Submission
No 81

INQUIRY INTO RURAL WIND FARMS

Name: Dr David Burraston and Ms Sarah Last

Date received: 21/08/2009

Inquiry into rural wind farms

Submission to the Legislative Council General Purpose Standing Committee No 5

by

Dr David Burraston and Ms Sarah Last

EXECUTIVE SUMMARY

The current push for fast tracking industrial wind power stations in rural NSW is being put forward as solution to the problems of climate change. However, the public are not being presented with balanced information on the issues surrounding industrial wind energy. Landholders are being persuaded to host industrial wind turbines with little knowledge of the impact this will have on their own and other people's property, the environment or the wider community in general. In this submission we present evidence that demonstrates that industrial wind energy does not live up to the claims of its proponents, and counters the misleading information the wind industry continues to distribute.

The research and information presented in this submission will be of interest to people who care about the environment, the truth and a sustainable future. Our submission comprises of the following broad themes :

- Synopsis of major research requirements for industrial wind energy research
- Brief overview of problems with electricity generation by wind turbines
- Research demonstrating industrial wind energy's **failure** to displace fossil fuels or significantly reduce greenhouse gas emissions
- Discussion of environmental concerns, project lifespan and the urgent need for a realistic decommissioning policy
- Negative health effects and noise pollution
- Negative impacts on property values
- Negative visual impact
- Myths surrounding "green jobs"
- Sustainability considerations for rural landholders without industrialisation of the landscape
- Negative social impacts on rural communities
- Comments on Renewable Energy Strategy
- Conclusions from a rural landholders perspective on the reasons not to sign up to a wind power company lease

Table of Contents

Appendices attached separately : These are a selection of some of the papers referenced throughout this submission.

1. INTRODUCTION

We wholly support the production of energy from sustainable, clean, renewable sources and public education on energy conservation. We are very interested in the development of farming strategies to offset carbon emissions, it is a fast advancing industry, and we regard it as an imperative global/local issue, where farmers will have an increasingly important role and responsibilities.

We have done significant research about renewable energy and the industrial wind power generation industry. We conducted this research when we and our community were approached by industrial wind energy developers, in order to inform ourselves and others. This research includes:

- Dialogue with an Ecological Consultant who has done assessments on Australian industrial wind power stations
- Dialogue with an ARC (Australian Research Council) Professorial Research Fellow and IPCC (Intergovernmental Panel on Climate Change) contributing author with specialist knowledge in global change modelling and carbon cycle interpretation
- Statements by people already affected by industrial wind farm developments
- Peer reviewed journal and conference papers
- Local, national and international media

Based on this information we have concluded that, with its significant social and environmental impacts, industrial wind energy developments are not sustainable, and would be to the detriment of NSW state, its landowners, environment and surrounding communities. We are strongly opposed to all industrial wind turbine power developments of this type, and will be continuing our research to include further IPCC reports, journal and conference papers, and new results and information as it is published.

Sarah grew up on the family farming property in rural NSW and David has spent many years living in rural areas in the UK and NSW. We have now taken over Sarah's family farming property in rural NSW. We are both trained academic researchers, Sarah in the arts and community cultural development, and David in acoustics, electronic engineering, sound, computer science and complex systems science; this training employs methodologies that seek information from a range of considered objective, quantitative and experiential resources. After reviewing this research we conclude that industrial wind farm developments have far too many detrimental impacts in the short and long term. These detrimental impacts include (but are not limited to):

- Decreased community health
- Poor greenhouse gas mitigation potential
- Poor electricity generating potential
- Increased bush fire risks
- Increased noise pollution
- Decreased land values and reduction in future land use rights for stakeholders, other properties and wider communities
- Strobe like 'flickering' across the landscape created by turbines during sunset and sunrise
- Decreased privacy
- Increased interference with communications devices and resources

- Irreparable destruction to farming resources and related ecologies near or adjacent to industrial wind turbines
- Irreparable destruction to native habitats such as the endangered Box Gum Grassy Woodlands and its associated tree, grass, forbs, bat and bird species
- The liability of landholders for third party claims for loss and damages associated with industrial wind turbine power stations.
- Industrial infrastructure on land zoned for farming/food production and the preservation of natural resources and habitat
- Industrial infrastructure and development that is counter productive to any nature regeneration and conservation efforts

