# 16 Other Issues

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# 16 Other Issues

## 16.1 Executive Summary

16.1.1 This chapter covers the following technical disciplines:

- television and telecommunications;
- marine radar; and
- carbon calculator.

16.1.2 A review of telecommunications links showed a Joint Radio Company (JRC) link crossing the site. Further analysis and consultation was undertaken by JRC to agree the acceptable locations for turbines.

16.1.3 Consultation was undertaken with Orkney Islands Council (OIC) Marine Services who identified a potential impact to their marine radar system as a result of the Proposed Development. To mitigate this a condition will be imposed on the consent for a bond to mitigate any impacts that arise during the first 12 months of operation.

16.1.4 Although the Proposed Development will generate carbon free electricity, carbon will be released during the manufacturing, delivery and construction of the wind farm. Vestas lifecycle analysis was used to estimate the carbon released by the Proposed Development and compare it to the carbon saved by the generation of carbon free electricity. It is estimated that carbon generation will be offset by the Proposed Development's carbon savings within three months of operation. The site would in effect be in a net gain situation following the estimated three month carbon payback period and will be contributing to national objectives of reducing greenhouse gas emissions. Therefore, the Proposed Development is evaluated to have a beneficial effect on meeting current climate change targets.

## 16.2 Telecommunications

16.2.1 This section considers the likely effects of the Proposed Development on telecommunications infrastructure, both within the site and in the wider area, during construction and operation.

16.2.2 Wind turbines like any other large structure have the potential to interfere with electromagnetic signals, which are used in a variety of communications. If sited within or near to the path between a transmitter and its intended receiver a turbine has the potential to degrade the signal performance. The two possible mechanisms for signal degradation for terrestrial transmissions are physical blocking by the structure, or reflection from the structure sides. Physical blocking will create a 'shadow' zone behind the structure where there will be a reduction in signal levels. The reflection of signals from the tower and rotating blades of wind turbines can cause complex fluctuations in signal reception. Interference can disrupt the image resulting in a delayed image on screen.

### *Legislation, Policy and Guidelines*

16.2.3 The assessment has been informed by relevant legislation, policy and guidelines, details of which are provided below.

- Wireless Telegraphy Act (2006);
- The Orkney Local Development Plan (Orkney Islands Council, 2017a);
- The Orkney Local Development Plan. Supplementary Guidance: Energy (Orkney Islands Council 2017b);
- Planning Advice Note: PAN 62 Radio Telecommunications (2001); and
- Tall structures and their impact on broadcast and other wireless services (Ofcom 2009).

### *Consultation*

16.2.4 Consultation was undertaken with relevant statutory and non-statutory stakeholders to identify any fixed wireless links or scanning telemetry links in the area, and a summary of their responses are set out in Table 16.1 below.

**Table 16.1 – Consultee Responses**

| Consultee | Response | Actions |
|---|---|---|
| Joint Radio Company | JRC confirm that two UHF telemetry links and one microwave point to point link belonging to Scottish and Southern Electricity Networks (Hydro) (SSE) are within the coordination zone. | A confidential desk study was conducted by JRC to identify the exact locations of the links and suitable locations for the turbines to ensure no impacts would result from the Proposed Development. |
| Atkins | No objection | No further action required |
| Boston Networks | Links identified in the study area, however no objection to the Proposed Development. | No further action required |
| Arqiva | Links identified in the study area, however no objection to the Proposed Development. | No further action required |
| BT | Links identified in the study area, however no objection to the Proposed Development. | No further action required |
| OIC | Links identified in the study area, considered unlikely to result in any conflicts. | No further action required |
| MBN/Everything Everywhere | Links identified in the study area, however no objection to the Proposed Development. | No further action required |
| Vodafone | Links identified in the study area, however no objection to the Proposed Development. | No further action required |
| Airwave Solutions Ltd | Links identified in the study area. | Further analysis undertaken via a study to be commissioned by Airwave Solutions Ltd.'s consultants. The confidential report confirmed no conflicts. |

## *Assessment Methodology*

16.2.5 This section describes the methods by which the key baseline conditions were identified and how the potential effects of the Proposed Development on these has been assessed.

