themselves (Meek *et al.*, 1993).

Red-throated divers are long-lived and highly site-faithful and their attachment to a breeding site may outweigh any potential response to change due to disturbance. A study in Shetland found that once a bird had bred at a loch it rarely changed sites and if it did it would move to the nearest available loch. Male birds in particular, return to lochs close to where they were hatched whilst females disperse widely (Okill, 1992).

Construction disturbance

Noise and visual disturbance associated with construction activities could temporarily displace breeding and foraging birds from the area. Potential effects would be greatest during the breeding season if nest sites are located close to the development site. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects that could lead to a reduction in the productivity or survival of bird populations. These include chilling or predation of exposed eggs or chicks and damage of eggs or chicks due to panicked adults. Birds subject to disturbance may also feed less efficiently and breed less successfully. A study of red-throated divers in Shetland found that breeding

success was lower on lochs with a high degree of disturbance, either by fishermen, peat cutters or birdwatchers (Bundy, 1976). Other studies in Shetland and Sweden have found no correlation between breeding success and the distance from the nest to the nearest road (Gomersall, 1986; Norberg & Norberg, 1971). Disturbance during construction is short-term and can be readily mitigated against by scheduling construction to occur outwith the breeding season.

Post-construction disturbance and collision with wind turbines are spatially mutually exclusive (if a bird stays away from the wind turbine it is not at risk of colliding with the rotor blades). The relationship between the two processes may change over time. Birds may initially avoid the turbine but then habituate to it or conversely, for site faithful birds, the original occupants may continue to use the area but the turbine may reduce the attractiveness of the site to potential replacements when the original occupants die.

At the site-specific level, the impact of disturbance would be of Very High magnitude and therefore of Very High significance. The importance of any disturbance effect at this site will depend on the availability of alternative suitable breeding habitat in Shapinsay and, if there is suitable habitat, whether having to move has any implications for survival or future breeding success of the birds.

Collision risk

Assuming displacement does not occur; the red-throated divers could potentially be at risk of collision risk with the wind turbine.

There is general agreement that several aspects of their biology make red-throated divers particularly vulnerable to collision risk with wind turbines. Divers make many flights each day to and from their breeding lochs including flights at dusk and dawn and in poor visibility. Reimchen & Douglas (1984) found that adults made an average of 11 flights per day to the sea. Mean flight speed during foraging flights is 60.4km per hour (17m per sec) (Norberg & Norberg, 1971). Although divers fly strongly and quickly, divers have a high wing-loading and are amongst the least agile of flying birds; they can only change direction or gain height relatively slowly.

Red-throated divers may be more susceptible to population impacts as they are long-lived, they do not breed until several years old and they generally have low annual reproductive rates. Mean productivity for birds in Orkney was recorded as 0.79 chicks per nest (Booth, 1982). The annual mortality rate for adults is relatively low at 16%. Mortality rate in the first and second years of life is higher at 40% and 38% respectively (Hemmingsson & Eriksson, 2002). As a species with high adult survival rate and low breeding rate, red-throated divers may be more susceptible to adverse population impacts as they would be less able to replace any losses. A small level of additional mortality due to collision may therefore have an impact of considerable magnitude.

Habitat loss

The total land-take resulting from the construction of a single wind turbine and associated infrastructure would result in the permanent loss of a very small proportion of the available heathland and rough grassland habitat available in Shapinsay and would not affect the breeding habitat of the red-throated divers. The magnitude of the impact would be considered Negligible (<1% of habitat lost) and therefore of **very low** significance.

7.2.3 Cultural heritage visual

The Zone of Visual influence has been divided into four discrete areas by ORCA in the Archaeological and Cultural Heritage impact Assessment (ORCA, 2008a). These are as follows: 0-2km, 2-5km, 5-15km and 15-30km. These zones are illustrated in Figure 7.1 below except for the 15-30km zone. This zone has been excluded as the significance of the visual impact at this distance is regarded as none except for sites of national importance such as Scheduled Ancient Monuments (SAMs) and Grade A listed buildings when it is regarded as Minor (ORCA, 2008a). The development is not visible from The Heart of Neolithic Orkney World Heritage Site in West mainland. All sites out to the 15km boundary are shown in Figure 7.1 which also shows of the level of archaeological importance afforded to each site according to the methodology outlined in the ORCA report, page 6 of Appendix 7. A full list of the sites identified has also been included in Appendix 7.

Sites within 2km of Howe

Within the immediate area of the proposed development (0-2km) a total of 48 sites were identified (including those identified by the walkover survey). In total there are 4 sites of high archaeological importance, 5 of medium and 35 of low archaeological importance identified in this zone.

Sites 2-5km from Howe

Within this zone a total of 144 sites were identified of which 5 are SAMs and 25 are listed buildings. In total there are 7 sites of high, 49 of medium and 88 of low archaeological importance identified in this zone.

Sites 5-15km from Howe

Within this zone a total of 310 sites were identified of which 61 are SAMs and 96 are listed buildings and 5 sites are detailed in the Non Statutory List (ORCA, 2008d). In total there are 173 sites of high and 137 of medium archaeological importance identified in this zone. Sites of low archaeological importance were not included at this distance.

The visual impact of the development within each of these zones out to 15km has been defined as of Major significance due to the high number of important sites in the area. A full definition of the significance criteria is given on page 7 of the Archaeological and Cultural Impact Assessment, ORCA 2008a.

7.2.4 Noise

Hayes McKenzie were asked to carry out noise predictions for 6 single turbine sites proposed within the Orkney Islands (including Shapinsay) with a view to advising on any noise issues which arise.

Planning Advice Note PAN45: Renewable Energy Technologies

Planning Advice Note (PAN) 45 issued by the Scottish Office Environment Department in January 2002 covers noise from wind turbines at Paragraphs 65-69 within the general section on Wind Power.

It notes that the report "*The Assessment and Rating of Noise from Wind Farms*" (ETSU-R-97) "*describes a framework for the measurement of wind farm noise and gives*

indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or planning authorities". It states that "*the report presents a series of recommendations that can be regarded as relevant guidance on good practice".*

ETSU-R-97, The Assessment and Rating of Noise from Wind Farms

ETSU-R-97 describes a framework for the measurement of wind farm noise and contains recommended noise limits, which were derived with reference to existing standards and guidance relating to noise emission from various sources.

