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INTRODUCTION

- 17.1 This chapter considers any remaining effects that are within the scope of the EIA that are not already considered elsewhere in the EIA Report. These are:
- shadow flicker;
 - telecommunications links and other infrastructure; and
 - television.

SHADOW FLICKER

Introduction

- 17.2 The term 'shadow flicker' refers to the flickering effect caused when rotating wind turbine blades periodically cast shadows over neighbouring properties as they turn, through constrained openings such as windows. The magnitude of the shadow flicker varies both spatially and temporally and depends on a number of environmental conditions coinciding at any particular point in time, including; the position and height of the sun, wind speed, direction, cloudiness, and position of the turbine to a sensitive receptor.
- 17.3 Shadow flicker occurs only within buildings where the flicker appears through a narrow window opening, and experience has shown that shadow flicker has the potential to cause annoyance to the occupants of affected properties, under certain circumstances.
- 17.4 The likelihood and duration of the effect depends upon the:
- direction of the property relative to the turbine(s): in the UK, only properties within 130 degrees either side of north, relative to the turbines, can be affected, as turbines do not cast long shadows on their southern side;
 - distance from the turbine(s): the further away the observer/window is from the turbine, the less pronounced the effect would be. Flicker effects have been known to only occur within ten rotor diameters of a turbine (see the Legislation, Planning Policy and Guidance section below);
 - turbine height and rotor diameter;
 - time of year and day; and
 - weather conditions (i.e. cloudy days reduce the likelihood of any effects occurring).
- 17.5 Shadow flicker effects are only considered during the operational phase of a wind farm development.

Legislation, Planning Policy and Guidance

Scottish Government Guidance

- 17.6 The Scottish Government's online information on onshore wind turbines (Ref. 17.1), states that

“under certain conditions of geographical position, time of day and time of year, the sun may pass behind the rotor and cast a shadow on neighbouring properties. When the blades rotate, the shadow flicks on and off, the effect is known as “shadow flicker”. It occurs only within buildings where the flicker appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the potential site.”

- 17.7 The Scottish Government’s advice states that where shadow flicker could be a problem, *“developers should provide calculations to quantify the effect. In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters) “shadow flicker” should not be a problem. However, there is scope to vary layout/reduce the height of turbines in extreme cases”.*

Planning Guidance and Best Practice Guidance

- 17.8 Planning guidance in the UK requires developers to investigate the impact of shadow flicker. This guidance does not specify how to assess the impact, or how to assess the significance of the impact. Assessments are usually based on PAN 45 (Ref 17.2; now revoked) and current guidance is available in the Scottish Government Specific Renewables Advice Sheet on “Onshore Wind Turbines” (revised May 2014; Ref 17.3).
- 17.9 In England, the National Planning Policy Framework (NPPF), Planning Practice Guidance (Ref. 17.1) identifies that: *“Flicker effects have been proven to occur only within ten rotor diameters of a turbine”* and that *“only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK.”*
- 17.10 Guidance from Northern Ireland in Best Practice Guidance to PPS18: Renewable Energy (Department for the Environment, 2009; Ref. 17.4) states that: *“shadow flicker at neighbouring offices and dwellings within 500 metres should not exceed 30 hours per year or 30 minutes per day”.*
- 17.11 This is widely accepted in shadow flicker analysis for wind farms as a useful metric. Additionally, the 10 rotor diameter rule has been widely accepted across different European countries, and is deemed to be an appropriate assessment area, although there is potentially a need to take into consideration a different number of degrees either side of north, according to the different latitudes of a site.

Scope and Consultation

Scope

- 17.12 The proposed developments turbines have a 140m rotor diameter. Therefore, in line with current planning policy and guidance, residential receptors within 130 degrees of due north of any of the proposed turbines and within a ten rotor diameter radius of the nearest turbine have been considered and fully assessed for shadow flicker if applicable. To account for any micro-siting that may take place during construction, an additional 50m has also been modelled, giving a total study area of 1450m.

Consultation

- 17.13 A request for a Scoping Opinion was submitted to the Scottish Government’s ECU in April 2017, and an updated request submitted in October 2018. The proposed approach to be taken in relation to

shadow flicker was outlined within the Scoping Report.

- 17.14 No comments in relation to the assessment of shadow flicker were received from consultees as part of the Scoping process.

Effects Scoped Out

- 17.15 The Scoping Report states that *“Shadow flicker only occurs in relative proximity to sites and typically at a distance of 10 rotor diameters... In the event that no properties are located within the potentially affected area [i.e. 1400m] shadow flicker will be scoped out”* (page 56).
- 17.16 As part of the design evolution of the proposed development, shadow flicker was one of a number of considerations used to determine the final locations of the turbines (see Chapter 2: Site Description and Design Evolution for more detail). By mapping the locations of the proposed turbines using GIS software, it was possible to identify any residential receptors within 1450m and 130 degrees either side of north of the proposed turbines location, and then slightly alter the turbine locations as required, to avoid or minimise effects on residential properties.
- 17.17 Figure 17.1 shows the 1450m study area and illustrates that no residential properties would lie within 10 rotor diameters of the proposed turbine locations or the turbines of the Clashindarroch II Wind Farm.
- 17.18 Effects from shadow flicker have therefore been scoped out of further assessment within this EIA Report.

