Executive Summary
Three Windfarm Studies and An Assessment of Infrasound

Written Submission by *Tharpaland International Retreat Centre*
(Accompanied by various additional documents)

Introduction

Tharpaland International Retreat Centre (TIRC) is the main international retreat centre and residential centre for the educational programmes in Scotland of a major worldwide Buddhist tradition (see Tharpaland, 2003a and 2003c). It is located within the beautiful and isolated setting of the Forest of Ae, in Dumfries and Galloway.

As Buddhists, we cherish the natural environment and all who live in it, and are committed to the development of clean and sustainable forms of energy and are therefore not opposed in principle to the development of windfarms.

However, in March 2003, following news of a proposal to build a massive windfarm in the Forest of Ae, Tharpaland set about assessing the wider implications this would have on the Centre's ability to provide suitable conditions for meditative retreat, if the windfarm was approved. To this end, Tharpaland decided to study the possible impact a windfarm might have on meditative retreaters, in particular. Studies were then carried out at 3 Scottish windfarms – Hagshaw Hill, Beinn An Tuirc and Deucheran.

The findings of these studies (see *'Effects of Windfarms on Meditative Retreaters – A Human Impact Assessment'* Tharpaland, 2003b), were so surprisingly negative and adverse that there was little room for doubt that the proposed windfarm, if approved, would force Tharpaland to close. However, although originally concerned with the impact that the proposed windfarm would have on just Tharpaland, it became increasingly apparent that the results of the studies could have potentially serious implications for the health of the Scottish population as a whole. Therefore, a follow-up analysis of the data was also carried out to explore this further (see *'An Assessment of Infrasound and Other Possible Causes of the Adverse Effects of Windfarms'* Tharpaland, 2004).

This submission '*Three Windfarm Studies and An Assessment of Infrasound'*, presents a synopsis of the results of the Tharpaland windfarm studies (2003b). Whilst covering most of the topics requested in the remit, the submission focuses on those issues most relevant to the main points of the Tharpaland studies (2003b, 2004), such as planning and local issues, and in relation to windfarms specifically. Tharpaland welcomes the opportunity to share their concerns and positive recommendations with the Committee and hopes they will bring clarity and benefit to those in charge of renewables policy.

Human Impact Assessment of Windfarms

In our response to Scottish Power's Scoping Report (see Appendix 1 – Tharpaland, 2003b), we stated that the current assessment methodology proposed in Scottish Power's Scoping Report to assess the impact of the proposed windfarm on human beings, in general, and on highly sensitive meditative retreaters in particular, was inadequate.

An Environmental Impact Assessment must include an appropriate and vigorous human impact assessment, because human beings constitute an essential part of the environment. A human impact assessment must

take into account human experience and since the very nature of human experience is subjective, a subjective assessment methodology is required. Objective measures of physical variables alone, such as decibel noise levels and landscape features, are not enough to adequately predict the human impact. To assess the probable impact of a proposed windfarm on the human experience requires a thorough assessment of subjective variables including many psychological, health, social and spiritual factors not included in the standard assessment methodologies. The Tharpaland study (2003b) has to some extent redressed this omission. The assessment methodology adopted is explained in more detail in the full report (Tharpaland, 2003b).

Effects on Concentration and Psychological and Physiological Health

As the development of concentration is absolutely central to all of the education and meditation programmes at Tharpaland – indeed, to the whole Buddhist spiritual path – concentration was selected as the key variable against which windfarm impact was assessed in all of the studies (Tharpaland, 2003b). However, it should be noted that the development of concentration is also essential to learning ability in general and therefore the whole educational process, as well as job efficiency at work, and so the results of these findings point to implications beyond those concerning Buddhist retreat alone.

