Submission
No 68

INQUIRY INTO RURAL WIND FARMS

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The Director,
General Purpose Standing Committee No. 5,
Legislative Council,
Parliament House,
Macquarie Street,
Sydney NSW 2000.

Dear Sir or Madam,

I am making a submission to the NSW Legislative Council's Standing Committee on Rural Wind Farms.

I am totally opposed to the construction of wind farms, on rural lands, for the large scale generation of electric power.

I wish to thank the NSW Legislative Council for the opportunity to put forward my views in opposition to rural wind farms.

Yours sincerely,

Dennis Workman.

SUBMISSION

to

THE NSW LEGISLATIVE COUNCIL

STANDING COMMITTEE NO.5

on

RURAL WIND FARMS

by

Dennis Workman

INTRODUCTION

In making this submission to the NSW Legislative Council's Standing Committee on Rural Wind Farms I declare that I am opposed to the construction of wind farms, on rural lands, for the large scale generation of electric power.

Recently the NSW Premier, Nathan Rees foreshadowed that wind farms be deemed to be **critical-infrastructure** and thus remove any recourse for opposition to them. I believe that it would be more appropriate that wind farms be declared to be **critically-flawed-infrastructure** because the NSW State Government has not considered the **adverse-consequences** of wind farms. In any rational decision making process a potential problem analysis must be performed. A potential problem analysis will take into account the probability and severity of the **adverse consequences** which might possibly occur.

When I was born in 1943 coal was the only local indigenous fuel and NSW was blessed with deposits of high grade coal that were the envy of most other Australian States. NSW coal fuelled power generation, household gas, and rail transport in NSW, Victoria and South Australia. In 1943 indigenous oil and gas had yet to be discovered and there were small plants to extract oil from oil bearing shale deposits at Glen Davis, & Joadja in NSW.

Coal also fuelled the steelworks at Newcastle and Port Kembla, and later at Whyalla in South Australia. I think it can be said that abundant, high grade coal helped to make NSW the dominant industrial state in Australia.

And yet here in 2009 coal is being talked of as "dirty" in comparison to "clean" "green" wind power. A Greens member of the Legislative Council, M/s Lee Rhiannon, on Thurs 13th August 2009, referred to the NSW Minister for Mineral Resources, as a **"carbon criminal"**. It is an understatement to say that the debate on climate change and renewable energy is getting, emotive, and animated.

Despite the elevated feelings that abound, some sanity must be brought into this debate otherwise we, as a society, might unwittingly take a wrong turn into a one-way energy cul-de-sac from which there may be no return except as a third-world country.

The finger of accusation is pointed at coal as being the culprit that got us into this climate change mess but coal is also the saviour that can help get us out of this mess. Using coal as fuel in new, more efficient power stations can achieve the same reductions in CO2 emissions that wind power can achieve in combination with our older less efficient power stations. The critical advantage that new efficient coal fired power stations have over wind and the older less efficient power stations is that they can achieve the same outcome for a far lower cost.

In 2005 I believed that wind farms were an environmentally sustainable way of generating electricity. I was also of the opinion that the energy generated would cause a corresponding reduction in the energy generated from fossil fuel sources and thus less CO2 would be produced. However I had some reservations about wind power which led me to conduct my own studies. My studies have shown that my reservations were justified and I now do not believe that wind is an environmentally sustainable way of generating electricity.

THE EFFECT OF WIND POWER ON THE ELECTRICITY GENERATING SYSTEM

I located, on the Internet, a report commissioned and published by the Renewable Energy Foundation U.K., authored by David White, BSc,C Eng, F I Chem E, titled "Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution from Wind-power". The report has had a major

impact on my understanding of the issues. The crux of David White's REF report, from my viewpoint, is that the additional unpredictability and variability from wind farms will reduce the efficiency of the existing coal fired plant held in reserve for wind farms.

Let us say, for arguments sake, that the Taralga Wind Farm, as finally approved, has 61 x 3 megawatt wind turbines. Let us also say, that the Taralga Wind Farm has a load factor of 30%. Therefore we can say that when the wind is blowing at maximum design velocity the Taralga Wind Farm will generate 183 megawatts of electricity. We can also say that when the wind velocity is below the minimum design wind velocity the Taralga wind farm will produce no electricity at all. On average the Taralga Wind Farm will produce about 30% of its maximum or 55 megawatts.

The electricity generating system has no storage. At any instant the electricity supplied by rotating generators must match the demand. The mix of other generating plant in the electricity generating system (mainly coal fired thermal plant in the case of NSW) already has to cope with a variable but predictable demand. Wind farms will place an additional variable and unpredictable fluctuation in output on top of that already variable but predictable demand.

Let us assume, for arguments sake, that the operators of the electricity grid have 183 megawatts of existing coal fired power generating plant held in reserve for the Taralga Wind Farm. On average this reserve plant will produce 128 megawatts such that the combined output of the Taralga Wind Farm and the reserve plant is 183 megawatts.

It is not an unreasonable assumption because the Taralga Wind Farm could have been producing 183 megawatts all night and then the wind might die away just at the morning peak. In such a situation you would need not just 183 megawatts of reserve capacity to be available, but you would need it to be spinning and ready to accept the load shed by the wind farm.

In another situation the reserve generating plant could have been operating at full 183 megawatts in the middle of the night when there is minimum demand for electricity and the Taralga Wind Farm is becalmed. A storm arrives and suddenly the Taralga Wind Farm starts producing at 183 megawatts maximum output. The reserve generating plant sheds all of its load but it must be kept spinning in case the Taralga Wind Farm trips off on wind over-speed and its output drops to zero.

David White, the author of the REF report, says that reserve generating plant, operating at such extreme conditions and anything in between, could easily operate 2% less efficiently than it otherwise would have. He conservatively estimates that CO2 emissions will increase from 0.95 to 1.1 tonne per megawatt-hour for that reserve plant. Fuel consumption will increase proportionally. This means that, when operating with coal fired thermal plant as reserve, wind power will be responsible for 0.36 tonne of CO2 per megawatt hour of electricity it produces.

The proponents of wind power as a sustainable energy source have stated that ***"Wind farms with a generating capacity 20,000 MW, together with a little additional peak-load plant, could substitute for 6,600 MW of coal power",*** *(and would avoid 19.8% CO2 emissions).* Let us then use that 20,000 MW of wind power to substitute for 6,600 megawatts of coal power and demonstrate the case in point.