These noise limits are related to background noise, as derived from measurements, for integer wind speeds up to 12 m/s at 10m height. For day-time hours, the noise limits are 35 - 40 dB(A) or 5 dB(A) above the prevailing background as measured during quiet day-time periods, whichever is the greater. The actual value within the 35 - 40 range should depend on the number of dwellings in the vicinity; the effect of the limit on the number of kWh generated; and the duration of the level of exposure.

For night-time periods the noise limit is 43 dB(A) or 5 dB(A) above the prevailing night-time background, whichever is the greater. The 43 dB(A) lower limit is based on a sleep disturbance criteria of 35 dB(A) with an allowance of 10 dB(A) for attenuation through an open window and 2 dB(A) subtracted to account for the use of LA90 rather the LAeq.

Where the occupier of a property has some financial involvement with the wind farm, the day and night-time lower noise limits are increased to 45 dB(A) and consideration can be given to increasing the permissible margin above background. These limits are applicable up to a wind speed of 12 m/s measured at 10 m height on the site.

Quiet day-time periods are defined as evenings from 1800-2300 plus Saturday afternoons from 1300-1800 and Sundays from 0700-1800, which are referred to as the amenity hours. Night-time is defined as 2300-0700. The prevailing background noise level is set by calculation of a best-fit curve through values of background noise plotted against wind speed as measured during the appropriate time period with background noise measured in terms of LA90,t. The LA90,t is the noise level which is exceeded for

90% of the measurement period 't'. It is recommended that at least 1 week's worth of measurements are required.

Where predicted noise levels are low at the nearest residential properties, a simplified noise limit is specified such that noise is restricted to an LA90 level of 35 dB(A) for wind speeds up to 10 m/s at 10 m height. This removes the need for extensive background noise measurements for smaller or more remote schemes.

It is stated that the LA90,10min noise descriptor should be adopted for both background and wind farm noise levels and that, for the wind farm noise, this is likely to be between 1.5 and 2.5 dB less than the LAeq measured over the same period. The LAeq,t is the equivalent continuous 'A' weighted sound pressure level occurring over the measurement period 't'. It is often used as a description of the average noise level.

The noise limits take into account the fact that all wind turbines exhibit the character of noise described as blade swish to a certain extent. ETSU-R-97 specifies that a penalty should be added, however, to the predicted noise levels, where any tonal component is present. The level of this penalty is described and is related to the level by which any tonal components exceed audibility.

Where there is already a wind farm development in the vicinity of a proposed development, ETSU-R-97 states that 'absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question'.

Orkney Islands Council Supplementary Planning Guidance Document: Onshore Wind Energy Development 2006

The Supplementary Planning Guidance for the Development of Onshore Wind Energy Projects in Orkney September (OIC 2006) states that:

"For the purpose of the assessment, and unless demonstrated to be otherwise, background noise levels in rural areas are assumed to be as shown in the table below:

Wind Speed (m/s)	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Background dBA	*24*	*25*	*27*	*29*	*31*	*33*	*35*

The loss of amenity from noise will be assessed on the following basis:

- *A difference of 3dB or less – insignificant*
- *A difference of 4-9 dB – marginal loss of amenity*
- *A difference of 10dB of more – significant loss of amenity".*

Orkney Islands Council Supplementary Guidance Onshore Wind Energy Development - Final Draft May 2008 states that: "*The noise generated from a proposed wind turbine/wind farm must be assessed to ensure compliance with the Department of Trade and Industry publication "The Assessment and Rating of Noise from Wind Farms", September 1996 or subsequent amendments/publication and to the satisfaction of the Planning Authority".*

Noise predictions

Noise predictions have been carried out using International Standard ISO 9613, Acoustics – Attenuation of Sound During Propagation Outdoors. The propagation model described in Part 2 of this standard provides for the prediction of sound pressure levels based on either short-term down wind (ie. worst case) conditions or long term overall averages. Only the down wind condition has been considered in these assessments, that is for wind blowing from the proposed turbine locations towards the nearby houses. When the wind is blowing in the opposite direction noise levels will be significantly lower, especially where there is any shielding between the site and the houses.

The ISO propagation model calculates the predicted sound pressure level by taking the source sound power level for each turbine in separate octave bands and subtracting a number of attenuation factors according to the following:

Predicted Octave Band Noise Level =
Lw + D – Ageo - Aatm – Agr - Abar - Amisc

These factors are discussed in detail below. The predicted octave band levels from each of the turbines are summed together to give the overall 'A' weighted predicted sound level from all the turbines acting together.

LW - Source Sound Power Level

The noise predictions have been based on source sound power levels for the proposed Enercon E44 900 kW turbines as warranted by the manufacturer and shown in Table 7.2

Table 7.2: Assumed Source Sound Power Levels

Wind Speed at 10m* (m/s)	Enercon E44 Sound Power Level (dB L_{WAeq})
7	101.7
8	103.3
9	104.0
10	104.0
11	104.0+
12	104.0+

* Standardised wind speed at 10m height based on an assumed ground roughness of 0.05m.

+ Not warranted explicitly but Enercon states that sound power level does not increase above rated power.

The noise spectra assumed, shown at Table 7.3 for a wind speed of 10 m/s, have been taken from measurements carried out on sample turbines according to IEC 61400-11, normalised to the warranted sound power level at each integer wind speed.

Table 7.3: Assumed Octave Band Spectra

Octave Band Centre	63	125	250	500	1k	2k	4k	8k

Frequency (Hz)								
Enercon E44 900	86.1	91.8	95.2	98.2	99.3	96.0	88.7	81.8

D – Directivity Factor

The directivity factor allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measured in a down wind direction, corresponding to the worst case propagation conditions considered here and needs no further adjustment.

A_{geo} – Geometrical Divergence

The geometrical divergence accounts for spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to:

$A_{geo} = 20 \times \log(d) + 11$

where d = distance from the turbine

The wind turbines can be considered as a point source beyond distances corresponding to one rotor diameter.

