SUBMISSION FOR SENATE SELECT COMMITTEE ON WIND TURBINES

Submission

I am aware of the Terms of Reference, and while all points carry an equal importance, the point I will be addressing is point (i) any related matter, and while what I have here with my submission might also refer to point (h) the energy and emission input and output equations from whole-of-life operation of wind turbines; my submission deals with the actual electrical power delivered from Wind Plants, during normal operation and also across the whole of their (expected) whole-of-life operation.

This actual power delivery from wind power is probably one of the least understood of things when it comes to wind power, and that is understandable, because it takes some expertise in electrical power generation to effectively understand this vital point, and because of that, there has been some emphasis placed on matters other than this, and while not wishing to lower the importance of those other points, this power delivery aspect is in fact the most important part of understanding wind power.

To better explain this power delivery, I will be making comparisons with traditional power generation, and here I will use coal fired power, because, that after all, is the main thrust of the wind power debate, that wind power can replace coal fired power, and as you will see here, that in fact is most definitely not the case. In saying this, it is not meant to be a case in favour of coal fired power, but merely as a relevant point of comparison.

With most wind power proposals the main point being made is the total power of these plants, and this is referred to as the Nameplate Capacity of those plants, the up-front total power if you wish to refer to it as.

So here, let’s take a large scale wind plant of 660MW, and note how straight away, this makes it look like this is indeed a large plant.

(Here, I have purposely made this example to be a specific total of 660MW for the purpose of the comparison I will be making, using a similar total power rating for the equivalent coal fired power generator. In most cases, a typical large scale wind plant would be 400MW to 500MW in nameplate size.)

With this wind plant example there are individual towers, and on top of each tower is what is called a nacelle. This nacelle houses the operating mechanisms, and of most importance here the generator itself. Out the front of this nacelle are the three large blades, similar to an aircraft propeller, only much larger and spinning at a much lower speed. This provides the driving force for that generator, the blowing wind turning the blades, and usually driven through a constant speed drive, which is similar in nature to a gearbox.

While there are differing sizes for the generator inside the nacelle, the average currently is around 2.5 to 3 MW, and here the larger the generator, then the taller the tower, and the longer the blades.

So, for this example of a 660MW wind plant, and using an average 3MW generator (currently, a large generator) for each tower, we have 220 of these towers spread across the large area of the wind plant.

As everyone knows, wind plants are driven by the wind, and because of that, they provide intermittent power only, subject as they are to the vagaries of the blowing wind, and only operational at certain wind speeds, the blades stopped from turning at the low speed setting and also at the high speed setting as well. There will be days when the whole plant might generate a lot of power, and also, there will be days when the plant will only generate small amounts of power. There is however a standard which is used to show the total power actually delivered from these wind plants, and that is expressed across a whole year. That standard is as follows here, and this standard is the same for all methods of electrical power generation:

NP X 24 X 365.25 X CF (where NP is the nameplate capacity, 24 for the hours in a day, 365.25 for the days in a year, the added 0.25 here accounting for the leap year, and CF being the Capacity Factor.) The result is expressed as MegaWattHours (MWH) or GigaWattHours. (GWH)

Now, here the only variable would be that CF. There is a theoretical value for this, and that value is usually quoted in the original proposal at 38%, in other words the percentage of the total power which is delivered from these plants.

However, that CF is invariably much lower when the actual delivered power is totalled at the end of each power generation year, and the same formula is used, working backwards from the actual delivered power to re-calculate the exact CF for the year, a simple mathematical equation. That actual CF is more often than not closer to 30% for recent wind plants. As an example, the current whole of World CF for wind power is 18%. In Germany, which has a large fleet of wind power plants, that CF is 19%. In China, which also has a large and growing wind power component, that CF is barely 15%. In the US, which also has a large wind component, that CF is 30%, and currently here in Australia, our small wind fleet is also operating at a CF of 30%

So, what does this CF mean?

It means that, during a whole year the wind plant is only delivering 30% of its full rated power to the grids of (here) Australia for consumption across all sectors of power usage.

