



Wind Power North Two Limited

Balblair Wind Farm

Environmental Impact Assessment Report (Volume 2)

Chapter 14 – Other Issues

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14 OTHER ISSUES

14.1 Introduction

14.1.1 This chapter considers the likely significant effects of the Proposed Scheme on the following environmental factors:

- Shadow Flicker (Section 14.2)
- Telecommunications (Section 14.3)
- Aviation (Section 14.4)

14.2 Shadow Flicker

Introduction

Purpose of Assessment

14.2.1 This assessment considers the potential effects of shadow flicker on receptors within 11 rotor diameters of the proposed turbines of Balblair Wind Farm (hereafter referred to as the “proposed Development”).

14.2.2 Shadow flicker occurs when the sun passes behind the rotors of a wind turbine and casts a shadow. It can occur under certain combinations of geographical positioning and time of day. Shadow flicker is caused when rotating wind turbine blades cause brightness levels to vary periodically, with the shadow created by the blades flickering on and off. The effect of shadow flicker is an issue inside buildings, where the flicker appears through windows, creating a nuisance for residents of the receptor. Shadow flicker can cause annoyance if it occurs for a significant time period.

Policy and Guidance

14.2.3 This shadow flicker assessment has been carried out in accordance with relevant policy in the National Planning Framework 4 (2023a). Policy 11 (e) of NPF4 requires that project design and mitigation for development proposals demonstrates how impacts, including shadow flicker, on communities and residential receptors have been minimised.

14.2.4 Further guidance on shadow flicker is provided in Policy 67 of the Highland-wide Local Development Plan (HwLDP) (2012) and its Onshore Wind Energy Supplementary Guidance (2017). The Highland-wide Local Development Plan’s Policy 67 Renewable Energy Developments states that the Council will support proposals where it is satisfied that they are located, sited and designed such that they will not be significantly detrimental overall, either individually or cumulatively with other developments, having regard in particular to any significant effects safety and amenity of any regularly occupied buildings, including from shadow flicker.

14.2.5 The Highland Council’s (THC) Supplementary Guidance states that proposals should seek to avoid significant adverse effects on the safety of any residential or regularly occupied receptors including shadow flicker. It goes on to state that:

“Wind energy schemes should always be designed to avoid causing shadow flicker, blade glint, glare and light effects to any regularly occupied buildings not associated with the development. Where this cannot be achieved, the Council will expect wind energy developments to be located a minimum distance of 11 times the blade diameter of the turbine(s) from any regularly occupied buildings not associated with the development. Within a distance less than 11 times the blade diameter, a shadow flicker assessment will be required.”

14.2.6 As per Section 24(3) of the Town and Country Planning (Scotland) Act 1997, where there is incompatibility between a provision of the National Planning Framework and a provision of a local development plan, whichever of them is the later in date would prevail. Therefore, NPF4 (adopted in February 2023) holds primacy over the HwLDP and its supplementary guidance. This was further clarified by the Chief Planner's letter of 8th February 2023 Scottish Government (2023b), which states:

“Provisions that are contradictory or in conflict would be likely to be considered incompatible.”

14.2.7 In respect of shadow flicker, there is no incompatibility between NPF4 and HwLDP and its supplementary guidance. Both NPF4 and HwLDP outline expectations that developments should be designed to minimise the impacts of shadow flicker on communities and local residences. Therefore, while NPF4 takes precedence, this assessment has been undertaken in accordance with HwLDP and local planning policy, as these documents provide specific guidance on carrying out shadow flicker assessments and address mitigation.

Consultation

14.2.8 Consultation was undertaken with relevant regulatory bodies through the scoping process. THC's response in regard to shadow flicker and the Applicant's comment / action taken is provided in **Table 14.1**.

Table 14.1: Consultation responses

Consultee	Response	Comment / Action taken
The Highland Council	"The Council is not currently content for the shadow flicker study area to be scoped out due to nearby residential properties."	A shadow flicker assessment has been prepared for inclusion to the EIA Report.

Scope and Methodology

14.2.9 The magnitude of the shadow flicker effect varies both spatially and temporally is dependent on several environmental conditions occurring at the same time, including:

- the position and height of the sun
- wind speed and direction
- cloud cover
- proximity of the turbine to a sensitive receptor.

