Select Committee on Wind Turbines

January 18 2015

I believe that Wind turbines are extremely expensive, intermittent and unreliable and that the MRET should be rescinded entirely, not just amended. The argument that rescinding the MRET would harm existing renewable generators is a specious one. Prospective harm to fossil fuel generators seems to have been of no concern when the introduction of subsidies for renewable generators was first considered and I see no reason why it should receive any weight now when it is the renewables that will suffer.

Wind farms take up vast amounts of land to produce relatively small amounts of electricity, very low density.

Renewables and Carbon Taxing/Trading have a profound effect on the price of electricity as I will demonstrate below.

The exact price of renewables is hard to determine. According to a NSW State publication, mentioned below, average electricity user pays about $40 a year for large scale renewables and so adherents claim that subsidies for wind are not large. This hides a lot.

The annually averaged wholesale (w/s) spot price of electricity in NSW at the time of this calculation was approximately 3 cents per kWh, Page 12 Ref Ref (1). In that IPART fact sheet average yearly electricity use of 6500 kWh per household was used used determine the $40/annum cost for large scale renewables, mainly wind generated electricity, Page 7 Ref (1). The yearly w/s electricity cost for that 6500 hWh was $195.00. The proportion wind generated electricity at the time that this was written according to Wikipedia was 3.1% of the w/s amount which is ~$6.05. To determine the extra cost simply divide $40 by $6.05 = $6.62. In other words for each dollar spent on w/s wind generated electricity $6.62 extra is paid out. That makes wind over 7.6 times more expensive than average w/s price for electricity. This doesn't include costs of extra poles & wires. I think that is significant. Other data below supports wind turbine generated electricity being extortionately expensive.

The American EIA (Energy Information Authority) estimates 15 cents per kWh for wind by 2016. So much for how cheap wind is. The study, Ref (3), demonstrates that the w/s costs may be greater than 12 times that of gas fired electricity generation which tends to agree with the EIA estimate considering the effects of capacity factor, discussed below, and that O&M costs are not included.

Remember, that the transmission infrastructure for wind affects the

overall cost of wind generated electricity. Without the wind generators that capacity would not be needed and therefore not built and maintained and not add to the infrastructure cost. It is very naive to assume otherwise.

Wind generated electricity is hugely expensive but some of the costs are hidden, itemised under other headings such as RECs, much more generating infrastructure to generate its proportion because of the capacity factor and increased transmissions infrastructure etc !

The cost of wind is anything but modest. For instance, are the costs of extra power transmission infrastructure for wind and solar farms and subsidies from federal and state governments, plus back-up generators, to be included ? Governments seem very loath to mention such. You cannot claim that fossil fuelled generation also requires power lines and transformers etc since you still need those generator for base load generation and as back-up for renewables because they are intermittent so you must have it anyway.

Both wind and solar electricity generation, because of their intermittent nature, must be backed up by reliable spinning reserve of fossil fuelled generators and this must also be added into the equation. The fossil-fuelled generators will have to operate in a very inefficient mode when backing up these renewables and so will consume fuel at a much faster rate, giving off more CO2 than they would if operated at a steady rate. You might say that demand varies and requires such generators running in that mode. That is true but with wind farms the problem is greatly exaggerated and requires much more such generator capacity to cope.

Also there is the capital cost of multiple sources of generator for the one load instead of one source for the load, plus some spinning reserve to cover breakdowns, and this has cost implications. It is interesting that with the backup operating in this inefficient manner, CO2 savings with wind turbines are small or non-existent.

Do wind and solar renewables reduce the amount of CO2 emitted by coal-fired power plants ? The answer is a **definite NO**. Coal fired power plants produce base-load power, they run at or near full output continuously and are not affected by renewables at all. However, there has been a reduction in coal-fired electricity generation over the last few years which has been claimed to be as a result of renewables but in actual fact is a result of reduced electricity use because of the high cost of electricity and the use of more OCGT (Open Cycle Gas Turbine) & CCGT (combined cycle gas turbine) powered generation.

Wind Turbines are in addition to the useful fossil-fuelled generators and cannot be used on the grid without additional fossil-fuelled back up! Electricity on the grid must be kept within specifications as to voltage and frequency or customer equipment may be damaged and litigation for punitive damages result. Wind Turbines destabilise the grid as their output varies very quickly between the time when they start to produce electricity and when they reach

maximum output. The main factor governing their output is the cube of the wind speed and that can change very, very quickly.

