Submission to NSW Department of Planning

In relation to

The Paling Yards Wind Farm - App. MP 10 0053

SUMMARY OF CONTENTS

1. INTRODUCTION

In making this submission to the NSW Department of Planning in relation to the Paling Yards Wind Farm, I declare that I am opposed to the construction of Paling Yards Wind Farm, for the large scale generation of electric power for the many reasons I have set out in this submission.

Back in 2005 I believed that wind farms might be 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 and the numbers for wind just don't add up. I now believe that wind is not an environmentally sustainable way of generating electricity. More significantly, I am no longer of the opinion that the energy generated from wind farms will cause a corresponding reduction in the energy generated from fossil fuel sources, and therefore, will not lead to a corresponding reduction in CO2 emitted from fossil fuel sources; it may even lead to an increase in CO2 emissions.

2. WIND FARMS AND THE ELECTRICITY GENERATING SYSTEM

2.1 GEOGRAPHIC DISPERSION OF WIND FARMS

According to the article, "Wind Power Storms Forward", (Science Illustrated, Issue 8 2010) the local placement of wind turbines is critical. The article claims that some spots on the local topography yield more than seven times the energy that other nearby places yield. This possibly explains why turbines on many wind farms are crammed into spacing far less than the NSW Wind Energy Handbook 2002 recommends. The NSW Wind Energy Handbook 2002 comes with a map of the State which shows the "sweet" localities for wind energy. The NSW State Government has more recently proclaimed a "gateway process". But the absurdity is that the placement of wind turbines in Australia is not a structured process. Wind turbines are placed wherever developers can achieve maximum return. Rolling out the "red carpet", by the NSW State Government, to encourage developers to stick their collective "snouts" into the wind energy "pig trough" via the "gateway process", is achieved by stripping away the rights of affected land owners to object. Anyone beyond the 2 kilometre "gateway process" threshold is no better off than they were under the previous State Labor Government.

However the really sad thing about the "gateway process" is that it will do very little to achieve effective geographic dispersion; in fact it will probably achieve a concentration of wind farms in the wrong places. The wind farms of NSW, Victoria and South Australia, even though they are connected to the most extensive (by world standard) electricity grid only span a fraction of the weather systems that pass over the continent. There will be times when the light winds associated with high pressure systems will envelop most of the wind farms, and there will a dearth of electricity generated. Similarly there will be times when strong winds envelop most of the wind farms leading to a surfeit of electricity generated. This variability already happens, and it has big implications for the conventional generating plant. Firstly it will ensure that none of generating plant is displaced and secondly it will ensure overall, that generating plant will operate less efficiently. Furthermore it will guarantee that electricity prices will keep on rising significantly even though they have already risen significantly and, more likely than not, it may also mean that no reduction in CO2 emissions is achieved. Unthinkable though it may be, after all this renewable energy drivel that has been bombarding our senses, CO2 emissions might actually increase and the much maligned coal fired thermal power stations may even become more polluting. However, in her infinite wisdom, a previous Prime Minister, Julia Gillard, effectively closed off the possible construction of new, more efficient (IGCC) coal fired power stations unless they are **"carbon capture ready".**

2.2 THE EFFECT OF WIND POWER ON THE ELECTRICITY GENERATING SYSTEM

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.

The electricity generating system has no storage; it is not a battery. 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 & Victoria) 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.

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 about 0.36 tonne of CO2 per megawatt hour of electricity it produces. As the population of wind turbines increases the more acute the problem becomes.

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.

2.3 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,

3. ADVERSE CONSEQUENCES OF WIND FARMS

3.1 TURBINE WAKE INTERFERENCE - OBLIQUE ENTRY – THUMPING & BEATING

3.1.1 DEMONSTRATION OF TURBINE WAKE INTERFERENCE & WAKE ROTATION

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-host 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 C_D in the range of 0.7 to 0.75 and a power coefficient C_P of 0.35 to 0.4. Keith states that the fraction of energy removed from the atmosphere as electricity (by a wind turbine) is C_P/C_D 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, 15 metres a second and another part will be running in turbulent air with much lower axial velocity, 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, and the more closely the turbines are spaced, the more pronounced the effect will be.

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 probably generate very little power and probably a lot of noise.

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”***.

3.1.2 EFFECTS OF TURBINE WAKE INTERFERENCE & WAKE ROTATION

The NSW Wind Energy Handbook 2002 on page 053 advises that *“A wind-farm layout must take into account that turbines have substantial ‘wakes’, which interfere with each other depending on wind direction and spacing. The general rule of thumb for spacing (the ‘5r-8r rule’) is five times rotor diameter abreast and eight times rotor diameter downwind. On very directional sites the ‘abreast spacing’ can be decreased by around 15 per cent, but the down-wind spacing is not as variable. Layout geometry can be primarily driven by the need to follow narrow ridgelines or to align arrays across the prevailing wind. On more complex terrain, individual sites need to be carefully evaluated to make best use of the wind resource, so the spacing may be quite variable”.*

By stark contrast above paragraph, the proposed Paling Yards Wind Farm has some turbines spaced as close as 2.1 rotor diameters across the wind and 2.6 rotor diameters downwind.

The extremely close, across the wind, turbine spacing of the proposed Paling Yards Wind Farm (2.1 rather than 5) and downwind turbine spacing (2.6 rather than 8) is testament to the fact that the guidelines stated in the NSW Wind Energy Handbook 2002, page 053, are being completely ignored; by the developer. The contemptuous treatment accorded a previous NSW Government’s Wind Energy Handbook 2002, endorsed with a foreword by Kim Yeadon the then NSW Minister for Energy, show how utterly meaningless, useless and toothless any sort of guidelines really are.

The turbines of the Paling Yards Wind Farm are arranged extremely closely spaced along the ridges. The result is that developers achieve 2.1 times more turbines in a wind farm than they would if they followed the guidelines of the NSW Wind Energy Handbook 2002. It logically follows that neighbours will have to listen to 2.1 times more turbines (an increase of 3.2 dB) than they otherwise would have if the guidelines had been followed. Unless there are mandatory set minimum, turbine to turbine spacings, proponents will continue to cram as many turbines into a site as they possibly can to, increase the rental paid to host, to generate as much electricity as they can. However cramming more turbines into a site will make the turbines noisier, less efficient, less able to generate electricity from all directions, and more prone to fatigue.

The Paling Yards Wind Farm will likely experience disproportionately greater noise problems due to wake interference, accentuated by the closer turbine spacing, when the wind is blowing at a direction other than the prevailing wind. Furthermore some turbines will always be experiencing wake interference no matter which way the wind blows. As the wind direction changes the set of turbines experiencing wake interference problems will vary. In my opinion, the turbines of the Paling Yards Wind Farm will produce unacceptable noise levels.

Compliance with the “5r-8r” rule of the NSW Wind Energy Handbook 2002 would require that the number of turbines, on the Paling Yards properties be reduced from 46 to 22 and, on the Mingary Park properties from 9 to 4, the wind farm total being 26. The Department of Planning should demand that the proponent show good reasons why the turbine population of the Paling Yards Wind Farm should exceed 26 turbines and their justification for ignoring compliance with the “5r-8r” rule of the NSW Wind Energy Handbook 2002. Reduction in the number of turbines from 55 to 26 would reduce noise from the wind farm by about 3.3 dB.