We have also experienced at first hand the inappropriate conduct and divisive tactics employed by industrial wind energy companies within our own community, pitting neighbour against neighbour, blatantly lying and telling farmers that *"everyone else is signing or has signed"*. We have repeatedly asked the industrial wind energy developers to get all the landholders together for a meeting rather than be divisive, nut to no avail. The industrial wind developers even admitted that these tactics are divisive to us, and that we should see it from their perspective. This sentiment was stated several times. Such an admission clearly demonstrates a wilful resistance towards transparency and due process, with lack of regard to the concerns landholders and residents may have about the large scale development and impacts associated with industrial wind turbine power stations. The industrial wind developers stated that should the wind farm proposal proceed any direct impact would only be on the landholders with the turbines, not those on surrounding properties. This statement again demonstrates a lack of regard to legitimate community concerns and totally misrepresents the magnitude of industrial wind power developments, their turbines, risk issues and detrimental impacts.

When we asked the industrial wind developers for unbiased information on wind energy we were directed to unreliable industry propaganda. We have watched as our neighbouring landholders have been constantly harassed by industrial wind developers whose only goal is to get a lease contract signed. Such a contractual arrangement for industrial scale development, especially development that is emergent in the Australian context with very few precedents and no Australia specific long-term impact studies, is grossly unfair to landholders, their neighbours and surrounding communities.

We are in no doubt that the wind energy industry and current NSW government's main motivation is money rather than addressing climate change.

2. INDUSTRIAL WIND ENERGY STILL REQUIRES MAJOR RESEARCH

The Proceedings of the 2008 Intergovernmental Panel on Climate Change (IPCC) "*Scoping Meeting on Renewable Energy Sources*" contains some information on problems associated with industrial wind energy (http://www.ipcc.ch/pdf/supporting-material/proc-renewables-lubeck.pdf). This document reports ongoing research and investment into all renewable energy sources, conducted by Working Group III, and will conclude with a Special Report in December 2010. This report discusses renewable energy options and issues, in parallel with the IPCC's other documents leading up to the 5th Assessment Report in 2014. It is worth noting that in the chapter "*Status and Perspectives of Wind Energy*" authored by Prof. A. Zervous, President, European Wind Energy Association and Chairman, Global Wind Energy Council in Section IV Challenges and Perspectives on page 117 he states that "*This agenda for research should be seen as only the first edition of an ongoing identification process, which is currently being updated through the European Technology Platform for Wind Energy. The Priorities listed below are divided into three categories: showstoppers, barriers and bottlenecks*"

i) *Showstoppers : "These are the key priorities, which is to say that they are considered to be issues of such importance that failure to address them could halt progress altogether. Thus they need special and urgent attention."*

ii) *Barriers : "Barriers are defined as being principal physical limitations in current technology, which may be overcome through the opening up of new horizons through generic / basic research over the medium to long term."*

iii) *Bottlenecks : "Bottlenecks are problems which can be relatively quickly overcome through additional short or medium term R&D, i.e. through the application of targeted funding and / other resources."*

These 3 areas are discussed over several pages. Among the 5 showstoppers it should be noted that these include the requirement for research into wind farm energy storage systems, which as yet do not exist, to make up for variability and unpredictability of wind resource. The current storage systems for wind energy are conventional fossil fuel power stations, which have to be kept running as a back up to cover variability in wind resource, which places the conventional plant under greater stress and leads to greater inefficiency. Also important are the need for research results on the effects of wind turbine power plants on ecological systems and public support. Ecological research and public support are also discussed again in regards to barriers and bottlenecks, as are the need for standards and certification, wind resource studies, grid integration and other issues.

A later chapter in this IPCC Scoping Report is titled "Global Investment in the Renewable Energy Sector" by Eric Usher, Head, Renewable Energy Finance Unit, United Nations Environment Program. Fig 5 on page 153 shows that Venture Capital and Private Equity places wind energy in 3rd position, with solar 2nd and biomass 1st. The overwhelming majority of the investment for wind is installing wind turbine capacity only, **leaving a very large shortfall for future research needs.** Fig 8 on page 154 shows Global Asset Financing by Sector for the period 2004 to 2007. In 2004 the $12bn total was mainly taken up by wind, but as overall renewable energy financing increases in the

following 3 years wind shows a reduction in proportion and by 2007 is roughly 45% of the $56bn total.