At face value it does appear that 20,000 MW of wind power can substitute for 6,600 MW of coal power and avoid 54,404,856 tonnes of CO2 which would otherwise be emitted. However if the reserve coal plant operates 2% less efficiently because of wind then only 34,169,256 tonnes of CO2 emission is avoided. What happened to the other 20,235,600 tonnes of CO2 emissions? It will be emitted from the reserve coal plant but in reality it belonged to wind power. Thus in a MRET scenario wind power gets the credit for avoiding 54,404,856 tonnes of CO2 emissions when in fact only 34,169,256 tonnes of CO2 emissions are avoided. Who pays for the discrepancy of 20,235,600 tonnes of CO2 emissions? The reserve coal plant pays but will pass on the cost to the consumer. **Of course we will delude ourselves and believe that 54,404,856 tonnes of CO2 emissions are being avoided when only 34,169,256 tonnes of CO2 emissions will be avoided.**

MRET's are a monstrous delusion. The proponents of sustainable energy would have you and I believe that we can make a 19.8% reduction in CO2 emissions when it is more likely to be only 12.4%. And instead of increasing electricity charges by 20.3% they will have to increase by 27.6%. In fact to achieve something approaching (18.7%) the 20% reduction in CO2 emissions, which the proponents of sustainable energy are advocating, it would be necessary to install 30% wind power. Electricity charges would have to rise by 41.4%; more than double the 20.3% originally anticipated.

But that is not all that will happen. As wind power capacity is progressively increased up to 30%, existing coal fired plant will cease being base load plant and become reserve plant for wind power. At 30% wind power all of the base load coal plant will have become reserve plant for wind. The installed capacity of wind power will then be 33,000 megawatts but the electricity generating system will not be capable of producing any more electricity than before unless additional base load plant is provided.

Wind power cannot work without other generating plant in the system capable of accommodating its fluctuations in output. It is not a symbiotic relationship where each type of generating plant needs the other in order to succeed. It is a parasitic relationship and wind is the parasite literally sucking the efficiency out of coal fired thermal plant and will force the coal fired thermal plant to be operated in a way it in which it was never designed to be operated.

Thus the statement by the proponents of sustainable energy is false. It would be closer to the truth to say that ***"Wind farms with a generating capacity 33,000 MW, together 33,000 MW of coal power as reserve, could substitute for 33,000 MW of base load coal- power"*** *(and would avoid 12.4% of CO2 emissions).*

In any case wind power is one of the most expensive ways of reducing CO2 emissions; the cost per tonne of CO2 avoidance is high in comparison to other methods of electricity generation.

It is my contention that the people represented by the Taralga Landscape Guardians have been failed by the NSW Department of Planning and the NSW Department of Energy and Utilities & Sustainability. If there were people who should have been aware of the delusion about wind power, then you would expect them to be employed in those Departments.

GEOGRAPHIC DISPERSION OF WIND FARMS

If, as claimed by the proponents of wind power that ***"Wind farms with a generating capacity 20,000 MW, together with a little additional peak-load plant, could substitute for 6,600 MW of coal power",*** then it would be necessary to span the entire continent from west to east with wind turbines. According to the NSW Atlas, published by the NSW State Government in 1987, the weather systems take from 5 to 7 days to pass over the continent. A complete weather system is about a continent wide. At present the electricity grid spans a mere one third of the width of the continent, and some parts of the grid are tenuous. It is obvious that to span the continent with wind turbines then it is also necessary to span the continent with the electricity grid; an expensive undertaking, but nonetheless necessary to make wind farms work as claimed by the proponents.

If geographic dispersion of wind farms was working as claimed, then AGL would not have to build the recently approved straight gas turbine power station near Appin, NSW to supply peak power demand.

THE COST OF CO2 AVOIDANCE

To demonstrate the high cost of CO2 avoidance by wind power, I reproduce the text of a letter I sent, on 30th January 2007, to Gerard Walsh, Editor, Goulburn Post

Dear Sir,

Subject: Wind-farms Debate – Cost of CO2 Avoidance

It may sound absurd but the most cost effective way to reduce CO2 emissions from coal fired power stations is to build new power stations using coal as fuel. Integrated Gasifier Combined Cycle (IGCC) power stations using coal as fuel can produce electricity at, 4.4 cents and emit 0.6 kilogram CO2, per kilowatt-hour. By comparison, conventional coal-fired thermal power plant produces electricity at, 3.95 cents and emits 0.95 kilogram of CO2, per kilowatt hour. Therefore IGCC, for a cost of 0.45 cents, avoids 0.35 kilogram of CO2 per kilowatt-hour being produced. The cost of CO2 avoidance using IGCC technology is 1.29 cents per kilogram.

It may sound equally absurd but one of the least cost effective ways of reducing CO2 emissions is to build wind farms for the large scale generation of electric power. Wind power can, at face value, produce electricity at 7.95 cents per kilowatt-hour and be responsible for a negligible amount of CO2 in comparison to conventional coal-fired thermal power plant which produces electricity at 3.95 cents per kilowatt-hour and emits 0.95 kilogram of CO2 per kilowatt-hour.

Advocates of wind power have assumed that a kilowatt-hour of electricity generated by wind can displace a kilowatt-hour electricity generated by coal fired thermal power and thus save 0.95 kilogram of CO2 per kilowatt-hour. If that assumption were correct the cost of avoiding a kilogram of CO2 is 4.2

cents for wind power compared to 1.29 cents for IGCC coal technology. The cost of CO2 avoidance, by wind power, is at least 3 times that of IGCC coal technology.

However assumption by the advocates of wind power that, a kilowatt-hour of electricity generated by wind can displace a kilowatt-hour electricity generated by coal fired thermal power and save 0.95 kilogram of CO2 per kilowatt-hour is a fallacy.

A report, commissioned and published by the Renewable Energy Foundation U.K., authored by David White, BSc,C Eng, F I Chem E, titled "Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution from Wind-power", claims that wind power adversely affects the efficiency of coal fired thermal power plant held in reserve to accommodate the unpredictable and variable output from wind-farms. CO2 emissions of the reserve plant increase from 0.95 to 1.1 kilogram per kilowatt-hour. I estimate that a kilowatt of coal power reserve capacity will be required for each kilowatt of wind power capacity. Assuming a load factor of 30% for wind the load factor for the reserve coal plant will be 70%. Using the data from David White's report I calculate that 0.35 kilogram of additional CO2 will be produced by the reserve coal fired plant for each kilowatt-hour of electricity generated by wind power. That additional CO2 really belongs to wind power.