**Telecommunications**

16.2.6 Consultation has been undertaken with the relevant telecommunication providers to determine the potential for impacts from the Proposed Development (refer to Table 16.1 above).

**Television**

16.2.7 The nearest transmitters have been identified and the transmission between them, the Proposed Development and residential properties beyond the Proposed Development have been considered, together with appropriate mitigation measures.

## *Baseline Conditions*

**Telecommunications**

16.2.8 As detailed above, the baseline was determined through consultation with the key stakeholders, this process identified that there is one UHF telemetry link within the site boundary and one UHF telemetry link and one point to point microwave link in close proximity of the site.

**Television**

16.2.9 Since 2010 the North of Scotland including the Orkney Islands has been fully switched over to digital television from the previous terrestrial signals. Digital signals are considered to be less susceptible to disruption from reflections and do not suffer from ghosting. Digital transmitter powers increased to around ten times previous levels at the point of digital switchover. At the same time digital signals were added to the relay transmitter network. These improvements greatly increased the availability and robustness of digital terrestrial reception.

16.2.10 The closest television transmitter to the Proposed Development Area is the Keelylang Hill transmitter on the Mainland of Orkney. A second transmitter at Rumster Forest in Caithness was also identified as giving coverage to the area. Both transmitters have switched to digital transmission only.

## *Likely Effects*

**Telecommunications**

16.2.11 The Proposed Development has been designed to avoid impacts to the links through the turbine iteration process (refer to Chapter 2). No impacts or effects upon telecommunication links are anticipated as a result of the Proposed Development.

**Television**

16.2.12 The Proposed Development would be located between the Keelylang Hill transmitter and residential properties on the north-west corner of Shapinsay, southern half of Eday and on Sanday. Therefore there is potential for the Proposed Development to have a significant impact on the television signal at these locations, although it is considered unlikely given the relative heights of the transmitter and the properties.

## *Mitigation*

**Telecommunications**

16.2.13 Although no impacts or effects are anticipated on telecommunication links, the Proposed Development will have a micro-siting allowance of up to 50 m in all directions in respect of each turbine and its associated infrastructure in order to address any potential difficulties which may arise in the event that preconstruction surveys identify unsuitable ground conditions or

environmental constraints that could be avoided. In order to ensure this micro-siting allowance does not impact upon telecommunication links, turbine T5 which will not be micro-sited between 141° and 341°.

**Television**

16.2.14 As noted above it is determined that the Proposed Development has the potential to impact upon television signal. Should a complaint arise from a resident on the north-west corner of Shapinsay, southern half of Eday or on Sanday the Applicant will fully investigate and provide alternative television reception, for example a satellite dish, should it be determined that the Proposed Development is the cause of an unacceptable level of interference. It is proposed that this is secured through a mitigation scheme requirement condition attached to the permission.

### *Residual Effects*

16.2.15 Through the implementation of the proposed mitigation measures no residual impacts or effects upon telecommunication links or television services from the Proposed Development are anticipated and it is therefore deemed that there is no significant effect as a result of the Proposed Development.

### *Cumulative Effects*

16.2.16 As no residual effects from the Proposed Development alone are anticipated, the Proposed Development will not have cumulative effects with other wind farm developments on telecommunication or television links.

### *Summary*

16.2.17 This section has reported on the assessment of the potential effects of the Proposed Development on television and telecommunications infrastructure, both within the site and in the wider area.

16.2.18 Through implementing design changes and conditions to the consent the Proposed Development will have no residual effects on television or telecommunication links.