3.1.3 OBLIQUE WIND ENTRY INTO WIND TURBINES

The turbines situated at the top of rising ground along the Defiance Range at Paling Yards Wind Farm, where the prevailing wind is rising up from the Abercrombie River Valley, will probably be subject to oblique entry of the wind into the turbines. The wind is probably rising at the same angle as the rising ground; about 10° on average. In addition to that a typical turbine rotor is pitched back at say 3° (so that the turbine blades do not hit the tower). This means that wind is entering the turbine rotor at an oblique angle of about 13° (i.e.10° plus 3°) to the axis of the turbine rotor.

The apparent pitch of a typical wind turbine, having a rotor diameter of 135 metres and rotating at 11 RPM in a 15 metre/second wind is 82 metres. The corresponding apparent pitch angle at the blade tip is 11°. However, as the turbine rotates, the apparent pitch angle changes. At 0° and 180° angle of rotation, from the vertical, the apparent pitch angle is 11°. However at 90° and 270° angles of rotation, the apparent pitch angle is 24° (i.e. 11° plus 13°) and -2° (i.e. 11° minus 13°) respectively. This is quite a variation and is quite likely to be a source of aerodynamic noise.

A property, neighbouring my property, has a small wind turbine of about 2 metres rotor diameter. This turbine is situated a few hundred meters from my residence. Normally I can’t hear it operating, however, in a blow, the turbine governs its speed and prevents itself from over-speeding by tilting back. When the turbine tilts back it thumps very noisily indeed. I can hear the noise from it, in a blow, over all the other wind noises. This small turbine highlights what happens when the wind passes through a turbine rotor at an oblique angle.

Horizontal axis wind turbines are high performance machines and are very sensitive to the wind not blowing perpendicularly and uniformly, onto the plane of the rotor. If turbines are to be located where the wind is rising up a slope then they should be of a design which can adjust to that condition. A turbine with the nacelle mounted in gimbals such that the rotor can yaw horizontally and luff vertically might be one way of achieving that requirement.

While it is understood that wind turbines are variable pitch machines it is also understood that the pitch setting applies to all blades. It is also noted that variable pitch turbines can only be correct for one given pitch. At other settings, parts of the turbine blade will not be at the correct pitch.

3.1.4 THUMPING & BEATING TURBINES

The turbines to be used in the Paling Yards Wind Farm, I believe will be, <u>variable speed</u> types; i.e. the speed of the turbines is not locked to the electricity grid frequency. The speed of the turbines increases as the wind velocity increases and decreases as the wind velocity diminishes. The NSW Wind Energy Handbook – 2002 points out that at the time of publication most of the turbines were of the <u>fixed speed</u> type. Fixed speed turbines of identical type would not produce a beat.

Each turbine produces its familiar “thump” sound. The sound level of the familiar “thump” sound could be significantly increased by partial and full wake interference accentuated by the adoption of closer than recommended turbine spacing. The "thump" could be further accentuated by the turbine wind vane giving erroneous signals and yawing a turbine incorrectly because it is affected by the interfering wake of an upstream turbine, which is too closely spaced. And the "thump" could also be accentuated In places where the turbines are situated near to steeply rising ground where the wind is entering the turbine rotor at an oblique angle to the axis of the turbine rotor.The frequency of the "thump" sound is the product of the turbine rotational speed times the number of blades divided by 60. For a 3 bladed turbine running at 11 rpm the frequency of the "thump" is 0.55 Hz. Where there are two or more turbines in a wind farm of the variable speed type, then the turbines will beat. The 55 turbines of the Paling Yards Wind Farm will produce 30.25 "thumps" per second if the turbines are running at an average speed of 11 rpm. If the turbines were synchronous there would be no beat produced. The proponent of the Paling Yards Wind Farm has indicated that turbines with an output less than 4.5 megawatts rating will be used in some places. Lesser rated turbines will probably have smaller rotor diameters and run at a higher rotational speed than 4.5 megawatt turbines. This variation in rotational speeds between differently rated turbines will also produce a beat as the characteristic thumps of two or more turbines coincide.

When a wind gust passes through a wind farm a windward turbine will increase speed over its leeward neighbour and , at some point, they will beat ("thump" simultaneously) and as the windward turbine decreases speed and its leeward neighbor increases speed they will, at some point, beat ("thump" simultaneously) again. Thus for passage of a gust each pair of turbines will beat twice. If the gust period is 40 seconds (chosen arbitrarily) then the beat frequency between a pair of turbines is 20 seconds. The beat between two turbines will produce more noise. If a listener were equidistant from a pair of beating turbines, the amplitude of the beat would be twice the amplitude of the thump of 1 turbine (or 3 dB).

3.1.4.1 A 10 TURBINE WIND FARM (subject of NHRMC Study)

For a 10 turbine wind farm the product of the number of combinations and the thump frequency of the combination of any:-

No of turbines beating	Occurrence frequency	Increase in noise
2	2.2 Hz	up to 3 dB
3	0.3 Hz	up to 4.8 dB
4	0.03 Hz	up to 6 dB
5	0.0016 Hz	up to 7 dB

3.1.4.2 A 55 TURBINE WIND FARM (Paling Yards Wind Farm, NSW.)

For a 55 turbine wind farm the product of the number of combinations and the thump frequency of the combination of any:-

No of turbines beating	Occurrence frequency	Increase in noise
2	74 Hz	up to 3 dB
3	66 Hz	up to 4.8 dB
4	42 Hz	up to 6 dB
5	22 Hz	up to 7 dB
6	9 Hz	up to 7.8 dB
8	1 Hz	up to 9 dB
9	0.25 Hz	up to 9.54 dB
10	**0.06 Hz**	**up to 10 dB**
14	0.00005 Hz	up to 11.5 dB

3.1.4.3 A 26 TURBINE WIND FARM (Paling Yards Wind Farm, NSW.)

For a 26 turbine wind farm the product of the number of combinations and the thump frequency of the combination of any:-

No of turbines beating	Occurrence frequency	Increase in noise

2	16 Hz	up to 3 dB
3	6.5 Hz	up to 4.8 dB
4	1.9 Hz	up to 6 dB
5	0.411 Hz	up to 7 dB
6	**0.07 Hz**	**up to 7.8 dB**
8	0.0012 Hz	up to 9 dB
9	0.00012 Hz	up to 9.54 dB
10	0.00001 Hz	up to 10 dB

3.1.5 SUMMARY- THUMPING & BEATING TURBINES

I observe from the above examples (3.1.4.1, 3.1.4.2 & 3.1.4.3) that as the population of turbines increases, the propensity for the number of turbines to beat also increases and so the amplitude of the beat also increases. The frequency of the beats also increases with an increasing turbine population. And where there is a variation in rotational speeds between differently rated turbines then those combinations will also beat.

