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**GREEN KNOWES WINDFARM**  
**ENVIRONMENTAL STATEMENT**  
**Comments on Noise Section**

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**SUMMARY**

- 1 The purpose of this report is to review the Noise Section of the Environmental Statement for the proposed windfarm at Green Knowes and to provide an opinion as to the impact of the windfarm on local residents.
- 2 The method of assessment used by the applicant, which I will call the ETSU method, is commonly used to assess windfarm noise and is incorporated into the Planning Advice Note, PAN45 *Renewable Energy Technologies*. However, it is not a method of assessing the impact of noise on neighbours but a framework for achieving a balance between a reasonable degree of protection to neighbours and reasonable restrictions on developers. In view of this, in addition to commenting on the applicants ETSU assessment I have made an assessment of the impact of turbine noise on neighbours.
- 3 There are some misleading and unsubstantiated assertions in the text of the document though they do not affect the assessment itself.
- 4 The background noise presentation is poor. The figures show the background noise as a straight line with no further details. I have since received detailed data, which go some way towards clarifying the position but there are still some anomalies.
- 5 It should be noted that the turbine noise calculations are based on the Vestas V66 running in low power/low noise condition. If it is run in the normal mode then the noise levels will be significantly higher. The noise levels shown for the V66 do not appear to be correct at wind speeds other than 8m/s. Turbine noise levels at higher speeds are understated and at lower speeds overstated.
- 6 A significant omission is that, other than the three assessed properties, no mention is made of the 50 or so residential properties including a 12 bed hotel and a 28 bed youth hostel within the vicinity of the proposed wind farm. However, I have assessed the properties in the area and turbine noise at all of them is below the most stringent of the ETSU guidelines.
- 7 I have assessed the likely loss of amenity at the surrounding properties. Although there appears to be a marginal loss of amenity at Borland and Glenfoot it unlikely that this will occur in practice due to topographical shielding. Apart from this none of the properties will suffer a loss of amenity.
- 8 Should the proposal be granted planning permission I recommend that there should be conditions attached that limit noise levels at surrounding properties. There should also be a condition limiting the sound power levels of the turbines.
- 9 If planning permission is given for this and other windfarms nearby there may be a cumulative effect on any residents. I have written a separate report on this.

## 1 INTRODUCTION

This report is prepared on the instructions of Perth and Kinross Council. The purpose is to examine and comment on the Noise Section (Chapter 11 and Technical Appendix B) of the Environmental Statement for the proposed windfarm at Green Knowes and to provide an opinion as to the impact of the windfarm on local residents. Note that references to the Environmental Statement refer only to the noise section.

I have not been asked to comment on construction noise.

## 2 METHODS OF ASSESSMENT

The method of assessment used by the applicant is set out in *The Assessment and Rating of Noise from Windfarms* (ETSU-R-97). This is commonly used to assess windfarm noise and is incorporated into PAN45 *Renewable Energy Technologies*. However, it is not a method of assessing the impact of noise on neighbours. This is not merely a personal view but is clearly stated in the first paragraph of the Executive Summary of ETSU-R-97 where it explains that the report *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*. Section 3 of this report contains my comments on the Environmental Statement in terms of ETSU-R-97.

The most commonly used method of assessment of the impact of a new noise is by comparing the new noise with the pre-existing background noise by the method set out in British Standard 4142. At low noise levels there is some controversy about using this method but, for all its faults, BS4142 has been around for nearly 30 years and is widely used in rural Scotland even for low background levels. The Appendix sets out the issues in more detail.

Since the Environmental Statement does not clearly set out the noise impacts on neighbouring properties I have used BS4142 to do this in Section 4.

## 3 ETSU-R-97 ASSESSMENT

This is the method used in the Environmental Statement. The ETSU method compares the predicted noise from turbines with the background noise or, where background noise is low, with a fixed noise level. This requires that measurements of background noise are made, turbine noise levels are calculated, and a comparison is made of the two.

All noise levels in this section are shown as  $L_{A90}$  unless otherwise stated, in accordance with ETSU-R-97.

### 3.1 General Comments

In the Noise section of the non-technical summary the methodology of assessment is described but there is no conclusion as to the impact of the development and it does not say whether it meets ETSU guidelines. This is unsatisfactory as this is the section that most people will read.

Paragraph 11.29 says that *new wind turbine designs are much quieter than those of a few years ago*. This is not correct. On the whole turbines are getting more noisy as they get bigger though the ones selected here are only marginally more noisy than the smaller ones of ten years ago because they are to be run at reduced power.

