

## Project Note

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Project: Farr Wind Farm Life Extension

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## Farr Wind Farm - life extension and noise conditions

General guidance and policy in Scotland concerning noise, both in general and that associated with windfarm developments specifically, is presented in the following documents:

- Planning Advice Note 1/2011: Planning and Noise
- The Scottish Government's Web Based Advice on Onshore Wind Turbines (last updated in May 2014).

This references the methodology presented in the ETSU guidance on "The Assessment and Rating of Noise from Windfarms" (ETSU-R-97) which remains accepted good practice for assessing the effects of noise from windfarms. This sets out limits for operational noise from windfarms which apply to the total cumulative noise levels.

The noise assessment included in the 2002 Environmental Statement (ES) for the Farr Wind Farm was undertaken in line with the ETSU-R-97 methodology. This identified that the closest noise-sensitive residential receptors were approximately 3 to 5 km away from the turbines. The ES did not include baseline background noise measurements, and this was not necessarily according to ETSU-R-97 because of the relatively large separation distance between turbines and dwellings. Nonetheless, measurements were subsequently undertaken in July-August 2005 at a representative number of neighbouring dwellings.

The 2004 consent for the Farr Wind Farm includes conditions on noise, including condition 7.13 which sets out operational noise limits in line with ETSU-R-97 at neighbouring dwellings. The conditions are however generic with no specific numerical values specified, as is now common good practice.

This was effectively superseded by the assessment for the Glen Kyllachy Wind Farm submitted in 2013 (initially referenced as the Kyllachy Wind Farm). This scheme comprises additional turbines to the south-west and south-east of those of the Farr Wind Farm and which are located in closer proximity to some of the receptors previously identified. The noise assessment presented in Chapter 14 of the ES for the Glen Kyllachy Wind Farm (and the relevant technical appendix) is in line with ETSU-R-97,



including an assessment of cumulative noise from both wind farm sites (other wind farms in the area are relatively distant and have negligible noise contributions). This assessment, based on the 2005 baseline noise measurements, demonstrated that noise from the Farr Wind Farm turbines, combined with the (then) proposed Glen Kyllachy Wind Farm turbines, would not result in an excess of noise criteria determined in line with the ETSU-R-97 guidance.

The Glen Kyllachy Wind Farm was consented on appeal (reference PPA-270-2115) in April 2015 and is currently under construction. Condition 20 of this consent sets out noise limits which apply to the cumulative noise from both wind farms, which means that Glen Kyllachy Wind Farm is equivalent to an extension of the Farr Wind Farm from the point of view of this condition.

Operational noise, both from each of the wind farms in isolation and cumulatively, is not anticipated to change from the present situation which is considered to be the baseline. This was previously considered acceptable based on the cumulative assessment presented in the ES for the Glen Kyllachy Wind Farm, and this assessment remains relevant. As such, no additional significant effects are considered likely. We are not aware of other cumulative sites that have been proposed or consented within 5 km of either wind farm since the Glen Kyllachy Wind Farm was consented, and any further proposal coming forward would have to consider the baseline of both sites being present as part of any cumulative noise analysis.

The existing cumulative noise limits which apply to the Glen Kyllachy Wind Farm (see overleaf) could therefore also be applied in a consent for a life extension of the Farr Wind Farm to reflect the most up-to-date position in terms of cumulative noise.



## Cumulative noise conditions for the Glen Kyllachy Wind Farm

The rating level of noise immissions from the combined effects of the wind turbines comprising the Glen Kyllachy wind farm (including the application of any tonal penalty) hereby permitted together with the noise immissions of the wind turbines comprising the Farr wind farm (including the application of any tonal penalty) when determined in accordance with the attached Guidance Notes (to this condition), shall not exceed the values for the relevant integer wind speed set out in, or derived from, the tables attached to these conditions at any dwelling which is lawfully existing or has planning permission at the date of this permission and:

- a) The wind farm operator shall continuously log power production, wind speed and wind direction, all in accordance with Guidance Note 1(d). These data shall be retained for a period of not less than 24 months. The wind farm operator shall provide this information in the format set out in Guidance Note 1(e) to the planning authority on its request, within 14 days of receipt in writing of such a request.
- b) No electricity shall be exported until the wind farm operator has submitted to the planning authority for written approval a list of proposed independent consultants who may undertake compliance measurements in accordance with this condition. Amendments to the list of approved consultants shall be made only with the prior written approval of the planning authority.
- c) Within 21 days from receipt of a written request from the planning authority following a complaint to it from an occupant of a dwelling alleging noise disturbance at that dwelling, the wind farm operator shall, at its expense, employ a consultant approved by the planning authority to assess the level of noise immissions from the wind farm at the complainant's property in accordance with the procedures described in the attached Guidance Notes. The written request from the planning authority shall set out at least the date, time and location that the complaint relates to and any identified atmospheric conditions, including wind direction, and include a statement as to whether, in the opinion of the planning authority, the noise giving rise to the complaint contains or is likely to contain a tonal component.
- (d) Prior to the commencement of any measurements by the independent consultant to be undertaken in accordance with these conditions, the wind farm operator shall submit to the planning authority for written approval the proposed measurement location identified in accordance with the Guidance Notes where measurements for compliance checking purposes shall be undertaken. Measurements to assess compliance with the noise limits set out in the Tables attached to these conditions or approved by the planning authority pursuant to paragraph (f) of this condition shall



be undertaken at the measurement location approved in writing by the planning authority.

(e) Prior to the submission of the independent consultant's assessment of the rating level of noise immissions pursuant to paragraph (g) of this condition, the wind farm operator shall submit to the planning authority for written approval a proposed assessment protocol setting out the following:

(i) The range of meteorological and operational conditions (the range of wind speeds, wind directions, power generation and times of day) to determine the assessment of rating level of noise immissions.

(ii) A reasoned assessment as to whether the noise giving rise to the complaint contains or is likely to contain a tonal component.

The proposed range of conditions shall be those which prevailed during times when the complainant alleges there was disturbance due to noise, having regard to the information provided in the written request from the planning authority under paragraph (c), and such others as the independent consultant considers necessary to fully assess the noise at the complainant's property. The assessment of the rating level of noise immissions shall be undertaken in accordance with the assessment protocol approved in writing by the planning authority and the attached Guidance Notes.

(f) Where a dwelling to which a complaint is related is not listed in the tables attached to these conditions, the wind farm operator shall submit to the planning authority for written approval proposed noise limits selected from those listed in the Tables to be adopted at the complainant's dwelling for compliance checking purposes. The proposed noise limits are to be those limits selected from the Tables specified for a listed location which the independent consultant considers as being likely to experience the most similar background noise environment to that experienced at the complainant's dwelling. The rating level of noise immissions resulting from the combined effects of the wind turbines when determined in accordance with the attached Guidance Notes shall not exceed the noise limits approved in writing by the planning authority for the complainant's dwelling.

(g) The wind farm operator shall provide to the planning authority the independent consultant's assessment of the rating level of noise immissions undertaken in accordance with the Guidance Notes within 2 months of the date of the written request of the planning authority made under paragraph (c) of this condition unless the time limit is extended in writing by the planning authority. All data collected for the purposes of undertaking the compliance measurements shall be made available to the planning authority on the request of the planning authority. The instrumentation used to undertake the measurements shall be calibrated in accordance with Guidance Note 1(a) and certificates of calibration shall be submitted to the planning authority with the independent consultant's assessment of the rating level of noise immissions.



(h) Where a further assessment of the rating level of noise immissions from the wind farm is required pursuant to Guidance Note 4(c), the wind farm operator shall submit a copy of the further assessment within 21 days of submission of the independent consultant's assessment pursuant to paragraph (d) above unless the time limit has been extended in writing by the planning authority.

Table 1 – Between 07:00 and 23:00 – Noise limits expressed in dB LA90,10 minute as a function of the standardised wind speed (m/s) at 10 metre height as determined within the site averaged over 10 minute periods.