Many of the pro-wind farm submissions to the Senate Inquiry on Rural Wind Farms pointed to the NHMRC study. However, the NHMRC study only considered a 10 turbine wind farm. The above estimate of beating turbines suggest that a 10 turbine wind farm is comparatively benign when compared to a 55 turbine Paling Yards Wind Farm. The above hypothetical examples of beating turbines suggest that the NHMRC study has no relevance whatsoever in assessing wind farms with turbine populations greater than 10.

For the proposed 55 turbine wind farm the beating of turbines will give rise to a pulsating noise output of a wind farm. Combinations of 2 turbines beating occurs frequently at 74 Hz whereas, combinations of 10 turbines beating, occurs infrequently 0.06 Hz (about 17 seconds) and combinations of 16 turbines occurs even less frequently at 0.00005 Hz (about 5.5 hours). This spike in noise has the potential to disturb sleep.

If the number of turbines was reduced to 26 then the noise produced by beating turbines would be greatly reduced. Combinations of 2 turbines beating would occur less frequently at 16 Hz (about 0.6 second) whereas, combinations of 10 turbines beating, occurs infrequently at 0.00001Hz (about 28 hours). By comparing the proposed 55 turbine wind farm with 10 turbines (beating at an occurrence frequency of 0.06 Hz), with the reduced 26 turbine with 6 turbines (beating at an occurrence frequency of 0.07 Hz), the spike in noise is substantially reduced by 2.2 dB from 10 dB to 7.8 dB.

3.1.6 INFRASOUND – DEFINITION

The following definition of Infrasound is from Wikipedia, the free encyclopedia.

Infrasound *is sound that is lower in frequency than 20 Hz (Hertz) or cycles per second, the normal limit of human hearing. Hearing becomes gradually less sensitive as frequency decreases, so for humans to perceive infrasound, the sound pressure must be sufficiently high. The ear is the primary organ for sensing infrasound, but at higher levels it is possible to feel infrasound vibrations in various parts of the body.*

The study of such sound waves is sometimes referred to as ***infrasonics****, covering sounds beneath 20 Hz down to 0.001 Hz. This frequency range is utilized for monitoring earthquakes, charting rock and petroleum formations below the earth, and also in ballistocardiography and seismocardiography to study the mechanics of the heart. Infrasound is characterized by an ability to cover long distances and get around obstacles with little dissipation.*

3.2 ADVERSE CONSEQUENCES OF WINDFARMS – PALING YARDS WIND FARM

I expect that the Paling Yards Wind Farm will have a wind rose similar to Taralga Wind Farm wind rose (see Attachment C), where 70% of the wind frequency is from the west and north-west. **This would mean 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.** The Paling Yards Wind Farm is at or near to the tops of ridges to the west and running parallel to the Great Dividing Range and gain the advantage of topographic effect in increasing wind speed.

3.2.1 PALING YARDS WIND FARM - HYPOTHESIS

The following hypothesis, or scenario, is similar to a hypothesis I gave in August 2008, as 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.

This hypothesis considers the possible adverse effect that The Paling Yards Wind Farms, on the Mt Defiance Ridge, could have on the catchment of the Abercrombie River. The Abercrombie River flows into Wyangala Dam and is a major tributary of the westward flowing Lachlan River, which is a part of the Murray-Darling River System.

Let us say it is daytime and the prevailing NW wind is blowing a parcel of air at 18°C DB from Abercrombie River Valley, 800 metres elevation, up the slope towards Defiance Ridge 1,000 metres elevation. The parcel of air from Abercrombie River Valley arrives at Defiance Ridge, 1,000 m elevation, and it has increased in velocity but it is still 18° C.

A wind turbine, 180 metres high, is placed on top of Defiance Ridge, (elevation 1,000 metres). The top of the wind turbine is approximately 1180 metres elevation. The difference in elevation from Abercrombie River, (elevation 800 metres) to the top of a turbine on Defiance Ridge is approximately 380 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 temperature decrease is 3.8° C. Hence the expected air temperature at the top of the rotor is 14.2° C.

The turbine wake is a gigantic mixer, and the air from Abercrombie River Valley, at 18° C at the bottom of the turbine, keeps going and is eventually caught up in the turbulent wake which has a significant rotational component. At the end of the wake the temperature is uniform and I would expect it to be about 16.1° C which is the mean of the top and bottom temperatures. The catchment of Abercrombie River, SE of the wind farm, is in the wake and it experiences the mixed air which is 16.1° C and is turbulent. Had the wind turbines not been atop the Defiance Ridge the air parcel from Abercrombie River at 18° C would have continued on over to the catchment, of the Abercrombie River, SE of the wind farm, at 18 ° C

So in the daytime scenario just described, the effects at the catchment of Abercrombie River, SE of the wind farm, changed from, 18°C without a turbine, to 16.1° 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 6° C. The same conditions would also exist at the catchment of Abercrombie River, SE of the wind farm. However there is wind at the top of the turbine and the DB temp remains about the same at 14.2° C. The air, at 6° 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 10.1° C and it is now turbulent. The catchment of Abercrombie River, SE of the wind farm, is in the wake so the temperature is 10.1°C and turbulent. Had the turbine not been atop the Defiance Ridge, the air at ground level at the catchment of Abercrombie River, SE of the wind farm, would be still and the same as at Defiance Ridge 6° C.

So in the night time scenario, just described, the effects on the catchment of Abercrombie River, SE of the wind farm, have changed from 6 °C and calm, without a turbine, to 10.1° C and turbulent, with a turbine. If these hypotheses turn out to be true then the Paling Yards Wind Farm will have induced local climate change on the catchment of Abercrombie River, SE of the wind farm.

3.2.2 PALING YARDS WIND FARM HYPOTHESIS - IMPLICATIONS

People, like myself, have no alternative but to construct scenarios or hypotheses that attempt to understand the adverse consequences wind farms 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, or conveniently, not measured.

To prove whether or not the hypothesis, is true or false, it is simply necessary to measure dry-bulb and wet-bulb temperatures, not just at hub height, but also at ground level and the uppermost tip of the turbine blade, both upstream and 10 rotor diameters downstream of the turbine. Making a hypothesis and testing it by measurement is what scientific method is all about.

Given that wind turbines are purported to reduce CO_2 emissions in electricity generation and hence reduce the effects of climate change why has it not been considered that the intruding wakes of wind turbines can have a profound effect upon local climate change on non-associated neighbouring properties and in particular the catchment of Abercrombie River? All of the wind turbines will thoroughly mix the stratified air arriving at the turbines into a rotating, turbulent, expanding wake. The mixing effect changes the dry bulb temperature and humidity of the turbine wake.

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” and *“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. How far downwind of the turbine the enhanced drying properties will persist is now known and it extends for 20 kilometres downwind.

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.

3.2.3 COMPARISON OF WIND TURBINES TO FROST FANS

I reproduce an abstract by the author H J 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 180 megawatt wind farm extracts about 360 megawatts of power from the wind. 180 megawatts is output as electrical power and 180 megawatts of power is lost mostly to rotating the wake of the wind turbines. Essentially a wind farm is a gigantic mixer of the airstream; **a wind farm is therefore a frost fan/dryer par excellence!**

Pro-rata to a frost fan, a 180 MW wind farm has the potential to frost free (or dry) 80,000 hectares. The 55 turbines of the Paling Yards Wind Farm present an 11 kilometre wide front across the prevailing wind. Therefore the frost free effect could theoretically extend for 73 kilometres downwind of the turbines.