Paragraph 11.33 says that *the . . . ETSU document provides a framework for the impact assessment of windfarm noise and gives indicative noise levels believed to offer a reasonable degree of protection to neighbours of windfarms*. This is misleading. As can be seen from the quotation in section 2 above ETSU does not claim to make an impact assessment and the other half of the key sentence that refers to burdens on the developer has been omitted.

Again paragraph 11.46 is misleading for the same reason that ETSU is not a measure of environmental effects.

In paragraph 8.3 of Appendix B and elsewhere it says that the high noise level at Coulshill is due to its exposed position on high open moor. This is clearly not the case because if it were the noise levels at low wind speeds would be very low which they are not. In fact the noise at Coulshill is due to noise of the farm and of the adjoining burn. This is further demonstrated by the fact that there is hardly any correlation between noise level and wind speed.

### 3.2 Background Noise

A meeting was held on 13<sup>th</sup> July 2004 at which representatives of the applicant, their consultant, Perth and Kinross Environmental Health Department and I were present. I and the officers of the Environmental Health Department expressed some concern regarding the background noise levels and asked if these could be investigated and explained. There was no response and the information now provided in the ES is less than that presented at the meeting.

No background noise levels have been reported in the ES. The only background noise results are the (presumably) average ones shown in Figures 11.1, 11.2 and 11.3 (and repeated in figures 4 to 9 inclusive in Appendix B). These show the background noise as a straight line with no explanation and only show results for three of the five locations. Normally the “average” line is made by a polynomial, as a straight line is too simplistic to represent background noise.

I therefore asked for the detailed background noise levels, which I received on 31<sup>st</sup> December 2004. These contained measurements for Coulshill, Borland and High Cleugh. I have presumed that the figures headed “LAF, Perc6” are the LA90 background noise figures. The quality of the measurements is unsatisfactory for the following reasons:

The noise data has been taken in 10 minute 1 second intervals. Although this is probably not highly significant it is inaccurate in that the noise data gradually gets out of synchronisation with the wind data.

The data for High Cleugh was taken from 19<sup>th</sup> May to 21<sup>st</sup> June 2004. There is clearly a fault in the LA90 data between 22<sup>nd</sup> May and 2<sup>nd</sup> June as can be seen from the chart in the spreadsheet.

The data for Borland and Coulshill have sections missing. Whilst this may not affect the results it has been stated in the ES that 20 days of measurements were taken whereas there are about 13 and 15 days respectively.

### **3.3 Turbine Noise**

It should be noted that the turbine noise calculations are based on the Vestas V66 running in low power/low noise condition. If it is run in the normal mode then the noise levels will be significantly (4.5dB) higher than shown. Section 4.5 in Chapter 4 of Volume 1 shows that other possible candidates are the Bonus 1.3 and the GE 1.5MW. The Bonus 1.3 is slightly quieter and I do not have figures for the GE 1.5.

The noise levels shown for the V66 in figures 11.2, 11.3 and 11.4 appear to be correct at 8m/s but the variation of noise of the V66 with windspeed shown in the figures is wrong. The line shows that sound power increases by 0.4dB per m/s whereas the manufacturers figures show (for example) that the level at 10m/s is 2dB more than that at 8m/s.

### **3.4 Proposed Turbine Noise Standards**

The maximum permitted noise level of turbines has been derived using paragraphs 21 and 22 of ETSU R-97. This permits levels of 5dBA above background noise except where background noise is low when there is an absolute limit of 35 to 40dBA during the day and 43dBA at night.

The applicant has not selected an absolute day time level but, since it is suggested that all the sensitive properties meet the lower 35dB, this absolute level can be adopted.

### **3.5 Assessment**

In paragraphs 11.13 and 11.14 five locations were selected as sensitive receptors. No mention is made of the fact that there are around 50 residential properties, a 12 bed hotel and a 28 bed youth hostel within the same sort of distance as the five receptors mentioned. Even if there is no significant impact, such a large number of properties should at least be identified so that residents can be satisfied that their interest has been assessed.

Section 11.52 of the ES shows that at the three assessed properties all the ETSU criteria are met. To clarify the position I have assessed all the properties in the area and turbine noise at all of them is below the most stringent of the ETSU guidelines.

## 4 NOISE IMPACT ASSESSMENT

I have set out in this section my assessment of the likely loss of amenity to residents using the spirit of British Standard 4142.