TELECOMMUNICATION LINKS & OTHER INFRASTRUCTURE

Introduction

- 17.19 Wind turbines have the capability of affecting electromagnetic transmissions by physically blocking or dispersing the transmission/signal. Wind turbines can therefore potentially cause interference to telecommunication links by reflecting and shadowing electro-magnetically propagated signals, including terrestrial fixed microwave links managed by telecommunications operators, and television reception.
- 17.20 This Chapter assesses whether there would be any such impacts caused by the proposed development.
- 17.21 It also assesses the likelihood of any conflict between the location of the proposed development and the location of physical infrastructure (or assets) owned by utilities and power regulators.

Legislation, Planning Policy and Guidance

Scottish Planning Policy

- 17.22 Scottish Planning Policy (Ref. 17.6) states that *“Proposals for energy infrastructure developments should always take account of spatial frameworks for wind farms and heat maps where these are relevant. Considerations will vary relative to the scale of the proposal and area characteristics but are likely to include: impacts on telecommunications and broadcasting installations, particularly*

ensuring that transmission links are not compromised."

Scottish Government Guidance

- 17.23 The Scottish Government's online information on onshore wind turbines (Ref. 17.1), states that *"Wind turbines can potentially affect electromagnetic transmissions (e.g. radio, television and phone signals). Specialist organisations responsible for the operation of electromagnetic links typically require 100m clearance either side of a line of sight link from the swept area of turbine blades. Ofcom acts as a central point of contact for identifying specific consultees relevant to a site."*

Ofcom Guidance

- 17.24 During August 2009, Ofcom published a planning guidance note (Ref. 17.7) *"Tall structures and their impact on broadcast and other wireless services"* and this further underlines the need to consider wireless networks during the planning stages.

Scope and Consultation

Scope

- 17.25 The aim of the study was to identify all fixed link radio facilities, all broadcast and radio transmitters within a 30km radius of the proposed development.

Consultation

- 17.26 A request for a Scoping Opinion was submitted to the Scottish Government's ECU in April 2017, with an updated request made in October 2018. Requests for a Scoping Opinion were sent in order to determine the location of electromagnetic transmissions and other potential conflicting infrastructure. Consultation has been undertaken with the following operators and service providers:
- British Telecommunications (BT);
 - Ofcom: Ofcom analyses Fixed Terrestrial Links or Fixed Wireless Systems (FWS) which are terrestrial based wireless systems, operating between two or more fixed points, operating across a wide range of frequency bands, currently ranging from 450MHz to 86GHz;
 - Joint Radio Company: JRC analyses proposals for wind farms on behalf of the UK Fuel & Power Industry to assess their potential to interfere with radio systems operated by utility companies; and
 - Scottish Water.
- 17.27 Table 17-1 provides a summary of the key issues that were raised in scoping and in respect of the rescoping exercise.

Table 17-1
Key Issues Identified During Scoping

Consultee	Summary of Key Issues	How it is Addressed in the EIA Report
British Telecom (BT)	The project should not cause interference to BT's current and presently planned radio networks.	No action required (N/A)
Joint Radio Company (JRC)	Proposal has no impacts on radio link infrastructure operated by JRC.	N/A
Ofcom	No Response	It is assumed that Ofcom have no comment to make on the proposed development.
Scottish Water (SW)	<p>There are Scottish Water assets within the proposed Site (including the access route):</p> <ul style="list-style-type: none"> - Two raw water mains in potential conflict with the Site access route; - 1x 6" asbestos cement main; and - 1x 9" cast iron main. <p>The location of the assets should be confirmed through obtaining detailed plans from Scottish Water's Asset Plan Providers. All of Scottish Water's processes, standards and policies in relation to dealing with asset conflicts must be complied with.</p>	The location of infrastructure has been confirmed in correspondence with Scottish Water. It has informed the Site design and there is no conflict with the layout for the proposed development.

Effects Scoped Out

- 17.28 Consultation confirmed that the proposed development would not interfere with telecommunications links. Furthermore, the design evolution process has not spread turbines beyond the requested consultation radius of 30km from the turbine locations provided at the consultation stage.
- 17.29 All Scottish Water Assets have been considered during the design of the development and appropriate safeguards will be put in place during construction of the proposed development as appropriate.
- 17.30 The effect of the proposed development upon telecommunications systems and other infrastructure/assets owned by third parties has therefore been considered to be negligible and has not been considered further within the EIA Report.

TELEVISION RECEPTION

- 17.31 When wind turbines are operational, they can have the potential to interfere with television broadcasting systems causing receiving viewers to experience degradation in picture quality or loss of reception.
- 17.32 The proposed development is located within the STV North Ltd television region and television transmissions for properties near the proposed development are provided by the Gartley Moor,

Durris and Knockmore transmitters.

- 17.33 Ofcom did not respond to the Scoping process and it is therefore assumed that there would be no interference to broadcast television reception and therefore this issue is not considered further within this EIA Report.
- 17.34 If a problem with interference occurs that is linked to the operational phase of the proposed development, this would be dealt with using reasonable measures such as an onsite survey and/or installation of satellite television or upgrades of the current antennae system.

REFERENCES

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