3.3 EFFECTS ON LOCAL CLIMATE

3.3.1. EFFECTS ON LOCAL CLIMATE – AT A MURRAY – DARLING BASIN LEVEL

I made a submission to the EPA, Wind Farms Consultation, Reform and Compliance Branch, regarding Golspie Wind Farm in relation to the Protection of the Environment Operations Amendment (Wind Farms) Regulation 2012 (the draft Wind Farms Regulation). In that submission I expressed my concern about the potential loss of soil moisture due to the operation of Wind Farms. A large fleet of wind turbines over SE Australia could remove a significant amount of soil moisture.

The Federal Government's renewable energy target calls for 45,000 gigawatt-hours of electrical energy to be generated from renewable sources by 2020. About 70% of that, or 31,500 gigawatt-hours of electrical energy, is expected to come from wind power because it is a mature technology and the lowest cost of the renewables.

The production of 31,500 gigawatt-hours of electrical energy would require the wind turbines to have an average output power of 3,600 megawatts. Using a 30% capacity factor, to allow for wind's intermittency, an installed capacity of 12,000 megawatts of wind turbines would be required. If the turbines were rated at 2 megawatts each then 6,000 turbines would be required.

If the 6,000 x 2 megawatt turbines were spaced 5 rotor diameters apart, across the prevailing wind, and had rotor diameters of 100 metres (typical for this 2 megawatt rating) then the turbines would be spaced 500 metres apart, across the wind.

Studies on the topic of effect of Wind Farms on local hydro-meteorology, have been performed by Somnath Baidya Roy (Baidya Roy, S., Simulating impacts of wind farms on local hydrometeorology. J. Wind Eng. Ind. Aerodyn. (2011), doi:10.1016/j.jweia.2010.12.013). In discussion on the Effect of Wind Farm Size (p5) S B Roy states:-

"While the strongest impacts occur within the wind farms, they can also be felt up to a significant distance beyond the confines of the wind farms, especially in the downwind direction. For wind farms of all size, the impacts start to decrease right at the eastern edge gradually becoming zero at a distance of 18–23 km from the edge. It appears from these simulations that the length-scale of wind farm wakes is approximately 20 km irrespective of the length-scale of the wind farms and background meteorological conditions".

(Note: In the above extract that the <u>eastern edge</u> is referring to the downwind edge.)
And in the Conclusions (p7) S B Roy states that:-

"Sensitivity studies show that these impacts are not confined to the wind farms but extend a significant distance downwind. The typical length-scale of the wind farm wakes is approximately 20 km that is independent of the size of the wind farms as well as background meteorology. However, more simulations with a wider range of initial conditions are required to conclusively demonstrate this phenomenon".

The above extracts from, US researcher, Somnath Baidya Roy's, research paper, suggest that the effect of a turbine's wake on the hydro-meteorology, takes over 20 kilometres downwind of the turbine to diminish.

Thus the area of land affected by an individual turbine could be considered as a strip of land 500 metres wide and 20 kilometres long, i.e. 1,000 hectares.

In an earlier simulation Baidya Roy estimated that the average loss of soil moisture from a wind farm could be as much as to 0.3 millimetres per day (110 millimetres per year)**.**

I have reproduced below an article from Science News, "Change in the Weather? Wind farms might affect local climates" (by Sid Perkins) Oct. 16, 2004, p. 246, where the findings of S.B. Roy's research were reported.

"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 metres 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".

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

If we assume that the loss of soil moisture diminishes (linearly) from 0.3 millimetres per day, at the turbine, to 0 millimetres per day 20 kilometres downwind of the turbine, then the average daily loss of soil moisture is 0.15 millimetres per day over the affected area. The loss of soil moisture at the average rate of 0.15 millimetres per day over 1000 hectares is 1,500 cubic metres or 1.5 megalitres. Thus a single 2 megawatt wind turbine could result in an average loss of 1.5 megalitres of soil moisture per day (548 megalitres per year).

A fleet of 6,000 x 2 megawatt turbines could therefore result in a soil moisture loss of 3,300 gigalites a year. Of course this is a "ballpark" figure which assumes that a wind farm is a line of turbines arrayed across the prevailing wind. That figure could be reduced by half to 1,650 gigalitres a year if there were two lines of turbines arrayed across the wind instead of one.

Even 1,650 gigalitres loss of soil moisture is a lot of water when you consider that the draft Basin Plan made available by the Murray-Darling Basin Authority on 28th November 2011 proposed that 2,750 gigalitres per year is to be recovered to achieve balance in the system. The Authority states that almost half of that volume has been recovered through buyback and infrastructure, and 1,468 gigalitres per year remains to be recovered over the next seven years. Changes to the Basin Plan, in November 2012, added another 450 gigalitres to be achieved by efficiency measures.

Of course I am not suggesting that all of those 6,000 x 2 megawatt turbines will be in the Murray-Darling Basin, however a lot will be. The Murray-Darling Basin (see map) extends over parts of four States, Queensland, New South Wales, Victoria and South Australia. But irrespective of where those 6,000 turbines are located their wakes will be literally "sucking" water from the soil. This loss of soil moisture is not recoverable, nor is there any readily available substitute, like the Kurnell desalination plant powered (intermittently) by Capital Wind Farm. The cruel irony is that much of the MDBA's "painfully public" struggle to recover 2,750 gigalitres per year (as well as the additional 450 gigalitres per year to be achieved by efficiency measures), could be partly, or possibly even fully, negated by the effects of wind turbines in the Murray-Darling basin.

The availability of soil moisture has a direct effect on plants growing in the soil. Loss of soil moisture has implications for run-off from the land. Run-off occurs from the land when the soil moisture reaches field capacity. Therefore soil moisture must be replenished before run-off occurs. A reduction in run-off will impact on farm water storages, stream flow, public water supplies, and water supplies for irrigation and environmental flow.

The cost of replacing the water removed by soil moisture loss depends on the source chosen to replace that moisture. Desalination will use about 6 kWh of electricity per kilolitre and at a rate of $0.32 per kWh the cost will be $1.92. The cost of desalinating 3,300 gigalitres of water will consume 19,800 gigawatt-hours of electricity and at a rate of $0.32 per kilowatt-hour the cost will be $6.34 billion. And incidentally those 19,800 gigawatt-hours of energy demand for desalination will consume 63% of the 31,500 gigawatt-hours of electricity produced by wind farms.

3.3.2. EFFECTS ON LOCAL CLIMATE – AT A PALING YARDS WIND FARM LEVEL

The Paling yards wind farm will make its contribution to soil moisture loss primarily in the Abercrombie River Valley. The Abercrombie River is a tributary of the Lachlan River which is in turn a tributary of the Darling River and that in turn is a tributary of the Murray River. The Paling Yards Wind Farm presents an 11 kilometre wide front to the prevailing wind. Multiply that front by 20 kilometre length of wake and you obtain an area of 22,000 hectares which is affected by the wake at any one time. Multiply that affected area by 0.15 mm per day and you get an average 33 megalitres of soil moisture loss per day, and that works out to 12 gigalitres per year. 12 gigalitres a year would satisfy the drinking water requirements of 220,000 people for a year at a consumption rate of 150 litres/ person.day.