Thus wind power, in displacing an equivalent amount of conventional coal fired thermal power, saves only 0.6 kilogram of CO2 rather than 0.95 kilogram, per kilowatt hour. Wind power is no better than IGCC coal technology which, coincidentally also produces 0.6 kilogram of CO2 per kilowatt-hour of electricity generated.

It is also necessary to adjust the cost of wind power because it was responsible for the coal fired thermal reserve power plant to use more fuel. I estimate that 7.95 cents goes up to 9.4 cents, per kilowatt-hour. The cost of producing a kilowatt-hour of electricity increases by 5.45 cents. The cost of CO2 avoidance, for wind power, is 9.08 cents per kilogram. Thus the CO2 avoidance cost of wind power is as much as 7 times that of coal using IGCC technology.

Wind power cannot work without other generating plant in the system capable of accommodating its fluctuations in output. It is not a symbiotic relationship where each type of generating plant needs the other in order to succeed. It is a parasitic relationship and wind power is the parasite literally sucking the efficiency out of coal fired thermal plant and will force that plant to be operated in a way it in which it was never designed to be operated. It should be a matter of concern for all of us that our electricity generating system will be trashed for the questionable and dubious benefits of wind power, masquerading as renewable energy.

MRET's (mandatory renewable energy targets), which Premier Iemma will legislate if he wins the election in March, unduly and unfairly favour wind power over, not only non-renewable energy sources, but they also unduly and unfairly favour wind over other sources of renewable energy such as geothermal energy. Premier I am convinced that IGCC coal technology is the way ahead for the immediate future, I am also convinced that wind power is an expensive delusion pedalled by midnight snake oil salesmen and will only achieve very limited reductions in CO2 from electric power generation at great cost.

Yours sincerely,

THE HYPOCRISY OF APPROVING WIND FARMS WHILE EXPORTING COAL

I want to demonstrate the cant hypocrisy of the NSW State Government by approving wind farms while at the same time approving coal mines to export massive amounts of coal. I make this demonstration by reproducing the text of another letter I wrote, on 10th June 2007, to Gerard Walsh, Editor, Goulburn Post.

Subject: Taralga Wind Farm

Dear Sir,

Last year Planning Minister Frank Sartor approved the Taralga Wind Farm. He said it would save 250,000 tonnes of CO2 being emitted a year.

Some residents in the Southern Tablelands are grievously affected by the Taralga Wind Farm. The affected residents were told by the NSW Department of Planning and the Land and Environment Court that they have to make altruistic sacrifices for the greater good of the community. The sacrifices affected residents have to make is to cop the negative aspects of wind farms, such as incessant

noise, devaluation of their property's worth, disruption of their lives, destruction of rural landscapes. The wind farm will also be a destroyer of birds and an agent of local and global climate change and an evaporator of soil moisture from prime agricultural land.

Last week Planning Minister Sartor approved the Anvil Hill coal mine. Combustion of the coal from Anvil Hill will produce 12.3 million tonnes of CO2 per year. Minister Sartor said that he could not stop a particular development and allow others to proceed.

So much for the greater good Minister Sartor! The affected residents of Taralga have been betrayed & sacrificed on the political altar of window dressing expediency.

At very least, Minister Sartor could have made the Development Approval of the Anvil Hill Coal Mine, conditional upon the mine owner selling coal from the mine to buyers who agreed to burn that coal using the most efficient technology available.

The uranium oxide export industry has controls over the end uses of uranium to prevent proliferation of nuclear weapons. Similarly there is no reason why the coal mining industry should not be forced to impose conditions on coal sales which mandate efficient end use of that coal.

On the Minister's figures it would take 50 Taralga wind farms comprising 2,500 two megawatt wind turbines to make up for just one Anvil Hill Coal mine and we are told that there are more coal mines to come. If arranged in a line, down the Great Dividing Range, those 2500 two megawatt wind turbines, would stretch from Sydney to Melbourne, there are obviously a lot more of them to come too.

There was scope to achieve significant reductions in CO2 emissions in electricity produced from the combustion of Anvil Hill coal. Integrated Gasifier & Combined Cycle (IGCC) technology emits 0.6 tonne of CO2 per megawatt hour of electricity compared to conventional coal fired thermal technology at 0.95 tonne of CO2 per megawatt hour.

A saving of up to 37% in CO2 emissions, per unit of electricity generated, could have been achieved, by inserting a CO2 emission limit clause in the Development Approval. If prospective buyers of coal from Anvil Hill mine were willing to comply then we would have won an ethical victory and achieved massive reductions in CO2 emissions per unit of electricity generated; far more than we could ever achieve by building wind farms. If prospective buyers of Anvil Hill coal don't want to use the most efficient technology then so be it. Do the people of NSW really want to sell coal to these polluting customers anyway? The people of NSW will have to pay a lot more for so called "green" electricity from wind farms.

If Minister Sartor had imposed conditions on the end uses of Anvil Hill Coal he could have achieved up to 58% more units of electricity being generated for the same amount of CO2 emissions.

Yours sincerely,

ADVERSE CONSEQUENCES OF WIND FARMS

In August 2008 I gave objector's evidence to the NSW Land & Environment Court in relation to the Taralga Wind Farm to support the opposition of the Taralga Landscape Guardians to the rating of wind turbines being increased from 2 MW to 3 MW. I believe that my evidence had a material effect upon the Court's decision to order the buyout of a further 2 non-associated properties.

I conducted two demonstrations to the Court using two small fans.

The first demonstration showed that a fan has a rotating component in its wake in addition to an axial component. The demonstration also showed that the rotation could be detected for at least 8 rotor diameters downstream of the fan.

The second demonstration showed that moving the fans closer together increases the interference of the downstream fan in partial and full wake interference conditions. Moving the fans closer together also increases the arc over which partial and full wake interference conditions occur.

At 8 rotor diameters turbine spacing the arc of partial wake interference is about 8% of the total. At 4 rotor diameters turbine spacing the arc of partial wake interference is about 16% of the total. At 2 rotor diameters turbine spacing the arc of partial wake interference is about 33% in total. It was also noted

that as the turbine spacing is reduced the blade distance from the upstream fan to its downstream neighbour is further reduced by a greater amount than the reduction in spacing.

I built the apparatus used in the demonstrations to the LEC to assist the Court's understanding of what happens in the wake of axial flow fans so that I could make projections about what happens in the wake of horizontal axis wind turbines.

A horizontal axis wind turbine is driven by the air stream to produce a mechanical output power to drive a generator which converts mechanical power to electric power. A wind turbine typically extracts a large portion of the kinetic energy of the air stream by reducing its axial velocity. I made a projection that a horizontal axis wind turbine would have a wake with an axial and a rotational velocity components as was demonstrated with the fan.