A_{atm} - Atmospheric Absorption

Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. The attenuation depends on distance according to:

$A_{atm} = d \times \alpha$

where d = distance from the turbine

α = atmospheric absorption coefficient in dB/m

Published values of 'α' from ISO9613 Part 1 have been used, corresponding to a temperature of 15ºC and a relative humidity of 70%, which give relatively low levels of

atmospheric attenuation, and subsequently worst case noise predictions as given in Table 7.4 below.

Table 7.4: Atmospheric Absorption Coefficients

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient (dB/m)	0.0001	0.0004	0.0011	0.0023	0.0041	0.0087	0.0264	0.0937

A_{gr} - Ground Effect

Ground effect is the interference of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects are inherently complex and depend on the source height, receiver height, propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable G which varies between 0 for 'hard' ground (includes paving, water, ice, concrete & any sites with low porosity) and 1 for 'soft' ground (includes ground covered by grass, trees or other vegetation). The predictions here have been carried out using a source height corresponding to the proposed height of the turbine nacelle, a receiver height of 1.2m and an assumed ground factor G = 0. This ground factor corresponds to hard ground between the source and receiver and represents a worst case corresponding to waterlogged or frozen ground. In practice noise levels may be up to 2 dB lower.

A_{bar} - Barrier Attenuation

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO 9613 model have, however, been shown to be significantly greater than that measured in practice under down wind conditions. The results of a study of propagation of noise from wind farm sites carried out for ETSU concludes that an attenuation of just 2 dB(A) should

be allowed where the direct line of sight between the source and receiver is just interrupted and that 10 dB(A) should be allowed where a barrier lies within 5 metres of a receiver and provides a significant interruption to the line of sight. There are no significant barrier effects between this site and the nearest properties, however, and no such attenuation has been included here.

A_{misc} – Miscellaneous Other Effects

ISO9613 includes effects of propagation through foliage, industrial plants and housing as additional attenuation effects. These have not been included here and any such effects are unlikely to significantly reduce noise levels below those predicted.

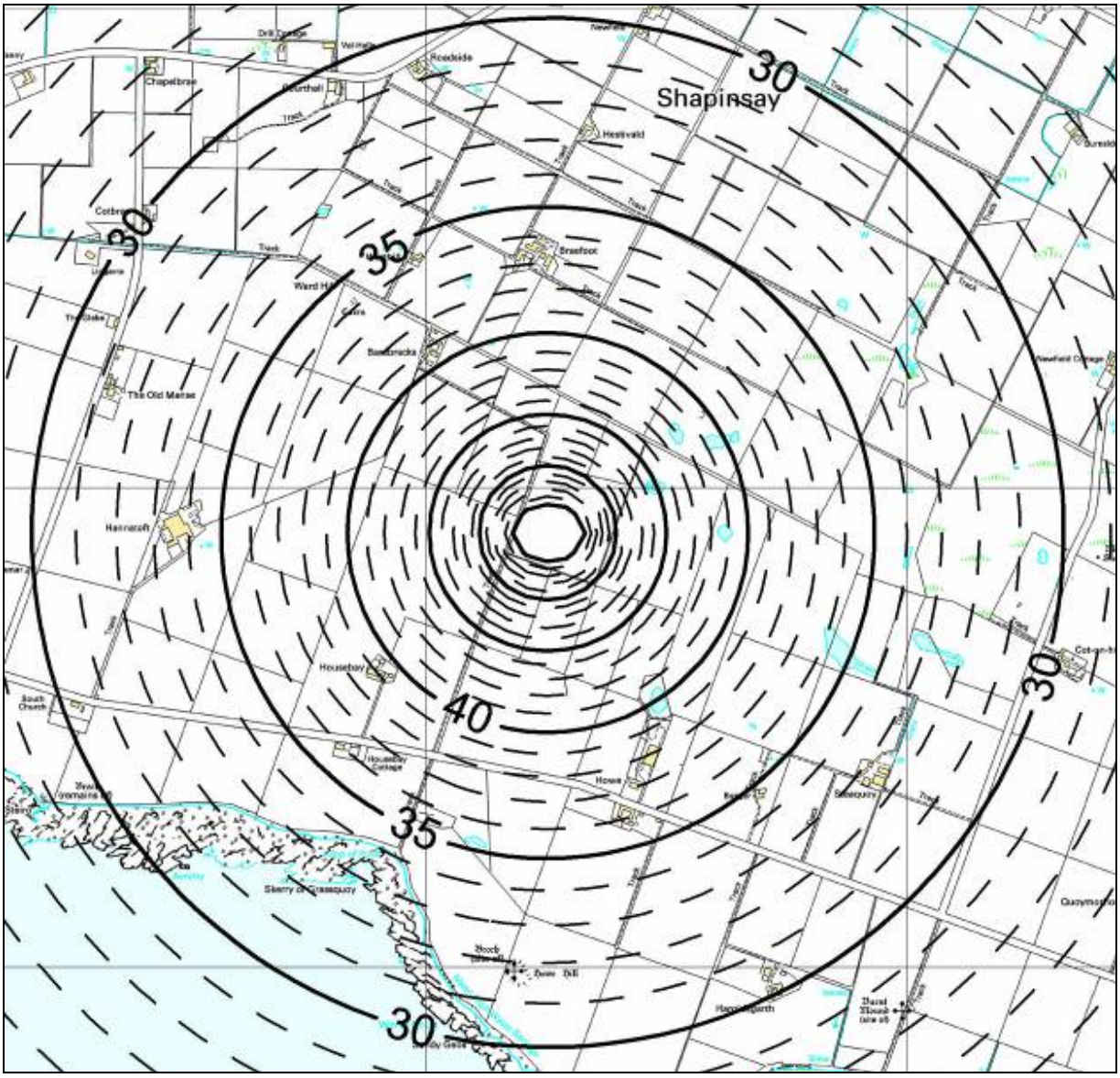
Results of Noise Predictions

The results of the noise predictions for the Enercon E44 turbines are plotted in the form of noise contours shown in Figures 7.2.

It should be noted that these contour plots represent downwind propagation in all directions simultaneously, which clearly cannot happen in practice.

The predicted turbine noise L_{Aeq} has been adjusted by subtracting 2 dB to give the equivalent LA90 as suggested in ETSU-R-97.

