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Recent developments in wind farm noise in Australia

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Summary

In recent years, the noise from wind turbines has become increasingly controversial. In Australia, continuing claims have been made that the noise causes direct health impacts. The controversy has spread to Senate inquiries, court hearings, the general media, social media and the community.

Although Australia has some of the most contemporary and onerous wind farm noise guidelines in the world, representations made opposing the approval of wind farms often include the following components:

- Claims of unethical behaviour by acoustic engineers engaged by the proponents to assess a wind farm proposal against those guidelines;
- Criticism of the noise guidelines;
- Criticism of the authority responsible for the guidelines;
- Personal accounts of health issues adjacent to existing wind farms;
- Claims that the health issues are related to infrasound from wind turbines;
- Selective quotes from technical papers relating to infrasound and health;
- Measurements of infrasound in the vicinity of wind farms.

Regulators are reacting by placing additional requirements on wind farm proponents, such as minimum setback distances, assessment of special audible characteristics and extensive background noise and compliance monitoring. These requirements result in wind farms being the most analysed noise source in Australia, despite noise levels being significantly lower than transport noise sources.

1. Introduction

There are approximately 60 operating wind farms in Australia, with a capacity of more than 2,500 MW and there are an additional 90 wind farms being considered (Clean Energy Council 2012). With this level of generation comes a need to ensure their advantages are balanced against the amenity of the communities in the vicinity.

This Paper has been prepared to summarise the current state of environmental noise assessments for wind farms in Australia. In particular, the paper provides a summary of:

- Current noise assessment standards and guidelines;
- The common concerns raised during applications for proposed wind farms;
- The reaction of regulators to the current controversy including additional requirements for noise assessments, minimum setback distances between turbines and residences and comprehensive post construction monitoring regimes;
- The reaction of professional acoustic bodies.

2. Current Noise criteria

In broad terms, the wind farm noise standards and guidelines used in Australian jurisdictions are based on the 'ETSU-97' document (Department of Trade and Industry 1997) and include the following common elements:

- Objective standards which provide a base noise limit and a background noise related limit;
- A background noise and wind speed measurement procedure to determine the applicable background noise related limits;
- A noise level prediction methodology to enable a comparison of the predicted noise level from the wind farm against the noise limits at each dwelling;
- The required adjustments to the predicted noise levels to account for any special audible characteristics of the wind farm noise;
- A compliance checking procedure to confirm the operational wind farm achieves the predicted noise levels at each dwelling.

Wind farm noise assessments in Australian jurisdictions are amongst the most stringent and contemporary in the world. A summary of the criteria is provided in Table 2.1.

The criteria summarised in Table 2.1 are similar to the limits for industrial noise in rural areas (eg South Australian Environment Protection Authority 2007, New South Wales Environment Protection Authority 1999) but specify significantly lower noise limits than those which apply for transportation noise (eg New South Wales Environment Protection Authority 2011, New South Wales Environment Protection Authority 2013).

Table 2.1 Summary of wind farm noise criteria in Australian States

State	Assessment Procedure	Criteria
South Australia	South Australian Environment Protection Authority 2009	Base noise limit: 40 dB(A) (in most areas) Base noise limit: 35 dB(A) (in exceptional Rural living areas) Background noise limit margin: 5 dB(A). The greater of the above limits applies
New South Wales	South Australian Environment Protection Authority 2003	Base noise limit: 35 dB(A) Background noise limit margin: 5 dB(A). The greater of the above limits applies.
Western Australia	South Australian Environment Protection Authority 2003	Base noise limit: 35 dB(A) Background noise limit margin: 5 dB(A). The greater of the above limits applies.
Victoria	Standards Council New Zealand 2010	Base noise limit: 40 dB(A) (in most areas) Base noise limit: 35 dB(A) (in exceptional high amenity areas) Background noise limit margin: 5 dB(A). The greater of the above limits applies.

3. Representations Relating to Wind Farm Applications

Following the announcement of a proposal for a wind farm, it is common for those opposed to the wind farm to form an action group. These groups are often well resourced and often engage a lawyer and/or an acoustic engineer to assist with representations or to give presentations at public meetings.

In addition to the appropriate scrutiny applied to noise assessments, the representations against approval of the wind farms often include the following components:

- The adequacy of the guidelines and standards to deal with the audible aspects of wind farm noise. The concerns are often accompanied with claims of unethical behaviour in conducting an assessment in accordance with the guidelines and standards. Reference is often made to the difference between the objective noise limits in the standards and the lowest background noise levels in the environment as justification for the inadequacy.
- The amount of infrasound produced by a wind farm and the alleged link with adverse health impacts. The health impacts are accompanied by a range of supporting studies (which often include personal accounts and social surveys) without the context of evidence to the contrary, even when the evidence to the contrary is provided by the relevant authorities. Recent representations shift the issue away from a comparison with a perception threshold to a suggestion that infrasound content at frequencies below 10 Hz (corresponding to the

frequency of the turbine blades passing the tower) is the cause of adverse health impacts if it can be measured at any level.

