

Context

The approval of wind farms and management of their compliance is becoming an increasingly contentious issue as their size and number grow and more rural people are affected by them. Under current arrangements they are causing increasing social tension and community disruption as well as the potential for wider litigation.

Approvals are particularly contentious because ultimately, under current arrangements, they depend on subjective judgements by decision makers and developers' consultants, which is not a mechanism that will ever give economically efficient outcomes. In addition, it gives rise to perceptions of unfairness and partial behaviour in favour of wind farm developers, which in turn leads to suspicion and claims of corrupt behaviour.

Most of the contention arises because wind farms potentially impact on the interests of private parties (existing landowners) and so decisions currently become a subjective tradeoff by government officials between those private interests, the private interests of the developer, and public interests in both the landscape and renewable energy.

While there are debates about environmental issues, such as the impact on birds and bats, most of the protracted and enduring contention is about advantaging one set of private interests over another.

A Fair and Efficient Solution

Most of this contention can be eliminated, and the approval process streamlined, by applying the following three standardised elements to wind farm approval and control:

1. An evidence-based, **setback** (ie protected zone) around existing properties and key public view points, within which wind turbines cannot be erected;
2. A requirement for developers, within 6 months of approval, to commercially agree a visual easement over all potentially affected properties in a systematically defined, larger, **visual easement zone**; and
3. Rigorous, permanent noise monitoring around wind farms, to enforce compliance with established noise conditions, funded but not controlled by the operator as a standard safety measure, and with recurrent breaches automatically triggering severe penalties.

Most of the direct adverse effects on neighbours, which then affect property values, are due to visual impact and noise impact. The first two points above deal with visual impact. The third deals with noise impact.

Making Visual Impact a Private Sector, Commercial Matter

Assessing the visual impact of a wind farm is done now using the concept of Zone of Visual Influence (ZVI), which is the zone of visibility if not obstructed. Not surprisingly, the ZVI is related to the height of wind turbines. Turbines 150 metres high have a much larger ZVI than those 50 metres high. Evidence-based, best practice tables linking ZVI to turbine height exist¹.

¹ *Visual Assessment of Windfarms: Best Practice*, Commissioned Report F01AA303A for Scottish Natural Heritage by University of Newcastle, 2002; *Visual representation of windfarms: good practice guidance*,

There is not much visual impact of a wind farm seen from the full ZVI distance. However, anywhere up to about one sixth of the ZVI, turbines are likely to dominate the landscape². Out to about one third of the ZVI, they are a major, intrusive part of the landscape, if not obstructed.

It is therefore proposed the **setback** be set at one eighth³ of the height-related ZVI and visual easements be required within a zone one third of the ZVI.

For a wind turbine over 150 metres to tip, the best practice ZVI is 45kms ⁴, so the **setback** would be a bit over 5 kms and the **visual easement zone** would be about 15 kms.

A **setback** for private property would not absolutely prohibit wind turbines within that zone. But wind farm developers would have to either acquire those properties from existing owners at a price satisfactory to the owners or make other arrangements.

In the wider **visual easement zone**, the developer would be required to either negotiate a visual easement over the property OR offer to acquire the property at an independently assessed market value unimpaired by the proposed wind farm, plus transaction and relocation costs.

In financial terms, the essential difference between the **setback** zone and the broader **visual easement zone** is that within the **setback** zone, any buyout price is wholly up to the landowner, if they are prepared to sell, while in the broader **visual easement zone** any buyout price would be determined using independent parties.

Together, these two requirements would make the placement of turbines largely a commercial matter between existing property owners and developers. It would allow wind farm developers to build almost anywhere – provided they are prepared to pay for the visual impact on neighbours, and it replaces the current subjective arrangement which grants commercial value to wind farm developers at the expense of large numbers of existing property owners.

Setting distances based on some proportion of an evidence-based ZVI removes the subjectivity involved in current approaches, where that subjectivity is the views of either the consultant employed by the developer or some public servants who do not live in the affected

Scottish National Heritage, 2006; *Visual Representation of Wind Farms, Version 2*, Scottish Natural Heritage, July 2014.

² Though not stated exactly in those terms, see Campaign for the Protection of Wales, The “Sinclair-Thomas Matrix” in *Evidence to the House of Lords European Communities Committee, Sub-Committee B-Energy and Transport. Appendix 1: The Potential Visual Impact of Wind Turbines in Relation to Distance*, 1999.; also *Visual Assessment of Windfarms: Best Practice*, Commissioned Report F01AA303A for Scottish Natural Heritage by University of Newcastle, 2002; Robert G Sullivan, et al, “Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes, Argonne National Laboratory, University of Chicago, 2012

³ Note. Using 1/8 th rather than 1/6 th of the ZVI for the *protected zone* is less restrictive. However, the rest of the 1/6 th zone would still fall into the *visual easement zone*. The main difference between the two zones is that in the smaller, *protected zone*, existing property owners determine the price. In the larger, *visual easement zone*, the buyone price is set as an unimpaired market price estimated by an independent valuer.