The demonstration showed that a fan operating in the partial and full wake of another fan resulted in increased noise. I concluded that this increased noise was due to the affected fan experiencing an air flow with a varying velocity and direction profile. I made a projection that a horizontal axis wind turbine downwind of neighbouring turbine would also experience a wake with a varying velocity and direction profile. I also projected that, as a consequence of a wind turbine operating in the partial and full wake of another wind turbine, increased noise would result.

The amount of power removed from the wind is substantial. In a research paper, by David Keith and others, titled "The influence of large-scale wind power on global climate" appearing in the Proceedings of the National Academy of Sciences, Keith used a drag co-efficient CD in the range of 0.7 to 0.75 and a power coefficient CP of 0.35 to 0.4. Keith states that the fraction of energy removed from the atmosphere as electricity (by a wind turbine) is CP/CD which yields an atmospheric efficiency of 47 to 57%. I observe that roughly as much power is lost as is converted into electrical power.

I am of the opinion that the power, lost in the wake, is largely responsible for the rotation & turbulence of the wake. Ultimately, friction will diminish the rotation to zero, and the lost power will appear as low-grade heat power in the wake.

A turbine subjected to partial wake interference, might have one part of the turbine running in free air, at say, 12 metres a second and another part will be running in turbulent air with an axial velocity of, somewhat greater than, 7 metres a second, and also having a significant rotational component. I am of the opinion that the effect of partial wake operation on the turbine will result in increased noise, and increased fatigue.

In a full wake interference situation it is evident that the drag of the upstream turbine will have extracted much of the kinetic energy from the air stream. The second and subsequent turbines in a row will generate very little power and probably a lot of noise.

CUSHENDALL VINEYARD SCENARIO PROPOSED TO NSW LEC

The following scenario was put, as a submission, to the NSW Land & Environment Court in respect to Taralga Wind Farm's adverse effect on neighbouring Cushendall vineyard.

Let us say it is daytime and the wind is blowing a parcel of air at 15° C DB from Taralga, 845 metres elevation, up the slope towards Hughes trig 962 metres elevation. The parcel of air from Taralga arrives at Hughes trig 962 m elevation and it has increased in velocity but it is still 15° C.

A wind turbine 130 metres high is placed on top of Hughes trig so the top of the wind turbine is 1092 metres high. The difference in elevation from Taralga to Hughes trig is 247 metres. From rule of thumb I know that the dry bulb air temperature decreases by approximately 10° C per 1000 metres increase in elevation. By interpolation I calculate that the expected temp difference is -2.47° C. Hence the expected air temperature at the top of the rotor is 12.53° C.

The turbine wake is a gigantic mixer, and the air from Taralga, at 15° C at the bottom of the turbine, keeps going and is eventually caught up in the turbulent wake which has a rotational component. At the end of the wake the temperature is uniform and I would expect it to be about 13.77° C which is the

mean of the top and bottom temperatures. Cushendall Vineyard is in the wake and it experiences the mixed air which is 13.77° C and is turbulent. Had the wind turbine not been atop Hughes trig, the air parcel from Taralga at 15° C would have continued on over to Cushendall vineyard at 15 ° C

So in the daytime scenario just described, the effects at Cushendall vineyard changed from, 15 °C without a turbine, to 13.8° C with a turbine.

At the night the conditions at ground level are calm and the DB temp drops by 12 ° C. So the temperature at ground level under the turbine is 3° C. The same conditions would also exist at Cushendall vineyard. However there is wind at the top of the turbine the DB temp remains about the same at 12.53° C. The air, at 3° C at the bottom of the turbine, is induced into the wake and mixed with the air in the wake. The temperature in the wake is 7.7° C and it is now turbulent. Cushendall is in the wake so the temperature is 7.7° C and turbulent. Had the turbine not been atop Hughes trig, the air at ground level at Cushendall would be still and the same as at Hughes trig; 3° C.

So in the night time scenario, just described, the effects at Cushendall vineyard changed from 3 ° C and calm, without a turbine to 7.7 ° C and turbulent, with a turbine. If these hypotheses turn out to be true then the Taralga wind farm will have induced local climate change on Cushendall vineyard.

CUSHENDALL VINEYARD - OBSERVATION TO NSW LEC

Changes like this are very significant, especially if they result in a decrease in humidity and it is not just Cushendall vineyard and, other non-associated properties, which could hypothetically be affected, the vegetation to the east of the wind farm could also be significantly affected by local climate change induced by the Taralga wind farm. That vegetation is habitat for flora and fauna, which may have to cope with changed local climatic conditions induced by the Taralga Wind Farm.

Environmental Impact Statements do not even take the effects of turbine wakes into account.

In a scenario just described where I outlined the probable local climate change effect the Taralga Wind Farm would have on Cushendall Vineyard. I stated that the "the turbine wake is a gigantic mixer". I am convinced, from my demonstrations to the LEC with fans, that turbine wakes are indeed gigantic mixers and that wind farm induced local climate change will become a reality not only for Cushendall vineyard but also for other non-associated properties.

I observe, from the wind-rose accompanying the EIS for the Taralga Wind Farm, that wind from the W and NW account for 70% of the wind. If the wind rose was uniform then the wind from the W & NW directions would account for only 25% of the wind. Thus the wind from the W & NW directions occurs more frequently than it would in a uniform wind rose by a factor of 2.8.

I made an example, of Cushendall vineyard, in my evidence to the LEC of what I believe would happen should Taralga Wind Farm is built as proposed. Cushendall vineyard is nestled in a valley and sheltered from the effects of the prevailing W & NW winds. In most years the vines grow without resort to irrigation. I am of the opinion that the LEC took into account the effects that the Taralga Wind Farm, and in particular the three proposed turbines in closest proximity, would have on Cushendall vineyard when it ordered a buyout of that property.

The turbines, in closest proximity were spaced 167 metres apart, a mere 1.62 rotor diameters. The turbines are spaced more closely than, the 5 rotor diameters, that the SEDA guidelines recommend by a factor of 3. If the wind rose had been uniform then the wind from the W & NW would have occurred with a frequency of 1 and the turbine spacing would have a factor of 1. The product of those would be 1. Unfortunately for Cushendall vineyard the wind rose is not uniform. Wind from the W & NW will occur with a frequency of 2.8 compared to a uniform wind rose and the turbine population has increased by a factor of 3 whereas with a uniform wind rose the wind turbine population factor would have been 1. The product of the wind frequency factor and the turbine population factor is 8.4. The non-uniformity of the wind rose and the applicant's desire to make maximum use of this non-uniformity by reducing turbine spacing, amplified the effect that the Taralga wind farm will have on Cushendall Vineyard by a factor of 8.4. In addition to that the Court has already granted the

applicant's request to increase the turbine power by a factor of 1.5. So the amplification factor on Cushendall vineyard is 12.6.