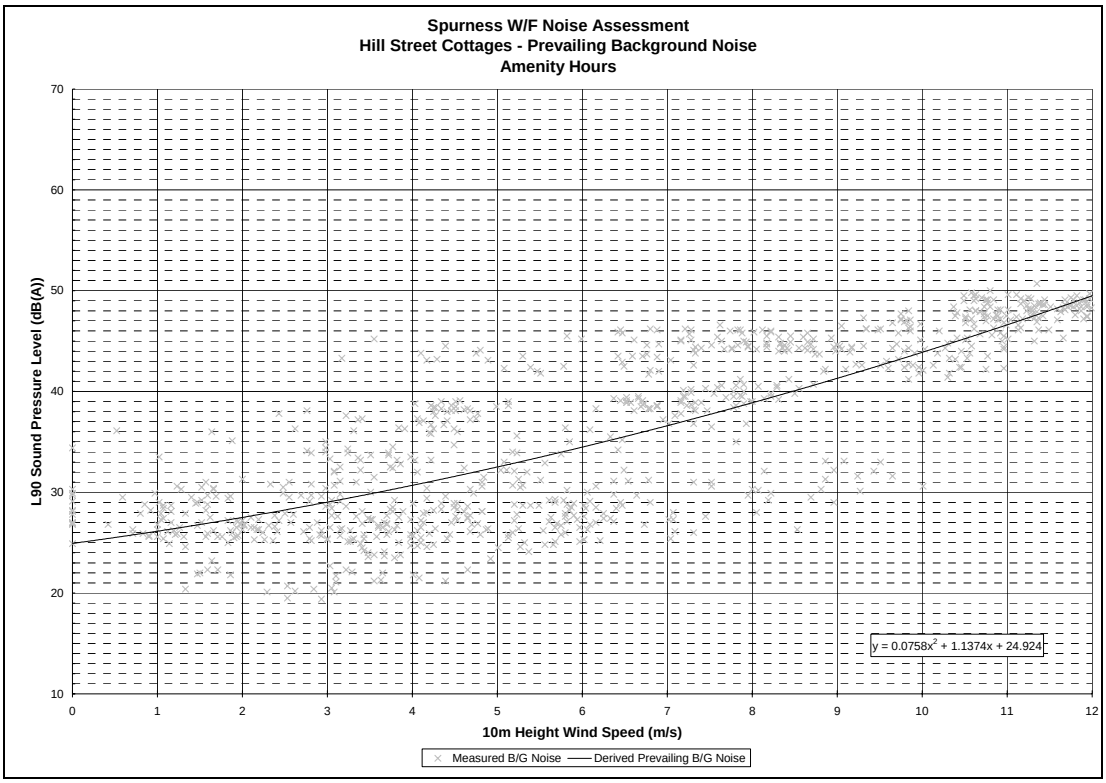
Figure 7.2: Shapinsay: Predicted Noise Levels for 10m Height Wind speed of 10 m/s



Discussion

It can be seen that the 35 dB LA90 criterion is exceeded at a number of locations by up to 5 dB. However, ETSU-R-97 allows for the noise limit to be increased based on an allowable margin of 5 dB above the 'prevailing' background. If background noise levels are taken into consideration other studies undertaken in Orkney indicate that these levels could exceed the turbine generated noise. To illustrate this Figure 7.3 below shows the measured background noise at a location on Sanday (prior to the construction of any turbines) at 10m/s wind speed to be 44dB, 9dB above the 35 dB LA90 criteria.

Figure 7.3 Prevailing Background Noise: Hill Street Cottages, Amenity Hours



Mitigation

It is understood that the OIC SPG for onshore wind projects is currently going through a state of flux, and there are currently two possible interpretations:

1. If the adopted 2006 guidelines are used to determine the acceptability of the proposed development the exceedance of the 35dB limit would result in a marginal loss of amentity.

2. If the unadopted 2008 guidelines are used to determine the acceptability of the proposed development the exceedance of the 35dB limit may require an onsite noise assessment to be undertaken.

If required Enercon have indicated that it would be possible to run the E-44 in the same noise reduced modes as the E-48. The E-44 has the same generator, only with shorter blades. Enercon did also comment that the E-44 is normally installed at high wind speeds sites where background noise levels are such that noise problems are not normally encountered.

Construction noise

In the UK, no fixed limits apply to the construction site noise. However, guidelines can be found in PAN 56 which refers in turn to British Standards BS 5228 Noise control on construction and open sites, BS 1997.

BS 5228 Part 1 does not specify suitable daytime noise levels from construction sites, but lists a number of factors which might affect the acceptability of noise from construction sites.

- Site location
- Existing ambient noise levels
- Hours of work
- Attitude to site operator
- Noise and vibration characteristics of the work

It does however suggest that acceptable noise levels in the evening may need to be 10dB(A) lower than daytime levels.

It should also be noted that local authorities have powers under the Control of Pollution Act 1974 to control noise from construction sites.

Mitigation

Much of the countryside experiences noise from transport, farming and other rural enterprises. Noise generated from the proposed machines and plant are in the range level from existing farm machinery for example; a tracked excavator would operate at a

sound power level of 104 dB (Lwa), where as a large tractor may be rated at 107 dB (Lwa).

The construction phase is likely to involve combinations of noise emissions from various, mainly mobile, machines or plant, for in the main a short duration from different locations on the proposed site.

The distance from the proposed works and residential properties is such that no significant noise impact is anticipated with respect to construction activities.

In line with good practice an informal agreement with the local authority will be sought to satisfy that the works will be compliant and in planning the works, try to use plant and equipment with low operating noise levels where possible.

Decommissioning Noise

Predicted noise levels at the decommissioning stage are likely to be similar to the construction stage. The Decommissioning Method Statement will take the prevailing legislative noise prevention practices into account, which will be submitted to the local authority at the appropriate time.

Conclusions

Noise predictions show that there is likely to be an exceedence of the ETSU-R-97 simplified noise criterion of 35 dB LA90¬ for 10 metre height wind speeds up to 10 m/s for the Enercon E44 turbine at the proposed location. The document does however allow for the noise limit to be increased based on an allowable margin of 5 dB above the 'prevailing' background, which could be determined by the undertaking of an onsite noise assessment if required. Other noise studies undertaken on Sanday indicate that when background noise levels are taken into consideration the necessary noise standards are likely to be met leading to little or no loss of amenity to the local Shapinsay residents.