Location	Standardised wind speed at 10 metre height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
Ardachy Consented Property	35.0	35.0	35.0	35.0	35.0	35.0	37.4	39.7	41.6	42.6	42.8	42.8
Asgard	36.4	36.4	36.4	36.4	36.4	36.8	37.5	38.5	39.8	41.2	41.9	41.9
Corrievorrie	35.0	35.0	35.0	35.0	35.0	35.0	37.4	39.7	41.6	42.6	42.8	42.8
Dalmagarry	46.9	46.9	46.9	46.9	48.4	49.9	51.3	52.8	54.3	55.8	56.5	56.5
Easter Woodend	35.0	35.0	35.0	35.0	35.0	35.0	37.4	39.7	41.6	42.6	42.8	42.8
Gaich	35.0	35.0	35.0	35.0	35.0	35.4	37.9	39.9	40.6	40.6	40.6	40.6
Garbole	36.4	36.4	36.4	36.4	36.4	36.8	37.5	38.5	39.8	41.2	41.9	41.9
Kennels House	35.0	35.0	35.0	35.0	35.0	35.0	35.4	38.3	40.9	43.1	44.0	44.0
Kyllachy House	35.0	35.0	35.0	35.0	35.0	35.0	37.4	39.7	41.6	42.6	42.8	42.8
Moy More House	35.0	35.0	35.0	35.0	36.1	38.3	40.8	43.3	45.7	47.8	48.7	48.7
Tomatin Consented Property	35.0	35.0	35.0	35.0	35.0	36.9	39.4	42.4	45.7	49.6	51.6	51.6
Tomatin Distillery	35.0	35.0	35.0	35.0	35.0	36.9	39.4	42.4	45.7	49.6	51.6	51.6
Wester Auchintoul Lodge	35.0	35.0	35.0	35.0	35.0	35.0	37.4	39.7	41.6	42.6	42.8	42.8
Wester Lairgs	35.0	35.0	35.0	35.0	35.0	35.0	35.3	37.0	38.9	41.1	42.3	42.3
Woodend	35.0	35.0	35.0	35.0	35.0	35.0	37.4	39.7	41.6	42.6	42.8	42.8

Table 2 – Between 23:00 and 07:00 – Noise limits expressed in dB LA90,10-minute as a function of the standardised wind speed (m/s) at 10 metre height as determined within the site averaged over 10 minute periods.

Location	Standardised wind speed at 10 metre height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
Ardachy Consented Property	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	40.2	41.6	41.6	41.6
Asgard	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.4	39.4	39.4	39.4
Corrievorrie	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	40.2	41.6	41.6	41.6
Dalmagarry	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.8	39.7	39.7	39.7
Easter Woodend	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	40.2	41.6	41.6	41.6
Gaich	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.4	38.4	38.4
Garbole	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.4	39.4	39.4	39.4
Kennels House	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.9	38.9	38.9
Kyllachy House	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	40.2	41.6	41.6	41.6
Moy More House	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.2	41.2	44.8	44.8	44.8
Tomatin Consented Property	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	42.0	46.9	46.9	46.9
Tomatin Distillery	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	42.0	46.9	46.9	46.9
Wester Auchintoul	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	40.2	41.6	41.6	41.6
Wester Lairgs	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Woodend	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	40.2	41.6	41.6	41.6



Table 3: Coordinate locations of the properties listed in Tables 1 and 2.

Property	Easting	Northing
Asgard	275666	824218
Dalmagarry	278793	832298
Easter Woodend	279388	826364
Gaich	268940	831224
Kennels House	267617	829078
Moy More House	276649	835444
Tomatin Distillery		
Wester Laings	270408	834885
Corrievorrie	277304	824768
Garbole	275623	824224
Kyllachy House	278624	825925
Wester Auchintoul	278196	824492
Woodend	279124	826217
Ardachy Consented Property	277821	825138
Tomatin Consented Property	278287	829146

Note to Table 3: The geographical coordinate references are provided for the purpose of identifying the general location of dwellings to which a given set of noise limits applies.