- The amount of low frequency noise experienced at dwellings in the vicinity of a wind farm. Whilst the representations often use the terms “low frequency” and “infrasound” interchangeably, concerns are regularly raised regarding the inability of lightweight houses to deal with the low frequency noise content from a wind farm and the resultant sleep disturbance.
- Wind shear effects and the potential impact on excessive amplitude modulation. Whilst the authorities do not require a specific assessment of the potential for high wind shear conditions, representations regularly highlight this as an inadequacy of the assessment and a high potential to result in sleep disturbance effects. Representations regularly request the probability of excessive modulation to be quantified.
- Background noise monitoring data capture and analysis. Representations regularly raise concerns with noise logger locations, insufficient data capture and incorrect removal of adverse data from the background noise monitoring regime. The response from authorities has been to seek extended monitoring periods and more detailed sector (downwind) and time based (separation of night and day) analysis. The increased data analysis results in the potential for further representations, such as night time graphs providing higher criteria than the 24 hour analysis, or the sector analysis not providing sufficient data points. A low correlation co-efficient is also regularly highlighted as an inadequacy of the monitoring process rather than an accurate indication of the relationship between the wind speed and the noise at the monitoring location.
- The use of representative turbines in lieu of a final selection at the pre-approval stage of a project. Whilst the planning assessment process needs to show that the criteria can be achieved, greater levels of assurance are often sought by representors, despite conditions of approval which require a final assessment after procurement and micro-siting. The validity of sound power level data measured from a single turbine under IEC61400 in the absence of the wake from other turbines is often raised as an inadequacy of an assessment.
- The issue of tonality has emerged following the presence of a tone at a wind farm in Australia. Whilst the enforcement leverage of a 5 dB(A) penalty resulted in measures to rectify the tonality at the wind farm, representors now request detailed guarantees based on testing in close proximity to the turbines. The response of the applicant is often to simply commit to a procurement guarantee of no audible tones in close proximity to a turbine rather than attempt to conduct an assessment of the potential for tonality at a dwelling.
- Amplitude modulation and the delineation between the inherent “swish” and excessive modulation. Representations often request the pre-emptive application of a 5 dB(A) penalty during the planning stage of a project to account for the potential for excessive modulation.
- Noise propagation models and inputs. Representations include requests for adding the level of uncertainty to the predicted noise levels and accounting for the influence of turbine wake on the sound power level inputs.
- The wind mast locations and the application of their wind speed data across the site is becoming a representation issue. This is often addressed by a wind

resource map, or a statement to the effect that the wind mast is located at a point that represents the highest wind speeds on the site.

- On a broader level, particularly with health related impacts, representations regularly "cherry pick" research outcomes without providing the broader context and/or other findings to the contrary. This is often despite clarification from the author regarding the inability to apply the cited research to wind farms.

4. Reaction of regulators

In response to the continuing controversy regarding wind farm noise, politicians, government departments, planning authorities and peak bodies have been required to consider the issue.

4.1 Commonwealth

4.1.1 Australian Parliament

It is generally accepted that environmental noise controls reside with state jurisdictions (as summarised in Table 2.1). However, the Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012 was introduced into the Australian Parliament as a private members bill. The legislation included the following:

> For the purposes of this Act, a wind farm ***creates excessive noise*** if the level of noise that is attributable to the wind farm exceeds background noise by 10 dB(A) or more when measured within 30 metres of any premises:
>
> (a) that is used for residential purposes; or
>
> (b) that is a person's primary place of work; or
>
> (c) where persons habitually congregate.

The legislation did not prescribe a measurement procedure, did not define the term 'background noise' and did not define the measurement period or descriptor to be used when measuring the wind farm noise. Therefore, the legislation could have been interpreted as requiring that the noise from a wind farm not exceed the background noise level by 10 dB(A) at any time. As the background noise in areas surrounding wind farm developments in Australia sometimes reduces to levels lower than 15 dB(A), this would have effectively set a noise criterion of less than 25 dB(A).

As part of the consideration of the Bill, the Senate's Environment and Communications Committee held an inquiry. The Committee received more than 200 submissions and held a public hearing.

Ultimately, the legislation was defeated and therefore did not pass into law.

4.1.2 National Health and Medical Research Council

The National Health and Medical Research Council (NHMRC) is Australia's peak body for supporting health and medical research; for developing health advice for the Australian community, health professionals and governments; and for providing advice on ethical behaviour in health care and in the conduct of health and medical research.

In July 2010 the NHMRC issued a rapid review of evidence associated with wind turbines and health (National Health and Medical Research Council 2010). The rapid review included the following conclusion:

> *There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.*

The NHMRC is currently conducting a more detailed assessment taking into account the latest research.

4.2 New South Wales

Although New South Wales currently uses the South Australian 2003 Guidelines, the Department of Planning and Infrastructure released Draft Wind Farm Guidelines (Draft Guidelines) for comment in December 2011(New South Wales Department of Planning and Infrastructure 2011).

The Draft Guidelines introduce procedural changes to the assessment of wind farms including the requirement for an additional layer of assessment where a residence is located within 2km of a proposed turbine. The additional layer of assessment requires a preliminary noise assessment, on the basis of which, the proposed wind farm can be refused prior to a full planning assessment being conducted.