14.2.10 It is generally accepted, as outlined in the Onshore Wind Turbines: Planning Advice (2014), that a range of 10 rotor diameters is the maximum limit within which significant

shadow flicker effects can occur. THC's Onshore Wind Energy: Supplementary Guidance (2017) suggests that a shadow flicker assessment is required for all residential receptors within 11 rotor diameters of each turbine. Whilst the HwLDP and supplementary guidance are not the primary guidance for the proposed Development, for the purposes of this assessment, an 11-rotor diameter distance has been adopted on a precautionary basis and to align with THC's recommendations for a shadow flicker assessment.

- 14.2.11 Based on the candidate turbine rotor diameter (136 m), with an additional 50 m buffer to account for potential micro-siting, the shadow flicker study area for the proposed Development's turbines extends to 1,546 m.
- 14.2.12 Shadows are cast by the sun as it crosses the southern sky. Shadow flicker can hypothetically occur only at locations 130° either side of north (Parsons Brinckerhoff 2011; UK Government, 2015). The zone of potential shadow flicker for Balblair Wind Farm, in a worst - case scenario is therefore 1,576 m and 130° either side of north). This is the shadow flicker study area as illustrated on **Figure 14.1**.
- 14.2.13 The locations of receptors and the locations and maximum dimensions of turbines of the proposed Development have been inputted into a model run on industry standard ReSoft WindFarm® Release 5 software. For the receptors identified within the shadow flicker study area, a window centred at 2 m from ground level with 1 m x 1 m dimensions facing directly towards the proposed wind turbines has been assumed for 'worst-case' scenario results. A minimum sun elevation of 2 degrees has been considered. The model assumes that:
- The sun is shining from sunrise to sunset (cloudless sky).
 - The turbine blades are turning 100% of the time.
 - The turbine rotor is oriented directly between the sun and the sensitive receptor.
 - There is no screening between the turbine and the receptor (excluding topography).
- 14.2.14 The model was used to predict and quantify shadow flicker effects on receptors within the vicinity of the proposed Development. The result from the model is a predicted 'worst-case' scenario. As outlined within the UK Shadow Flicker Evidence Base Report (Parsons Brinckerhoff, 2011), for the 'worst-case' scenario to occur, all of the above listed conditions would have to occur continuously, throughout the year. Therefore, in real life conditions, the actual shadow flicker durations would likely be less than the theoretical levels estimated by the model.

Significance Criteria

- 14.2.15 Within the UK, there is no formal guidance on the amount of shadow flicker that is considered the limit beyond which amenity effects are significant. European countries do have guidance on shadow flicker; however, these vary from one country to another. As outlined in Parsons Brinckerhoff (2011), guidance from Northern Ireland, Germany and Belgium suggests a shadow flicker limit not exceeding 30 hours per year or 30 minutes per day as a threshold for potential significant effects. For the purposes of this assessment, exceedance of this limit is considered to result in a significant effect on the amenity of the occupants of the receptor and may require mitigation. These threshold limits have been used consistently in previous applications submitted to the Energy Consents Unit (ECU).

Difficulties and uncertainties

- 14.2.16 For the shadow flicker assessment, the outputs of industry standard software such as ReSoft WindFarm® adopt a ‘worst-case’ scenario approach, as they do not factor in variables such as atmospheric conditions (e.g., wind speed, cloud cover) which reduce the potential for shadow flicker.
- 14.2.17 Furthermore, the ‘worst-case’ scenario approach of the assessment does not consider any screening objects (vegetation or buildings) that may exist between the proposed turbines and receptors, preventing or reducing the potential for shadow flicker.

Existing Environment

- 14.2.18 As shown in **Figure 14.1**, the receptors listed in **Table 14.2** are within the shadow flicker study area and have been identified for further review and assessment. As identified in **Technical Appendix 6.6: Residential Visual Amenity Assessment**, Receptor 2 (Reidbreac) is currently unoccupied but is considered immediately inhabitable. Consequently, Receptor 2 is therefore included in the shadow flicker assessment.

Table 14.2: Identified Receptors

ID	Receptor	Easting	Northing	Distance from nearest turbine (m)	Current status
1	Craigton	262743	896145	1015	Occupied
2	Reidbreac	263575	896423	1413	Unoccupied, but considered to be immediately inhabitable

Assessment of Effects

- 14.2.19 The results of the shadow flicker assessment are shown in **Table 14.3** and **Figure 14.2**. The assessment is indicative of the ‘worst-case’ scenario, meaning it does not take into consideration physical intervening objects or environmental and / or weather conditions such as cloud coverage which may reduce or prevent shadow flicker effects.
- 14.2.20 Based on the ‘worst-case’ scenario, the results of the shadow flicker assessment for the proposed Development are that at both receptors, predicted shadow flicker effects do not exceed the threshold limits of 30 minutes (0.5 hours) per day or 30 hours per year. It is therefore concluded that shadow flicker effects from the turbines of the proposed Development would be **Not Significant**.