## 16.3 Marine Radar

### *Introduction*

16.3.1 This section considers the likely effects of the Proposed Development on Marine Radar infrastructure.

16.3.2 Wind turbines have the potential to disrupt Marine Radar leading to effects such as ghost targets, multiple reflections, target spreading, shadowing and side lobe detection.

16.3.3 A ghost target is an illusion whereby the reflected wave arrives at the actual target but returns on a path that is not the shortest path. This makes it difficult to accurately detect an object and decreases the reliability of the sensor by increasing the probability of false alarm (Ryu, Won and Kwon, 2018).

16.3.4 Target spreading occurs when a relatively far away large object is detected across the whole radar beam width. Target spreading within wind farms creates difficulties when attempting to identify specific targets (Rashid and Brown 2010).

16.3.5 Shadowing due to object obstruction can result in the prevention of detecting specific objects, such as other turbines or landforms.

### *Consultation*

16.3.6 OIC's Marine Services department has been consulted with respect to any marine and shipping radar installations and the potential for the Proposed Development to create conflicts with any such installations (refer to Table 16.2).

**Table 16.2 - Consultation with OIC Marine Services**

| Consultee | Consultation Undertaken |
|---|---|
| Marine Services and Harbour Authority: Orkney Islands Council (Sept 2019) | Marine Services and Harbour Authority are concerned that turbines near the radar effect the radars by preventing/distorting the tracking of vessels. |
| Marine Services and Harbour Authority: Orkney Islands Council (Oct 2019) | The Applicant and Marine Services met to discuss the baseline services and the potential issues that may arise due to the Proposed Development. |
| Marine Services and Harbour Authority: Orkney Islands Council (Dec 2019) | The Applicant and Marine Services met to discuss the baseline described in Appendix 16.1 and consider potential mitigation options. The operational turbine at Hatston was granted consent based on a planning condition that required a £100,000 bond in place for the first 6 months of operation to pay for any mitigation should the turbine cause an impact to the Kirkwall radar. No impact was caused, and the bond was released. The Applicant has suggested a similar planning condition for the Proposed Development. |
| Marine Services and Harbour Authority: Orkney Islands Council (Jan 2020) | Marine Services requested that the bond should be in pace for the first 12 months of operation. The value of the bond will be agreed between the Applicant and Marine Services. |

## *Assessment Methodology and Significance Criteria*

16.3.7 This section describes the methods by which the baseline marine radar infrastructure has been identified and how the likely effects of the Proposed Development on this infrastructure have been assessed.

**Assessment**

16.3.8 An analysis of the potential impacts of the Proposed Development on the marine radar was undertaken by Anatec Ltd and provided in Appendix 16.1.

## *Baseline Conditions*

16.3.9 There are six Automatic Identification System (AIS) and radar sites across Orkney which form part of the Orkney Harbour Authority Vessel Traffic Services (VTS). The closest one to the Proposed Development is located on Wideford Hill (Kirkwall Radar) (refer to Appendix 16.1).

16.3.10 Within 3 nautical miles (nm) of the Proposed Development on average 25 unique vessels were recorded per day (noting that this only includes those which have an AIS system on board (smaller fishing vessels, recreational vessels and military vessels are not required to broadcast on AIS) to allow for direct counting of the vessel and does not include vessels making multiple trips on the same day).

## *Likely Effects*

16.3.11 As described above, wind turbines have the potential to disrupt radars leading to effects such as radar shadow and multiple echoes. All likely effects are described in detail within Appendix 16.1 and summarised below.

**Radar Shadow**

16.3.12 Due to the technology of modern radars, it is estimated that there would be no effect on vessels being tracked by the Kirkwall Radar station when passing north of the site and into the radar shadow and the vessels would continue to be tracked. There are limited number of vessels using the affected the area due to the shallow water and there will be no impacts to the main shipping channel leaving Kirkwall.

16.3.13 Small vessels which are stationary with a turbine located in between the vessel and the radar could theoretically be dropped by the Kirkwall Radar and therefore would be no longer detected.