3. WIND TURBINE ELECTRICITY GENERATION

We have given much consideration regarding the viability of hosting industrial wind turbines to enhance our farms income stream. The amount of income per turbine must be carefully calculated and it should be noted the "nameplate" capacity represents the *theoretical maximum* MW output e.g. 1MW, 2MW etc.

3.1 LOAD FACTOR

In order to estimate the actual output of each turbine a Load Factor (LF) figure of 20 to 30% of nameplate capacity is often suggested, due to the high variability of wind speed and the turbines power curve. It should be stressed that 20 to 30% is a *very generous* estimate of efficiency, and the majority of wind installations do not reach this capacity, especially those with relatively poor wind resources such as inland NSW. It is highly unlikely that NSW industrial wind power stations will attain a 30% Load Factor.

This reduction in efficiency is due to a fundamental physical law relating the electrical output to the cube of the wind speed for a wind turbines power curve, usually between about 4m/s (metres per second) and 12 m/s wind speed. This demonstrates how sensitive a turbines output is to wind speed. If the wind speed is below 4m/s (its minimum speed) no power at all is generated from the turbine. If a turbine reaches its maximum capacity at around 12m/s any further increase in wind speed will not result in more power being generated. If the wind speed eventually increases above the turbines maximum rating, often around 25m/s, the turbine is shut down to prevent mechanical damage and no power is generated. Also, if the operating temperature is above 40C wind turbines are shut down to prevent turbine failure.

There is another fundamental physical law, derived by the German physicist Albert Betz in 1919 that further compounds the inefficiency of wind turbines. This law relates to the amount of energy in the wind that a rotor blade can convert. The power extracted from the wind can be no more than 0.59 of the total incoming wind energy. This is due to the fact that the wind is slowed down, but it is not completely stopped. This law puts a fundamental limit on the energy extracted from the wind, resulting in further losses for industrial wind energy.

These two fundamental unchanging physical laws, coupled with variability and unpredictability of the wind has prompted some illuminating studies around the world. We recommend examining documents at the Renewable Energy Foundation (REF) (www.ref.org.uk) who have commissioned independent reports from leading consultants and scientists. In 2006 the REF produced the UK Renewable Energy Data files (www.ref.org.uk/Pages/4/uk_renewable_energy_data.html) which presents publicly available data regarding renewable electricity generation since 2002 (wind, biomass, hydro, landfill gas and sewage gas) in the UK. The raw data for this project is obtained from the Ofgem Renewables Obligation Certificate Register (http://www.rocregister.ofgem.gov.uk/main.asp), which publishes data concerning the issue of Renewables Obligation Certificates to renewable electricity generators. These documents present the Ofgem wind farm data in an easily readable form together with summary, review and comparison to some other European countries. The average

national Load Factor for the UK is 27.4% for 2005 to 2007 compared to Germany 22.6%, Spain 20.2% and Denmark 26.2%.

3.2 NSW POOR WIND RESOURCE

We have looked at the Australian Government Department of the Environment, Water, Heritage and the Arts *Renewable Energy Atlas* (http://www.environment.gov.au/settlements/renewable/atlas/index.html). In our area in South West NSW this reports an average wind speed estimate of 6.9m/s at a 3km resolution (higher resolution data will give a more accurate representation). Given that this wind resource estimate is not very high, the other major criteria for sighting industrial wind turbine power stations is their locality to the electricity grid. The fact that such a powerline exists will have a major effect on any wind industry company decisions before and after they have conducted their wind monitoring phase. Proximity to the electricity grid will significantly reduce startup costs and enable a poor quality wind resource to become financially viable for a wind power company, but not for NSW landowners. A poor quality wind resource further reduces the meager greenhouse gas reductions and electricity output of industrial wind power stations in NSW.

