

Technical Appendix 10.1: Environmental Noise Assessment

Ravengill Energy Park.
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Environmental Noise Assessment.

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Executive Summary

Hoare Lea (HL) have been commissioned by Ramboll to undertake a noise assessment for the construction and operation of the proposed Ravengill Energy Park (the Proposed Development). Noise will be emitted by equipment and vehicles used during construction and decommissioning of the wind farm and by the turbines during operation. The level of noise emitted by the sources and the distance from those sources to the receiver locations are the main factors determining levels of noise at receptor locations.

Construction Noise and vibration

Construction noise has been assessed by a desk-based study of a potential construction programme and by assuming the proposed development is constructed using standard and common methods. Noise levels have been calculated for receiver locations closest to the areas of work and compared with guideline and baseline values. Construction noise, by its very nature, tends to be temporary and highly variable and therefore much less likely to cause adverse effects. Factors to control noise immission levels, including in particular the restrictions of hours of working, have been taken into consideration. Vibration levels for activities such as ground compaction were also estimated based on available guidance. It is concluded that noise and vibration generated through construction activities would result in short-term moderate impact at most. This could however be mitigated to a negligible to minor impact magnitude through measures such as acoustic screening and limiting working hours at closest point of activity to sensitive receptors.

Decommissioning is likely to result in less noise and vibration than during construction of the Proposed Development. The construction phase has been considered to have minor noise and vibration impacts at most, following implementation of relevant mitigation measures decommissioning will, in the worst case, also have minor noise and vibration impacts.

Operational Noise

Operational turbines emit noise predominantly from the rotating blades as they pass through the air. This noise can sometimes be described as having a regular ‘swish’. The amount of noise emitted tends to vary depending on the wind speed. When there is little wind the turbine rotors will turn slowly and produce lower noise levels than during high winds when the turbine reaches its maximum output and maximum rotational speed. Background noise levels at nearby properties will also change with wind speed, increasing in level as wind speeds rise due to wind in trees and around buildings, etc.

Noise levels from operation of the turbines have been predicted for those locations around the Site most likely to be affected by noise. Surveys have been performed and historical baseline data has been used to establish existing baseline noise levels. Noise limits have been derived from data about the existing noise environment following the method stipulated in national planning guidance. Predicted noise levels take full account of the potential combination of the noise from the Proposed Development along with Clyde Windfarm, Middle Muir Windfarm, Andershaw Windfarm, and the M74 West Renewable Energy Park. Other, more distant wind farms were not considered as they do not make an acoustically relevant contribution to cumulative noise levels.

Predicted operational wind turbine noise levels have been compared to the limit values to demonstrate that turbines of the type and size which would be installed can operate within the limits so derived. It is concluded therefore that operational noise levels from the wind farm will be within levels recommended in national guidance for wind energy schemes.

The impact of the proposed substation and battery storage has been considered on a precautionary basis using a simplified distance propagation calculation and was determined to correspond to negligible impacts. The addition of these sources to that of the wind turbines would not affect the outcome of the above assessment and operational noise would remain a minor impact

This Executive Summary contains an overview of the noise assessment and its conclusions. No reliance should be placed on the content of this Executive Summary until this report has been read in its entirety.