**Multiple Echoes**

16.3.14 Radar studies undertaken at existing United Kingdom (UK) offshore wind farms have shown that vessels may generate multiple echoes on shore based radar scanners where vessels are within 0.5 nm of a wind turbine.

16.3.15 Noting the shallow waters adjacent to the site, there are not anticipated to be a large number of vessels within 0.5nm of the wind turbines. There is also a significant amount of clear space amongst the returns to ensure the recognition of vessels moving amongst and behind structures. Therefore, the effects of multiple echoes on vessels surrounding and adjacent to the site would be of a low level. Echoes on vessel marine radars have been found to be manageable by mariners using their existing controls (as per MGN 372(Maritime and Coastguard Agency, 2008)).

### *Requirements for Mitigation*

16.3.16 In order to mitigate for the potential impacts to marine radar by the Proposed Development the Applicant proposes that a bond will be in place for the first 12 months through a mitigation scheme requirement condition attached to the permission. The bond would be released after 12 months at the discretion of the Department of Marine Services assuming no unacceptable impacts from the Proposed Development. The value of the bond will be agreed between the Applicant and Marine Services.

### *Residual Effects*

16.3.17 As the mitigation proposed would ensure that there are no impacts to the VTS system by the Proposed Development no residual effects to marine radar are anticipated.

## 16.4 Air Quality

### *Introduction*

16.4.1 This Section considers the potential for air quality impacts from the Proposed Development. The release and offsetting of carbon by the Proposed Development is covered in Section 16.5.

### *Consultation*

16.4.2 OIC requested an assessment of air quality with the EIA Scoping Opinion.

**Table 16.3 - Consultation with OIC**

| Consultee | Consultation Response | Applicant Response |
|---|---|---|
| Orkney Islands Council (Scoping Opinion) | It is noted that potential quarrying is highlighted within the scoping report within section 15.3.1. Impacts for sourcing of stone should be fully addressed with the impact of such development considering environmental, transport, visual, air quality and potential heritage impacts | The Applicant can confirm that no quarrying or borrow pit are proposed as part of the Proposed Development. |

| Consultee | Consultation Response | Applicant Response |
|---|---|---|
| | arising from such. In the event that sourcing of stone on site via borrow pits is used, this would require further assessment for environmental affects arising within the EIA Report with consideration and comparison of environmental impacts accruing between sourcing stone from pre-existing quarries and the use of on-site borrow pits. A map and site layout of borrow pits together with borrow pit site management plan of pollution prevention measures will be required. Mitigation measures should be identified to avoid or minimise the potential for adverse impacts. A restoration plan for any such borrow pits should also be prepared. | |
| | Full assessment of the impacts on air quality should be provided within the EIA report. | The traffic levels and air emissions from the Proposed Development do not meet the requirements for a full air quality assessment. |
| Environmental Health Officer (OIC) (September 2019) | With respect to Air Quality our comments at Scoping stage were based on the potential for any quarrying of borrow pits etc. on site that could result in adverse Air Quality/dust impacts. We now understand significant ground works of this this are not expected, therefore we have no adverse comments regarding Air Quality risks from the proposed development. | No action |
| Planning Officer (OIC) 9November 2019) | Given the information submitted to the OIC Environmental Health Officer and pasted onto me on the 25th October I note what you say, however you have not provided any detailed information of where materials will come from and the status of that site/quarry you will be using, therefore although you indicate that no borrow pits and/or quarrying on site at Quanterness Wind Farm. Without clear information on where material will come from and how it would be transported to site I am not in a position to amend the opinion given within the scoping opinion as there is still a potential for impacting on air quality and environment | The location of materials for site has not been identified as this will be open to competitive tender by OIC following consent of the Proposed Development. OIC will implement a strict tender procedure and will ensure that all providers of materials have appropriate licences (e.g. PPC licence) and have undertaken appropriate assessments as part of their consent to operate. Similarly, any haulier employed by OIC (which will need to be appointed through competitive tender) will be required to ensure they implement best practice for the control of dust, for example |

| Consultee | Consultation Response | Applicant Response |
|---|---|---|
| | | the sheeting of vehicles during transit and wheel-washes. |

## *Methodology*

**Baseline**

16.4.4 The air quality baseline was identified through Orkney Islands Council Air Quality Annual Progress Report 2019 (OIC, 2019a).