Offering a buyout price does not mean the property owner would be forced to sell. Essentially they would have 3 options: (1) accept a visual easement price negotiated with the wind farm developer; (2) be bought out at an independently determined unimpaired value; or (3) stay but take nothing. This arrangement would ensure property owners in the *visual easement zone* could not hold the developer to ransom.

⁴ *Visual Representation of Wind Farms, Version 2*, Scottish Natural Heritage, July 2014, p. 13.

area. There is obviously scope for debate about what the ZVI proportions should be for the *setback* distance and the *visual easement zone*. But, after debate, those proportions should be fixed by regulation.

In terms of visual impact there is also clearly a difference between someone being exposed to a single turbine or multiple turbines. Within the visual easement zone, land owners would take that into account in deciding whether they were prepared to accept some payment for the exposure they would have, or prefer to be bought out on fair terms. Since most people do not want their lives uprooted, there is a bias towards accepting some payment for the loss of amenity unless those affected believe the impact will be too severe.

This is preferable to an official in Sydney trying to decide how severe the loss of visual amenity will be based on the number of turbines involved, their distance from the land owner and the extent of visibility in each case.

Note. Such a policy would not affect other sorts of development in rural areas. Mines or manufacturing projects don't erect massive, moving, towers more than 150 metres high (higher than most Sydney buildings), nor do so in massed groups of 50, 100, or more. Nor do they typically cover the huge expanse occupied by a wind farm.

Use of land zoning might sound like a possible alternative control mechanism but in reality is not because of the height of modern wind turbines and the distance of their impact. Zonings in some areas vary considerably with some residents in rural residential and others within rural zones. To say only rural zones would be acceptable would not solve the problem. It is evident councils can, and do, change zonings to suit their purposes leaving residents without any protection. It also leaves it open for developers to place turbines on hosts' boundary fences with no distance setback in place which could result in turbines being quite close to non host residents.

Noise

Wind farm noise is the other main problem. The NSW Industrial Noise Policy⁵ has long recognised industrial noise can cause recurrent *sleep deprivation*, which the UN describes as a form of torture⁶, and other harm to health. Wind farm noise is particularly problematic because of the relatively high proportion of low frequency sound which travels long distances and has been implicated in severe sleep and health problems⁷. This is the area likely to be laying the grounds for future litigation and human rights cases if the NSW Government does not act to rigorously and reliably control it.

All wind farm approvals include noise conditions but in practice they are not enforced. Since the government determines the noise conditions under which wind farms are allowed to operate, it should also enforce the conditions.

⁵ *NSW Industrial Noise Policy*, January 2000, p. 1.

⁶ *UN Committee against Torture*, <http://waubrafoundation.org.au/resources/un-convention-against-torture/>

⁷ Recent acoustic survey research by Emeritus Professor Colin Hansen's team from Adelaide University has validated the residents' reports of sleep disturbance out to distances 8.7km from the nearest wind turbine near Waterloo wind development in South Australia, because of the levels of excessive low frequency noise measured inside these residents' homes. See <http://waubrafoundation.org.au/resources/hansen-zajamsek-hansen-noise-monitoring-waterloo-wind-farm/>

The main enforcement problem is that the local impact of wind farm noise depends on multiple changing factors, such as wind direction and speed, atmospheric conditions, and operator action in controlling the turbines. Consequently any attempt to monitor in response to complaints may well occur when the problem has temporarily subsided, relocated (because of different wind direction), or been diminished by operator action during monitoring.

The only effective solution is permanent noise monitoring, located at multiple points around a wind farm, independently controlled, with an effective mechanism to impose serious costs for any breach of noise conditions to deter such occurrences. This should be paid for by the wind farm as a safety measure, just as many industrial operators are required to pay for facilities, mechanisms and practices that increase the safety of their operation. The cost of such safety provisions would be very small, typically amounting to less than 0.1% of a wind farm's capital cost.

There is debate about the adequacy of existing noise guidelines, which will ultimately be resolved as more evidence accumulates. However, the simple concept that any noise conditions imposed on a development must be enforced hardly seems disputable.

If noise guidelines are breached, it will be in relation to specific residences / buildings. The appropriate remedy is not a penalty paid to the government but to appropriately compensate the injured party. The simplest way is to require that after a certain number of breaches, the wind farm is obliged to make a financial arrangement with the affected party (either buying their property or buying a noise easement over the property).

