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2 November 2012

Committee Secretary
Senate Standing Committees on Environment and Communications
PO Box 6100
Parliament house
Canberra ACT 2600 **By email: ec.sen@aph.gov.au**

Dear Sir / Madam

Alstom Limited response to the Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012

As a global leader in power generation technology, and an advocate for the greater deployment of renewable technologies, Alstom welcomes the opportunity to provide the attached submission in response to the Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill Inquiry 2012.

The Australian wind resource is one of the best in the world and is a cheap form of renewable energy that should be exploited to help achieve Australia's goals of 20% renewables by 2020, and of 80% reduction in CO_2 emissions by 2050. We trust that the information provided in our submission will assist the Inquiry to assess the merits of the Bill, taking into account an objective and considered view from leading experts in the field of wind power generation.

Yours faithfully,

Chris Raine
CEO
Alstom Australia and New Zealand

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ALSTOM SUBMISSION

Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012 Inquiry

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Introduction to Alstom

Alstom is a global leader in power generation with a portfolio of products covering all major fuel types, from fossil fuels and biomass through nuclear to renewables such as Hydro and Wind. Currently, close to 25% of the world's power production capacity depends on Alstom technology or services.

Renewable energy sources are an essential element of global power strategies for the 21st century. While renewables may not be able to meet all of our electricity needs, there is clear potential for dynamic growth from today's usage levels. Incorporating renewable energy not only supports the power industry's environmental goals, but also addresses national needs for energy security and independence.

Alstom has over 30 years' experience in providing all-round wind power solutions. Our technology development is focused on improving availability, increasing the efficiency of energy conversion, and lowering construction and maintenance costs. Social acceptance of wind farms is also an important consideration in our technological development. Alstom has installed Wind farms across the globe totaling approximately 3 GW, including projects in Brazil, France, India, Japan, Italy, Morocco, Portugal, Spain, Turkey, the UK and USA.

Alstom welcomes the opportunity to provide the following information based on our extensive global experience by way of this submission to the Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012 Inquiry.

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ALSTOM submission to the Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012 Inquiry

The last decade has seen rapid development in wind technology. Turbines have developed from a diameter of around 10m in the early 1980s for constant-speed stall controlled turbines, to state-of-the-art variable-speed pitch controlled turbines such as Alstom's ECO110-3MW with a 110m rotor diameter for onshore applications, and Alstom's new Haliade™ 150-6MW with a 150m rotor diameter for offshore applications.

In terms of noise there have been some critical developments in the industry:

- Firstly, early turbines initially operated at a fixed speed (or RPM), meaning that the tip speeds were generally higher and the aerodynamic loading of the blades was also much higher. Modern turbines are generally variable speed, meaning that they are rotating at much lower speeds at lower wind speeds and increase in RPM with wind speed. This has resulted in much lower noise output, as well as the ability to actively control the noise output if need be (active noise control).

- Secondly, the tip speed of the blades is now typically fixed at around 70-75 m/s, meaning as rotors get larger the rotational speed drops. This has reduced the rotational frequency of the rotor, and reduced the mechanical noise output of the drive train.

The majority of turbine noise is generated by the turbine tip speed, and is what is called aerodynamic noise – or "white noise". This noise is typically in a wide frequency band, meaning that the energy is dispersed through the spectrum and gentler on the human ear in a subjective sense – this noise is often equated to other aerodynamic noise such as wind rustling through the leaves of a tree. The peak noise output of modern turbines occurs at rated power, when the RPM is at a maximum. At rated power however, the wind speed is also at a much higher level, meaning that the background noise (due to tree movement and wind noise) is also at its highest level – therefore, somewhat paradoxically, turbine noise is typically only higher than background noise and therefore perceptible at lower wind speeds – and therefore at much lower sound power levels. When we look at the test data, we see a distinct lack of low frequency noise.