Loss of Concentration

The 3 windfarm studies (Tharpaland, 2003b) showed a consistent and progressive average 70% loss in ability to develop concentration over the various distances approaching the windfarms, and virtually a total loss in ability to develop concentration at the turbine site itself (see Appendix 4–Tharpaland, 2003b). A simple preliminary regression analysis (see appendix 6–Tharpaland, 2003b) of the data of two of the windfarm studies indicates that…

> (1) Proximity to a windfarm does have a significant adverse impact on the development of concentration (at a 99% level of confidence)
>
> (2) To be able to meditate normally, a meditative retreater would have to be between 6-10 km from the windfarms (at a 95% level of confidence)

A control study at a non-windfarm site was conducted to assess the methodology, but showed no significant change in ability to develop concentration, indicating that the assessment methodology itself did not contribute to the observed results of the windfarm studies (Tharpaland, 2003b).

Adverse Health Effects

In all of the windfarm studies, subjects reported a variety of other, often intensely disturbing, adverse effects (see full subjective reports in Tharpaland, 2003b):

(1) Effects on the Development of Concentration

The subjective reports for all 3 windfarm studies indicate a progressive intensification of three of the principal obstacles to developing concentration, (1) mental excitement (2) mental dullness and (3) mental sinking, during the approach to and within each windfarm[1]

[1] **Mental Excitement** – occurs when the mind wanders to an object of desirous attachment; **Mental Dullness** – functions to make both the body and mind heavy and inflexible; **Mental Sinking** – caused by mental dullness, the mind loses clarity and intensity of the object of meditation.

(2) Acute Physical Symptoms

Many of the subjects reported the development of acute physical symptoms including (1) head and chest pressure and pain, and even intense pain (2) heart palpitations (missed beats) (3) nausea, stomach pain and dry retching (4) breast pain and (5) dizziness, both approaching and on site at all 3 windfarms.

(3) Negative Psychological Reactions

Subjects also reported disturbing negative psychological reactions including (1) confusion (2) loss of self-confidence (3) effects similar to depression (4) effects similar to mania (5) irritability and anger (6) heightened emotionality and crying.

(4) Adverse Auditory Impact

Most of the subjects reported that they found many of the different types of sound/noise produced by the turbines to be highly intrusive and disturbing. The mechanical noise (high pitched, pervasive humming sounds) emitted by the turbines was clearly audible at 2.2 km, and the aerodynamic noise (whooshing sounds) of the turbine field at Beinn An Tuirc could be heard at a distance of 4 km. The noises made by the turbines were clearly not masked by ambient background sound/noise.

(5) Adverse Visual Impact

The visual impact of the turbines, even at considerable distances of up to 8.6kms, was found to be highly disturbing. Amongst other visual factors reported to be disturbing at all 3 windfarms studied were (1) the constant rotation of the turbine blades (2) the lack of synchronicity of blades within clusters of turbines (3) the view of partial blades 'flicking' on a horizon (4) the strobe effect of shadow-flicker and (5) the dominating presence of the turbine structures. These findings indicate that 'visual impact' is not merely in the 'eye' of the beholder and related to visual amenity alone, but is related to deep physiological and psychological processes within that beholder.

(6) Disturbing After-Effects

Subjects also reported a number of disturbing visual after-effects. Many of the other preceding adverse effects as well as other symptoms or reactions that developed later, persisted after leaving the windfarms, sometimes into later that evening or even over the next few days.

(7) Adverse Effects at Varying Distances from Windfarm

The greater number of these adverse effects (74%) were experienced at the assessment points within a 2.2 km distance from the turbine fields. However, 26% of the effects were reported at assessment points at a distance of 3.8 km or greater from the turbine fields and 6% of the reports were made at a distance of 8.6 km from the turbine field.

Conclusions

For most of the subjects in these studies, these windfarms were centres of massive and traumatic disturbance, even after only a few hours. In almost all cases, subjects reported a 'relief' in leaving the turbine field. The subjects participating in the 3 windfarm studies (Tharpaland, 2003b) represent not a general population, but the specific population of meditative retreaters who frequently attend retreats at Tharpaland. However, many people living near existing windfarms have reported adverse effects and experiences that are very similar and, in many cases, identical to those reported by the subjects of the 3 windfarm studies (see appendix 7– Tharpaland, 2003b).

