20 Telecommunications

20.1 Introduction

Overview

20.1.1 Wind turbines, like any large structure have the potential to affect electromagnetic communication signals. Adverse or significant impacts can be avoided or mitigated by siting the turbines outside of any safeguarding buffer zones, re-routing the links or modifying the transmission equipment.

20.1.2 The Office of Communications (Ofcom) is the regulator for the UK communications industries and is responsible for dealing with any complaints of interference to communication mediums including television, radio, and telecommunications.

20.1.3 This Chapter has been prepared by Wardell Armstrong, who have extensive experience in providing electromagnetic interference (EMI) studies for wind farms to determine whether there is any likelihood of turbines effecting telecommunications links in the vicinity. This experience has been gained across the whole of the UK including Scotland.

20.1.4 Since the preparation of this chapter an updated consultation has been undertaken with telecommunications operators and infrastructure providers to check if there have been any changes since the Beaw Field Wind Farm was granted planning permission.

Microwave links

20.1.5 Wind turbines have the potential to affect microwave telecommunication links if developed in or near the path of the signal. Microwave links rely on 'line of sight' to beam signals from one location to another. Line of Sight essentially means a straight line along which the signal path is unobstructed.

20.1.6 Operators of these links will often ascribe a safeguarding buffer zone around the line of sight of a microwave link in order to ensure they are unobstructed. Should a link be identified that traverses the potential development site then it is usually possible to move the turbine(s) outside of the zone of influence to mitigate any potential issues. If this is not possible then it is also sometimes feasible to move one of the link endpoints or divert the signal around the windfarm (such mitigation is discussed more fully in Paragraph 20.7.3 in relation to the Consented Development).

Ultra High Frequency (UHF) telemetry links

20.1.7 UHF telemetry links work in similar way to microwave links but do not rely on line of sight. They are therefore less sensitive to wind farms but can still be affected in certain circumstances.

TV & radio

20.1.8 Wind turbines also have the potential to cause reception problems to terrestrial television transmissions. The two potential types of interference are 'shadowing' effects and 'reflection' effects.

20.1.9 'Shadowing' is the effect wherein the received signal power fluctuates due to objects obstructing the propagation path between transmitter and receiver. 'Reflection' can be caused by a large object scattering the incident signal. In these instances, a direct signal travels to a receiver while a signal

reflected by the object travels further and thus arrives later. This can result in a 'delayed' or 'ghosted' image on the screen.

20.1.10 The entire STV North Scotland region which includes the Shetland Islands completed its digital switchover in October 2010. There is, therefore, no need to consider potential degradation to analogue signals any further. Digital television signals are considerably more robust than analogue signals and are less likely to be affected.

20.2 Legislative framework

20.2.1 Ofcom is an independent regulatory body whose primary duties are set out in the Communications Act of 2003. These include ensuring optimal use of the electromagnetic spectrum. In addition, under the Wireless Telegraphy Act of 2006, Ofcom is responsible for protecting the spectrum from interference or abuse, be it either deliberately or unintentionally caused. Under this act Ofcom have no powers of remedy should interference take place. Instead, the focus is on up front identification and mitigation in order to avoid any conflicts.

20.2.2 As a result of this Ofcom provides a fixed link clearance service to help ensure compatibility between proposed wind turbines and existing fixed point to point links that make use of Ofcom-assigned spectrum.

20.3 Methodology

Study area definition

20.3.1 For the purpose of this assessment the Study Area was considered to be that area of land in immediate proximity to the wind turbines, with sufficient buffer to capture any potential telecommunications links that could be affected by the Consented Development. Ofcom was provided with a list of all the turbine locations and undertook a search based on five centre points within the Site, each buffered to 500m. These were selected to cover all of the turbine locations but there was variable coverage beyond these positions. Once Ofcom identified affected links these companies were approached individually and provided with the turbine locations. They used their own search radii based on the locations provided.

Consultation

20.3.2 In order to establish which links were present within the Study Area and what potential effects may occur, consultation was undertaken with the various network operators. Network operators were invited to identify whether they expected any operational impacts to arise on assets they manage as a result of the construction of the Consented Development. An updated consultation has been undertaken to check that there have ben no changes since planning permission for the wind farm was granted.

20.3.3 An initial approach was made to Ofcom as it holds a database of those network operators that have telecommunication links in the area as part of its wind farm fixed link clearance service. Ofcom responded to identify which consultees should then be contacted directly to further establish likely effects.