The trigger event could be stated as "X breaches occurring within (say) 6 months, or 2X within any 18 month period", where X might be say 5 and a breach is any 24 hour period during which there is an exceedance of the noise conditions. One can debate about what X should reasonably be, but it has to be well below a frequent occurrence.

The price in such cases should be whatever the affected party requires or the offending part of the wind farm must be shutdown. Obviously this would be financially expensive for the operator but the operator will have had a number of options to avoid such a cost. It could have got its noise modelling and wind farm layout right so as to prevent any breaches. It could have reached a financial arrangement with the landowner before the wind farm began operating at what would have been likely a lower price. And once breaches started to occur, it could have controlled the wind farm operation to ensure that the trigger number of breaches was not exceeded.

So long as X is greater than 1 or 2, the wind farm is not caught in a "sudden death" situation, though once they allow the number of breaches to mount, they could place themselves in such a situation, rather like a motorist who has accumulated a number of points for traffic offences until they are in a position where the next offence will lead to an automatic loss of licence.

As with the proposals in relation to visual impact, this solution requires essentially no discretion on the part of government agencies. They may be involved in the monitoring process but, so long as the data is transparently collected and publicly available, they don't, for instance, have to rule whether the noise breaches "are acceptable". They just note whether the number of occurrences exceeds the fixed trigger level and if they are unwilling to do that the harmed party can approach the courts to enforce their rights.

Noise Monitoring

Airservices Australia has permanent, full-time monitoring of noise around all major Australian airports. Under the title of WebTrak, it is available online ⁸ for anyone to view in real time and to review past periods.

As with wind farms, the noise around airports is sporadic, so the only way to monitor it effectively is continuously. Also, for people close to the airport, that noise is sleep disturbing – which is why Sydney airport has a curfew. The only salient differences are that research shows wind farm noise is far more disturbing and it includes harmful infrasound.

NSW coal mines, such as Mount Thorley Warkworth, are required to continuously monitor and report on a variety of polluting emissions, including depositional dust, mine water discharge, and vibration from blasts. So the principle of continuous monitoring for variable form of pollution is hardly novel.

The only way to effectively enforce wind farm noise conditions is with permanent noise monitoring facilities, established at residences around the wind farm, and not in any way under the control or influence of the wind farm. Those facilities and their operation should be paid for by the developer but not operated by the developer or anyone associated with them. The EPA would be the appropriate body to commission the facility but would presumably use an external contractor as AirServices Australia does. The data collected (at least SPLs and wind speed) should be continuously available online, as with WebTrak.

To fully cover wind farm noise conditions, recording at those locations needs to be more than just sound pressure levels. It needs to include full spectrum, continuous recording of the sound, so that aspects like tonality and amplitude modulation can be detected. It also needs to include infrasound measurement. Full spectrum sound records are likely to be too bandwidth intensive to be made available online, but can certainly be stored for call up and examination if there are relevant complaints.

There need to be at least a dozen noise monitors around a wind farm, located at potentially affected residences, and they should be semi-permanent, i.e. relocatable, so that the EPA, in consultation with the affected community, can periodically relocate them to ensure coverage of all residences that appear to be materially affected by wind farm noise.

Current techniques for wind farm noise monitoring involve practices that assume the monitoring is only a very infrequent occurrence, where the equipment is set up specifically for the task and then removed. Much of those techniques would be inappropriate if monitoring of noise, wind speed and direction, and knowledge of whether the wind turbines were operating, was continuously collected.

Such a facility would not only allow detection of breaches but offer real time feedback to the operator so it could take quick action to stop breaches.

⁸ <http://www.airservicesaustralia.com/aircraftnoise/webtrak/>

Summary

Despite lots of pseudo-analysis presented, the current NSW wind farm approval process is largely subjective and it depends heavily on data and opinions from parties sourced by the developer. Consequently it involves the arbitrary transfer of wealth from nearby property owners to the wind farm developer. Noise conditions included in development consent are almost entirely ignored, creating human rights abuses through recurrent sleep deprivation and harm to health.

It is possible to largely remove these problems through the use of three requirements that can be standardised. Two requirements relate to visual impact. They use the well established concept of Zone of Visual Influence, with best practice, evidence-based ZVI tables, to set zones within which the wind farm developer is either excluded or has to offer fair financial compensation to existing property owners.

Introducing permanent, well placed noise monitoring under control of independent parties, where recurrent breaches allow affected landowners to be bought out on terms favourable to them, would ensure compliance with whatever noise conditions are imposed, which need to adopt the precautionary principle in applying the most recent relevant evidence.

These arrangements would force wind farm developers to absorb most of the costs associated with their activity and thus encourage them to establish wind farms in locations with the lowest true social costs.