The fan demonstration showed that there is rotation in a fan wake and it extends for least 8 rotor diameters. I projected that there will be rotation in a turbine wake. Coppin and co-authors, Section 6.4 " Wakes" on page 48 of the CSIRO publication "Wind Resource Assessment in Australia – A Planners Guide" say that "***.....wakes extend for a considerable distance; more than 10 rotor diameters"***. I believe that the atmospheric turbulence created by the Taralga Wind Farm will penetrate into the little valley in which Cushendall vineyard has been deliberately situated and change the local climate profoundly.

And that is not all. I have already observed, from the wind-rose accompanying the applicant's EIS, that wind from the W and NW account for 70% of the wind. For a another 8% of the wind rose turbines, in closest proximity, will be in partial or full wake interference mode and are likely to be far noisier than they would be if running in free air. Thus Cushendall vineyard is likely to be severely affected by Taralga Wind Farm for 78% of the wind rose, or 78% of the time that the wind is blowing.

CUSHENDALL VINEYARD SCENARIO RECOMENDATIONS PROPOSED TO NSW LEC

I believe that it is necessary to measure dry-bulb temperature and wet-bulb temperature, not just at hub height, but also at ground level and the uppermost tip of the turbine blade. This information is necessary to be able to make a judgement of upon possible adverse consequences of wind farm induced local climate change on non-associated properties.

People, like myself, have no alternative but to construct scenarios or hypotheses that attempt to understand the adverse consequences that the Taralga Wind Farm would have on surrounding non-associated properties because essential data such as wet and dry bulb temperatures and wind speed data are not available to the public.

A court can only make a decision on what is put before it. Citizens opposing wind farms have limited budgets and have to choose the issues which they believe will give the best chance of a successful outcome. The most important issues may never come before the Court for decision because they are seen as too complex or too risky or merely not even properly understood at the time. Such was the case with turbine layout of Taralga Wind Farm.

Given that wind turbines are purported to reduce CO2 emissions in electricity generation and hence reduce the effects of climate change why has it not been considered that the intruding wakes of Taralga Wind Farm turbines could have a profound effect upon local climate change on non-associated neighbouring properties?

The CSIRO publication "Wind Resource Assessment in Australia – A Planners Guide" P.A. Coppin, K.A. Ayotte & N. Steggel, Ver.1.1, October 2003, Page 48, alludes to the structural fatigue aspect of the problem of wake interference.

"The characterisation of wakes is very important not only for the prediction of wind farm energy yields but also for the assessment of any enhanced turbine blade fatigue possibilities."

ADVERSE CONSEQUENCES OF WINDFARMS - CROOKWELL

There are now significant numbers of wind farms under construction or approved or proposed, and there are probably more wind farms being contemplated. I want to discuss the adverse consequences of the following wind farms:- Gullen Range Wind Farm, Crookwell I Wind Farm & Crookwell II Wind Farm

I expect that the above wind farms will have a wind rose similar to Taralga Wind Farm wind rose, where 70% of the wind frequency is from the west and north-west. This means that properties or land to the east and south-east of these wind farms will be subject to the effects of the turbine wake **2.8 times more often** than they would have if the wind rose had been uniform. In fact 2.8 times is probably understating the effect because higher velocity winds tend to be associated with increased frequency from a particular direction. The power extracted from the wind and the turbulence in the

wake of a turbine varies as the cube of the wind velocity. Therefore if the velocity of the most frequent wind is 15% higher than the mean then the wind has 50% more power.

The Gullen Range Wind Farm, Crookwell I Wind Farm & Crookwell II Wind Farm are near the tops of ridges off the Great Dividing Range and gain the advantage of topographic effect increasing wind speed.

Scenarios or hypotheses, similar to the hypothesis developed for Taralga wind farm can be developed for all of the abovementioned wind farms. I expect that all of the above-mentioned wind farms will produce local climate change similar to that anticipated for Taralga wind farm.

All of the wind farms will thoroughly mix the stratified air arriving at the turbines into a rotating, turbulent, expanding wake.

According to Coppin and co-authors, Section 6.4 " Wakes" on page 48 of the CSIRO publication "Wind Resource Assessment in Australia – A Planners Guide", ***"Depending on the prevailing conditions the deficit in velocity can persist for a considerable distance down wind of the turbine, more than 10 rotor diameters."***

However even at 10 rotor diameters the wake is mixed; it does not suddenly become unmixed or re-stratified. The airstream continues on with higher surface velocity and reduced humidity which will enhance the drying properties of the airstream on the soil and plants. Just how far downwind of the turbine the enhanced drying properties will persist is not known and has not, in so far as I am aware, been the subject of any local study.

It appears that the studies of wind farms have been driven by where to site wind turbines to achieve maximum energy output. The impact of the wakes of wind turbines upon the land appears to have been conveniently ignored.

Gullen Range, Crookwell I & Crookwell II wind farms are situated to the west and northwest and north of Pejar reservoir. The wake from those wind turbines from the prevailing westerly and north-westerly winds will impact directly on the properties in the Pejar reservoir catchment.

It is only a few years ago following the drought of 2003 that Pejar reservoir was empty. Pejar is the largest reservoir supplying the City of Goulburn. During that drought period Goulburn City's population of 22,186 persons were on Level 5 water restrictions which targeted consumption at 150 litres per person per day. Over one year, that demand equates to 1.215 gigalitres.

COMPARISON OF WIND TURBINES TO FROST FANS

I reproduce an abstract by the author HJ Frith, titled "Trials of a wind machine for frost protection in citrus" and published on the CSIRO website

http://www.publish.csiro.au/paper/AR9550903.htm

"A horizontal axis wind machine for prevention of frost damage, built in Australia, has been tested under local conditions in a citrus grove. It was shown to be effective in raising orchard temperature by 2°F (1.1°C) over an area of up to 10 acres (4 hectares) at a power expenditure of 12 h.p. (9 kW) (electrical input) per acre, which is comparable to results obtained with similar machines in California and with the low speed Australian type of wind machine".
Australian Journal of Agricultural Research 6(6) 903 - 912

A frost fan works by replacing cold air at ground level with warmer air from higher layers above the ground. Frost fans can also be used to dry field crops.