Unless otherwise stated in this section, turbine noise is in  $L_{Aeq}$  and background in  $L_{A90}$  as provided for in BS4142. I have no evidence that there are any tonal components in windfarm noise and so the  $L_{Aeq}$  value is the same as the rating level described in BS4142. Wind speeds are those at 10m height.

As a rule of thumb I think that all properties within 2km of a turbine should be assessed. This is less than the minimum distance for these turbines in the Wind Energy Policy Guidelines produced by Perth and Kinross Council.

I have assembled the list of properties from the Ordnance Survey map, visits to the area, enquiries of local people and information from the internet. The numbers of properties shown is approximate. In the case of Glendevon Park I understand that planning permission has been granted for a total of 160 homes.

### 4.1 Background Noise

I have not analysed the raw data in sufficient detail to use it for an assessment. Instead, I have taken typical background noise levels based on my own experience of similar locations to those here. The basic level chosen is 31dBA at 8m/s rising at 2dBA for each 1m/s increase of wind speed and falling by 2dBA for each 1m/s decrease of wind speed to a minimum value of 24dBA. The background noise levels computed in this way are incorporated into Perth and Kinross Wind Energy Policy Guidelines June 2004. I have modified these figures in the case of Glendevon because of the particular circumstances. All the properties except Coulshill are significantly affected by noise from the River Devon and burns feeding it. Most of the properties were subject to levels of up to 45dBA when I was there but there had been heavy rain in the preceding few days and there will be a significant period when noise levels are much less than this.

To allow for this I have assumed that the background noise is a minimum of 30dBA at those properties near the river and 27dBA at Borland and Glenfoot.

I see no reason to differentiate between day and night since the turbine noise levels will be no different. In any case, in most rural areas there is only a small difference in background noise levels between day and night.

The table below shows these background noise levels. The second column shows the approximate number of properties in the area. The Youth Hostel (28 beds) and the Hotel (12 beds) are each treated as one property.

	Prop	Wind Speed m/s									
		4	5	6	7	8	9	10	11	12	
Coulshill	2	24	25	27	29	31	33	35	37	39	
Borland	1	27	27	27	29	31	33	35	37	39	
High Cleugh	2	30	30	30	30	31	33	35	37	39	
Church	5	30	30	30	30	31	33	35	37	39	
Hunthall	2	30	30	30	30	31	33	35	37	39	
Glendevon Park	18	30	30	30	30	31	33	35	37	39	
Glenfoot	1	27	27	27	29	31	33	35	37	39	
Glendevon	20	30	30	30	30	31	33	35	37	39	
Burnfoot	10	30	30	30	30	31	33	35	37	39	

## 4.2 Turbine Noise at Neighbours

I have used the noise levels at the neighbouring properties as calculated by the CONCAWE method, which takes account of different meteorological conditions. The conditions taken are Category 6, which is favourable to downwind propagation. In practice the results from this method are usually within about 1dBA of those obtained using ISO 9613-2, which is the applicants model. In accordance with BS4142 the values are  $L_{Aeq}$  so the noise levels are typically 2dBA higher than the ETSU figures.

I have used the manufacturers data for the Vestas V66 running at low power (102dB) rather than those in the ES.

The table below shows the turbine noise levels at the properties.

Location	Wind Speed m/s									
	4	5	6	7	8	9	10	11	12	
Coulshill	23	27	30	31	32	33	34	35	36	
Borland	24	29	32	32	33	34	36	37	37	
High Cleugh	24	28	31	32	33	34	35	36	37	
Church	25	29	32	33	34	35	36	37	38	
Hunthall	21	25	28	29	30	31	32	33	34	
Glendevon Park	25	30	33	33	34	35	37	38	38	
Glenfoot	24	28	31	32	33	34	35	36	37	
Glendevon	19	23	26	27	28	29	30	31	32	
Burnfoot	19	23	26	27	28	29	30	31	32	

## 4.3 Assessment of Impact

BS4142 says that *A difference of around 10dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance.*

An increase in noise level of up to 3dB is not readily detectable.

Based on the principles above, I suggest an assessment of loss of amenity as follows shown below and in Perth and Kinross Wind Energy Guidelines June 2004.