**Traffic Assessment**

16.1.1 Assessment of construction and operation traffic is undertaken in line with the Institute of Air Quality Management (IAQM) Land Use Planning and Development Control: Planning for Air Quality guidance which sets out indicative criteria for requiring an air quality assessment as per Table 16.4.

**Table 16.4 – Criteria for Air Quality Assessment**

| The development will: | Criteria to Proceed to an Air Quality Assessment |
|---|---|
| 1. Cause a significant change in Light Duty Vehicle (LDV)<br>traffic flows on local roads with relevant receptors. (LDV<br>= cars and small vans <3.5t gross vehicle weight). | A change of LDV flows of:<br>- more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an Air Quality Management Area (AQMA)<br>- more than 500 AADT elsewhere. |
| 2. Cause a significant change in Heavy Duty Vehicle (HDV)<br>flows on local roads with relevant receptors. (HDV =<br>goods vehicles + buses >3.5t gross vehicle weight). | A change of HDV flows of:<br>- more than 25 AADT within or adjacent to an AQMA<br>- more than 100 AADT elsewhere |

**Dust Assessment**

16.4.5 Fugitive emissions of airborne particulate matter are readily produced through the action of abrasive forces on materials and therefore a wide range of site preparation and construction activities have the potential to generate this type of emissions, including:

- demolition work;
- earthworks, including the handling, working and storage of materials;
- construction activities; and
- the transfer of dust-making materials from the site onto the local road network known as track-out.

16.4.6 The IAQM adopts a broad definition of dust that includes the potential for changes in airborne concentration, changes in deposition rates and the risk to human health and public amenity, when considering the significance of effects from emissions of fugitive particulate matter.

16.4.7 The nature of the impact requiring assessment varies between different types of receptor. In general, receptors associated with higher baseline dust deposition rates are less sensitive to impacts, such as farms, light and heavy industry or outdoor storage facilities. In comparison some hi-technology industries or food processing plants operate under clean air conditions and increased airborne particulate matter concentrations may have an increased economic cost associated with the extraction of more material by the plants air filtration units.

16.4.8 A qualitative assessment of construction phase dust and fine particulate emissions will be undertaken in accordance with the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2016). It is assumed that a desk-based assessment will be sufficient without any additional baseline dust monitoring

## *Baseline*

16.4.9 The Proposed Development is not within an AQMA and there is no AQMA within Orkney. The Annual Report states that Orkney is currently meeting the air quality objectives and that pollutant levels remain consistently low with no significant risk of Orkney exceeding these objectives. The Council has not identified any areas where action is required to improve air quality (OIC, 2019a).

## *Potential Effects*

**Construction**

Traffic

16.4.10 The site is not located within an Air Quality Management Area and the anticipated traffic flows for LDVs and HDV are less than the criteria outlined in Table 16.4 (a maximum of 56 and 52 respectively per day) (refer to Chapter 12 for further details). Therefore, no air quality assessment is required, and no significant effects are anticipated.

Dust

16.4.11 Although emissions/dust may be created during construction of the Proposed Development these would be controlled through legislation (e.g. Pollution Act) and standard best practice (e.g. as outlined by Institute of Air Quality Management Guidance on the Assessment of Dust from Demolition and Construction) which would be detailed in the Construction Environmental Management Plan (CEMP) (refer to Appendix 3.2). As per the guidance, as no impacts are anticipated following the implementation of the mitigation, no assessment is required, and no significant effects anticipated.