A 2 megawatt wind turbine extracts 4 megawatts from the wind. 2 megawatts is output as electricity and 2 megawatts is lost mostly to rotating the wake of a wind turbine. Essentially a wind turbine is a gigantic mixer of the airstream; **a wind turbine is therefore a frost fan/dryer par excellence!**

Pro-rata to a frost fan, a 2MW wind turbine has the potential to frost free 90.4 hectares. Therefore 80 x 2 MW wind turbines have the potential to frost free (or dry) 7,233 hectares of land.

The 30 turbines of the Bannister group of the Gullen Range wind farm extend for 6 kilometres north to south, and have the potential to frost free (or dry) 2,700 hectares. To do this, the drying effect of their

wakes, in the prevailing wind, could easily extend 4.5 kilometres eastward. Pejar Dam is only 12 kilometres east of this group of wind turbines. Therefore the frost free (or drying) effect could extend well into the Pejar Catchment.

Pejar is the uppermost public water supply reservoir in the Wollondilly Catchment. The Wollondilly River flows into Warragamba Dam. The Wollondilly contributes a major portion of the inflow into Warragamba Dam; Sydney's largest reservoir.

One has to wonder how much the catchment of the head waters of the Wollondilly River will suffer from the wind farms in that area. Gullen Range (80 x 2MW), Crookwell I (8 x 0.6 MW), Crookwell II (46 x 2 MW) totalling 257 MW installed capacity with the potential to frost free (or dry) 11,600 hectares of the Pejar Catchment. The Pejar Catchment area is 14,200 hectares.

I anticipate that the people of Goulburn City would regard Pejar Dam as **critical infrastructure**. I also anticipate that the people of Goulburn City would also regard any infrastructure that impacted adversely on one of their vital water storage infrastructure as **critically-flawed-infrastructure.** And yet the NSW State Government has approved Gullen Range and Crookwell II wind farms; Crookwell I wind farm has been operating for some years.

A potential problem analysis taking into account the probability and severity of the **adverse consequences** of the Gullen Range and Crookwell II wind farms upon the water supply catchment for the city of Goulburn has never been considered let alone performed.

COMPARISON OF WIND TURBINES TO A THERMAL POWER STATION

Let us say hypothetically that, if instead of a wind farm, the owners of the land wanted a developer to build a 50% efficient 77 megawatt thermal power station to produce a similar output to Gullen Range, & Crookwell I & II wind farm's 134 wind turbines. The cooling water make-up requirement for such a power station would be in the order 1.1 gigalitre per year.

Gullen Range, & Crookwell I & II wind farms comprising 134 wind turbines have an average output of 77 megawatt and if operating with an atmospheric efficiency of 50 % won't consume any cooling water but they will create a moisture deficit in the wake of 1.1 gigalitre per year.

One might be inclined to say that the wind farm it is better that a thermal power station when in fact it is far worse. The rotation in the wake of the wind turbines will bring warmer dryer air from higher levels down into contact with the soil.

I cannot envisage the State Government approving a 77 megawatt thermal power station above Pejar Dam; yet the State Government has already approved Gullen Range and Crookwell II wind farms to augment the Crookwell I wind farm.

ADVERSE CONSEQUENCES OF WIND FARMS – EFFECTS ON LOCAL CLIMATE

There has been little research done into the effects of wind turbines on local climate. One such study was conducted by S Baidya Roy and others at Princeton University in the U.S. I have reproduced below an article from Science News, Oct. 16, 2004, p. 246.

Change in the Weather? Wind farms might affect local climates by Sid Perkins

Large groups of power-generating windmills could have a small but detectable influence on a region's climate, new analyses suggest.

Windmills once were quaint several-story-high mechanisms that pumped water or ground grain. They've since evolved into sky-scraping behemoths that can each generate electrical power for more than 100 homes.

Some modern turbines are 72 meters tall and have rotor blades that are about 25 m long, says S. Baidya Roy of Duke University in Durham, N.C. Future windmills may reach higher than 100 m, and their rotor blades may measure 50 m long, he notes.

All such turbines disrupt natural airflow to extract energy from wind. To investigate potential effects of a wind farm that includes thousands of windmills, Roy and his colleagues used a detailed climate model based on wind speeds, temperatures, and ground-level evaporation in north-central Oklahoma

during a 2-week period in July 1995. In their scenario, the researchers considered a 100-by-100 array of windmills spaced 1 kilometer apart.

The simulation suggests that during the day, while sun-induced convection handily mixes the lower layers of the atmosphere, such a wind farm wouldn't have important climatic effects.

In predawn hours, however, when the atmosphere typically is less turbulent, a large windmill array could influence the local climate. For example, at 3 a.m., the average wind speed at ground level was 3.5 meters per second (m/s) in the absence of windmills. Adding the wind farm would increase the average wind speed to 5 m/s. Also, the 10,000 windmills would increase the temperature across the area by about 2°C for several hours.

Averaged over an entire day, the wind speed at ground level would go up about 0.6 m/s and the temperature would jump 0.7°C.

Turbulence caused by the rotating blades would shunt some of the high-speed winds typically found 100 m off the ground down to Earth's surface, says Roy. Those surface winds would boost evaporation of soil moisture by as much as 0.3 millimeter per day.

The researchers describe their simulation in the Oct. 16 Journal of Geophysical Research (Atmospheres).

The findings may stimulate scientists to validate the analysis with real-world tests, says Neil Kelley, a meteorologist at the National Renewable Energy Laboratory in Golden, Colo. In general, says Kelley, the simulation agrees with atmospheric data he gathered at a wind farm in California.

From Science News, Oct. 16, 2004, p. 246.

The above article, although written over five years ago, points to wind turbines on a large scale having a small but detectable influence upon local climate, however the turbines used in this study are dwarfed by the proposed Taralga wind farm turbines and the turbines of the Taralga Wind Farm as spaced much more closely than the turbines in the model.

Enhanced evaporation at the rate of 0.3mm per day, over the 11,600 hectares of Pejar catchment made frost free by the wind turbines, has the potential to reduce the inflow into Pejar reservoir by 9 gigalitres per year. The storage capacity of Pejar reservoir is 9 gigalitres. The potential reduction in inflow is 7 times Goulburn City's 1.215 gigalitre per annum Level 5 demand.