Possible Causes of the Adverse Health Effects

Many possible causes of the adverse health effects reported in the windfarm studies (Tharpaland, 2003b) are listed in the follow-up report to these studies (Tharpaland, 2004). However, although the findings of the studies (Tharpaland, 2003b) indicate that many aspects of the auditory and visual impact complex were functioning to produce many of the reported effects, many of the symptoms reported were closely correlated with those related to 'infrasound'. Therefore, the follow-up report (Tharpaland, 2004) includes a detailed comparative analysis between the Tharpaland windfarm studies and extensive citations from the research literature on low frequency noise and infrasound and their effects.

Infrasound

Infrasound is mainly inaudible sound, below the threshold of human hearing, at or below the frequency of 20 Hz (Leventhall, 2003). It is well-known that not only do large turbines produce infrasound, but that "…the peak acoustic energy radiated by the large wind turbines is in the infrasonic range, with a peak in the 8-12 Hz range" (Kelley, 1998). In other words, the main acoustic output of large turbines is infrasound, not the audible sounds of the turbines which can be heard.

"Infrasound is difficult to control"… "attenuating factors, such as absorption by the ground and shielding by barriers are also low at low frequencies…The net result is that the very low frequencies of infrasound are not attenuated during propagation as much as higher frequencies… Attenuation by an enclosure requires extremely heavy walls, whilst absorption requires a thickness of absorbing material up to and about a quarter wavelength thick, which could be several metres" (Leventhall, 2003).

The infrasonic impact of an operational windfarm, may therefore be far greater than that which the audible noise of the windfarm would indicate, may produce its effects at a far greater distance from the windfarm than the audible noise level would suggest, may be impossible to mitigate in situ by either enclosure, shielding or absorption, and may be subliminal, and therefore not consciously attributable to its source.

The most frequently reported health effects reported in both the research literature on infrasound and the 3 windfarm studies (Tharpaland, 2003b) are: head pressure/pain, chest/heart pressure/pain, nausea, loss of concentration, mental excitement, fatigue, anxiety, disturbance, distress, impaired performance and sleep disturbance (see Table 3–Tharpaland, 2004)

Many adverse health effects have been attributed to long-term exposure to low-frequency noise and infrasound, including heart disease, stroke, cancer, epilepsy, rage reactions, and suicide (Alves-Pereira, 1999b). Scotland is already a world leader in the incidence of cancer and heart disease (ISD, 2003). The siting of windfarms near locations of human habitation, especially major cities such as Glasgow (Whitelee Forest) and Aberdeen (off-shore) may dramatically increase the incidence of heart disease and cancer in those cities in the coming years.

The ETSU-R-97 guidelines (1996) for noise assessment of windfarms stipulate noise limits only at frequencies above 20 Hz and therefore infrasound is not measured.

Therefore, at present, the measurement and assessment of the infrasonic outputs of windfarms are not required within the statutory or advisory guidelines of the wind industry, are not a part of their standard Environmental Impact Assessment methodologies, and are therefore not included within the Environmental Statements accompanying windfarm development applications. To safeguard the health of those residing in the vicinity of windfarms, these should be re-considered and incorporated into all relevant noise policies, planning policies and advice notices.

The Human Impact Assessment carried out by Tharpaland (2003b, 2004) demonstrated that windfarm impacts can produce a wide range of the same kinds of adverse health effects known to be caused by exposure to infrasound. The results of the Tharpaland (2003b) study are also corroborated by surveys of the physical and psychological complaints of communities living near existing windfarms in the UK, Sweden and Germany (see appendix 7–Tharpaland, 2003b). Infrasound should therefore be considered to be one, but not the only one, of the main probable causes of many of the adverse health effects observed in the Tharpaland studies.