20.3.4 The relevant consultees identified by Ofcom as having links in or crossing the Study Area were BT, Vodafone, Airwave Solutions and Shetland Islands Council. These network operators were all consulted and asked to provide – where appropriate – the origin and termination points of any links that crossed

the Study Area. This allowed those links to be plotted on a GIS system, and their potential interaction with the Consented Development to be assessed.

20.3.5 The Joint Radio Company (JRC) and Atkins were also consulted as per Ofcom's instruction. Atkins subsequently advised that its response was not on behalf of Scottish Water so Scottish Water was consulted separately.

20.3.6 A valid objection (i.e., one in which the network operator has set out a technical case showing that there will be an adverse operational impact) is considered to be 'significant' for EIA purposes and as such will require mitigation.

20.3.7 In summary the organisations that were contacted are:

- Ofcom;
- The Joint Radio Company;
- Atkins;
- Ministry of Defence (MoD);
- BT;
- Vodafone;
- Airwave Solutions;
- Shetland Islands Council;
- Scottish Water.

20.4 Baseline

20.4.1 The results of the consultation process identified four links that crossed the Study Area, although two operate between the same masts. These links are shown on Figure 3.11 and are detailed below:

Table 20.1: EMI links crossing the Beaw Field Farm site

Link operator	*Link start*	*Link end*	*Link length*
BT	Symbister, Whalsay	Mid Yell	26.5km
Vodafone	Swinister, Mainland	Fetlar	23.9km
Shetland Islands Council	Swinister, Mainland	Fetlar	23.9km
Airwave Solutions Ltd	Bressay	Mid Yell	49.5km

20.4.2 The baseline assessment assumes that all residential and commercial properties within 1km of the windfarm can receive a digital TV signal.

20.5 Assessment of impacts

20.5.1 BT confirmed that there was a microwave link operating from Symbister, Whalsay, due south of the Consented Development to a receiver at Mid-Yell, due north of the site. The layout being proposed at the time of the telecommunications consultation included a turbine (T13) whose rotor blades were too close to the path of the microwave link, and which would adversely affect the transmissions over the link. BT advised that this link is part of the main communications network providing connectivity to Yell and onward connectivity for other islands within the Shetland cluster. As such the effects would be significant and mitigation would be required.

20.5.2 Vodafone confirmed that it operated a link from Mainland Shetland, to the southwest of the Site to Fetlar to the northeast. This link also crossed the Site. Although several of the turbines were in close proximity to the link route Vodafone was able to confirm that it had no objection based on the distance of these nearby turbines from the second Fresnel zone[a] of the link and that there would be no significant effects and no mitigation would be required.

20.5.3 Shetland Islands Council (SIC) also operates a link using the same masts as Vodafone. Initially SIC was concerned of potential interference along the path of the microwave link. Following its own detailed assessment, which included a site visit, the position of the link and PWFY's subsequent confirmation that the closest turbine would be outside of the second Fresnel zone by approximately 59m, SIC's technicians confirmed that it was unlikely there would be any operational impact. The work was presented to SIC's Management Board at an internal meeting on 19 November 2015 and further discussed between senior members of SIC over the following weeks. Confirmation was received from SIC on 22nd December 2015 that it would not object to the application but it would expect a condition to be imposed on any consent to protect it against any interference once the turbines became operational.

20.5.4 In addition, SIC suggested that consideration should be given to whether there would be any interference to the marine VHF link operating between Sullom Voe and an anchorage to the south of Fetlar in Colgrave Sound which is used by vessels sheltering while waiting to enter the harbour. There are not expected to be any such impacts as studies elsewhere into the effects of wind turbines on VHF systems have concluded the interference would be negligible due to the wavelengths involved[b].

20.5.5 Airwave Solutions confirmed that the link it manages on behalf of the emergency services runs from Bressay to Mid Yell, again crossing the Study Area in a north / south direction. This link is the longest of those that traverse the Study Area and of a low frequency. As a consequence the second Fresnel zone is relatively wide and so the clearance zone afforded to safeguard the link was increased