ADVERSE CONSEQUENCES WIND FARMS - GLOBAL

An article in the Canadian publication, The Globe and Mail (9th Nov 2004), by Stephen Strauss, sounded an ominous warning on how wind farms might affect global climate. Canadian and US Scientists used computer simulations to show that using wind farms for large scale electric power generation could **".....create a significant temperature change over the earth's land masses.** While the precise trade-off between the climate change from wind farms versus that from carbon-based power systems is still a matter of contention, the fact that wind power isn't climate neutral leaps out of the simulations. ***"We shouldn't be surprised that extracting wind energy on a global scale is going to have a noticeable effect. ... There is really no such thing as a free lunch,"*** said David Keith, a professor of energy and the environment at the University of Calgary and lead author of the report, which appeared in the Proceedings of the National Academy of Sciences. Specifically, if wind generation were expanded to the point where it produced one-10th of today's energy, the models say cooling in the Arctic and a warming across the southern parts of North America should happen. The exact mechanism for this is unclear, but the scientists believe it may have to do with the disruption of the flow of heat from the equator to the poles.

Depending on how much energy is ultimately generated by wind power, the study's simulations say these changes could range from one-third of a degree to 2 degrees Celsius. One unexpected finding to the study is that the hotter temperate zone / cooler Arctic effect exists in the simulations if the wind farms are concentrated in a few spots or scattered across the world".

There are a couple of questions that need to be asked. Does the simulation translate to the southern hemisphere by the models saying "a cooling in the Antarctic and a warming across the southern parts of Australia should happen"?

What will be the consequences if wind power generation were increased by twice as much, as the 10% used in the global simulation, to 20% forecast by Dr. Diesendorf in his letter to the editor Goulburn Post Wed. 9th February 2005?

Some people may regard wind as a nuisance, like the lady who says "it mucks up my hair" but is not until you are confronted with the imminent arrival of wind turbines that you start learning about the wind and wind turbines, and the adverse consequences wind turbines may have on the climate and the environment.

The kinetic energy of the wind has an important job to do in transporting heat energy from the hot equatorial regions to the cold polar regions of the planet by the process of atmospheric circulation. The wind is a part of a heat energy transportation system. The global simulation conducted by Dr. David Keith and others shows, that wind farms on a large scale, may interfere with atmospheric circulation and the climate. That is to say that wind turbines will interfere with the global transport of heat energy.

The effect of wind farms spread across South Eastern Australia, is to intercept, with turbines, the prevailing wind on its journey from the equatorial regions to polar regions. The process slows the wind, by stealing much of its kinetic energy, and loads the wind with low-grade heat energy, being a consequence of the inefficiency of the process, and then sends the wind on its way, crippled and degraded. According to Dr. Keith a wind turbine producing 2 megawatts of electricity will place 4 megawatts of drag on the wind. It follows then that the 2 megawatts of the winds kinetic energy is turned into low-grade heat.

By reducing the velocity of the wind, we have reduced the ability of the wind to go as far as it did before. In other words we are degrading the wind. However that is not all that we do to the wind. The 2 megawatts of electricity a turbine converts into electricity is led somewhere else by cables and is used. Most of it ends up as low grade heat and adds to the 2 megawatts of heat that was lost due to the inefficiency of the process.

Thus a 2 megawatt turbine will strip 4 megawatts of kinetic power from the wind and load up what is left of the wind with 4 megawatts of low grade heat.

An entirely possible and logical consequence of degrading the wind and loading it up with heat is that Antarctica gets colder and the temperate zone, Southern Australia, where we live, gets hotter.

TURBINE WAKE – DEFICIT IN WIND VELOCITY

A wind turbine with a 103 metre diameter rotor, at a wind velocity of 12 metres per second, has an input power of 8.7 megawatts. Assuming that the wind turbine has an atmospheric efficiency of 50 %, of the 8.7 megawatts input wind power 3 megawatts is converted into electricity, a further 3 megawatts is lost due to inefficiency of the turbine and ends up as low grade heat in the turbine's wake. The wind exiting the rotor has an output power of 2.7 megawatts and an axial velocity of 6.7 metres per second. The wake has rotation, it is also turbulent and has an axial velocity significantly slower than the free air stream.

The CSIRO publication "Wind Resource Assessment in Australia – A Planners Guide" P.A. Coppin, K.A. Ayotte & N. Steggel, Ver.1.1, October 2003, Page 48 had this to say about wind velocity in the wake. ***"Depending on the prevailing conditions the deficit in velocity can persist for a considerable distance down wind of the turbine, more than 10 rotor diameters."***

For a wind turbine to produce power, there must be wind, and if there is wind to produce power then there will be a wake. It is my contention that the wake is an integral part of a wind turbine, and the effects of the wake on non-associated properties must be considered; up to this point they have not been considered.

For every one home supplied with electricity from a wind farm the water supply for one home will probably be evaporated. The adjectives "dry", "brown", "degradable" and "expensive" might be more appropriate.

Sydneysiders should not be complacent and regard the problems of wind farms as mere local problems confined to the Southern Tablelands and Goulburn. Most of the water that flows into Warragamba catchment comes from the Wollondilly River and the Wollondilly River rises near Crookwell in the Great Dividing Range just above Pejar Dam. Gullen Range and Crookwell II wind farms have been approved to be built fringing the catchment above Pejar Dam. The Taralga wind farm has also been approved to be built in the Tarlo River catchment. The Tarlo River also rises in the Great Dividing Range not far from the Wollondilly. The Tarlo River flows into the Wollondilly near Marulan; the Tarlo River also flows up in Warragamba Dam.

CONCLUSIONS

Global warming and climate change may make many places hotter and wetter, but South Eastern Australia is forecast to become hotter and drier as a consequence of global warming and climate change. To that gloomy forecast we might need to add the global heating effects of wind farms and if you live near them you might need to add the local heating and drying effects as well.

The locality of Bannaby near where the Taralga wind-farm is to be sited will have 122mm less rain by 2040 according to Bureau of Meteorology forecast mean rainfall trends . The local effect of wind farms, could account for as much as 110mm. Therefore the locality of Bannaby could be 230 mm drier by the year 2040. This is climate change and almost half of it possibly attributable to Taralga Wind Farm.

The locality of Bannaby will, according to Bureau of Meteorology forecast mean temperature trends, be 0.5 degrees C hotter by the year 2040. The global effects or wind farms could add between 0.33 and 2 degrees C and the local effects of wind turbines could add a further 0.7 degrees C. Therefore the locality of Bannaby could be between 1.5 and 3.2 degrees C hotter by the year 2040. Again this is climate change and most of it possibly attributable to Taralga Wind Farm.