7.2.5 Visual amenity

Shapinsay's location (lying centrally amongst other islands and Mainland Orkney) and its low-lying topography, suggests that the turbine would be visible over a large area and the Zone of Theoretical Visibility confirms that the turbine would, indeed, be seen from

the majority of the island itself, from parts of Rousay, Egilsay, Wyre, Eday, Sanday, Stronsay, from the Quanterness/Kirkwall area, parts of Firth and Rendall and parts of East Mainland.

The turbine would be seen from the pier, but would not interrupt any key views out to sea from the island but would feature in some attractive views, both within the island and from the sea and other islands.

The access track would not be visually intrusive as it follows an existing track between two field boundaries. unless carefully reinstated after construction work is complete.

The turbine would generally present a simple, clear image, with rotors set mainly against the sky. The only significant exceptions to this are views from Balfour Village (viewpoint 5) and the Mill Dam bird-hide (viewpoint 7), from where the top of the rotors would be seen behind rising ground.

The use of viewpoints, has concluded that the most significant visual impact, 'High', would be from viewpoints 2 (B9059 Near Housebay), 3 (west of Quoymorhouse), 4 (Bonnyhill) and 6 (the Mor Stein). 'Moderate/ High' impacts were identified at viewpoint 1(B9059 east of Hilton) and at viewpoint 7 (Mill Dam). The turbine would not, therefore, appear dominant from any viewpoint.

7.2.6 Aviation interests

The potential effects that the supporting structure and rotating turbine blades may have on communications, navigation and surveillance systems including radar, and other equipment have not been assessed as no response was received from HIAL (see Section 3.2.5), but will be addressed at planning.

Due to the distance from Kirkwall airport the proposed turbine is not considered to be an obstruction during take-off and landing. Potential electro-magnetic interference on communications, navigation and surveillance systems will be assessed at planning

7.3 Impacts associated with the decommissioning phase

There are no impacts which have been ranked as Significant or higher associated with this phase of the development.

7.4 Cumulative impacts

7.4.1 Landscape character and visual amenity

The cumulative impacts of all six HICEC supported projects have been assessed in a stand alone document as requested by Orkney Islands Council and Scottish Natural Heritage. This document addresses the interactions between the six proposals and is available in Appendix 8. The findings from this stand-alone report were then fed back into each individual landscape and visual impact assessment.

Cumulative impact with other existing, approved and applied for developments in Orkney

This study has attempted to assess the potential cumulative effects caused by this development in combination with any other existing, approved or applied-for developments within Orkney. It was found that a single turbine on Shapinsay would contribute little to any cumulative effects on the 'Ridgeline Island Landscapes' landscape character type.

Study using ZTVs and visualisations has determined that there are only very minor cumulative visual effects when viewing the Shapinsay turbine in combination with the Sanday and Stronsay turbines from the Covenanters Memorial (and other nearby parts of East Mainland) and from the Hatston junction area of Mainland Orkney.

It has been shown that the Shapinsay turbine would contribute only very minor additional cumulative sequential effects on the island's B9058 and 9059 roads and on the Shapinsay and north isles ferries.

Cumulative with other proposed HICEC community turbines

The separate stand-alone document concludes that the Shapinsay turbine would interact visually with the proposed Rousay on views from the north of Deerness (Covenanters Memorial) from where these cumulative effects are assessed as 'Moderate/High'.

These appear to gain be on the north of East Mainland from where the Shapinsay turbine would be seen in combination with Burgar Hill, Rousay, Eday, Sanday and Stronsay.

Section 8 Conclusions and mitigation

8 Conclusions and mitigation

8.1 Overall conclusions

8.1.1 Approach

Environmental criteria have had an important role to play throughout the decision-making process of this project. From the feasibility study stage environmental constraints were given the highest level of priority in identifying the preliminary areas of search for the Shapinsay wind turbine project. This included consideration of designated nature conservation areas, areas of high bird activity and areas particularly vulnerable to landscape and visual impact.

Throughout this EIA process major efforts have been made to accommodate environmental information in the more detailed project design process including micro-siting of the proposed turbine, access track and cable route. The project has strived to gather the most up to date information to provide a robust environmental baseline with which to inform the EIA including commissioning a number of individual assessment, see Section 8.3.

It should be noted when considering the environmental impact of this development the positive aspects of the development, namely the reduction in CO_2 emissions, see Section 5.5.5 and the many positive aspects of the development to the local community of Shapinsay and the wider community of Orkney, see Sections 1.2.3 and 5.5.1. These positive aspects to the proposed development should also be considered when viewing the project as a whole.

Although a number of environmental issues have been removed / reduced during the process of the EIA a number of residual issues remain.

8.1.2 Residual environmental issues

Landscape and visual

- The following are the main conclusions drawn from this Landscape and Visual Impact Assessment :

- Shapinsay is an island with a gentle, low-lying, farmed and inhabited landscape.
- The proposed site lies on rising ground amidst the working agricultural landscape.
- The turbine would not be seen from the World Heritage Site or the National Scenic Area.
- There would be very limited effects on the grounds of Balfour Castle.
- The significance of impact on the landscape character of the area has been assessed as 'high'.
- The turbine generally presents a clear, simple image. The exceptions to this are from Mill Dam and Balfour Village where views show the rotor tips only behind rising ground.
- The highest visual impact, 'High' has been identified as from the east and west of the site on the B9059, from Bonnyhill on the B9058 and from the Mor Stein. The visual impact from the Balfour Village conservation area has been assessed as 'Moderate/High'.
- The turbine would not appear dominant from any viewpoint.
- Cumulative visual effects (with existing, approved or applied for projects) have been shown to be very minor.
- Cumulative visual effects (with the other five proposed community projects) have been identified as 'Moderate/high' from the Covenanters memorial path, where both Shapinsay and the Rousay turbine would be seen lying in the same line of view.
- The highest overall cumulative visual effects are therefore on the north of East Mainland from where the Shapinsay turbine would be seen in combination with Burgar Hill, Rousay, Eday, Sanday and Stronsay.