The renewables, being intermittent, displace CCGT generators which are used to handle variations in demand above the base load as coal fired power is too slow reacting. The windy period must be very long in order to cut back coal-fired electricity generation as it is so slow to vary other than by spilling steam, that is venting it to the atmosphere rather than powering the turbine, thereby reducing electricity output. However you have already emitted CO2, paid the price for fuel in heating the steam and it wastes water so the practice is frowned upon, being both expensive and failing to reduce the CO2 emissions. Increasing the output of a coal-fired generator is slow as it takes time to heat additional steam, increase steam pressure etc.

If reducing CO2 emissions was the main objective and that is what is claimed, converting base-load generation to CCGT powered generators would be the way to go. The CO2 emissions would be cut by around 50% at each power plant so converted with very little increase per kWh price. Why is this not being done ?

Why use wind and solar renewables ?

Sunlight and the wind may be free, as adherents of renewables loudly proclaim, but electricity generated using them certainly is not as I will demonstrate below.

Problems with wind generated electricity

The winds are very intermittent. They vary rapidly as to strength and direction. In order for the wind turbine (WT) to produce power the wind must be in a particular range of strength and from a particular direction. One WT's specification, that I perused, claimed that no electricity was produced with the wind strength below 7 mph (miles per hour) and maximum output was attained at 22 mph. When the wind strength becomes too strong, in order to avoid damage to the wind turbine, the WT must have its blades feathered and a break applied preventing the blades turning thereby ceasing electricity generation. This is why they often don't produce any more power in very windy locations than they do in areas with less wind.

For the whole of February 2003, the output of more than 6000 turbines in Denmark was 0 kWh (stationary high weather pattern). This is a life and death matter as electricity is required to heat houses and people cannot manage without it in winter. Fortunately, electricity could be purchased from near-by countries.

During the northern winter, due to a stationary high, no wind generated power was produced over the whole of the UK for a period of two weeks on at least two occasions some years ago.

The capacity factor (percentage of rated power output achieved averaged out over a long period, say two years) for WTs is very low, that is, between 20% and 30%, in some cases as low as 12%. This means that additional expensive infrastructure is required to fill in when the WT is idling or producing little power. The capacity factor reduces as time goes by. Table 1 Page 11 Ref (5) Consequently more fossil-fuelled backup is required as the Wind Farms age.

Although geographical location determines in great part the capacity factor (CF) of a wind farm, it is also a matter of turbine design. Indeed, a large rotor combined with a small generator will take advantage of just about any wind and achieve an artificially high CF, obviously at the cost of a low yearly energy output. Page 1 Ref (2)

Capacity factors claimed by some groups are suspect. Some are theoretical calculations while others are calculated using electricity production statistics. Unfortunately cherry picking the windiest periods for the calculations can lead to higher results than if calculated using data over a longer period, say 2 years. Groups in Australia tend to quote around .36 which seems very high to me considering that windy places like the UK and Ireland have .26 to .3, Table 2 Ref (2). This is very important as it effects the perceived cost of using WTs.

As wind farms tend to be located away from population centres and the electricity grid, expensive power transmission infrastructure must be provided in order to use the WT farm output and often upgrading of existing wiring to handle the extra current, increasing the cost. Both resistive and reactive line losses must also be accounted for as well. It is so easy to account for this cost elsewhere and thereby artificially reduce the perceived cost of WT generated electricity. After all you wouldn't need that extra transmission infrastructure without the wind farm, would you ? The implications are greater than it first seems as you have to have sufficient transmission infrastructure to handle the maximum output of the wind farm while it will usually produce substantially less. Compare that with a fossil fuelled generator which can generate at full capacity most of the time and therefore requires much less transmission infrastructure to provide it's yearly output.

For instance, a fossil fuelled generator of 100 MW capacity would require lines to handle that maximum output. In the case of the wind farm with a capacity factor of .25, not unusual, you would need four times that much generating capacity and consequently four times as much transmission infrastructure to handle the peak output in order to match that output over a year. Whats more the increased current carrying capacity would be required from the generator to the load not just to the nearest grid power line.This results in infrastructure that is lightly used much of the time. The cost implications of

that are staggering.