1. Introduction

- 1.1
- This report presents an assessment of the potential construction and operational noise impacts of the Ravengill Energy Park (the Proposed Development) on the residents of nearby dwellings. The assessment considers both the construction and operation of the Proposed Development and also the likely impacts of its decommissioning. Assessment of operational noise accounts for the cumulative total of the Proposed Development as well as other wind farms nearby. Other wind farms considered were those closest that are operational, consented, or the subject of a valid planning application and consisted of: Clyde Wind Farm (operational, approximately 4 kilometres (km) east), M74 West Renewables Energy Park (in planning, approximately 4 km north), Middle Muir Windfarm (operational, approximately 4.8 km north), and Andershaw Windfarm (operational, approximately 5 km northwest). Other, more distant wind farms were not considered as their potential noise contribution was considered negligible compared to the closer wind developments listed above.
- 1.2
- Noise and vibration which arises from the construction of a wind farm is a factor which should be taken into account when considering the Proposed Development. However, in assessing the impacts of construction noise, it is accepted that the associated works are of a temporary nature. The main work locations for construction of the turbines are distant from the nearest noise sensitive residences and are unlikely to cause strong impacts. The construction and use of access tracks may, however, occur at lesser separation distances. Assessment of the temporary impacts of construction noise is primarily aimed at understanding the need for dedicated management measures and, if so, the types of measures that are required. Further details of relevant working practices, traffic routes, and proposed working hours are described in the construction and traffic chapters of the Environmental Statement.
- 1.3
- Once constructed and operating, wind turbines may emit two types of noise. Firstly, aerodynamic noise is a ‘broad band’ noise, sometimes described as having a characteristic modulation, or ‘swish’, which is produced by the movement of the rotating blades through the air. Secondly, mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise which is generally characterised by its tonal content. Traditional sources of mechanical noise comprise gearboxes or generators. Due to the acknowledged lower acceptability of tonal noise in otherwise ‘natural’ noise settings such as rural areas, modern turbine designs have evolved to minimise mechanical noise radiation from wind turbines. Aerodynamic noise tends to be perceived when the wind speeds are low, although at very low wind speeds the blades do not rotate or rotate very slowly and so, at these wind speeds, negligible aerodynamic noise is generated. In higher winds, aerodynamic noise is generally masked by the normal sound of wind blowing through trees and around buildings. The level of this natural ‘masking’ noise relative to the level of wind turbine noise determines the subjective audibility of the wind farm. The relationship between wind turbine noise and the naturally occurring masking noise at residential dwellings lying around the Proposed Development will therefore generally form the basis of the assessment of the levels of noise against accepted standards.
- 1.4
- The main noise sources associated with the substation are likely to be the power transformers and their cooling fans. The transformer noise is generally fairly constant, once energised, whereas the cooling fans operate as needed, depending on load and ambient temperature. The noise from the transformers is usually tonal in nature with most energy contained within discrete frequency components at 100 Hz and harmonics thereof. The noise generated by the cooling fans is likely to be broadband in nature but switch on and off. Battery storage facilities also include a range of electrical

- plant, such as inverters and transformers, as well as temperature control equipment but are less likely overall to have a noise which includes tones at low frequencies¹.
- 1.5 An overview of environmental noise assessment and a glossary of noise terms are provided in Annex A.

2. Policy and Guidance Documents

2.1 Planning Policy and Advice Relating to Noise

- 2.1.1 The Scottish National Planning Framework 4 (NPF)² provides advice on how the planning system should manage the process of encouraging, approving and implementing renewable energy proposals including onshore wind farms. NPF4 suggests that renewable energy developments must demonstrate how impacts including noise are to be addressed through design and mitigation, going on to advise that *“In considering these impacts, significant weight will be placed on the contribution of the proposal to renewable energy generation targets and on greenhouse gas emissions reduction targets.”*; however, NPF4 provides no specific advice on noise.. Planning Advice Note PAN1/2011³ provides general advice on the role of the planning system in preventing and limiting the adverse effects of noise without prejudicing investment in enterprise, development and transport. PAN1/2011 provides general advice on a range of noise related planning matters, including references to noise associated with both construction activities and operational wind farms. In relation to operational noise from wind farms, Paragraph 29 states that:

‘There are two sources of noise from wind turbines - the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise is related to engineering design. Aerodynamic noise varies with rotor design and wind speed, and is generally greatest at low speeds. Good acoustical design and siting of turbines is essential to minimise the potential to generate noise. Web based planning advice on renewable technologies for Onshore wind turbines provides advice on ‘The Assessment and Rating of Noise from Wind Farms’ (ETSU-R-97) published by the former Department of Trade and Industry [DTI] and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise.’

- 2.1.2 The Scottish Government’s Onshore Wind Policy Statement 2022⁴ confirms ‘The Assessment and Rating of Noise from Wind Farms’ (ETSU-R-97)⁵ *“provides the framework for the measurement of wind turbine noise, and all applicants are required to follow the framework and use it to assess and rate noise from wind energy developments”*. The aim of ETSU-R-97 is:

‘This document 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 local authorities. The suggested noise limits and their reasonableness have been evaluated with regard to regulating the development of wind energy in the public interest. They have been presented in a manner that makes them a suitable basis for noise-related planning conditions or covenants within an agreement between a developer of a wind farm and the local authority.’