<u>Birds</u>

- A study was undertaken by Aquatera Ltd, to assess the impacts of a proposed single wind turbine development on the ornithological interests of the site north of Howe and surrounding area in Shapinsay.
- The main concern regarding the proposed turbine location was in relation to the only regularly used breeding site of Red-throated divers (Gavia stellata) in Shapinsay which is located within 1km of the site.

- The only other 'High' sensitivity species known to breed within the area is Northern pintail (Anas acuta). Peregrine (Falco peregrinus) and Arctic skua (Stercorarius parasiticus) were identified as 'High' sensitivity species that may fly through the turbine site.
- To assess any habitat loss, disturbance or collision risk effects of the wind turbine on the red-throated divers, all available breeding records were obtained and a walkover survey was conducted to collect data for the 2007 breeding season.
- A Vantage Point (VP) survey was conducted to establish whether the red-throated divers fly through the proposed wind turbine site and to assess whether a significant effect in terms of collision risk on the divers and the other bird interests of the site was likely.
- The only active red-throated diver site recorded during the breeding survey was the previously known site, where a bird was seen incubating.
- Two VP watches were carried out amounting to 12 hours of observation before it was established that the breeding attempt had failed and that the red-throated divers had abandoned the site.
- Habitat loss The construction of a single wind turbine at this site would not result in the loss of any red-throated diver breeding habitat. The magnitude of the impact would be considered Negligible (<1% of habitat lost) and therefore of Very low significance.
- Disturbance At the site-specific level, the impact of disturbance at this site would be of Very High magnitude and therefore of Very High significance.
- In the absence of flight activity data, the collision rate for red-throated divers could not be calculated. It remains unknown whether the red-throated divers' flight routes pass through the turbine site.
- The collision risk impact at the site-specific or regional levels could not be fully assessed due to the absence of flight activity data. However, the loss of one pair of red-throated divers would not present a significant impact at the national population level.

Noise

Noise predictions show that there is likely to be an exceedence of the ETSU-R-97 simplified noise criterion of 35 dB LA90¬ for 10 metre height wind speeds up to 10 m/s for the Enercon E44 turbine at the proposed location. The document does however allow

for the noise limit to be increased based on an allowable margin of 5 dB above the 'prevailing' background, which could be determined by the undertaking of an onsite noise assessment if required. Other noise studies undertaken on Sanday indicate that when background noise levels are taken into consideration the necessary noise standards are likely to be met leading to little or no loss of amenity to the local Shapinsay residents.

Cultural heritage – visual

By definition, because of their proximity, the turbine development would have a major visual impact upon the sites identified during the walkover survey, although the significance of this impact is considered to be negligible as they are sites of low archaeological importance. There are three sites with statutory designations within 2km (Sites 5, 19 and 20) and one grade B listed building (Site 10), and the visual impact will be major. Within the 2-5km zone around the development there many sites with statutory designation (5 SAMs and 25 listed buildings). This includes the grade A listed Balfour Castle (Site 111) and the associated designated designed gardens. There are 61 SAMs, 96 listed buildings and five sites detailed on the Non Statutory List within 5-15km of the development. The development could be considered as having a major visual influence on all these sites. The proposal impacts at least as many more sites without designations. Such impacts may contradict several local and national policies and guidelines, and require consultation with the Regional Archaeologist and Historic Scotland.

8.2 Environmental management

It is important that the findings of this EIA are incorporated into the final design of the proposed development through effective environmental management. Although many of the issues associated with this development cannot be mitigated effectively e.g. visual impact, through best environmental practise other associated minor issues can be minimised or eliminated altogether. The following table outlines a number of commitments which should be taken forward into the next phase of the development to ensure that environmental impact is minimised.

Table 8.1 Environmental commitments

Aspect	Commitment
Potential for disturbance to breeding birds	All construction work on the turbine site and access track to be scheduled for outside the breeding season
Pollution prevention	Adherence to building control regulations and SEPA best practise guidelines and regulations where appropriate
Waste minimisation and management	All bulky wastes to be removed form the islands where possible All building wastes to be dealt with in line with current Waste Management Regulations Site waste management strategy to be undertaken to SEPA guidelines and best practise Work areas to be kept tidy
Work force	Local contractors to be used where possible Numbers of on-site personnel o be kept to a minimum Pre-construction briefing to be given to all staff and contractors to ensure awareness of key environmental issues e.g. otters
Wildlife	Outside construction work to be restricted to between the hours of 0800 and 1800 or two hours after sunrise to one hour before sunset which ever is later to avoid / minimise disturbance to wildlife.
Habitats	Temporary lay-down and other construction areas to be located on non-sensitive areas (see detailed habitat maps)
Archaeology	Discovery of any archaeological remains during the construction period to be reported immediately to County Archaeologist ORCA to be consulted on final construction details Watching brief to be carried out by a qualified archaeologist in the event that construction works disturb any sites identified during th Archaeological and cultural heritage impact assessment.
Sustainability	The following principles of sustainability are integral to the proposed development: ▪ Provision of renewable energy ▪ Sourcing of hardcore materials locally where possible to

	reduce transport emissions ▪ Final location and layout chosen to reduce effects on natural heritage ▪ Use of existing access track where possible ▪ Scheduling of construction works to reduce effects on natural heritage particularly birds ▪ Economic benefit for the local community ▪ Provision of local employment opportunities and associated benefits

8.3 Data gaps and uncertainties

During the environmental impact assessment a number of data gaps were identified for which additional work was commissioned to inform the environmental statement and project decision making progress. Specific studies undertaken for the project have been included as Appendices to the main document.

The following studies were undertaken:

- Habitat and vegetation survey and impacts assessment (where required);
- Archaeological and Cultural heritage impact assessment including desk based assessment, site walk-over and visual impact assessment;
- Landscape and visual impact assessment to investigate the impact of the project on the landscape character and visual resource of each island;
- Cumulative Landscape and Visual impact assessment to investigate the potential for cumulative effects between the six HICEC supported project (to be summitted simultaneously to planning);
- Assessment of the potential for otter activity;
- Socio-economic assessment;
- Desk based noise and shadow flicker assessments.