Table 14.3: Worst-case shadow flicker results

ID	Property name	Days per year	Maximum minutes per day	Mean minutes per day	Total hours per year	Turbines causing shadow flicker
1	Craigton	58	25	19	18.2	T5
2	Reidbreac	58	26	20	19.0	T3

Cumulative Effects

- 14.2.21 The cumulative shadow flicker effects with wind farms within the vicinity of the proposed Development has also been considered. Using a combination of the Highland Council's Wind Turbine Open Map Data¹, the closest turbines are those at the proposed Garvary wind farm (planning). These turbines are approximately 3.8 km away from the two receptors identified for the proposed Development, well beyond the area within which shadow flicker effects could occur. Furthermore, as of 8 November 2024, no additional onshore wind developments entering the scoping stage were identified that would contribute to cumulative shadow flicker effects on the receptors identified in the assessment of the proposed Development (Craigton, and Reidbreac). The closest turbine in the proposed Inveroykel wind farm (scoping), is located approximately 7.4 km west of the nearest receptor (Craigton). This is well beyond the area in which shadow flicker effects could occur. Consequently, in relation to in planning and scoping wind farms, there will be no cumulative shadow flicker effects.

Mitigation

- 14.2.22 Based on the 'realistic scenario', shadow flicker effects from the turbines in the proposed Development are assessed as **Not Significant**. Therefore, no mitigation is required.

Residual Effects

- 14.2.23 Based on the 'worst-case' scenario shadow flicker assessment, where no significant effects are predicted, and no mitigation is required, there will be no residual effects.

References

UK Government (1989), 'Electricity Act 1989'.

UK Government (1997), 'Town and Country Planning (Scotland) Act 1997'.

The Highland Council (2012), 'Highland-wide Local Development Plan'.

The Highland Council (2017), 'Onshore wind energy: supplementary guidance'.

UK Government (2015), 'Renewable and low carbon energy'.

Parsons Brinckerhoff (2011), 'Update of UK Shadow Flicker Evidence Base Report'.

Scottish Government (2014), 'Onshore wind turbines: planning advice'.

14.3 Telecommunications

- 14.3.1 The Applicant commissioned studies to investigate the potential impact of the pre-scoping 14 turbine layout on wireless communications infrastructure in the surrounding areas. The initial analysis concluded that several of the turbines were predicted to cause unacceptable interference to a number of microwave and UHF links in the area.

¹ A bi-annually updated dataset of Wind turbine locations in planning applications in the Highland Council Area. The version used for this assessment was updated in August 2024. Available at: https://map-highland.opendata.arcgis.com/datasets/fdad9392071a477087c9e0cb4184b5d4_0/about

- 14.3.2 Proposed mitigation strategies included micro siting and layout optimisation, re-networking of the link via existing telecommunication sites, and use of leased line.
- 14.3.3 Following a redesign of the development to take account of recommended buffers to telecommunications links, a further assessment was undertaken to understand the impact of the revised development on the links. The results showed two turbines were predicted to cause unacceptable interference upon one Joint Radio Company (JRC) communications link. Further layout optimisations were considered based on a more detailed analysis provided by JRC defining areas which would be unacceptable for development. The information provided by JRC was used in defining the final design for the proposed Development.
- 14.3.4 **Technical Appendix 14.1** is a Mitigation Analysis Engineering Report: Balblair Windfarm Report with the proposed mitigation solution as agreed with JRC.

14.4 Aviation

- 14.4.1 **Technical Appendix 14.2** is an Aviation Technical Report which presents an assessment of the potential effects of the proposed Development on aviation. The report summarises consultations undertaken with the relevant authorities at scoping stage; describes the existing environment; and presents potential impacts on radar and military low flying aircraft.
- 14.4.2 In respect of impacts on radar, a radar line of sight assessment and an assessment of the operational significance of technical effects on RAF Lossiemouth Primary Surveillance Radar was undertaken. It was concluded that the operational impact of the proposed Development's technical effects on the RAF Lossiemouth PSR will not be significant. Consultation is underway with the Ministry of Defence.
- 14.4.3 In respect of impacts on low flying aircraft, as the turbines in the proposed Development exceed 150m, turbines are required to be fitted with obstacle lighting. A proposal for a reduced lighting scheme has been approved by the Civil Aviation Authority. A copy of a letter from the Civil Aviation Authority dated 20th November 2024 is provided as Annex A to **Technical Appendix 14.2**.