Parliament of Australia Senate Wind Farm Inquiry

To: Parliament of Australia – Senate

Attention: **Contact:** by email

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Subject: Submission for Senate Inquiry into the Social and Economic Impact of Rural Wind Farms

To the Chairperson of the Senate Inquiry into the Social and Economic Impact of Rural Wind Farms

Please find attached a discussion of the following items discussed herein.

1. Noise Modelling

1.1 Background

The noise emissions from Wind Energy Facilities (WEFs) or 'wind farms' in Victoria are predicted using methodology outlined in the New Zealand Standard NZ6808:1998 as prescribed by the State Government guidelines. This standard provides a *guide* to acceptability of sound from a wind farm.

Mathematical models are used for *predicting* the level of noise emitted by turbines. These models determine placement of turbines in relation to neighbouring residences (both stakeholders and non stakeholders). Developers doggedly use these guidelines, despite being aware of issues that are not accounted for in the models, but exist in reality, to allow them to place turbines up as close as they can to people. These guidelines are resulting in the under prediction of noise emissions from turbines.

The consequence of under prediction is high, **resulting in the displacement of families, as has happened most recently at Waubra**. Acciona, the wind farm operator at Waubra, recently purchased another two houses late last year, due to non-compliance with noise emissions.

There are inherent risks associated with using models. Models do not need to be 100% perfect, before application. If this was the case, few models would ever be deployed, as it is doubtful that a model could be built that reflected every possible eventuality. However, what is important is the level at which the model can be relied upon to predict reality and that model weaknesses are recognised and understood, with sufficient conservatism applied to ensure that those eventualities it cannot predict are considered and appropriate allowances have been made.

1.2 A Case Study – Stockyard Hill Wind Farm, Victoria, Australia

The following section outlines some of the deficiencies with the current modelling process that have resulted in incorrect noise predictions.

The Stockyard Hill wind farm application will be used as a case study throughout this section, as the author is familiar with the material, having been a participant in the Stockyard Hill panel hearings. The list is certainly not exhaustive as the author did not have access to sufficient information to undertake a detailed validation, but offers an opinion on the information provided.

1.2.1 Developing site-layout

Wind farms are by definition clusters of turbines that are strongly influenced by surrounding turbines. Wake and turbulence affects will lead to heightened noise zones that shift with prevailing winds. The effects are cumulative and hard to predict.

Before site-layout can be planned, a turbine model is required to be chosen due to:

a) Different turbine models have different 'Sound power level profiles' and 'Octave band sound power level spectrum' which are used in determining set-back distances from neighbouring residences; and

b) Different turbine models have different underlying assumptions relating to observing minimum distances between turbines, proximity to plantations, position on slopes, etc.

If the turbines are not sited using the manufacturer's specifications, then the sound power curves and octave bands used in the noise modelling will not hold and may result in inaccurate predictions. If the assumptions are not observed, then the manufacturer will not be able to provide noise certification. Further, if a different turbine is used, then the modelling will not hold.

These may seem like simple points, however, at the Stockyard Hill Panel hearing, Origin applied for 2-3MW turbines with 104m blades for the Stockyard Hill Wind Farm. To determine site lay-out, Origin used a 2MW REpower turbine to undertake noise modelling and minimum distances between turbines as required by the manufacturer were not observed. Further, there is no 2MW turbine in the REpower range that has 104m blades, only a 3MW turbine, which likely has different sound power curves and octave bands[1].

1.2.2 Data preparation

Data preparation is the most critical activity in the model development process. Data underpins the model. If insufficient attention is given to collecting and understanding the data, there is a high risk that the eventual models will lead to incorrect predictions.

During the panel process, very little attention is paid to the models used to determine noise contour lines, which appear to be accepted as accurate. However, we know that this is not true from the post construction monitoring undertaken at Waubra, where at least 2 homes have been purchased due to

[1] I was unable to confirm this as REpower refused to supply the information and referred me to Origin for help.

non-compliance post construction monitoring. A review of publically available post-construction noise compliance results as provided by Marshall Day Acoustics at the Stockyard Hill Panel hearing shows a variation between predicted and actual noise is +/- 4dBA for the particular sites shown.

In practical terms, this means that we know that the models used for making noise predictions are inadequate. The Stockyard Hill panel hearing and indeed many in Victoria seem to get caught up in the errors surrounding the background noise monitoring, which given the R^2 for the line of best fit would be best dismissed as unable to relied upon.

We all know that sounds carries differently across gullies, as compared to flat terrain, on quiet still mornings as compared to windy days. How noise carries depends on many factors – terrain, atmospheric conditions, soil type, vegetation, type of turbine, etc. There is little information on the data used to create the models / equations used to determine noise contour lines. If the models / equations used were developed in completely different environments, this would help to partially explain the variation between prediction and actual results.