#### Guidance Notes for Wind Farm Noise Conditions

These notes are to be read with and form part of the noise condition. They further explain the condition and specify the methods to be employed in the assessment of complaints about noise immissions from the wind farm. The rating level at each integer wind speed is the arithmetic sum of the wind farm noise level as determined from the best-fit curve described in Guidance Note 2 of these Guidance Notes and any tonal penalty applied in accordance with Guidance Note 3. Reference to ETSU-R-97 refers to the publication entitled "The Assessment and Rating of Noise from Wind Farms" (1997) published by the Energy Technology Support Unit (ETSU) for the Department of Trade and Industry (DTI).

##### Guidance Note 1

(a) Values of the LA90,10 minute noise statistic should be measured at the complainant's property, using a sound level meter of EN 60651/BS EN 60804 Type 1, or BS EN 61672 Class 1 quality (or the equivalent UK adopted standard in force at the time of the measurements) set to measure using the fast time weighted response as specified in BS EN 60651/BS EN 60804 or BS EN 61672-1 (or the equivalent UK adopted standard in force at the time of the measurements). This should be calibrated in accordance with the procedure specified in BS 4142: 1997 (or the equivalent UK adopted standard in force at the time of the measurements). Measurements shall be undertaken in such a manner to enable a tonal penalty to be applied in accordance with Guidance Note 3.

(b) The microphone should be mounted at 1.2 – 1.5 metres above ground level, fitted with a two-layer windshield or suitable equivalent approved in writing by the planning authority, and placed outside the complainant's dwelling. Measurements should be made in "free field" conditions. To achieve this, the microphone should be placed at least 3.5 metres away from the building facade or any reflecting surface except the ground at the approved measurement location. In the event that the consent of the complainant for access to his or her property to undertake compliance measurements is withheld, the wind farm operator shall submit for the written approval of the planning authority details of the proposed alternative representative measurement location prior to the commencement of measurements and the measurements shall be undertaken at the approved alternative representative measurement location.

(c) The LA90,10 minute measurements should be synchronised with measurements of the 10-minute arithmetic mean wind and operational data logged in accordance with Guidance Note 1(d), including the power generation data from the turbine control systems of the wind farm.



(d) To enable compliance with the conditions to be evaluated, the wind farm operator shall continuously log arithmetic mean wind speed in metres per second and wind direction in degrees from north at hub height for each turbine and arithmetic mean power generated by each turbine, all in successive 10-minute periods. Unless an alternative procedure is previously agreed in writing with the planning authority, this hub height wind speed, averaged across all operating wind turbines, shall be used as the basis for the analysis. All 10 minute arithmetic average mean wind speed data measured at hub height shall be 'standardised' to a reference height of 10 metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres. It is this standardised 10 metre height wind speed data, which is correlated with the noise measurements determined as valid in accordance with Guidance Note 2, such correlation to be undertaken in the manner described in Guidance Note 2. All 10-minute periods shall commence on the hour and in 10-minute increments thereafter.

(e) Data provided to the planning authority in accordance with the noise condition shall be provided in comma separated values in electronic format.

(f) A data logging rain gauge shall be installed in the course of the assessment of the levels of noise immissions. The gauge shall record over successive 10-minute periods synchronised with the periods of data recorded in accordance with Note 1(d).

#### Guidance Note 2

(a) The noise measurements shall be made so as to provide not less than 20 valid data points as defined in Guidance Note 2 (b).

(b) Valid data points are those measured in the conditions specified in the agreed written protocol under paragraph (d) of the noise condition, but excluding any periods of rainfall measured in the vicinity of the sound level meter. Rainfall shall be assessed by use of a rain gauge that shall log the occurrence of rainfall in each 10 minute period concurrent with the measurement periods set out in Guidance Note 1. In specifying such conditions the planning authority shall have regard to those conditions which prevailed during times when the complainant alleges there was disturbance due to noise or which are considered likely to result in a breach of the limits.

(c) For those data points considered valid in accordance with Guidance Note 2(b), values of the LA90,10 minute noise measurements and corresponding values of the 10- minute wind speed, as derived from the standardised ten metre height wind speed averaged across all operating wind turbines using the procedure specified in Guidance Note 1(d), shall be plotted on an XY chart with noise level on the Y-axis and the standardised mean wind speed on the X-axis. A least squares, "best fit" curve of an order deemed appropriate by the independent consultant (but which may not be higher than a fourth order) should be fitted to the data points and define the wind farm noise level at each integer speed.