Full details of the individuals and organisations used to undertake this work are provided with each report in the Appendices.

Section 9 References

9 References

Aquatera Ltd, 2007a. Bird Studies to support Rousay, Egilsay and Wyre Development Trust Community Turbine Project. Report to HICEC, Aquatera Ltd, September 2007.

Aquatera Ltd, 2007b. Bird Studies to support Eday Development Partnership Community Turbine Project. Report to HICEC, Aquatera Ltd, October 2007.

Aquatera Ltd, 2007c. Desk based Bird study to inform South Ronaldsay and Burray Development Trust Community Wind Energy Project., Auatera Ltd. September 2007.

Aquatera Ltd, 2007d. Bird Studies to support Shapinsay Development Trust Community Turbine Project. Report to HICEC, Aquatera Ltd, November 2007.

Arnold, H.R. 1993. Atlas of mammals in Britain. London: HMSO.

BERR, 2007: The Department for Business, Enterprise and Regulatory Reform (BERR) (formerly the DTI) Renewable Energy Pages: accessed on the 20th November 2007 http://www.dti.gov.uk/energy/sources/renewables/index.html

Berry, R. J. 2000. Orkney Nature. T & A D Poyser, Natural History Series.

Booth, C. 2005. Otter Population and distribution and other protected Wildlife Species. Report for Aurora Environmental Ltd, re printed in Conroy 2005.

Booth, C., 2007. Desk based report on the possible effects on Otters of the HICEC Wind Eneregy Development. Report to Scotrenewables November 2007.

BTO 2007. British Trust for Ornithology website. Birds of Conservation Concern pages. Available at: http://www.bto.org/psob/index.htm. Accessed on 23/01/08.

Carter, P.K.L. & Churchfield, S., 2006. Distribution and habitat occurrence of water shrews in Great Britain. Environment Agency Science Report SC010073/SR, The

Environment Agency, Bristol and The Mammal Society Research Report No. 7, The Mammal Society, London.

Conroy, J.W.H. & Bacon, P.J. 2005. Seasonal breeding in Eurasian otters (Lutra lutra) with specific reference to Scotland. In: The Return of the Otter in Europe – where and how? Sabhal Mor Ostaig, Isle of Skye 30 June – 5 July 2003. (Edited by Conroy, J.W.H., Yoxon, G., Gutleb, A.C. & Ruiz-Olmo, J.)
International Otter Survival Fund, Broadford, Isle of Skye.

Conroy, J.W.H. 2005. Otter Survey EMEC Trial Test Facility, Eday, Orkney: An assessment. Report prepared by Celtic Environmental Ltd. For Aurora Environmental Ltd, available at:
http://www.hie.co.uk/otter-survey-and-impact-assessment.pdf
Accessed on 23/01/08

Corbet, G. B. and Harris, S. (eds.) 1991. The Handbook of British Mammals (3rd edition). Oxford : Blackwell.

CRis Energy, 2007a. Eday Community Wind Energy Project Technical Assistance (Feasibility Study): Final Report to HICEC.

CRis Energy, 2007b Hoy Community Wind Energy Project Technical Assistance (Feasibility Study): Final Report to HICEC.

CRis Energy, 2007c. Rousay, Egilsay and Wyre Community Wind Energy Project Technical Assistance (Feasibility Study): Final Report to HICEC.

CRis Energy, 2007d. Shapinsay Community Wind Energy Project Technical Assistance (Feasibility Study): Final Report to HICEC.

CRis Energy, 2007e. South Ronsaldsay and Burray Community Wind Energy Project Technical Assistance (Feasibility Study): Final Report to HICEC.

CRis Energy, 2007f. Stronsay Community Wind Energy Project Technical Assistance (Feasibility Study): Final Report to HICEC.

Crossley, John, 2008. Habitats and Vegetation Report to Scotrenewables on the proposed HICEC Wind Energy Development Sites.

Carter, P.K.L. & Churchfield, S., 2006. Distribution and habitat occurrence of water shrews in Great Britain. Environment Agency Science Report SC010073/SR, The Environment Agency, Bristol and The Mammal Society Research Report No. 7, The Mammal Society, London.

DEFRA, 2007: Department for Environment, Food and Rural Affairs Climate Change Pages, accessed on the 20th November 2007. http://www.defra.gov.uk/ENVIRONMENT/climatechange/index.htm

DTI, 2007, Meeting the Energy Challenge A White Paper on Energy May 2007 Department of Trade and Industry, Crown Copyright 2007

DTI, 1996, The assessment and rating of noise from wind farms, ETSU-R-97, by the Working Group on Noise from Wind Turbines (Final Report, September 1996).

Eday Partnership, 2004, Eday Development Plan.

Firth Ecology, 2008. Stronsay Community Wind Turbine: Desk Study on Birds and potential Birds related impacts, report produced for Scotrenewables Wind Power Limited, April 2008.

Flux, J.E.C. 1970. Life history of the mountain hare (Lepus timidus scotius) in northeast Scotland. Journal of Zoology London 161: 75-123.

Gorman, M.L. & Reynolds, P. 1993. The impact of land-use change on voles and raptors. Mamm. Rev. 23: 121-126.

Harris, S., Morris, P., Wray, S. and Yalden, D. (1995). A review of British mammals: population estimates and conservation status of British mammals other than cetaceans. Peterborough: JNCC.

Herman JS and JF Haddow, 1997. Recorded distribution of bats in Scotland: article in Scottish Bats Vol. 4 1997, South East Scotland Bat Groups.

Hewson, R. 1976. A population study of mountain hares (Lepus timidus) in northeast Scotland from 1956-1969. Journal of Animal Ecology 45: 395-414.

HICEC, 2007. Website Available at: http://www.hie.co.uk/community-energy.html
Accessed 31/10/07

HM Government, 2007, Meeting the Energy Challenge: A White Paper on Energy, May 2007, Department of Trade and Industry, TSO, available at, http://www.berr.gov.uk/files/file39387.pdf, accessed on 15/03/08

IEMA, 2004 (Institute of Environmental Management and Assessment): Guidelines for Environmental Impacts Assessments.