So, for our comparison wind plant we are using here, this power delivery equates to only 30% of that 660MW, or extrapolated backwards from the delivered power, that is now only 198MW, so here, we now have a considerably lower power delivery than the up front total of that 660MW.

Now, effectively, that 30% CF could also be related to the time this wind plant is delivering its full rated power, so 30% of that time, or in effect, only an average of 7 hours and ten minutes each day. Keep in mind I mentioned above that wind power will have big delivery days and small delivery days, so this is an extrapolation down to a daily AVERAGE for power delivery, again the Industry Standard.

So, then, why is this important?

Let’s look at the comparison with the coal fired generator of that same amount of Nameplate, 660MW. This is the same sized generator is what is currently in use at the Bayswater Power Station, near Musswellbrook in NSW, supplying the East Coast grids for Australia. Bayswater has 4 units, with each unit running one generator of 660MW, for a total Nameplate Capacity of 2640MW, but here I am only making the comparison for that equivalent wind plant of 660MW, hence just the one unit with one generator.

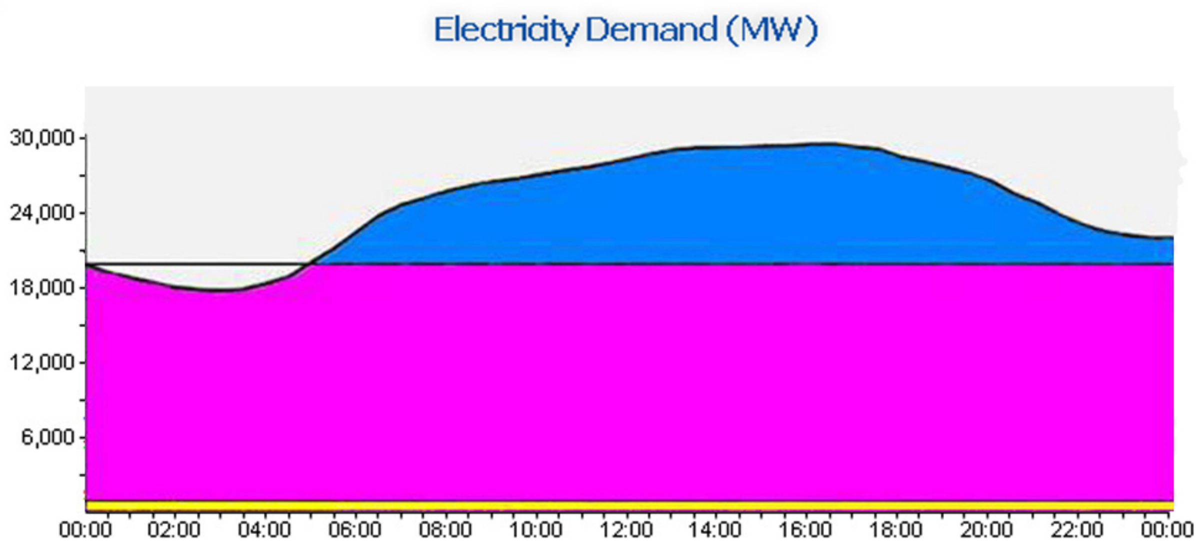
Note here that this is just the one generator at one power plant, as opposed to 220 separate generators all in nacelles on top of those tall towers for this example for a wind plant.

Now, with that one unit of the one generator at Bayswater, crushed, powdered coal is being forced into the furnace to boil water to high temperature and high pressure steam to drive the steam turbine which then drives the generator. While ever that coal is being fed into the furnace, the generator is running at its absolute maximum, turning over that near thousand ton generator at 50 times a second, and that generator is delivering its full rated 660MW all the time. This can go on indefinitely, while ever that coal is being fed into the furnace, and in fact, the only down time is for scheduled maintenance. So much so in fact, that one unit at an Australian plant, the Stanwell plant here, near Rockhampton, holds the World record of almost 3 full years of continuous operation, running flat out without stoppage for that whole time, delivering its full rated power for all that time.