To overcome this issue, the underlying model should be understood. Differences in the environment should be acknowledged and sufficient conservatism applied to ensure that under prediction does not occur. We know from the information provided at the Stockyard Hill panel hearing that the acoustic experts used an assumption of flat terrain for what is an undulating site. Further, no account has been taken for temperature inversions, which are typical in the valleys at certain times of the year and will affect how noise is carried.

1.2.3 Sample Design

Seasonality bias was not considered in the Stockyard Hill planning documentation. The 10 day period of monitoring in one season is insufficient to represent a season, much less a full cycle of seasons, particularly given the variability in recent seasons.

One anometer was used to collect wind speed data for the entire 156km^2 site. Given the scale of the project, it would appear that one site was insufficient to collect wind speed data. The wind speed data on the anometer was collected not at hub height (80m) as required, but at 42m and 60m. These recordings were then extrapolated using a conversion equation to 80m. The impact, if any, of this approach is unclear, but may potentially further bias results.

Weather data was collected for the Stockyard Hill wind farm from the Ballarat weather station. However, this is some distance from the project and weather patterns in Ballarat are different from the project site.

The noise contour modelling was used to place wind turbines at distances from neighbouring non-stakeholder houses to ensure the maximum possible noise limit of 40dBA at all wind speeds was used for all non-stakeholder properties, with the exception of those where background noise monitoring was undertaken. This is a big assumption, as it assumes that the modelling is 100% correct.

1.2.4 Modelling

As discussed in 1.2.1 above, if the criteria as set out in the manufacturer's specifications is not adhered to in the site lay-out plan, then the results of the noise modelling will be incorrect.

1.2.4.1 Model weakness

No model weaknesses have been identified, although we know that they occur. The following list are some of the weaknesses that were uncovered during the panel process, but certainly not exhaustive:

a) *Assumption of flat terrain and turbines at the same height*. The terrain is largely undulating with turbine placements on hills, with a difference in turbine height across the project of at least 50m.
b) *Special Audible Characteristics*. Enhanced sound levels due to meteorological conditions, not just inversions are well known. Inversions are typical and frequent at certain times of the year in this part of the Western Districts. No allowance has been made for these conditions, which will have a significant impact on noise emissions;
c) *Siting of turbines*. Some turbines have been sited closer together than that stated in the manufacturer's specifications.

The documentation is silent on these issues. It is obvious from non-compliance at other sites, that because these issues are not considered, sufficient conservatism is not applied to account for issues listed above, that turbines have been placed too close to people's houses.

1.2.4.2 Validation

No validation has been carried out on the results of the noise modelling. Given the issues described in 1.2.1 above, it would be pointless to have validation occur, until the turbine model was chosen and site lay-out determined in line with the manufacturer's specifications and noise certification achieved.

The Stockyard Hill documentation continually states that all non-stakeholder properties comply with the 40dBA noise limit at all wind speeds as specified in NZ6808:1998. This is not a fact, but is based on their noise modelling of noise contours, which may or may not be correct. Acciona have recently purchased a further 2 properties at Waubra, due to noise compliance issues. We can assume from this that the noise modelling for Waubra was inaccurate.

During the panel process the proponent's experts provided publically available post construction noise compliance results. All models will have an error term associated with them, so the +/-4 dBA cited in the documentation above, may or may not be reflective of the errors from the noise modelling produced for Stockyard Hill. However, we make the following observations:

a) The variation between the predicted and measured noise for 4 different sites around 2 commissioned Victorian wind farms vary by **+/-4dBA.**

b) If we apply the same margin of error to Stockyard Hill (which may or may not be appropriate, however the proponents have provided no statistical evidence of the accuracy of their model), then any non-stakeholder on 37dBA contour or above can expect that the 40dBA limit will be breached.

There is a massive cost to the individuals in getting this wrong, resulting in displacement of families and disintegration of communities.

1.2.5 Model Governance

The impact of the models being incorrect has the potential to **displace families and destroy the fabric of close knit communities**. To minimise this risk, best practice modelling involves validation by an external (non-interested) party.

A validation is undertaken to ensure that the modelling undertaken is 'fit for purpose' to minimise risk associated with the use of the model.

The validation should incorporate an end-to-end review of the modelling process, from collection of data to systems used to undertake modelling and use and interpretation of modelling results.

No validation of the noise modelling is required under the Victorian guidelines and is a significant contributor to the emerging noise problems at developments like Waubra, where larger turbines have been used and at a scale unseen before in Australia.

Given the significant issues with trying to determine exactly where a turbine should be placed in relation to a home, certainty could be provided to both the developer and neighbouring land owners if a minimum set-back from neighbouring homes and property boundaries was established.

1.3NZ6808:1998 is inconsistent with World Health Organisation guidelines

The current standard NZS6808:1998 and 2010 is inconsistent with the World Health Organisation (WHO) Guidelines for Community Noise. According to the WHO guidelines, an indoor noise level of 30dBA should not be exceeded for continuous noise if negative effects on sleep are to be minimised. The wind energy facilities that have been approved in Victoria have noise levels above those given by the World Health Organisation (WHO) as necessary for a good night's sleep.