**Operation**

Traffic

16.4.12 During operation there will be approximately one vehicle a week visiting the site (refer to Chapter 12), which is less than the criteria outlined above (refer to Table 16.4). Therefore, no air quality assessment is required, and no significant effects are anticipated.

## *Mitigation*

16.4.13 As mentioned in paragraph 16.4.11 the CEMP would contain standard best practice for the control of dust during construction which will be implemented during construction. This will include, but is not limited to:

- maintaining a water bowser on site to suppress dust along the access tracks as required;
- using a water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site;
- ensuring fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during deliver;

- ensuring sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case it will ensure that appropriate control measures are in place; and
- stripping of topsoil will occur as close as reasonably practicable to the period of excavation or other earthworks activities to avoid risks associated with run-off or dust generation.

16.4.14 Refer to Appendix 3.2 for further details.

### *Residual Effects*

16.4.15 No residual effects from traffic or dust emissions are anticipated due to the Proposed Development.

## 16.5 Carbon Savings

### *Introduction*

16.5.1 Increasing atmospheric concentrations of greenhouse gases (GHGs), including carbon dioxide ($CO_2$) – also referred to as carbon emissions – is resulting in climate change. A major contributor to this increase in GHG emissions is the burning of fossil fuels. With concern growing over climate change, reducing its cause is of utmost importance. The replacement of traditional fossil fuel power generation with renewable energy sources provides high potential for the reduction of GHG emissions. This is reflected in UK and Scottish Governments climate change and renewable energy policy.

16.5.2 The Intergovernmental Panel on Climate Change (IPCC) has warned that human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels and at the current rate global warming is likely to reach 1.5°C between 2030 and 2052 (IPCC, 2018). Following this, the Scottish Government and Orkney Islands Council both declared a climate emergency in May 2019, with OIC stating "This declaration serves to leave no doubt of the Council's focus on and commitment to reducing our carbon footprint…we'll seek to continue to support the pioneering renewables scene in Orkney – whether that is tidal, wave, wind, hydrogen or biofuels" (OIC, 2019b).

16.5.3 However, no form of electricity generation is completely carbon free; for onshore wind farms, there will be emissions as a result of manufacture of turbines, as well as emissions from both construction and decommissioning (if required) activities and transportation of materials to site.

16.5.4 In addition to the lifecycle emissions from the turbines and associated wind farm infrastructure, where a wind farm is located on carbon rich soils such as peat or within woodland, there are potential emissions resulting from direct action of excavating peat and/or felling trees for construction. The footprint of a wind farm's infrastructure will also decrease the area covered by carbon-fixing vegetation. Carbon losses and gains during the construction and lifetime of a wind farm and the long term impacts on the land on which they are sited need to be evaluated in order to understand the consequences of permitting such developments.

16.5.5 The aim of this section is to provide clear information about the whole life carbon balance of the Proposed Development to provide a context for carbon payback of the Proposed Development, and in response to queries during public consultation, requesting for information about the carbon budget of the Proposed Development.

16.5.6 In determining whether an application to build and operate a wind farm should be consented, the assessment of potential carbon losses and savings is a material consideration (Orkney Islands Council, 2019c).

### *Legislation, Policy and Guidelines*

#### Legislation

16.5.7 The key legislation for the Scottish Government's renewable targets are:

- the Climate Change (Scotland) Act, 2009;
- the Climate Change Act 2008 (2050 Target Amendment) Order 2019; and
- the Climate Change (Emissions Reductions Targets) (Scotland) Act 2019.

16.5.8 These create the statutory framework for greenhouse gas emissions reductions in Scotland and the recent Climate Change Act set a target of net-zero emissions by 2045. Decarbonisation of grid electricity through increasing the percentage of electricity generated by renewables is identified as one of the key ways to deliver carbon emission reductions.