So when the proponent makes the grandiose claim that the Paling Yards Wind Farm will supply renewable energy to the equivalent of 221,895 persons. I make an observation that the Paling Yards Wind Farm could remove 12 gigalitres of soil moisture which would supply the drinking water requirements of the equivalent of 220,000 persons.

You can assume that the stream flow down the Abercrombie River into Wyangala Reservoir will be reduced. You can also assume the stream flow into the Lachlan River from Wyangala Reservoir will be reduced. You can assume that less water will be available to the users of the Lachlan River, be they irrigators, municipal supplies or environmental flows. The effects of reduced stream flow, attributable to Paling Yards Wind Farm, will be felt all the way down the Lachlan, Darling & Murray Rivers as far as the City of Adelaide. Every other wind farm located within the Murray-Darling Basin will also make its contribution to reduced stream flow in the rivers of the Murray-Darling Basin.

Wyangala Dam is the uppermost public water supply reservoir in the Abercrombie-Lachlan catchment. I anticipate that the people of Cowra, Forbes and Condobolin, would regard Wyangala Dam as **critical infrastructure**. I also anticipate that the people of Cowra, Forbes & Condobolin, would also regard any infrastructure that impacted adversely on vital water storage infrastructure as **critically-flawed-infrastructure.** And yet the NSW State Government stands ready to approve the Paling Yards Wind Farm.

A potential problem analysis taking into account the probability and severity of the **adverse consequences** of the Paling Yards Wind Farm and, other Wind Farms within the catchment, upon Wyangala reservoir has never been considered let alone performed.

3.3.3. EFFECTS ON LOCAL CLIMATE – AT AN AFFECTED FARM LEVEL

The turbines, proposed for Paling Yards, are huge; they reach 180 metres into the air like gigantic columns with an equally gigantic fan on the top. They are not passive objects like obelisks or statues rather they are dynamic machines, not only do they reach 180 metres into the sky, but the effects of, the rotating, expanding wake from each of them extends for 20 kilometres down wind. The true sense in which these turbines achieve monument status, is that they are monuments to the incredible stupidity to State and Federal governments mandating that they be built by making ordinary citizens like me, pay for them by exorbitant electricity bills.

At a personal level I expect that the proposed Paling Yards Wind Farm, in the NSW Central Tablelands, and situated in an arc 9.5 kilometres north-west of my 90 hectares of farmland, will have an impact upon the soil moisture at my properties, since my properties are downwind of the prevailing W to NW winds from the wind farm. I expect that the impact could be an average of 0.16 millimetres per day (58 millimetres per year) equating to 52 megalitres per year of soil moisture. In an 800 millimetres per year rainfall zone, 58 millimetres per year, represents 7.3% of the rain falling on the soil; a not insignificant amount and for which I will not receive any compensation.

My farm dams which constitute about 1% of the surface area of my properties. The expected loss of due to increased evaporation at the rate of 58 mm per year is 0.52 megalitres per year. The energy required to pump 0.52 megalitres of stock water from a bore instead of it gravitating from a dam is approximately 1.5 kWh per kilolitre. At a current rate of $0.32 per kWh the current cost of pumping is $250 per annum. But to be able to pump from a bore I will need to install a bore and pump and that will cost about $12,000. If I amortise the bore cost over 20 years at 5% per annum then the annual cost of that will be $1130.

However the remaining 51.5 megalitres of soil moisture lost to enhanced evaporation is neither recoverable nor replaceable. Not all of it would have remained on my properties; a portion of that amount would have run-off and would have contributed to stream flows.

The loss of soil moisture due to enhanced evaporation will reduce the carrying capacity of my properties. My properties will carry say 600 DSE (dry sheep equivalents) for an average 800 mm annual rainfall so if the rainfall is reduced by 58 mm then the average annual rainfall will be 742 mm. If I assume that the nominal carrying capacity of my land is linearly proportional to the average annual rainfall then for 742 mm average annual rainfall the carrying capacity of my land is reduced by 44 DSE to 556 DSE. If I want to retain the stocking rate at 600 DSE then I have to buy in feed for 44 DSE. Those 44 DSE will consume 0.6 kg of dry matter per day. And over a year the 44 DSE will consume 9,636 kg of dry matter. If that 9,636 kg of dry matter is supplied in the form of grain at $0.30 per kg, then the feed will cost $2,890. So at a minimum the Paling Yards Wind Farm will cost me is the sum of $250 for stock water pumping plus $2,890 for stock feed plus the annual cost of a bore at $1,130 all of which totals $4,270.

The wake of the Paling Yards Wind Farm could similarly affect many other land holders. Conceivably the cost to farms, similarly affected by Paling Yards Wind Farm, could be in the order of $1,000,000 per annum. In a nutshell so that the hosts of Paling yards Wind Farm pocket something in the order of $550,000 per annum for hosting the turbines. However it could cost their wake affected neighbours up to 20 kilometres downwind an amount in the order of $1,000,000 per annum.

I do not mind the hosts of the Paling Yards Wind Farm becoming wealthier people than they already are but I do object if is at expense of myself and my fellow non-host landholders.

3.4 EFFECTS ON GLOBAL CLIMATE

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" however 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 research paper "The influence of large-scale wind power on global climate" by David W Keith and others acknowledges that they (the authors) ignored the adverse effect that turbine generated turbulence might have on the atmospheric efficiency of wind turbines and the effect that additional turbulence may increase the turbulent transfer of heat and moisture. The research concedes that they (the paper's authors) may have underestimated the climate impact of wind farms per unit of electricity. *"Including the effects of turbine-generated turbulence might significantly lower the effective atmospheric efficiency by increasing turbulent momentum transport and thus inducing additional drag on the ground downstream of the turbines. Additional turbulence will also increase turbulent transport of heat and moisture. Both effects are ignored here, and thus, we may underestimate the climate impacts per unit electricity".*

The research paper by Keith and others also acknowledges that the winds mediate much larger energy fluxes by transporting heat and moisture. *"Although the generation and dissipation of kinetic energy is a minor (<=0.3%) component of global energy fluxes, the winds mediate much larger energy fluxes by transporting heat and moisture. Therefore, alteration of kinetic energy fluxes can have much greater climatic effects than alteration of radiative fluxes by an equal magnitude."*

According to (Appendix E, Fig. E.3, "Energy – an Introduction to Physics" – Robert H Romer, Freeman & Co San Francisco ISBN 0-7167-0357-2) The rate of energy transfer of water vapour in the earth's atmosphere is twenty times that of the rate of energy transfer to wind and currents.

Thus a 2 MW wind turbine, which strips 4 MW of kinetic power, from the wind, could have at least twenty times that effect, i.e 80 MW, on the mediating (moisture and heat carrying) power of the wind.