1 Although inverters may produce high-frequency tonal noise above 2 kHz, this is more likely to be absorbed by the atmosphere.
2 Scottish National Planning Framework 4, Scottish Government. Adopted 13 February 2023.
3 Planning Advice Note 1/2011: Planning & Noise, Scottish Government, March 2011.
4 Scottish Government (2022) - Onshore wind - policy statement 2022, December 2022.
5 ETSU-R-97, the Assessment and Rating of Noise from Wind Farms, Final ETSU-R-97 Report for the Department of Trade & Industry. The Working Group on Noise from Wind Turbines, 1997.

- 2.1.3 The recommendations contained in ETSU-R-97 provide a robust basis for assessing the noise implications of a wind farm. ETSU-R-97 has become the accepted standard for such developments within the UK. Guidance on good practice on the application of ETSU-R-97 has been provided by the Institute of Acoustics (IOA Good Practice Guide or GPG)⁶. This was subsequently endorsed by the Scottish Government⁷, as confirmed in the Onshore Wind Policy Statement 2022. The methodology of ETSU-R-97 and the IOA GPG has therefore been adopted for the present assessment and is described in greater detail below.
- 2.1.4 The Scottish Government Onshore Wind Policy Statement 2022 mentions the potential for the advice in ETSU-R-97 to be modified in future based on a review from the UK Government, but continues to support its use in the meantime. A report on this topic commissioned by the UK Government has been published (WSP BEIS Report)⁸, with some recommendations for updates to some aspects of the ETSU-R-97 methodology which will need to be considered by the national governments. The WSP BEIS report does not provide a replacement or update to ETSU-R-97 and until it is replaced or updated, the Scottish Government has confirmed in the Onshore Wind Policy Statement 2022 that the ETSU-R-97 methodology continues to be applicable. The UK Government then published⁹ in July 2025 a draft for consultation of a revision of the ETSU-R-97 guidelines but noted that this draft guidance should not be used until a response to this consultation is published. The WSP Report also confirms that infrasound or low frequency noise from modern wind turbines do not require specific consideration.
- 2.1.5 For assessing noise from non-wind turbines sources associated with the Proposed Development, such as fixed plant associated with the substation and battery energy storage PAN1/2011 advises the use of the BS 4142 standard. Although PAN1/2011 references the 1997 version of the standard, the more recent 2019 version¹⁰ is now applicable.
- 2.1.6 PAN1/2011 and the Technical Advice Note¹¹ accompanying PAN1/2011 note that construction noise control can be achieved through planning conditions that limit noise from temporary construction-sites, or by means of the Control of Pollution Act (CoPA) 1974¹². The CoPA provides two means of controlling construction noise and vibration. Section 60 provides the Local Authority with the power to impose at any time operating conditions on the development site. Section 61 allows the developer to negotiate a prior consent for a set of operating procedures with the Local Authority before commencement of site works.
- 2.1.7 For detailed guidance on construction noise and its control, the Technical Advice Note refers to British Standard BS 5228¹³ ‘Noise control on construction and open sites’, Parts 1 to 4 but confirms that the updated version of this standard, published in January 2009 is relevant when used within the planning process. The 2009 version consolidates all previous parts of the standard into BS 5228-1: 2009 (amended 2014)¹⁴ (BS 5228-1) for airborne noise and BS 5228-2: 2009 (amended

6 A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, Institute of Acoustics, May 2013.
7 Letter from John Swinney MSP, Scottish Government, 29/05/2013
8 WSP, A Review of Noise Guidance for Onshore Wind Turbines, report for the UK Department for Business, Energy & Industrial Strategy, October 2022 (published 10 February 2023).
9 <https://www.gov.uk/government/consultations/assessment-and-rating-of-wind-turbine-noise-guidance-proposed-updates> [accessed December 2025]
10 British Standard 4142: 2014+A1 2019 Method for rating and assessing industrial and commercial sound. British Standards Institution. 2019.
11 PAN1/2011 Technical Advice Note – Assessment of Noise, Scottish Government, March 2011.
12 Control of Pollution Act, Part III, HMSO, 1974.
13 BS 5228 Noise and Vibration Control on Construction and Open Sites, Parts 1 to 4.
14 BS 5228-1:2009-A:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’.