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[a] The Fresnel Zone is the volume around the visual line-of-sight that radio waves spread out into after they leave the antenna / dish. The radius (R) of the nth Fresnel Zone (in kilometres) can be calculated thus:
$R_{Fn} = \sqrt{[(n.\lambda.d1.d2) / (d1+d2)]}$ where:
d1 is the distance in kilometres between the first antennae and the wind turbine
d2 is the distance in kilometres between the wind turbine and the second antennae
λ = The wavelength of the transmitted signal in kilometres, where $\lambda = c/(1000.f)$;
c is the speed of light in a vacuum in m/s and
f is the frequency in Hz at which the transmission occurs
The Second Fresnel Zone is commonly used by network operators as the threshold beyond which the level of interference that might be caused by a wind turbine is considered to be acceptable/

[b] .Experiments were carried out to test theoretical results on the impact of North Hoyle offshore windfarm on marine radio systems. Ref: https://www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping, Updated 12 Nov 2014.

correspondingly. This indicated that two turbines (T3 and T8) could directly affect the link and that mitigation would be required to prevent an objection.

20.5.6 JRC, Atkins and Scottish Water all confirmed that the wind farm would not affect the operation of links they manage in the Study Area.

20.5.7 Ofcom also advised that the developer should check “self-coordinated links operating in the 64-66 GHz, 73.375–75.875 GHz and 83.375–85.875 GHz bands”. This was done by consulting the tables published by Ofcom. None of these links will be affected.

20.5.8 With regard to TV reception, it is considered that the best way to deal with any potential effects would be via a planning condition. This is a standard approach and would involve PWFY Ltd producing a ‘mitigation scheme’ in the event that a complaint is received by SIC. Digital TV is rarely affected by wind turbines and as such a negative effect on TV reception is considered unlikely.

20.6 Cumulative impacts

20.6.1 There are no cumulative impacts expected as none of the identified links that traverse the Study Area are known to be affected by other wind turbine developments or proposed tall structures in the wider area.

20.7 Mitigation measures

20.7.1 During the course of the telecommunications consultation, it was necessary to modify the layout to avoid causing impacts on the normal operation of two of the links identified above.

20.7.2 Following the identification of the potential conflict with the BT link from Symbister to Mid Yell consideration was given to whether it would be possible to relocate the link but discussions with BT clarified that this option was not possible. In order to address this, the layout of the Consented Development was modified to move the turbine (T13) away from the link. BT required the rotor blades of the turbine to be at least 25m outside of the second Fresnel zone of the link. This standoff was achieved through a minor modification to the turbine layout moving T13 and hence T12 as well, to the north and east. As a consequence, the BT objection was removed.

20.7.3 It was also necessary to consider whether there was any scope to redirect the Airwave Solutions Ltd link that crosses the centre of the site. Following detailed analysis by the network operator (Airwave Solutions) a solution was identified that involves the construction of a lattice tower in the south eastern corner of the Site which would be used to redirect the signal around the turbines to the existing tower at Mid Yell. Although the exact design of this tower is still under discussion its height is unlikely to exceed 20m. Further details are given in Chapter 3: Project Description.

20.7.4 Following the layout modification and link relocation described above there were no significant effects identified and no further mitigation measures were required.

20.7.5 If a reduction in television reception quality occurs on the Isle of Yell, it would only be noticed when the wind farm becomes operational.

20.7.6 A number of mitigation measures can be adopted to improve viewing quality should any reduction in viewing quality be experienced. These include:

- Replace or upgrade the receiving aerials (e.g., with directional receiving aerials) for affected households;
- Re-tune the television receivers at affected households;
- Re-align the television aerial to an alternative transmitter and re-tune the receiver at affected households;
- Provision of an alternative source of television for affected households (this could be achieved by cable or satellite receivers for example); and
- Provision of a bespoke 'self-help' solution (this could comprise a new low-powered transmitter, a cable network, a satellite receiver, or a combination of these measures).

20.7.7 By using a solution based around these techniques, any effects from the Consented Development on television reception quality for existing viewers during its operational life will be fully mitigated.

20.8 Residual effects

20.8.1 There will be no residual effects following mitigation.

20.9 Monitoring

20.9.1 No ongoing monitoring is considered to be necessary. In the unlikely event of any interference being experienced PWFY Ltd will investigate any complaint received by SIC and, if the wind turbines are determined to be at fault, will seek to rectify the issue in accordance with the terms of the relevant planning condition.

20.10 Summary and conclusions

20.10.1 Following detailed assessment of the Consented Development and the communication links that cross the Study Area it has been established that there will not be any significant effects arising from the Consented Development following mitigation. This has been achieved through the iterative design process in modifying the turbine layout, altering microwave link locations to accommodate both without negative impact on each other and promoting a relevant planning condition relating to potential TV reception quality diminution.