Comparative noise for common activities

Source/activity	Indicative noise level (dB)
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City traffic	90
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

Source: CIEMAT

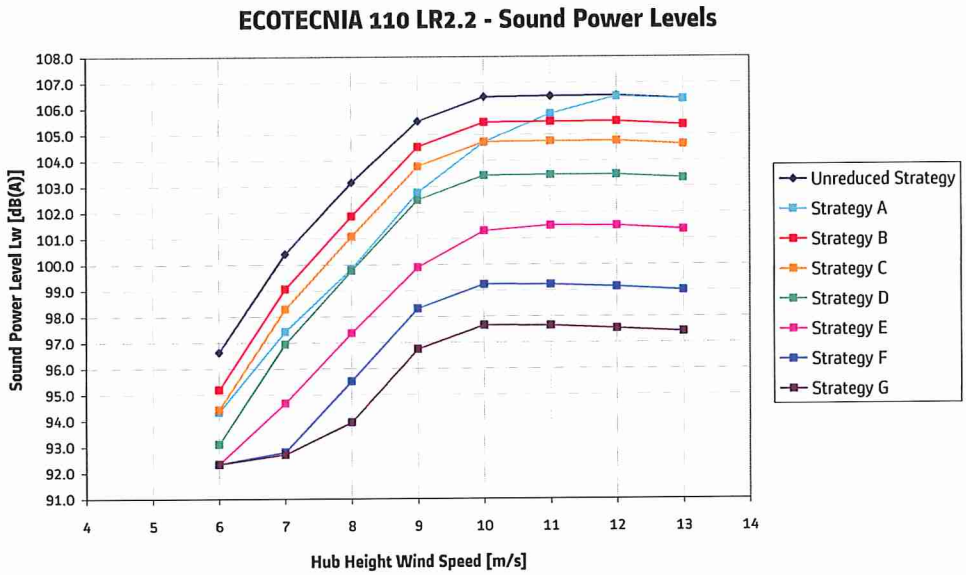

Figure 1 - typical Alstom Sound Power Levels (at turbine)

International working groups have independently developed tests and standards to test and characterize this noise, resulting in the internationally accepted IEC 61400-11 standard. This standard is the internationally accepted basis for the characterization of turbine noise which is well proven as accurate and reliable across the global wind industry. This standard measures the Sound Power Level of the turbine at the source (roughly 100m behind the turbine). This Sound Power Level is the basis for all noise receptor modeling, as well as the noise compliance testing required post construction.

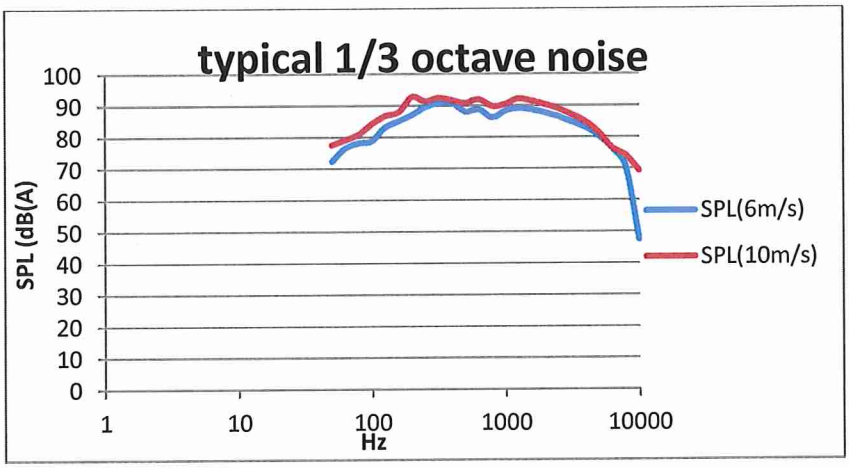

Figure 2 - typical Alstom noise spectrum

The human ear hears in the range of 20 Hz to 20,000 Hz, and recognizing that noise is a subjective experience to the listener, typically the dB(A) weighting system is used to weight the noise in various frequencies to better reflect the overall subjective experience of noise to the human ear. This A-weighting is used in the wind industry to both test and model the noise output of wind turbine and wind farms – so when the wind industry refers to noise, it is a reference to the Sound Power Level after taking this weighting into account – typically referred to as dB(A). The dB(A) measure has, of course, also been widely used and accepted for regulatory purposes as a measure of noise in many industries and applications outside of wind. There are therefore objective, and verifiable methods for wind turbine noise characterisation.