It also appears that wind industry lease contracts are based on a percentage of potential income of electricity generated or a flat fee. This is a significant gamble for the landowner hosting an industrial development. These percentage and flat fee figures are agreed in contracts before wind monitoring has taken place, or are based on wind modeling software predictions that are not disclosed by the power company. The primary financial driver for wind power companies in such areas is to place wind turbines near the major powerlines. This has a potentially further detrimental effect on landholders hosting the turbines, because it means that the taxable income from generated electricity will be far less than in an area with a good quality wind resource. It is our understanding that some NSW landholders are making erroneous assumptions of income potential. These assumptions on income are being based on nameplate capacity MW figures, rather than an at best Load Factor of 20% to 30%, and verbal non-legally binding estimates on number of turbines given by wind power company representatives. Any profits from such installations are clearly in favour of the wind power company and not in the interest of the landholder. It is quite possible, and has happened with other wind developments, that landholders signing lease agreements may not end up with any turbines, but are left with an onerous long term lease agreement and extensive access roads to turbines on other properties.

3.3 HOMES POWERED FIGURES ARE MISLEADING

The "homes powered" figures that are constantly portrayed by the wind industry, government and in the media are very misleading for the general public. Professor David JC MacKay in the Department of Physics at the University of Cambridge and member of the World Economic Forum Global Agenda Council on Climate Change in his book (2008) "*Sustainable Energy — without the hot air*", UIT Cambridge Ltd discusses this problem :

"The "home" is commonly used when describing the power of renewable facilities. For example, "The £300 million Whitelee wind farm's 140 turbines will generate 322 MW – enough to power 200 000 homes." The "home" is defined by the British Wind Energy

Association to be a power of 4700 kWh per year."

The "home" annoys me because I worry that people confuse it with the total power consumption of the occupants of a home – but the latter is actually about 24 times bigger. The "home" covers the average domestic electricity consumption of a household, only. Not the household's home heating. Nor their workplace. Nor their transport. Nor all the energy-consuming things that society does for them."

In the UK the Secretary of State for Energy and Climate Change, the Rt Hon Ed Miliband MP recently published a prominent article in *The Times* (27.04.09) regarding number of homes powered by wind energy. Following an enquiry from a member of the public, REF wrote an open letter (07.05.09) to Mr Miliband with regard to this, and published the correspondence on the REF website at : http://www.ref.org.uk/PublicationDetails/52 Mr Milliband stated in his article that :

"To all those who scoff at the idea of wind making a difference, my reply is that last year enough power for all the electricity for two million homes came from wind power."

Some of the REF's comments help to clarify matters (underlining and bold font is their emphasis) :

"...you should not in any case use the homes equivalent figure, which is misleading to the public since domestic houses typically use only 30% of national electricity, and because the comparison suggests that the turbines could take this many houses off-grid, which is not the case."

"... so1.8 million homes equivalent rather than 2 million. (Incidentally, most of this increase appears to be from offshore wind, confirming a long-standing REF argument that given the capacity limit for wind in the UK system, perhaps 10 GW, it makes sense to seek high yielding sites.)"

"However, the real issue is that there are good reasons for not employing the homes equivalent calculation and presentation method:

Explaining Energy Quantities to the Public

In fact, the concluding and main point of my letter goes unaddressed in your response.

I wrote:

8. Further, in my view, you should not in any case use the homes equivalent figure, which is misleading to the public since domestic houses typically use only 30% of national electricity, and because the comparison suggests that the turbines could take this many houses off-grid, which is not the case.

9. It would be much more accurate to express the significance of wind's generation in terms of national consumption (roughly 390 TWh in 2007):

5,777,249 /390,000,000 = 0.015.

My point was that "in any case", i.e. ***regardless of what exact figure is used, 1.2m, 1.8m, 2m, the "homes equivalent" calculation is potentially very misleading and not helpful in giving clear guidance as to progress towards meeting the 2020 targets.***

Specifically, the "homes equivalent" figure is likely to lead to a misperception of significance, and particularly so should the public wish to understand the value for money offered by the Renewables Obligation. Assuming a ROC price of about £48 in 2007, wind cost the consumer about £278 million in indirect subsidy, a very substantial sum, so it is important to be clear about the scale of the value returned."

"In my view, and I know this view is shared by many observers, a better method of expressing the output of a generator, any generator in fact, is as a fraction of total electrical energy generation, as noted above. (Despatchable generators can also be described as a fraction of peak load, as a means of estimating their national significance, but this option is not open to wind in any straightforward way.)