I have noted the willingness of Professor Ross Garnaut to publicly use the passage of monster tropical cyclone "Yasi" through northern Queensland as a prelude of what is to come with a changing climate. Professor Garnaut may be right. In the same vein as Professor Garnaut, I don't see how worldwide proliferation of wind farms can possibly ameliorate a changing climate and I am of the opinion that, irrespective of where they are located, they too may aggravate a changing climate and make their contribution to the formation of more intense tropical cyclones in the future.

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. Whatever the wind would have done with its kinetic energy before we started intercepting it will not be able to do to the same extent as before. If you upset the equilibrium you can expect that the planet will find a way to restore the equilibrium and it may well be in ways which we neither anticipate nor like. The planet restoring its equilibrium may possibly show up as more intense cyclones, an increase in the length of the cyclone season, changed rainfall patterns. The planet does not meekly accept the abuse we heap upon it, it fights back. The planet will not accept the grossly flawed philosophy of the pro-wind farm lobby.

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.

By intercepting the prevailing wind and stripping much of the energy from it and loading up what is left with low grade heat energy 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, because we have short-circuited the global heat energy transportation system.

An article titled *"Scientists find link between Southern Ocean winds and drying Australia"* on the ABC website via the following link:-

http://www.abc.net.au/news/2014-05-12/scientists-have-new-explanation-for-drying-australia/5445134

makes me wonder if that is indeed happening .

3.5 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.

3.6 ABERCROMBIE NATIONAL PARK

The Abercrombie National Park is in two separate segments. The larger park segment is located to the west of the proposed Paling Yards Wind Farm and the smaller park segment to the south east of the proposed Paling Yards Wind Farm. Effectively the two major properties "Paling Yards" and "Mingary Park" comprising the Paling Yards Wind Farm also separate the two segments of the Abercrombie National Park. On the "Paling Yards" property the Mt Defiance Ridge will be populated by the majority of the turbines comprising the Paling Yards Wind Farm.

Presumably the Abercrombie National Park is a sanctuary for many species of bird, mammal and insect life. If any of the avian inhabitants of one segment of the park wish to cross to the other segment of the park then they must run the gauntlet of a barrage of 55 massive, closely spaced wind turbines, each sporting 3 gigantic blades. Therefore there are 165 blades whizzing around with a tip speed approximately 270 kilometres per hour and quite able to kill any creature which comes into contact with them or even in close proximity to the vortices existing at the blade tip. There is no parallel in evolution which would equip any of the national park inhabitants with the instinct to avoid the consequences of these massive killing machines. These monstrous killing machines are totally foreign to the Australian Landscape and the creatures that dwell upon it. These monstrous killing machines certainly have no place to be sandwiched between the two separate segments of the Abercrombie National Park. There is an absolute and irreconcilable conflict of interest between the sanctuary of the Abercrombie National Park and the monstrous industrial scale killing machines of the Paling Yards Wind Farm.

The interest of an Abercrombie National Park that is a true sanctuary to the inhabitants of the park is paramount and must trump any phony contrived, arguments to obtain electricity generated by a Paling Yards Wind Farm. These grounds alone are sufficient justification to refuse approval for the Paling Yards Wind Farm.

Furthermore this is an opportunity to expand the Abercrombie National Park and amalgamate it into a single homogenous segment by the acquisition of the two major properties comprising the Paling Yards Wind Farm namely “Paling Yards” and “Mingary Park”. The most constructive action that the NSW State Government can take in relation to the Paling Yards Wind Farm is to acquire the wind farm host properties and amalgamate the Abercrombie National Park into a single segment.

3.7 TURBINE LAYOUT DEFICIENCIES

I have found the turbine layout presentation in the EA unsatisfactory. The turbine location plan shows the turbines but does not clearly show topographic information such as labelled contour lines which would assist a person attempting to make an informed judgement about this wind farm. I have therefore prepared a turbine location on topography plan (Attachment A) showing the turbines in relation to the topography. I have also indicated the (NSW Wind Energy Handbook – 2002) “5r-8r” rule by means of ellipses with a major diameter of 8 rotor diameters and a minor diameter of 5 rotor diameters I have oriented the ellipses in the expected direction of the prevailing wind. The expected direction of the prevailing wind is assumed to be similar to that of the Taralga Wind Farm as shown in Attachment C. If the “5r-8r” rule was being complied with then the ellipses would not overlap.

I have also prepared a turbine/turbine spacing table (Attachment B) from the information provided in the EA. This table shows, each turbine to turbine spacing, of the wind farm.

4. THE HAZARDS OF HOSTING AND NEIGHBOURING A WIND FARM

Farmers who are approached by wind farm developers are 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 hosting wind turbines 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. State Governments that are overly eager to facilitate wind farms appear as though they could not care less. If State Governments did care, then they would ensure that such odious practices were stamped out and that any deceptive contracts, entered into, were rendered null and void.

There is something distinctly odious and un-Australian about the secretive way in which wind farm developers go about signing-up hosts for wind farms that causes community friction the moment that a wind farm development is made public. Suddenly the owners’ of surrounding non-host properties are faced with the reality that their wind farm host neighbour(s) have secretly signed-up to a deal, perhaps many months before, which they are forbidden to discuss.

It is a rotten deal which will profoundly change the lives of the non-host property neighbours. The reality sinks in that they will have to look at, and endlessly experience the vibrations, noise and feelings, of living amongst a forest of wind turbines blighting their surrounding landscape; a landscape that they may love. They may regard the landscape as part of their ”little piece of paradise”. Suddenly their paradise is smashed to pieces; their aspirations squashed flat. Then comes the realisation that the little nest egg of land that they were sitting on to fund a reasonable quality of life in their retirement may not be worth anything like they thought it might be worth. Their land may no longer be subdividable it may not even be saleable. It is a devastatingly, cruel series of crushing blows visited capriciously on unsuspecting citizens by an uncaring society and complicit government, that has randomly singled them out for sacrifice, via the wind farm developers, to the dubious cause of renewable energy from the wind. Their community is ruptured, support gives way to antagonism and acrimony, long-time friends become bitter enemies.

Is Australia a country where the principle of a “fair go” is cherished or has it become a country where government sponsored “rorts” are the norm? The present process is secretive and unfair; it may even be corrupt. The process must be changed. The process must be made transparent and fair. The process must restore the basic common law right of affected citizens to sue for damages the neighbours hosting wind farms, the developers’ of wind farms and the complicit Governments.

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 cases to the courts, in an attempt to stop their lives, their livelihood and their assets being trashed

According to studies conducted by Dr. Sarah Laurie of the Waubra Foundation, wind farms are making some people, who live in the vicinity of them, sick. In most cases the symptoms, that people exhibit, disappear when they are removed from the vicinity of wind turbines. Many people who have lived in the vicinity of wind turbines have left their farms to live somewhere away from them. Those who stay are those who cannot afford to leave. Wind farms appear to be causing an exodus of farmers from the land. It appears that people co-existing healthily with wind farms is not possible.

By comparison, in the same span of years, the NSW Government introduced NRET’s. The Rudd Government introduced MRET’s despite the fact that Professor Ross Garnaut in his report advised against doing so. Professor Garnaut advocated letting market forces determine the penetration of renewable energy into the market. In the previous term of the NSW Parliament, the State Labor Government has deemed wind farms to be critical infrastructure and they also deemed certain specific areas to be renewable energy precincts. The Current State Liberal/National Party Government has created a “gateway process” process for wind farms.