- A difference of 3dB or less – insignificant
- A difference of 4 to 6dB – marginal loss of amenity
- A difference of 7 to 9dB – significant loss of amenity
- A difference of 10dB or more – major loss of amenity

The old planning guidance (Circular 24/73) provided some justification for this in the case of industrial noise generally. It says (in common with the Welsh guidance quoted on page 21 of ETSU-R-97) that *where, by the standards established in BS4142, “the noise from the development is likely to give rise to complaints” it will hardly ever be right to give [planning] permission.* PAN 56 is less specific but says in relation to windfarms that *Good acoustical design and siting of turbines is essential to ensure there is no significant increase in ambient noise levels as they affect the environment and any nearby noise-sensitive property.*

Taking the two tables above I have deducted the background noise level from the turbine noise level to obtain the values in the table below.

Location	Wind Speed m/s									
	4	5	6	7	8	9	10	11	12	
Coulshill	-1	2	3	2	1	0	-1	-2	-3	
Borland	-3	2	5	3	2	1	1	-1	-2	
High Cleugh	-6	-2	1	2	2	1	0	-1	-2	
Church	-5	-1	2	3	3	2	1	0	-1	
Hunthall	-9	-5	-2	-1	-1	-2	-3	-4	-5	
Glendevon Park	-5	0	3	3	3	2	2	1	-1	
Glenfoot	-3	1	4	3	2	1	0	-1	-2	
Glendevon	-11	-7	-4	-3	-3	-4	-5	-6	-7	
Burnfoot	-12	-7	-4	-3	-4	-5	-5	-6	-8	

There will be a marginal loss of amenity at Borland and Glenfoot in a narrow band of windspeed, otherwise none of the properties will suffer a loss of amenity. I think it unlikely that even this marginal loss of amenity will occur in practice due to topographical shielding.

There is a reasonably well used footpath from Glendevon to Auchterarder running close to some of the turbines.

#### 4.4 Other Matters

Should the proposal be granted planning permission then there should be conditions attached that limit noise levels in two ways:

A condition limiting the sound power level of the turbines to 102dBA at 8m/s and appropriate other levels at other wind speeds.

Maximum noise levels to be achieved at surrounding properties.



I am aware that there are other applications for windfarms pending in the immediate area. I have dealt with this in a separate paper.

## **5 RECOMMENDATION**

The application meets the most stringent of the ETSU guidelines. The calculations show that there will be a marginal loss of amenity at two properties for a very limited time though in practice this may not occur because of shielding by the topography. I therefore recommend that there be no objection on the grounds of noise.

## APPENDIX

ETSU R-97 is not, and does not claim to be, a method of assessing loss of amenity. It sets out maximum noise levels from windfarms that aim to achieve a balance between the need for windfarms and the protection of residents' amenity. The levels set are effectively the upper limits of acceptability or even higher. For example, for night time, the level proposed by ETSU R-97 is that which the World Health Organisation considered to be the highest level at which people are able to get back to sleep.

The ETSU R-97 method is quite different from general practice in assessing loss of amenity such as the use of BS4142. It is different even from the method normally used to assess other renewable energy developments such as landfill and biomass generators.

In my opinion an Impact Statement should clearly set out the potential loss of amenity to residents. Thereafter the decision as to whether any loss of amenity is outweighed by other factors is a political one.

### Normal Practice

Where a new noise is to be introduced into a residential area it is normal to set a noise limit relative to the pre-existing background noise.

### What is Background Noise at a Windfarm Site?

ETSU R-97 rejects BS4142 for two reasons related to background noise. The first is that it is not applicable in low background noise levels and the second is that it should not be used when wind speeds are above 5m/s. I see no reason to reject the principle of the method on these grounds.

### Low Background Noise

In low background noise levels much is often made of the suggestion that BS4142 precludes its own use where background levels are less than 30dBA. The current standard (which was published after ETSU R-97) actually says that *the method is not suitable . . . when the background and rating noise levels are both very low*. Very low is defined as 30dB for the background level and 35dB for the rating level.

The fact is that some measure of loss of amenity needs to be applied below a background level of 30dB and there is nothing better at present than to use the same method of comparing turbine noise with background.

### Wind

BS4142 also requires that measurements be made with wind speeds less than 5m/s. There are two reasons for this. The first is that, for most assessments, windy weather is not representative of quiet times and the second is that noise may be created by wind on the measuring equipment. Clearly the procedure needs some modification for wind turbines because they do not generally operate until wind speeds reach around 4m/s and it would be unreasonable to base the assessment in calm conditions when the turbines would not be working. BS4142 is

looking for the noise level in the quietest normal circumstances. With wind farms it would be reasonable to make background noise measurements when wind speeds at the development site were in the range at which the turbines operate. In fact, ETSU R-97 accepts this point and does make background measurements in this way. Clearly care needs to be taken to ensure that wind noise on the microphone is not a factor.