The noise assessment requirements of the Draft Guidelines are generally in accordance the South Australian 2003 Guidelines but additional components have been included in response to concerns raised. The changes take account of the influence of wind shear in stable atmospheric conditions and special audible characteristics such as low frequency and excessive amplitude modulation. The changes result in more onerous requirements.

4.3 South Australia

4.3.1 Parliamentary inquiry

A select committee of the Legislative Council of the Parliament of South Australia was formed in March 2012 to investigate wind farms in accordance with the following Standing Order:

That a Select Committee of the Legislative Council be established to investigate wind farm developments in South Australia, with the following terms of reference:

- *(a) Separation distances between wind turbines and residences or communities;*
- *(b) The social, health and economic impacts of wind generators on individual landholders, communities and the State;*
- *(c) The need for a peer-reviewed, independent academic study on the social, health and economic impacts of wind generators;*
- *(d) The capacity of existing infrastructure to cope with increased wind power;*
- *(e) The costs and benefits of wind power in South Australia;*
- *(f) The environmental impacts of wind generators and wind power generally;*
- *(g) The siting of wind generators in South Australia;*
- *(h) The approval process of wind farms in South Australia;*
- *(i) The preparation of the State Wind Farm DPA; and*
- *(j) Any other matter the Committee deems relevant.*

The committee has received more than 200 submissions and continues to investigate.

4.3.2 Changes to planning requirements

In October 2012, the South Australian Minister for Planning approved the *Statewide Wind Farm Development Plan Amendment* (DPA).

The DPA explicitly envisages wind farms in all rural type zones in the state. In these zones, wind farms are not subject to third party appeal rights unless a turbine falls within 2km of a non-associated dwelling or township type zone. If a turbine falls within 2km, then third party appeal rights apply.

Wind turbine generators need to be setback at least 1km from non-associated dwellings and tourist accommodation and at least 2km from townships.

4.3.3 Investigations by the South Australian EPA

The South Australian EPA has conducted studies into infrasound and low frequency noise from wind farms. The conclusions of the studies include:

> *The contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment.*
>
> *Overall, this study demonstrates that low frequency noise levels near wind farms are no greater than levels in urban areas or at comparable rural residences away from wind farms.*

In the current climate, these conclusions have been subject to public debate and criticism of the authors.

4.4 Victoria

4.4.1 Policy and Planning Guidelines for Wind Energy Facilities in Victoria

In July 2012 the Victorian Department of Planning and Community Development issued the Policy and planning guidelines for wind farm developments in Victoria. The Guidelines confirmed that the 2010 New Zealand Standard (Standards Council New Zealand 2010) is to be used for noise assessments but also required a setback distance between turbines and residences of 2km, unless the permission of the owner of the residence is given.

4.4.2 Victoria Health Statement

In May 2013, Victoria Health released a document which included the following conclusions:

- *The predominant sounds produced by wind farms are in the mid to high frequencies. Wind farm sound, including low levels of low frequency sound, may be audible to nearby residents.*
- *Infrasound from wind farms is at levels well below the hearing threshold and is therefore inaudible to neighbouring residents. There is no evidence that sound which is at inaudible levels can have a physiological effect on the human body. This is the case for sound at any frequency, including infrasound.*

4.4.3 Victorian Civil and Administrative Tribunal

The assessment procedure for the proposed 16 turbine Cherry Tree Wind Farm resulted in a hearing in the Victorian Civil and Administrative Tribunal (VCAT). VCAT heard evidence for twenty three days from experts and lay witnesses. At the completion of the hearing, VCAT determined that the proposed development would comply with the noise standard prescribed by the planning scheme but adjourned the hearing for six months to enable the parties to provide evidence relating to the impact of the wind turbines on the health and wellbeing of people living in the general vicinity.

5. Reaction of professional acoustic bodies

One of the criticisms levelled at acoustic engineers conducting environmental noise assessments of wind farms is that the engineers are not fulfilling their requirements in accordance with the Code of Ethics of the Australian Acoustical Society and/or the Association of Australian Acoustical Consultants.

The criticisms were outlined in a technical note of the Journal of the Australian Acoustical Society (Acoustics Australia Vol 40 No *2 August 2012)*, which elicited a range of letters to the editor in future editions of Acoustics Australia.

To date, the Australian Acoustical Society has not provided any guidance to its members regarding the ethics of assessing environmental noise in accordance with the relevant standards and guidelines.

The Association of Australian Acoustical Consultants is currently in the process of preparing a position paper on wind farm noise.

6. Conclusions

The assessment of wind farm noise in Australia is currently conducted in accordance with standards and guidelines which set base limits of 35 dB(A) or 40 dB(A) in low noise conditions and 5 dB(A) above the background noise level for higher wind speeds. This approach is similar to the approach taken for industrial noise sources in Australia. The noise levels are significantly lower than is accepted for transportation noise.

The controversy regarding the potential health effects of wind farms has led to additional requirements, such as minimum setback distances and more detailed analysis of the noise characteristics. These additional requirements result in wind farm noise being assessed in more detail than any other noise source in Australia.

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