#### Guidance Note 3

(a) Where, in accordance with the approved assessment protocol under paragraph (d) of the noise condition, noise immissions at the location or locations where compliance measurements are being undertaken contain or are likely to contain a tonal component, a tonal penalty is to be calculated and applied using the following rating procedure.

(b) For each 10 minute interval for which LA90,10 minute data have been determined as valid in accordance with Guidance Note 2 a tonal assessment shall be performed on noise immissions during 2 minutes of each 10 minute period. The 2 minute periods should be spaced at 10 minute intervals provided that uninterrupted uncorrupted data are available ("the standard procedure"). Where uncorrupted data are not available, the first available uninterrupted clean 2 minute period out of the affected overall 10 minute period shall be selected. Any such deviations from the standard procedure, as described in Section 2.1 on pages 104-109 of ETSU-R-97, shall be reported.

(c) For each of the 2 minute samples the tone level above or below audibility shall be calculated by comparison with the audibility criterion given in Section 2.1 on pages 104-109 of ETSU-R-97.

(d) The tone level above audibility shall be plotted against wind speed for each of the 2 minute samples. Samples for which the tones were below the audibility criterion or no tone was identified, a value of zero audibility shall be used.



(e) A least squares "best fit" linear regression line shall then be performed to establish the average tone level above audibility for each integer wind speed derived from the value of the "best fit" line at each integer wind speed. If there is no apparent trend with wind speed then a simple arithmetic mean shall be used. This process shall be repeated for each integer wind speed for which there is an assessment of overall levels in Guidance Note 2.

(f) The tonal penalty is derived from the margin above audibility of the tone according to the figure below.

#### Guidance Note 4

(a) If a tonal penalty is to be applied in accordance with Guidance Note 3 the rating level of the turbine noise at each wind speed is the arithmetic sum of the measured noise level as determined from the best fit curve described in Guidance Note 2 and the penalty for tonal noise as derived in accordance with Guidance Note 3 at each integer wind speed within the range specified by the planning authority in its written protocol under paragraph (d) of the noise condition.

(b) If no tonal penalty is to be applied then the rating level of the turbine noise at each wind speed is equal to the measured noise level as determined from the best fit curve described in Guidance Note 2.

(c) In the event that the rating level is above the limit(s) set out in the Tables attached to the noise conditions or the noise limits for a complainant's dwelling approved in accordance with paragraph (e) of the noise condition, the independent consultant shall undertake a further assessment of the rating level to correct for background noise so that the rating level relates to wind turbine noise immission only.

(d) The wind farm operator shall ensure that all the wind turbines in the development are turned off for such period as the independent consultant requires to undertake the further assessment. The further assessment shall be undertaken in accordance with the following steps:

(e). Repeating the steps in Guidance Note 2, with the wind farm switched off, and determining the background noise (L3) at each integer wind speed within the range requested by the planning authority in its written request under paragraph (c) and the approved protocol under paragraph (d) of the noise condition.

(f) The wind farm noise (L1) at this speed shall then be calculated as follows where L2 is the measured level with turbines running but without the addition of any tonal penalty:  $L1 = 10\log [10L2/10 - 10L3/10]$

(g) The rating level shall be re-calculated by adding arithmetically the tonal penalty (if any is applied in accordance with Note 3) to the derived wind farm noise L1 at that integer wind speed.

(h) If the rating level after adjustment for background noise contribution and adjustment for tonal penalty (if required in accordance with note 3 above) at any integer wind speed lies at or below the values set out in the Tables attached to the conditions or at or below the noise limits approved by the planning authority for a complainant's dwelling in accordance with paragraph (e) of the noise condition then no further action is necessary. If the rating level at any integer wind speed exceeds the values set out in the Tables attached to the conditions or the noise limits approved by the planning authority for a complainant's dwelling in accordance with paragraph (e) of the noise condition then the development fails to comply with the conditions.