Some would go further and say that since electrical energy is only roughly a third of total national ***energy*** *consumption, it would be best to express the wind energy generated as a fraction of Final Energy Consumption (i.e. all energy, heat, electricity, and transport), which is very roughly 1,745 TWh per year at present. Taking the 2007 figure for wind generation we can calculate:*

5,777,249 MWh / 1,745,000,000 MWh = 0.0033

In other words ***wind generated 0.3% of UK Final Energy Consumption*** *in 2007, at a cost in subsidy of £278 million."*

"I hope you will agree that this is a great deal less misleading than any homes equivalent figure which I really hope you or your department won't use again, however calculated."

4. ENVIRONMENTAL IMPACTS & LACK OF GREENHOUSE GAS REDUCTION

A significant concern worldwide is the environmental impacts of constructing industrial wind turbine power stations. These range from : calculations of the true carbon costs of industrial wind turbine power stations in the context of all green house gas emissions both nationally and internationally, to risks associated with catastrophic turbine failures, fire risk, fragmentation and destruction of wildlife habitat from industrial wind turbine power station development, irreparable destruction of fauna through industrialization of the landscape, and wind turbine collision fatalities of wildlife such as birds and bats. Research in these areas is ongoing which further demonstrates the need for considered, unrushed and reasoned debate before signing over land and government rubber stamping of such industrial development.

Some areas targeted for industrial wind power station developments are Box-Gum Grassy Woodland, and associated flora and fauna, which are listed as Endangered in NSW and Critically Endangered nationally. Understanding the environmental impact of industrial wind turbine power stations on flora and fauna is of critical importance, particularly in agricultural areas where many animals play a critical role in biological control such as the consumption of insects. For example see : Kunz, T. H., et al (2007) "Methods and metrics for studying impacts of wind energy development on nocturnal birds and bats." *Journal of Wildlife Management* 71: pages 2449-2486. These research studies require extensive monitoring of industrial wind turbine sites, and the use of dog handler teams on properties is likely to become the preferred technique for locating bird and bat carcasses : Arnett, E. B. (2006) "A preliminary evaluation on the use of dogs to recover bat fatalities at wind energy facilities." *Wildlife Society Bulletin*: 34: pages 1440-1445. Ongoing scientific research into bat fatalities are available at http://www.batsandwind.org This and other research clearly demonstrates that industrial wind turbines are environmentally destructive.

Our habitat of Box Gum Grassy Woodland is host to a number of vulnerable and endangered species of bats, birds, plants and trees that are being placed in further danger by industrial wind power station development. Also of note is the fact that NSW has the greatest level of diversity amongst its bird population. This has been identified as a major and growing sustainable tourist industry for NSW.

The wind energy industry and its associated environmental assessment studies claim that flora and fauna are more in danger from climate change than industrial wind power station development. This is completely misleading. Industrial wind power stations fail to live up to their environmentally friendly claim of significantly reducing greenhouse gas emissions as numerous studies have shown.

4.1 RENEWABLE ENERGY FOUNDATION STUDY

In December 2004 REF commissioned and published a report titled : *"Reduction In Carbon Dioxide Emissions: Estimating The Potential Contribution From Wind-Power".* This report is freely available at : http://www.ref.org.uk/PublicationDetails/27 and includes an executive summary. Some key points from the executive summary are reproduced here (all bold font is their emphasis) :

"Renewable electricity has become synonymous with CO2 reduction. However, ***the***

relationship between renewables and CO2 reduction in the power generation sector does not appear to have been examined in detail, and the likelihood, scale, and cost of emissions abatement from renewables is very poorly understood."

"Wind turbine technology has been developing in Europe for nearly twenty years, and ample experience has been gained to show ***wind generated power to be variable, unpredictable, and uncontrollable****. In fact, the European experience shows conclusively that the annual production is* ***routinely disappointing****, and this does not augur well for the UK's chances of achieving significant emissions abatement."*
"Indeed, the accommodation of the variable output from wind turbines into the transmission system is complex and the technical challenges are barely understood outside professional circles. ***Fossil-fuelled capacity operating as reserve and backup is required to accompany wind generation and stabilise supplies to the consumer. That capacity is placed under particular strains when working in this supporting role because it is being used to balance a reasonably predictable but fluctuating demand with a variable and largely unpredictable output from wind turbines.*** *Consequently, operating fossil capacity in this mode generates more CO2 per kWh generated than if operating normally.* ***This compromising effect is very poorly understood****, a fact acknowledged recently by the Council of European Energy Regulators."*