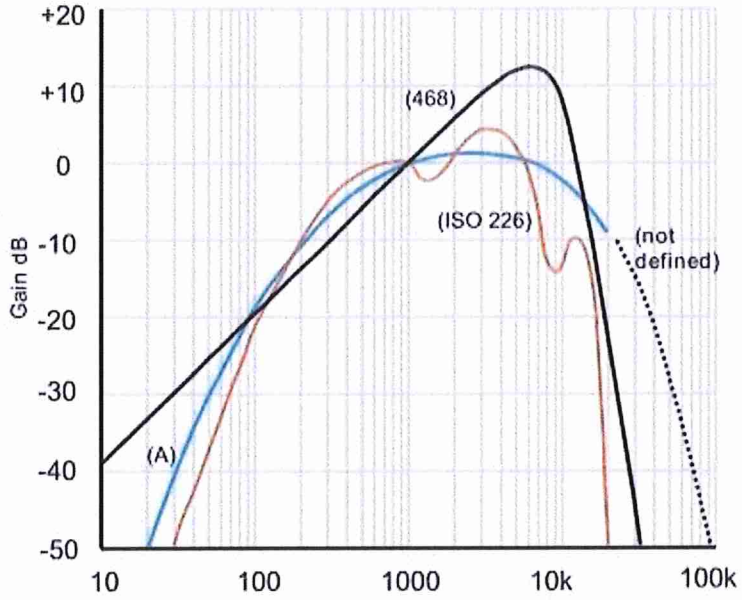

Figure 3 – A-weighting (ISO226)

Current noise standards in the Australian wind industry (such as the 2003 and 2009 SA guidelines) typically have focused around receptor noise limits – typically of around 35-40 dB(A) or 5 dB(A) above background noise. It should be noted that 35 dB(A) is characterized by a gentle whisper, and the World Health Organisation (WHO) recommends a 45 dB(A) limit – thus, these Australian requirements are already much more stringent. In fact, the measured background noise prior to wind farm construction is often significantly higher than these limits, and experience has shown that discerning the wind farm noise from the prevailing background noise during testing is often very difficult even for independent professional testing institutes – highlighting the near imperceptible noise footprint of windfarms meeting current Australian requirements against ambient backgrounds.

The proposed "excessive noise" bill proposes an additional requirement of 10 dB(A) above background noise for any residential premise measured within 22m, well in excess of any requirement of any requirement we are aware of elsewhere in the world. Whilst the Bill proposes to impose such a requirement, it does not, however, define the test

methodology or acceptance criteria by which such requirement could be accessed. It is vital that for a regulatory noise requirement, especially one that imposes a requirement at near background noise level, clearly define testing and acceptance methodologies and criteria due to the high inherent uncertainty in background noise measurement – which often varies by more than 10 dB(A) during measurement. Without such certainties, Windfarm developers will never be able to "prove" they meet their development permit noise requirements at the end of construction, potentially preventing them from legally operating. Such a lack of certainty on revenue stream will have the obvious effect on capital investment in windfarms, namely, it would bring them to a halt.