Wind energy sweet spots are where there is a favourable wind site, where there is an easy connection to the electricity grid, where there is a mandatory renewable energy target red carpet rolled out inviting wind farm developers to “pig out” on the spoils of the overvalued, intermittent electricity they generate. The sweet spots are where there are people. The same people who have paid for their electricity grid to be extended to them. The State Governments have given the developers the right to usurp the people’s electricity grid and if the grid is not strong enough then it has to be strengthened, not at the developer’s expense but at the people’s (the consumer’s) expense.

Exploitation of the wind energy sweet spots by the developers may lead to serious imbalances in the electricity generating system. Imbalances caused by the massive amounts of wind power that can arrive at a time when it is least needed and disappear when it is most needed. That is the time the electricity generating system teeters on the edge of collapse; it is also the time when wholesale electricity prices can soar in excess of $10,000 per megawatt-hour ($10 per kilowatt-hour). Guess what? Some of the wind farm developers are there ready and waiting with their inefficient, cheap, open cycle gas turbines to supply the electricity short-fall, caused by the wind turbines, for $10,000+ per MWh. Wow! What a rort! These “Gordon Gecko” developers simply can’t go wrong and our politicians have made it that way. However, the Government doesn’t pay from consolidated revenue; the Federal Government has mandated that you and I pay, through our inflated electricity bills, to these parasites and phonies that masquerade as saviours of the planet with their “clean”, “green” energy, whether we like it or not. In my vocabulary “clean” and “green” are words that have become cliches made meaningless by the puerile hype of the developers.

Once again the State Governments in question appear as though they could not care less. If the State Governments did care, then they would ensure that the health, and the basic rights, of the people, neighbouring wind farms was not compromised; they would ensure the Owners’ of properties affected by wind farm developments were adequately compensated; especially if they, the complicit State and

Federal Governments, believe that the pathetic amount of renewable energy from wind farms is so dammed important in solving the problem of climate change.

Is this **DEMOCRACY or DEVOCRACY ?** Is this government of the people, for the people, by the people or is it government of the politicians, for the developers, at the expense of the people?

5. THE BROADER PUBLIC GOOD

It appears that the proponent of the Paling Yards Wind Farm seeks to capitalise on the precedent established by Judge Preston for the Taralga Wind Farm that the proposed Paling Yards Wind Farm is for the broader public good in the same vein as the Taralga Wind Farm by quoting Chief Judge Preston of the Land & Environment Court in his prologue to the judgement:

"The insertion of wind turbines into a non-industrial landscape is perceived by many as a radical change which confronts their present reality. However, those perceptions come in different hues. To residents, such as members of the Taralga Landscape Guardians Inc. (the Guardians), the change is stark and negative. It would represent a blight and the confrontation is with their enjoyment of their rural setting.
To others; however, the change is positive. It would represent an opportunity to shift from societal dependence on high emission fossil fuels to renewable energy sources. For them, the confrontation is beneficial – being one much needed step in the policy settings confronting carbon emission and global warming.
Resolving this conundrum – the conflict between the geographically narrower concerns of the guardians and the broader public good of increasing the supply of renewable energy – has not been easy. However, I have concluded that, on balance, the broader public good must prevail".

The proponent of the Paling Yards Wind Farm goes on to say.

"Whilst the exact circumstances between the Taralga wind farm and the Paling Yards wind farm may differ, the comments provided by the Chief Judge make it clear that, in the circumstances of that case, there was a need for the broader public good to be put before the potential negative impacts on some members of the local community. Similar reasoning can be applied to the project".

In that initial judgement the TLG secured court ordered buyouts for two affected properties.

The Taralga Landscape Guardians had a limited budget in comparison to the proponent of the Taralga Wind Farm and only those matters in which the TLG thought it had a reasonable chance of success were bought before the court.

In a later judgment before LEC Commissioners Roseth and Moore, in which the TLG represented themselves, the TLG secured court ordered buyouts for a further two properties. In at least one of those court ordered buyouts (and possibly both), Commissioners Roseth and Moore may well have accepted the argument put forward of the effect that larger turbines might have on local climate change, wake, location downwind of the prevailing wind have an effect so adverse on the operation of the property as to make its operation as a business unviable.

The Taralga Wind Farm is, at the time of writing, under construction, with a reduced number of turbines from those approved in the first and second court judgements.

Ultimately the broader public good may well determine the outcome, however the proponent should not assume that the narrow band of precedents established by Judge Preston for the broader public good, give the imprimatur for an open slather approach and ignorance of many serious and not well understood issues. Many of those issues were never put before Judge Preston.

In my opinion the broader public good isn't about how many cars wind farms take of the roads or how many equivalent houses wind farms supply with electricity; spurious and irrelevant claims made by the pro-Wind Farm supporters in their deceptive grandstanding.

In my opinion, the broader public good will about recognition of the devastating effects, of local climate change attributable to wind farms, could have on the fragile Australian landscape and its long suffering river systems. It will be about recognition of the potential loss of production and income, the effects of local climate change attributable to wind farms, could cause to non-host landholders.

In my opinion the broader public good is about entire noise spectrum produced by wind farms including low-frequency noise and infrasound, and the deleterious effect that exposure has on human health. The broader public good is not merely about a narrow selected band in the audible human hearing range that wind turbines can supposedly operate within.

Certainly, wind farms will produce “renewable” energy, but it is not “free”, it will come at horrendous cost. If a rigorous, broad, accounting approach was adopted, then I am confident it would lead to the conclusion that wind farms will result in more energy being consumed than they produce. Their net effect will be negative, and if that is found to be the case, then it is in the broader public good that they should not be built.

6. 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.

Many localities where wind farms are being sited will have less rain by 2040 according to Bureau of Meteorology forecast mean rainfall trends. The local effect downwind of wind farms, could account for as much as 110 mm evaporation of soil moisture.

Many localities where wind farms are being sited, according to Bureau of Meteorology forecast mean temperature trends, will be hotter by the year 2040. The global effects or wind farms could add between 0.33°C and 2°C and the local effects of wind turbines could add a further 0.7°C. Therefore the localities where wind farms are being sited could be between 1.0°C and 2.7°C hotter by the year 2040. This is local climate change and a significant portion of it will probably be attributable to wind farms.

I observe that there are few voices speaking out in support of leaving the wind alone so that it can do its job as “mother nature” intended it to do. I don’t hear any voices urging caution before conducting another large scale experiment on the planet Earth’s atmosphere. Do the people who advocate wind farms understand why there is wind and the role of wind in maintaining the habitability of Planet Earth?

Do the people who peddle wind farms ever contemplate that there may be severe consequences by stripping a significant portion of the energy from the wind? It seems not. It seems to be just another resource to plunder and to make a profit from.

I find it alarming that we have embarked upon yet another climatic experiment without really knowing what the consequences will be. There appears to have been little research done into the effects of large-scale wind farm developments on global and local climate.