So, compare that now with the wind plant, which is only delivering its full power for a little more than 7 hours of every day on average.

So then, why is this 24 hours of actual total power delivery so vital?

Look at this deceptively simple looking diagram.



This is a typical Load Curve for actual power consumption, and in this case, this is for all of Australia, East of the WA border. The vertical axis indicates total power in MW, and the horizontal axis is for hours during the day, starting at Midnight and going through the day and back to Midnight. Now, while this Load Curve is for all of that vast area, the diagram would look the same for a small town, a large town, a city, a Capital city, a State, and a Country, and not just for here in Australia, but for everywhere on Planet Earth where there is a regulated and constant supply of electrical power in the already Developed World.

This Load Curve is a typical power consumption curve for the Summer Months, and a Winter Curve has the basic similarities except it shows two peaks with a slight dip in the middle of curve. Both Summer and Winter have approximately the same maximum power consumption, in this case, around 28,000 to 30,000MW of power. What is the same however is that dip at the start of the curve, and the low value, the same for Winter as shown here on this Summer curve.

The single main point that is of utmost importance here is not the total power consumed, but that dip you see there between Midnight and 5AM.

Note here that in the time from Midnight to 4AM, when nearly all of the people in Australia are comfortably tucked up in bed, asleep, power consumption is still around 18,000MW, which is approximately 60% of maximum power generation. That low point of around 18,000MW is the same, Summer, Winter, all year round, 365 days of every year.

Total power consumption never falls below that level. This power is required, and required absolutely for 24 hours of every day, every day.

This is referred to as the Base Load requirement.

That power is consumed in a number of areas, all of them vital. It is the power required to have breathing air circulated through every building taller than two or three stories, where there are air conditioning units on the roofs of every one of those buildings. Now, while it is referred to as air conditioning, the main reason for them is to circulate breathing air into and out of all those buildings, because there is no other access to air from outside in all of those buildings. The power to keep those units in operation is required all the time. You cannot just turn it off overnight and then back on the next morning. That air inside the structure needs to be circulated for the full 24 hours of every day.

That Base Load power is also required for the 24 hour operation of the electric rail system, inter urban and city transport, trams and electric buses, for traffic control and lighting in towns and cities, for hospitals, for all Commercial outlets, especially places like Coles and Woolworths with their huge banks of cold storage for food, all of them needing absolutely to be in operation for 24 hours of every day, for Industry which operates around the clock, for the mining companies which operate around the clock, and for a myriad of other things which require electricity to always be there all the time, including every refrigerator in every home.

So, as this power is required around the clock, there is a need for that amount of power to always be there, available for the full 24 hours.

Using the Capacity Factor for wind power of only 30%, and extrapolating that back to time, then it now becomes obvious that with wind only at an average full power total operation for a little over seven hours, then wind cannot supply that huge amount of power which is required absolutely for the full 24 hours of every day. Even though wind can supply some of its power around the clock, note again how much power is actually required for that full 24 hour period, that level of 18,000MW.

Currently in that same area shown on the Load Curve, there is a total wind power Nameplate Capacity of 3,562MW. However, at that Capacity Factor of 30%, then that total is now only 1,095MW, when just that Base Load is 18,000MW. That average of 1095MW of actual power delivery is only around 3.5% of the power which is actually consumed in Australia at maximum daily consumption, averaged across the whole year.

You may notice I have added colour to that Load Curve diagram. The large pink area, which basically supplies that Base Load requirement is in the main, virtually all of it, large scale Coal fired power, which can operate for 24 hours of every day, and because of the nature of those plants, it is not an easy thing to just turn them on and off, as they are at their most efficient when operating at their maximum capacity, and they are unable to be scaled up and down at short notice. The blue area on that Load Curve is referred to as Peaking Power and is supplied from other sources, all of them just required to run for shorter periods of time during the day to make up the level of power to a little more than what is actually being consumed. This is supplied from a variety of sources, some coal fired power (known as spinning reserve) but mainly Natural gas fired power plants.