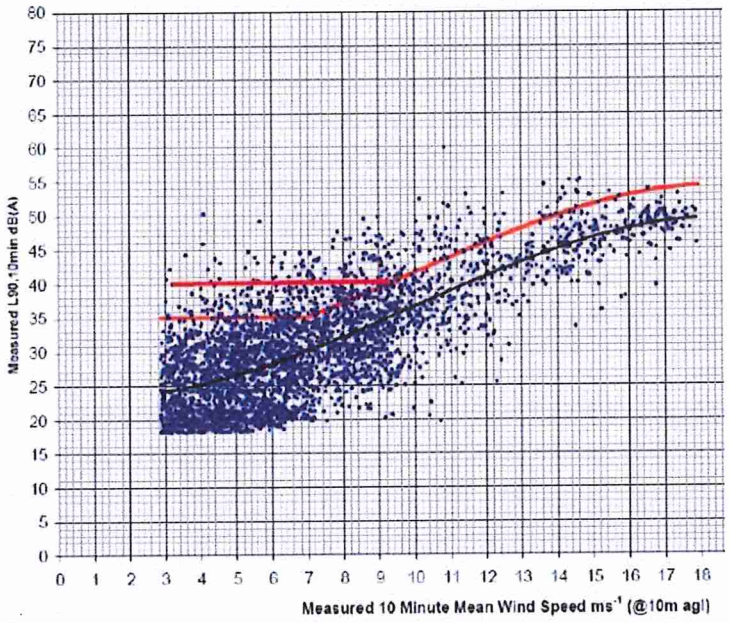

Figure 4 – Typical Background Noise characterisation

Tonality is the presence of narrow frequency sound power which can be subjectively noticed in a broader spectrum of noise – similar to the listener hearing the distinct narrow frequency of a triangle being struck during an orchestral performance. The clear majority of turbine noise is from the turbine blades, which is generally wide spectrum with no tonal sources. On the rare occasions where a tonal frequency is evident, this is often attributed to a mechanical noise from a gearbox or a cooling fan defect, which can be simply repaired. Additionally, as turbine rotor diameter has increased, and rotational speed consequently decreased, the mechanical drive train frequencies have become much lower relative to where they historically were – and are continuing to so trend. Tonality is also characterized under IEC 61400-11, with agreed testing procedures and limits to meet the specified requirements – again highlighting that the industry has developed independent and objective methods to meet these concerns.

On a technology level, most modern turbines now have active noise control (Figure 1). This is achieved by lowering the tip speed of the blades and therefore lowering the sound power level at the emission source. For Alstom, the tip speed can be reduced so that up to 10dB(A) can be reduced if need be. This noise control can be set by time of day,

wind direction, and season to manage any possible noise complaint. However, this has an adverse effect on energy production and increases the cost of energy, and should only be used as a last resort.

In terms of health effects, Alstom have seen no evidence globally of adverse health effects due to wind turbines or wind turbine noise. This is consistent with the broader global industry experience, as well as locally amongst governmental health authorities, and is in keeping with numerous independent and reputable studies that have been conducted. Low Frequency Noise is often referred to, which is typically below the level of human hearing (20Hz). – However, wind turbine noise output at these low energy levels is much lower than the dominant frequencies, and typically so low that it is very difficult to even measure due to its low energy level.

In conclusion, the Australian wind industry is already regulated by some of the highest standards in the world, something which the industry has worked hard to meet. The wind industry has developed objective, technically consistent and measurable test standards to characterize noise (which are recognized internationally), as well as developing a logical and scientific approach to estimating and measuring noise at household receptors, which can be a more subjective issue. Alstom wind technology has been developed to meet these stringent requirements, requirements that our global experience has shown are already much higher in Australia than in other markets.

The development of wind turbine technology has reduced the noise output of turbines, and active noise control has provided even greater flexibility to developers. Establishing additional stringent requirements such as those in the "excessive noise" bill, or further non-objective measurement techniques, will, at the least, push the development of wind farms much further from population centers. This would require more expensive grid connections and result in a higher cost of energy to the consumer. Such unreasonable and scientifically inconsistent requirements would also increase investment uncertainty in the industry, impacting its core economic viability as an investment. The Australian wind resource is one of the best in the world, and is a cheap form of renewable energy that should be fully exploited to help achieve Australia's goals of 20% renewables by 2020 and of 80% reduction of CO2 emissions by 2050.

Ends.

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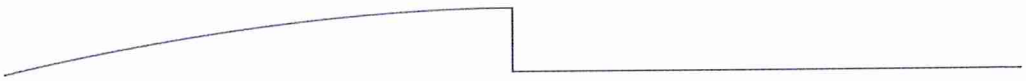

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