Sensitive Developments

The synopsis presented above indicates that a rigorous overhaul of the guidelines and policies on windfarm development is required with regards to the population as a whole. However protective measures are also needed to safeguard those other centres of human activity sensitive to the various impacts of windfarm developments including, for example:

- Educational establishments (such as nurseries, schools, colleges and universities)
- Spiritual and religious centres and institutions, especially those concerned with reflection and meditation (such as monasteries, churches and retreat centres)
- Hospitals and places dedicated to convalescence, care, and the enrichment of health and well-being
- Charities and businesses whose existence particularly depends upon the maintenance of present environmental conditions and standards (such as tourist accommodation)

As an international spiritual retreat centre offering regular educational programmes, with the aim of enabling others to find physical and mental well-being; as a thriving charity whose aims and functions depend upon a pure, quiet and mentally healing environment, and as a business whose financial viability depends on all of these factors, Tharpaland recognises the importance of the statutory protections needed for such establishments.

Windfarms as Tourist Sites

Windfarms should be seen for what they are -‘industrial power-generating plants’. In view of their potential health hazards, tragic consequences could result if windfarms are turned into tourist attractions.

Community Ownership of Windfarms

Simply diverting windfarms from corporate to community ownership will not redress their adverse effects on health. A small windfarm of only 7 turbines of moderate size presently operating in Barrow-in-Furness, Cumbria has been causing enormous suffering to at least 18 residents for over four years (see Appendix 7–Tharpaland, 2003b). Even community owned windfarms, no matter how small, should be sited far away from human habitation.

Possible Consequences of Meeting Current Renewables Obligation Targets Prematurely

Whilst the intention underlying the Renewables Obligation targets is to be applauded and sustained, without adequate research and a realistic strategic plan, the current rush for windfarm developments throughout the country and the impacts this will bring, could bring dire consequences for Scotland in the coming years.

For example:

• A decline in general public health and well-being, including a major increase in cancer, heart disease and immune-deficiency related diseases, mental illness, suicide and violent crime, adding a further burden on the health system.

• A decline in standards throughout the educational system, due to a degeneration of learning ability, which depends upon the ability to develop concentration.

• The main economic sector within the Scottish economy -tourism – could be wiped out.

• Spiritual centres and communities could be forced to close and disperse.

The Renewables Obligation targets, with their current emphasis on wind energy must be re-considered in light of the results of the Tharpaland studies (2003b, 2004) if potentially major health, social, economic, and in the end, political problems are to be averted.

With further research and a comprehensive strategic plan, the Renewable Obligations' attempts to affect climate change can be implemented and progressed without contributing to a global catastrophe of another kind, and another public inquiry a few years down the line.

Recommendations

Health -Research

• **Research into the potential health effects of windfarms** should be initiated immediately and carried out by impartial and independent organisations and consultants.

• A thorough and sympathetic **assessment of the complaints** of those living near to existing windfarms should be carried out.

• A detailed consideration of the **human subjective experience** should then be included within the Environmental Impact Assessment process.

• A full-range **infrasonic radiation assessment methodology** should be developed and included within the standard Environmental Impact Assessment methodology for windfarm developments.

• A systematic **assessment of the complete infrasonic output of wind turbines** should be undertaken.

• A complete **systematic assessment** of the infrasonic effects (physiological and psychological) of wind turbines and windfarms of **different sizes** should be undertaken.

Planning

• **No more windfarms should be approved or constructed near to locations of human habitation**, e.g. not within 10km (see appendix 6–Tharpaland, 2003b).

• **Buffer zones** should be included in new Planning guidelines that indicate the safe distance a windfarm can be from human habitation, and especially from sensitive developments, e.g. schools, hospitals, spiritual centres etc.

• A **strategic search** should be implemented to see if a few suitable locations can be found throughout Scotland, far from human habitation, tourist and environmentally protected areas, wherein all windfarm developments can be sited.

• If suitable locations are found, the **national grid should then be extended** into these remote areas to provide windfarm access to the national electricity supply.

Conclusion

Very serious implications raised by these studies are at risk of being overlooked or ignored in the rush to achieve the renewables targets so soon. These targets must be approached with a comprehensive and detailed consideration of the far-reaching impacts and implications for Scottish society.

Tharpaland are hopeful that the Committee can find ways for the Renewables Obligation targets to be met, bringing economic benefit to local communities and Scotland as a whole, whilst still ensuring the health, happiness, safety and well-being of the Scottish people.

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