**Policy**

16.5.9 Full details of the relevant policies are provided in Chapter 5 and include:

- Orkney Islands Council Statutory Development Plan (Orkney Islands Council, 2017a);
- Orkney Islands Council Supplementary Guidance: Energy (Orkney Islands Council, 2017b);
- Development Management Guidance on Energy (Orkney Islands Council, 2019c);
- Scottish Planning Policy (Scottish Government, 2014);
- Orkney Islands Council Council Plan and Delivery Plan (Orkney Islands Council, 2018);
- Sustainable Orkney Energy Strategy 2017-2025 (Energy of Orkney, 2017);
- Climate Change Plan, The Third Report on Proposals and Policies 2018-2032 February 2018 (Scottish Government, 2018); and
- Orkney Islands Council Declaration of a Climate Emergency (Orkney Islands Council, 2019b).

**Guidance**

16.5.10 In 2008 the Scottish Government funded a research report called Calculating carbon savings from wind farms on Scottish peat lands: a new approach (Nayak *et al,* 2008 and 2010 and Smith et al., 2011) and associated excel tool (referred to henceforth as the "Carbon Calculator") which utilises a life cycle methodology approach to estimating the wider emissions and savings of carbon associated with wind farms and for calculating how long the development will take to 'pay back' the carbon emitted during its construction. However, this tool was not designed for sites with no peat, like the Proposed Development site, and therefore is not appropriate to assess the carbon balance of the Proposed Development.

16.5.11 Although the Applicant has not confirmed which turbine would be erected at the site, should the Proposed Development be granted consent, a candidate turbine has been used for the assessment within this EIA Report. The candidate turbine is a Vestas V136 4.2 MW machine. Vestas have undertaken a full life assessment for this machine based on a 100 MW development (Vestas, 2019). This document has therefore been used to determine the carbon emissions and savings of the Proposed Development.

**Methodology**

16.5.12 The carbon emissions and carbon savings of the Proposed Development have been extrapolated based on the Vestas V136 4.2 MW candidate turbine lifecycle analysis undertaken by Vestas (Vestas, 2019). The Proposed Development has indicative capacity of 28.8 MW based on available turbines, however assuming a Vestas V136 4.2 MW machine is used the capacity would be 25.2 MW.

16.5.13 The lifecycle analysis by Vestas assumes an operational lifespan of 20 years, while the Applicant is applying for an in-perpetuity consent for the Proposed Development.

16.5.14 Therefore the results of the assessment below are conservative, as the Proposed Development may generate more renewable electricity than is assessed annually, and will be operational for longer.

### *Results*

16.5.15 Vestas anticipates 5.6 g $CO_2$-e (0.0000056 tonnes $CO_2$-e) will be produced per kWh of electricity generated across the lifespan of a turbine[1]. This is dominated by the manufacturing stage of the life cycle (83%), in particular production of the tower, nacelle, gear and mainshaft, foundations, blades and cables[2].

16.5.16 The Proposed Development built using six V136 4.2 MW machines is predicted to generate 84,548 MWh per annum (84,548,000 kWh per annum)[3], equating to 1,690,960 MWh (1,690,960,000 kWh) over a 20 year period[4].

16.5.17 Therefore the Proposed Development is estimated to generate approximately 9,469 tonnes $CO_2$-e[5] during the manufacturing, erection, operation and end-of-life processes.

16.5.18 The Proposed Development built using six V136 4.2 MW machines is predicted to save 38,046 tonnes $CO_2$-e per year[6] or 3,170 tonnes $CO_2$-e per month[7] in comparison with equivalent electricity generation by a fossil fuel mix. Therefore the payback period for the Proposed Development to offset the $CO_2$-e released during its lifespan (assuming operation for 20 years) is estimated to be 3 months[8]. This clearly indicates that the Proposed Development would provide a benefit in terms of renewable electricity generation and carbon reduction, given that after a very short (three month) payback period, the in-perpetuity operation of the Proposed Development would deliver carbon-free electricity and displace carbon emissions which would otherwise result from energy generation by fossil fuels.