Many stakeholder residences will experience levels above 30dBA inside their homes. There are studies that indicate that wind farm noise causes sleep disturbance.

Many non-stakeholder residences may also experience these levels if the predictions provided by the Acoustician at the Stockyard Hill panel hearing are incorrect (which on past experience is not unlikely).

According to the Victorian state government's Better Health website 'Children who do not get enough sleep may display symptoms including moodiness, tantrums and hyperactive behaviour' and 'regularly not getting enough sleep (chronic sleep deprivation) can affect a teenager's academic and sporting performance and may increase their risk of emotional problems such as depression. Even 30 minutes of extra sleep each night makes a difference'.

Most of us have experienced an overtired child. How is a child supposed to reach their full potential if they are unable to get a good night's sleep? We don't need a government website to tell us the impact of overtiredness on a child. However, you must question why the government, for all their rhetoric about the importance of a good education, would approve these developments knowing that some children will be adversely affected.

2. Private Airfields

2.1 Purpose

The purpose of this paper is to advise the Senate Inquiry the level of impact of Wind Energy Facilities (WEF's) on aviation safety.

2.2 Background

We have an Authorised Landing Area (ALA) or private airfield on our property identified by Airservices Australia as Beaufort (YBFT). The risk to aircraft using this airfield from proposed turbines was reviewed by consultants employed by the WEF developer and presented to the panel appointed to make recommendations for the Stockyard Hill Wind Farm.

The report prepared by The Ambidji Group, the consultants employed by Origin Energy stated that turbines as little as 1200m away from the end of the run way presented only a medium aviation risk. Their report also contained multiple technical errors including failing to publish the correct distances of the proposed turbines from the run way end (Appendix 1, Ambidji Report Response).

They also failed to take into consideration the potential impact of turbulence generated by the WEF and its potential impact on aviation safety.

If the numerous wind energy facility projects operating, approved and proposed go ahead, there would be over 2,000 turbines erected across Victoria affecting a land area of 100,000ha.

There is a number of ALA's across Western Victoria and country Australia in general. State government panels are allowing developers to place turbines dangerously close to ALA's and pilots are being placed at risk.

2.3 Risk to Aviation Safety

Turbines present two main risks to aviation safety, the first being the risk of direct strike of towers or blades by an aircraft and the second is as a result of air turbulence generated by their operation.

Aircraft Landing Areas are important in country areas for their use in aerial agricultural operations, for access by emergency services and to allow air travel in general.

2.4 Deficiencies in guidelines being used by WEF developers

Civil Aviation Authority publication CAAP 92-1 (1) is referred to by WEF developers when considering ALA's. This publication is advisory only and has been described as being totally unrealistic in certain situations by commercial pilots.

The guidelines provide recommended minimum physical characteristics of landing areas. These include areas to be kept clear for approach and taking off and areas to be kept clear either side of the airstrip itself.

Applying these guidelines there is no limit to the height of an obstacle that could be erect directly in line with the approach and departure path to an airfield used for day and night operations provided it is 900m away from the runway end. Similarly there is no limit to the height of an obstacle that could be erected 30m for day and 45m for night off to the side of the runway end. The presence of such obstacles would make the airfield totally unsafe to use and would therefore result in its closing down.

The other risk that turbines present to aviation is due to their height. Modern turbines are over 130m or 400ft in height. Under low cloud conditions or conditions of reduced visibility it is necessary to conduct circuits while approaching to land at less than the standard height of 1000ft above ground level. Under these conditions a circuit height of 500ft is allowed.

The area required to conduct a circuit is up to almost 5000m from the run way ends for a twin engine aircraft.

2.5Turbulence generated by wind turbines

Wind Turbines are dynamic structures that disrupt air flow. This disruption is caused by the passage of the blade through the air causing turbulence and reducing the speed of the air parcel, downwind of the turbine.

A review conducted by Ralph Holland in November 2009 in relation to the effect of turbines at the Crookwell Aerodrome has found that the speed of the air is reduced by 45% at ten times the blade diameter (1000m), downwind of a turbine and reduced by 37% at sixteen times the blade diameter (1600m) downwind of a turbine.

Air turbulence created by turbines represents a hazard for aircraft particularly in the taking off or landing phases when airspeed is low and the aircraft is close to the ground.

Mr Holland prepared a report on the risk presented to pilots and recommended set back distances for our airfield which have been passed to the panel and the developers of the Stockyard Hill Wind Energy Facility (Appendix 2, Stockyard Hill Wind Farm).

Mr Holland presented information to the NSW Land and Environment Court, which upheld the rejection of 11 turbines at Crookwell on the basis of aviation safety. The courts commissioner's findings can be found at:

http://www.austlii.edu.au/au/cases/nsw/NSWLEC/2009/1444.html

2.6Recommendations

An independent study is required to determine the safe set back distances for turbines from airfields.