The generating device that backs up WTs needs to react very fast since the output from WTs varies very rapidly, the main factor determining the WT output is the wind speed cubed. This means that the output increases and decreases very rapidly when the wind speed is in the range between where it first starts to generate and when it reaches maximum output. CCGT powered generators cannot keep up with it. Therefore, OCGT (open cycle gas turbine) or hydro generators are used as back up for Wind farms as they react much faster. So now we have a requirement for OCGT with the WTs, an amount of generating capacity approaching the Wind farms capacity. That causes a huge increase in capital cost. The OCGT operates in a very inefficient mode, having to idle for long periods and then rapidly increase output when the wind drops and reduce output rapidly when it increases. Hydro generation is fast enough to act in this capacity but is in limited supply and there is a lot of opposition increasing it.

Three studies (Netherlands Ref (3), Texas and Colorado) have found that when wind generated electricity is 3% or greater of the power on the grid, backed by OCGT, more CO2 is emitted than when using CCGT driven generators instead. These studies (FOI action required with the USA ones as the power company that instigated the studies did not want it publicised) also found no reduction in CO2 emissions for WT generated power on the grid.

Studies from Spain, Germany, Denmark, the UK and the USA have found that no CO2 emissions savings were achieved using WTs with OCGT backup and the cost was 5 to 6 and possibly 11 times higher using renewables than with fossil-fuelled power generation. Spain's CO2 emissions have gone up by 40% since making a valiant attempt to reduce its carbon footprint.

Wind turbines are prone to stress failure - gearboxes, blades etc.

WTs pose a significant fire risk as they have around 600 litres of flammable oil, lubricating and hydraulic, 60 to 100 metres above the ground, and are stuck in the middle of a field with those huge blades milling about. Bush fires are a real risk when one of these go up in flames as it usually occurs when the WT is under stress, high winds.

For each MW of Wind farm, up to 1 MW of OCGT generation is required as back up.

The triple blade assembly weighs around **36 tons** (depends on model). Throwing a blade is not a trivial matter. By the way, the longest distance recorded for throwing a blade is 1600 metres. That is impressive! How much damage could that do?

Maintenance is difficult because of the locations, height off the ground etc.

As stated above, they do not reduce the need for grid transmission infrastructure, in fact the grid most likely have to be altered to handle the additional current from these devices. As the output is so intermittent and

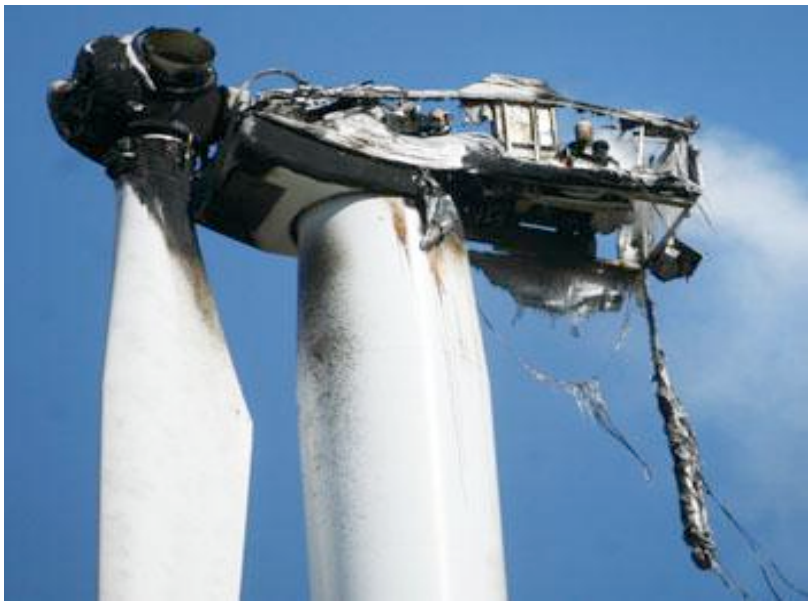
unreliable, no reduction in the grid infrastructure is possible, it must expand.

Power production is out of phase with demand both seasonally and daily.

The greatest wind power production is in spring and autumn while greatest demand for electricity is during summer and winter.

Wind generated power is of very little value as you cannot predict how much will be produced or when and it cannot be scheduled. You can't reduce or increase it when needed, in fact you cannot control it. **It is of little value !** Therefore electricity suppliers had to be forced by law to use it .

Ref (6) is well worth reading.

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