### *Assessment of the Impact of the Proposed Development on Orkney's Carbon Footprint*

16.5.19 Data from BEIS (2019a) shows that Orkneys Carbon footprint in 2017 (the most recent year for which analysis is available) was 192,490 tonnes of $CO_2$-e . Notable exceptions from the BEIS figures include domestic and international aviation and shipping along with military transport and exports. Given Orkney's island location and reliance on shipping and aviation for lifeline links, the figures for Orkney's Carbon footprint are therefore likely to be significantly underestimated.

16.5.20 Although Orkney is known to generate more than its net annual electricity needs from renewables already (OREF, 2018), electricity only accounts for 25% of Orkney's energy use (BEIS, 2019b). There is significant carbon production from other sectors.

16.5.21 Based on the BEIS (2019a) figure for Orkney's Carbon emissions and the expected annual savings against fossil fuel-mix electricity generation, the Proposed Development would offset Orkney's estimated carbon footprint (as noted above) by 19.77%.

16.5.22 The Proposed Development is assumed to contribute 28.8 MW to the Needs Case for a new interconnector for Orkney. Ofgem has stipulated that 135MW of new generation is required to

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[1] Vestas (2019) – page 50, Table 8, assumed to be 20 years

[2] Vestas (2019) – page 58, section 5.2.6

[3] This has been calculated by multiplying the annual capacity of the Proposed Development based on a 4.2 MW turbine (25.2 MW) by the hours in a year (8760) by the capacity factor (38.3%) (Renewable UK, 2019).

[4] 84,548 MWh per year multiplied by 20 years.

[5] Calculated by multiplying the kWH per annum of electricity generated (1,690,960,000 KWh) by the tonnes of $CO_2$-e produced (0.0000056 tonnes $CO_2$-e)

[6] This has been calculated by multiplying the GWh pa of the Proposed Development (84.548 GWh) by the number of tonnes of carbon which fossil fuels would have produced to generate the same amount of electricity (450 tonnes of carbon dioxide per GWh of electricity) (Renewable UK, 2019).

[7] 38,046 $CO_2$-e divided by 12 months.

[8] 9,469.4 tonnes $CO_2$-e generated over the lifespan of the Proposed Development divided by 3,170 tonnes CO2-e saved per month by generating renewable energy.

trigger construction of a new 220 MW cable, and only onshore wind projects currently under development have any chance of contributing to that figure. The Proposed Development therefore contributes 21% of the required capacity to trigger the cable and would require about 13% of the available capacity on the cable.

16.5.23 Although it is not practical to determine the exact carbon savings of all the renewable energy projects which would use the interconnector cable, given the scale of the potential renewable energy generation, it is possible that Orkney Islands could become a net zero emissions local authority area as a result of the new cable. The Proposed Development would contribute to achieving this goal, through both its carbon savings, and its contribution to the needs case for the new interconnector cable.

### *Summary*

16.5.24 Although the Proposed Development will generate carbon free electricity, carbon will be released during the manufacturing, delivery and construction of the wind farm. However, this generation of carbon is minimal in comparison to the generation of carbon free electricity, and it is estimated that carbon generation will be offset by the Proposed Development's carbon savings within three months. Compared to fossil fuel electricity generation projects, which also produce embodied emissions during the construction phase and significant emissions during operation due to combustion of fossil fuels, the Proposed Development has a very low carbon footprint and the electricity generated will displace grid electricity generated from fossil fuel sources. The site would in effect be in a net gain situation following the estimated three month carbon payback period and will be contributing to national objectives of reducing greenhouse gas emissions. Therefore, the Proposed Development is evaluated to have a beneficial effect on meeting current climate change targets.

## 16.6 References


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