International Panel on Climate Change (IPCC), 2001, Third Assessment Report - Climate Change, available at http://www.ipcc.ch/pub/un/syreng/spm.pdf, accessed on 15/03/08

Island Of Hoy Development Trust (IOHDT) Website
Available at: http://www.orkneycommunities.co.uk/iohdt/
Accessed 31/10/07

JNCC, unpublished. Scottish Otter Survey Database available of the National Biodiversity Network Gateway. Available at: http://www.searchnbn.net/datasetInfo/
Accessed on 23/11/07

JNCC, 2007. Protected sites designations directory. Available at http://www.jncc.gov.uk/page-1527. Accessed on the 28/01/08

Kruuk, H. 1995. Wild otters; predation and populations. Oxford University Press, Oxford.

Land Use Consultants, 1998, Orkney Landscape Character Assessment, Scottish Natural Heritage Review No. 100, SNH Battleby.

Macaulay Institute, 2007, Land research centre website accessed 28/11/07, http://www.macaulay.ac.uk/

Meek, E. 1995. Islands of Birds: A Guide to Orkneys Birds (3rd Ed.). RSPB.

MET office (UK Meteorological Office), unpublished data. Weather and climate statistics for Kirkwall, Orkney 1971-2000 averages. Crown Copyright.
Available at: http://www.metoffice.gov.uk/climate/uk/averages/19712000/sites/kirkwall.html
Accessed on 21/01/08

Mykura W., 1976 Orkney and Shetland: British Regional Geology, NERC Ist. Of Geological Sciences. The Stationary Office.

ORCA, 2008a, Orkney Research Centre for Archaeology, Archaeological and Cultural Heritage Impact Assessment: Sandybank, Eday, Orkney. Report to Scotrenewables Ltd to support the HICEC application.

ORCA, 2008b, Orkney Research Centre for Archaeology, Archaeological and Cultural Heritage Impact Assessment; Ore Farm, Hoy, Orkney. Report to Scotrenewables Ltd to support the HICEC application.

ORCA, 2008c, Orkney Research Centre for Archaeology, Archaeological and Cultural Heritage Impact Assessment; Kingarly, Rousay, Orkney. Report to Scotrenewables Ltd to support the HICEC application.

ORCA, 2008d, Orkney Research Centre for Archaeology, Archaeological and Cultural Heritage Impact Assessment; Howe, Shapinsay, Orkney. Report to Scotrenewables Ltd to support the HICEC application.

ORCA, 2008e, Orkney Research Centre for Archaeology, Archaeological and Cultural Heritage Impact Assessment; Berridale, South Ronaldsay, Orkney. Report to Scotrenewables Ltd to support the HICEC application.

ORCA, 2008f, Orkney Research Centre for Archaeology, Archaeological and Cultural Heritage Impact Assessment; Rothiesholm, Stronsay, Orkney. Report to Scotrenewables Ltd to support the HICEC application.

Orkney Islands Council, 2008, Development Services Policy and Projects: Supplementary Planning Guidance Onshore Wind Energy Development, Final Draft May 2008.

Orkney Islands Council, 2004, The Orkney Local Plan Written Statement, Department of Development, OIC, Kirkwall.

Orkney Local Economic Forum, 2003, Notes on the 2001 census, Paper No. LEF 04/03

Scottish Government, 2007, Rural Development web pages, accessed on the 21st November 2007. http://www.scotland.gov.uk/Topics/Rural

Scottish Executive, 2006, Changing Our Ways: Scotland's Climate Change Programme, Scottish Executive Crown Copyright 2006, available at http://www.scotland.gov.uk/Resource/Doc/100896/0024396.pdf, accessed on 15/03/08

Scottish Executive, 2005, Choosing Our Future: Scotland's Sustainable Development Strategy, Scottish Executive, Crown Copyright 2005

Scottish Executive, 2003, Securing a Renewable Future: Scotland's Renewable Energy Scottish Executive, Crown Copyright 2003

SHN (Scottish Natural Heritage) SiteLink, 2007a. Scottish Natural Heritage designated areas information service. Available at http://www.snh.org.uk/snhi/. Accessed during 11/12 2007.

SNH (Scottish Natural Heritage), 2007b, Report on preliminary analyses of changes in the first flowering dates of a range of plants between 1978 and 2001. Available at: http://www.snh.org.uk/press/detail.asp?id=930, accessed on 15/03/08

SNH Guidance, 2006, Assessing Significance of impacts from onshore windfarms on birds out-with designated areas, July 2006. SNH Battleby, Perthshire.

Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds). 2001. The UK SPA network: its scope and content. JNCC, Peterborough.
Volume 1: Rationale for the selection of sites. 90 pp.
Volume 2: Species accounts. 438 pp.
Volume 3: Site accounts. 392 pp.

OEP (The Orkney Environment Partnership), 2002. The Orkney Local Biodiversity Action Plan: A plan for action to conserve Orkney's biodiversity. Prepared by Orkney's Biodiversity Steering Group for the Orkney Environment Partnership. The Orcadian Ltd, Kirkwall, Orkney.

Royal Commission on Environmental Pollution, 2004, 22nd Report, available at: http://www.rcep.org.uk/newenergy.htm, accessed on 15/03/08

UKBAP, 2007. UK Biodiversity Action Plan: Species Action Plans available at: http://www.ukbap.org.uk/species.aspx, accessed on 10/01/08

UN Secretary-General Ban Ki-moon, Address to the High-Level Segment of the UN Climate Change Conference, Bali, Indonesia, 12 December 2007. Full speech available from: http://www.un.org/apps/news/infocus/sgspeeches/statments_full.asp?statID=161, accessed on 15/03/08

United Nations, 1998, Kyotot Protocaol to the United Nations Framework Convention on Climate Change, available at http://unfccc.int/resource/docs/convkp/kpeng.pdf, accessed on 15/03/08

Watson, I. G. 2003, A report produced for Orkney Islands Council – Air Quality in Orkney: Updating Screening and Assessment, April 2003.

Williams, 2007. (Ed.) Orkney Bird Report, Orkney Bird Report Committee 2007.

Wilson, D. E., and Reeder, D. M. 2005, (Eds.): Mammal Species of the World, 3rd edition, Johns Hopkins University Press, 292.