I find it alarming that there appears to have been little research done into the effects of large-scale wind farm developments on global and local climate. It seems that we to embark upon yet another climatic experiment without really knowing what the consequences will be? The scary thing is I don't think we want to know what the consequences might be!

Large scale wind farms for power generation will be a similar experiment to those experiments we have been conducting by burning fossil fuels or making synthetic refrigerant gases like the outlawed "freons". Those same outlawed "freons" still contribute to holes in the ozone layer and are also potent greenhouse gases. Before we take another great imprudent leap into the unknown I believe that we must conduct a very thorough study of the possible adverse consequences of wind farms for large-scale power generation on both local and global climate, from the perspective of South East Australia.

James Lovelock, the scientist who made the connection between the "freons" and holes in the ozone layer is sometimes referred to as the father of the greens. James Lovelock is on record as saying that we should be building nuclear power stations to combat climate change.

A wind farm of 6.6 gigawatts net capacity , comprising at least 11,000 2MW wind turbines, in south-eastern Australia is not a small undertaking; it is equivalent to six 1.1 gigawatt conventional coal fired thermal power stations or six 1.1 gigawatt nuclear power stations .

The cooling water make-up requirement for 6 x 1.1gigawatt 50% efficient thermal power stations would be would be in the order 16 gigalitres per year. However large thermal power plants would be sited near the seaboard and use seawater as coolant and thus not place a demand on coastal and inland rivers.

The cooling water make-up requirement for 6 x 1.1 gigawatt 30% efficient nuclear power stations would be would be in the order 37 gigalitres per year. However large nuclear power plants would be sited near the seaboard and use seawater as coolant and thus not place a demand on coastal and inland rivers.

By comparison11,000 x 2 megawatt wind turbines in SE Australia with an average total output of 6.6 gigawatts, if operating with an atmospheric efficiency of 50 %, will not consume any cooling water but will create a moisture deficit in their wakes of at least16 gigalitres. But the problem could be even far greater than that because the turbine wakes will remove water from the soils and plants in their path as a result of enhanced mass transfer brought about by the rotating air mass in the wake increasing

the wind velocity at ground level and also bring drier air from higher levels into contact with the plants and soil.

The environmental consequences 11,000 x 2 megawatt wind turbines could be severe, even catastrophic. The NSW State Government has been prepared to let these developments proceed on an unplanned, divisive, destructive, ad hoc, chaotic basis against the majority wishes of the communities where they are being sited, contrary to Local Council guidelines, and in total ignorance of the possible adverse consequences both globally and locally.

Farmers who are approached by wind farm developers are probably not told the whole story; they are probably told everything that the developer wants them to know, such as how "clean" & "green" wind turbines are. They are probably told the equivalent number of cars the turbines will take off the road. They are told how much they will be paid for having wind turbines sited on their properties. They are almost certainly not told that the wind turbines make incessant low frequency noise and vibration. They are almost certainly not told that their farm houses will be made uninhabitable by noise. They are almost certainly not told that their farms will be dried out by the turbine wake. They are probably not told that they will achieve the odium of polecats with their neighbours. They are probably conned into signing a contract with a clause that forbids them to speak against the wind farm development and are forever muzzled. What appears to be occurring is deception by omission. Farmers faced with such a situation need sensible honest advice, and they need protection from exploitation by slick salesmen. The NSW State Government appears as though it could not care less. If the NSW State Government did care, it would ensure that possibility of such odious practices occurring was nil, and any deceptive contracts entered into were rendered null and void.

Neighbours who adjoin or who are in close proximity to a wind turbines and who will be grievously affected by a wind farm development, should not have to 'pony-up' with huge sums of money, to take their case to the Land & Environment Court, in an attempt to stop their lives, their livelihood and their assets being trashed. Once again the NSW State Government appears as though it could not care less. If the NSW State Government did care, it would ensure that people and properties affected by wind farm developments were adequately compensated, especially if they believe that the pathetic amount of renewable energy from wind farms is so dammed important in solving the problem of climate change.

Science that selectively considers the beneficial aspects of wind farms without looking for and taking into account the adverse consequences is not science. The people who engage in such practices are not scientists but charlatans.

RECOMMENDATIONS

I make the following specific recommendations applicable to wind turbines for large scale power generation:-

An immediate moratorium should be placed on the construction of any new wind turbines in New South Wales, until further research, specific to SE Australia, is conducted to determine that the adverse consequences of wind turbines in SE Australia on the local climate and environment do not outweigh the benefits claimed for wind farms.

Wind farms should not be permitted to be built near to water catchments of public water supplies until it can be conclusively demonstrated that their effect on rainfall run-off into reservoirs is negligible.

Wind farms should not be permitted to be built in water catchments of reservoirs for irrigation and river regulation until it can be conclusively demonstrated that their effect on rainfall run-off into reservoirs is negligible.

Wind turbines must shoulder the costs of for any inefficiency they may cause to the existing electricity generating system. In particular wind farms should not treat the existing electricity generating system as a storage battery. The development of wind farms must be balanced so that geographic dispersion is achieved as the population of wind turbines grows. Achieving this may require that expensive and extensive long distance electricity transmission lies are constructed.

Wind farms must pay for the additional electrical plant and transmission lines required to integrate them into the electricity generating and distribution system.

Turbines in wind farms shall be spaced in accordance with the SEDA guidelines. The "5r-8r" rule shall be mandatory. In no case shall turbines be spaced no closer than 5 rotor diameters across the prevailing wind and 8 rotor diameters in the direction of the prevailing wind.

The boundary of a property not associated with the wind farm development shall be no closer than 20 rotor diameters to a wind turbine.

An agreement by a landholder to a developer for the placement of wind turbines on a land owner's property shall be registered like a mortgage, and it shall not be secret. The landholder shall be made aware that they may be adversely affected, and the intrinsic value of their land may be reduced. They should also be made aware that the dwelling(s) on their property may be made uninhabitable by the development.

Wind farms should not be treated any differently than any other development. Wind farms should not be deemed to be critical infrastructure. Wind farms shall be regulated by means of a special ordinance for wind farms. The special ordinance shall set out the minimum standards and requirements for wind farms. The ordinance shall be administered and enforced by the EPA.

Any new coal fired thermal power stations approved for construction in NSW should be of the Integrated Gasified Combined Cycle (IGCC) type.

Any new gas fired thermal power stations approved for construction in NSW should be of the Gas Turbine Combined Cycle (GTCC) type. Open cycle gas turbines should not be approved except for emergency or stand-by use.

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Dennis Workman

21st August 2009.