You'll also notice that there is a yellow coloured area at the bottom of the diagram. That is the amount of power supplied by wind power in that same area, virtually only a tiny amount.

So, is any of this mentioned at any of those wind plant sites?

Well, not in this manner. It is however shown there, but because of the general populace's lack of understanding of electrical power generation, then all but a few understand just what is being said.

Where it is being mentioned at those sites is with the following statement, and look at every wind power site, and a statement similar to this is written there at all of them.

This wind plant supplies the power needs for (X number of) homes.

It's an innocuous enough statement, and in fact is written as a source of pride by the proposers.

What it does indicate however is what I have indicated above.

Here, the proposers use the exact same Industry Standard calculation I showed above. They use the Nameplate Capacity for the plant, the same 24 hours in a day, the same 365.25 days in a year, and for the CF, they use the theoretical value they all use, usually around that figure of 38%.

This gives them a total amount of power which can theoretically be delivered from the wind plant.

They know the average amount of power consumed in the average home in that area, and what they then do is divide that average home consumption into their total power amount, and that gives them their theoretical (X number of) homes.

However, the wind plant is not connected directly to just those homes. It is connected to the local grid for that area, and supplies all power users connected to that grid, those in the three sectors of power consumption, Industry, Commerce, and Residential.

Even so, using that same number of quoted homes supplied, those homes also require their power on a 24 hour basis, so with the Wind plant only supplying for an averaged 7 hours a day, then at no time can it ever provide the full power requirement for those claimed homes.

It's a very clever ploy really, knowing that very few people in the public domain understand exactly what is being said with this statement, as very few people understand even the first thing about electrical power generation.

So, in Summary, wind plants can only provide limited amounts of power on a sporadic time basis, and they use people's lack of understanding to their favour.

There are undoubtedly health problems associated with wind power, and these are real and now proven in jurisdictions all around the World.

There are undoubtedly problems associated with the killing of wildlife, and these are also real and now proven in a number of places all across the World.

There are undoubtedly problems associated with subsidies, be they outright gifts from all levels of government, both federal and state, here in Australia and in other places around the World. Secondary subsidies apply with the states subsidising the sale of the generated electricity, and with guarantees that all generated power must be purchased, no matter when it is generated.

Look at the wind farm performance site and note that quite often, the time of greatest power generation from Wind plants is when there is the least consumption, during the hours from 10PM until 6AM, when the power (which must be purchased) is sold at a low price, and as per the contract, the remaining cost is made up with further subsidies.

Contrary to popular belief the true cost of wind power per unit of power generated is considerably higher than for existing traditional sources, even after the subsidies.

The whole of life expectancy for wind plants is always quoted as being 25 years, when evidence from other areas around the World shows that some wind plants are barely managing 10 to 15 years.

However, all of those points mentioned in the terms of reference for this Inquiry, as important as each one of them is, pale into insignificance when their actual power delivery is explained in full. They just do not deliver power on the basis required.

Consider this. If you were to purchase a brand new car and find that it would only deliver you to your destination one time in three, how happy would you be?

In closing, while here I have used a comparison between one unit at an existing power plant and a wind plant of equal Nameplate, let's do an actual comparison for the power actually being delivered by all the wind plants in that same area I mentioned above, everything East of the WA border.

The Nameplate Capacity for ALL the wind power in that area is 3562MW, and that equates to around 1700 to 2000 individual wind towers. At the current Capacity Factor of 30%, then the total power delivered from all of those towers across a full year comes in at 9,367 GigaWattHours.

Compare that with the Bayswater coal fired power plant, which has a Nameplate Capacity of 2,640MW, which is only 74% of the total for all that wind power. This Bayswater plant has 4 units, in other words four generators, each of 660MW. Bayswater delivers that same amount of power from all those wind towers, but it delivers that power in only 195 days of normal plant operation.

Wind power just fails to deliver, comprehensively.

I thank you for the opportunity to make this submission, and, as long as the submission is, I hope what I have said makes things a little clearer.

Anton Lang.