Large scale wind farms for power generation are 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.

The simulation studies by David Keith and others suggest that large scale deployment of wind power may result in increased temperatures in some parts of the world ranging from one-third of a degree to 2°C, depending on how much energy is ultimately generated by wind power. I suggest that any increase in temperature will have a generally adverse effect on efficiency of thermodynamic processes such as, steam turbine power plants, refrigeration plant and internal combustion engines. The point I make about all this is that if wind power makes up a 10% of the energy generation mix it can have a small adverse effect upon the remainder of the energy generation plant driven by thermodynamic processes, and energy consuming plant using thermodynamic process. Although the effect on process efficiency may be small (up to 0.5%) the capacity of plant affected could be more than 20 times that of wind power. One does not need to be a rocket scientist to realise that 20 times 0.5% amounts to 10% and that means that wind power making up 10% of the generation mix could entirely negate any benefit of having it at all, by its effect on thermodynamic processes alone.

A feature of wind-power, that recurs time and time again, is the potentially adverse “knock-on” effect of wind-power on other processes. The “knock-on effects of wind-power range from several times larger than wind power to orders of magnitude larger than wind power. To me that is a cause for concern. I suggest that before we imprudently plunge further, into the deepest end of the pool of unknowns, 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 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.

I am of the opinion that a wind farm, in SE Australia, of 3.6 gigawatts net capacity, i.e. 12 GW installed capacity, comprising at least 6,000 2MW wind turbines, **cannot achieve effective geographic dispersion.** As a consequence 4.5 gigawatts of additional peak-load plant could be required, but I don’t believe that it will be supplied in anything like the amount required. It will be **a little additional peak-load plant.** An inescapable consequence is that 12 GW of wind power will, unmercifully “push around” the rest of the electricity generating system and lead to loss of efficiency and reduced life in the rest of that generating plant.

A wind farm of 3.6 gigawatts net capacity , comprising at least 6,000 2MW wind turbines, in SE Australia, is not a small undertaking; it is equivalent to three 1.2 gigawatt conventional coal fired thermal power stations or three 1.2 gigawatt nuclear power stations. 6,000 turbines, if spaced as recommended by the NSW SEDA guidelines would stretch for 3,000 kilometres if arranged in a single line. That is a distance equivalent from Adelaide SA to Darwin NT by road.

The cooling water make-up requirement for 3 x 1.2 gigawatt 50% efficient thermal power stations would be would be in the order 9 gigalitres per year. However large thermal power plants should 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 3 x 1.2 gigawatt 30% efficient nuclear power stations would be would be in the order 20 gigalitres per year. However large nuclear power plants should be sited near the seaboard and use seawater as coolant and thus not place a demand on coastal and inland rivers.

By comparison 6,000 2 megawatt wind turbines in SE Australia with an average total output of 3.6 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 least 16 gigalitres per year. **But the problem could be many orders of magnitude 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 bringing drier air from higher levels into contact with the plants and soil; it could quite possibly be as much as 3,300 gigalitres per year. If 3,300 gigalitres per year were to be replaced by desalination of sea water then the energy demand for desalination would consume 63% of the 31,500 gigawatt hours of the renewable electrical energy required to be produced by wind farms.**

The environmental consequences of 6,000 x 2 megawatt wind turbines could be very severe, even catastrophic. State Governments have been prepared to encourage these developments to proceed on an unplanned, divisive, destructive, ad hoc, chaotic basis against the 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.

Science that selectively considers the beneficial aspects of wind farms without looking for and taking into account the adverse consequences is not science, it is fraud.

Wind turbines, for the large scale generation of electricity, handle vast quantities of air. It can be demonstrated that horizontal axis wind turbines will thoroughly mix the stratified air arriving at the turbines into a rotating, turbulent, expanding wake. The mixing effect changes the dry bulb temperature and humidity of the turbine wake in the vicinity of the soil; especially at night. **The mixing effect therefore is a form of pollution because it is modifying the environment downwind of the turbine.**

What studies have been performed (if any) on the sustainability of the loss of soil moisture due to the operation of wind farms and why has there been no provision made to compensate farmers for the loss of soil moisture directly attributable to the large scale operation of wind farms in pursuit of the Federal Government's ill-conceived mandatory renewable energy target?

7. RECOMMENDATIONS

I make the following specific recommendations relating to the Paling Yards Wind Farm:-

- An immediate moratorium should be placed on the approval of any new wind farms in New South Wales, until further research, is conducted to determine that the adverse consequences of wind turbines in New South Wales, on the local climate and environment, and public health do not outweigh the benefits claimed for wind farms.
- Wind farms should not be permitted to be built within 20 kilometres of water catchments for public water supplies. Wind farms should not be permitted to be built within water catchments of reservoirs for irrigation and river regulation.
- The Paling Yards Wind Farm must bear the costs of for any inefficiency it may cause to the existing electricity generating system. In particular the Paling Yards Wind Farm should not treat the existing electricity generating system as a storage battery.
- The future development of wind farms, including the Paling Yards Wind Farm, must be balanced nationally so that effective geographic dispersion is achieved as the population of wind turbines grows. Achieving this will require that expensive and extensive very long distance electricity transmission lines are constructed. Wind farms, including the Paling yards Wind Farm must pay for the additional electrical plant and transmission lines required to integrate them into the electricity generating and distribution system.
- An agreement by a landholder to a developer for the hosting of wind turbines on a land owner's property shall be registered like a property title, and it shall not be secret. The landholder hosting the wind turbines shall be made aware that their land may be adversely affected, and the intrinsic value of his/her land may be reduced. They should also be made aware that the dwelling(s) on their property may be made uninhabitable by the development. The land holder should be made aware that he may be left with a financially crippling decommissioning process at the end of the turbines' economic life. Furthermore a landholder hosting a wind turbines, on their land, shall be made aware that they will not be able to sub-divide their properties ; they should also be made aware that neighbours, not hosting wind turbines on their land, may not be able to subdivide their land either and may possibly sue for damages in a Court of Law. Furthermore, a landholder hosting wind turbines on his land shall be made aware that he may be the subject of future legal action if disturbance to the local hydrometeorology is proven to be attributable to wind farms.
- The NSW State Government should urge the Federal Government to immediately repeal the legislation creating <u>Mandatory Renewable Energy Targets</u> (MRET's) and allow market forces to determine the penetration of renewable energy into the electricity market.
- Wind farms should not be treated any differently than any other development.
- Since the drying effect of a wind farm's wake extends for 20 kilometres, the 'gateway' process shall also be extended to 20 kilometres. The boundary of a property not associated with the Paling Yards Wind Farm development shall be no closer than 20 kilometres to a wind turbine unless the owner of that property gives consent.
- The "5r-8r" rule, NSW Wind Energy Handbook 2002 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 Department of Planning shall set limits for audible noise and infrasound generated by the Paling Yards Wind Farm. The limits shall be, the lesser of 35dBA.or ambient noise +5dBA for noise frequencies above 20 Hz, and, the lesser of 35dBG or ambient + 5dBG for noise frequencies between 0.001Hz and 20 Hz.

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Dennis Workman – 26 th May 2014