"Thus, the CO2 saving from the use of wind in the UK is probably much less than assumed by Government advisors, who correctly believe that wind could displace some capacity and save some CO2, but have not acknowledged the emissions impact of matching both demand and wind output simultaneously. As a result, current policy appears to have been framed as if CO2 emissions savings are guaranteed by the introduction of wind-power, and that wind power has no concomitant difficulties or costs. ***This is not the case."***

"With this level of disagreement between governmental authorities and trade bodies it is hardly surprising that there is general public confusion over the issue. ***This uncertainty is most undesirable, not least because of the economic implications of an erroneously reasoned choice of carbon abatement technology."***

"Market forces will fix wholesale electricity prices at a level that discourages new investment in modern plant, *and* ***the focus on wind power for new generating capacity is likely to lead to the retention of old, low efficiency, coal-fired plant for an extended period."***

"In conclusion, it seems reasonable to ask why wind-power is the beneficiary of such extensive support if it not only fails to achieve the CO2 reductions required, but also causes cost increases in back-up, maintenance and transmission, while at the same time discouraging investment in clean, firm generation."

The REF also commissioned a recent study into the effectiveness and reliability of industrial wind turbine power stations to produce 16% to 18.8% of nationwide electricity supply in the UK : Oswald, J., Raine, M. and Hezlin, A., "Will British weather provide reliable electricity?" *Energy Policy* 36(8), August 2008, pages 3212-3225 available at : www.windaction.org/documents/18480 among the negative conclusions of this paper it is important to note that :

i. volatile power swings of up to 70% from wind turbines result in conventional fossil fuel power stations placed under greater stress, reducing reliability and utilisation
ii. this will have cost implications for the network, and hence the consumer
iii. the amount of backup conventional fossil fuel power station CO2 emissions need to be factored into wind industry carbon saving calculations
iv. electricity demand can reach its peak with a simultaneous demise in wind power output

The study for this paper is the British system, **but these are recognised worldwide as industrial wind turbine power station problems that are not yet solved.** Yet the industrial wind industry maintains that the wind will always be blowing somewhere when scientific studies have shown that this is still a major problem.

4.2 ONTARIO STUDY

A recent study in Ontario, Canada by Tom Adams and Francois Cadieux *"Wind Power In Ontario: Quantifying The Benefits Of Geographic Diversity"* presented at the 2nd Climate Change Technology Conference, May 12-15 2009 which specifically looks at the aggregated output of multiple industrial wind power stations states :

"Average wind output is high in winter and low during the summer, whereas demand is highest in summer. This imbalance represents a key limitation with respect to reliance on wind power in Ontario. The seasonal wind output pattern observed in Ontario is very similar to that of wind farms across Canada and throughout central and northern Europe."

"Measurements presented here based on wind outputs from major wind developments in and near Ontario indicate that distances over 250 km between wind farms are required for hourly output correlations to drop to 50%, and distances over 350 km are required for daily correlations to drop to 50%. Moreover, the results presented here suggest that correlation coefficients will be positive over distances greater than 800 km and are not likely to be negative over conceivable distances within the province. The modest benefit of diversifying locations is illustrated when one large wind farm located more than 360 km away from another group of nearly equal capacity was added: the standard deviation in output decreased by only 2.7% of installed capacity. Other studies present similar results for Europe, although distance appears to be less effective in mitigating variability in Ontario than in Europe."

"Thus, to meet the policy objective of maximizing wind's penetration of Ontario's electricity generation mix while minimizing grid impacts, any new wind power capacity should thus be installed far away from other wind farms. Conversely, allowing concentrated wind development, either by co-locating wind farms or building relatively large farms, reduces the total wind capacity the system can accommodate within a given level of load balancing expenditure."

Although adding a distant wind farm to an existing fleet fills the valleys of average output and drops the standard deviation of output by a small fraction, it also increases the magnitude of overall output swings. Large overall wind output swings are inevitable because wind farms within the province are statistically more prone to increase and decrease generation synchronously due to the nature and size of the meteorological

fronts that largely drive wind speeds. In other words, if wind power output swings or peaks challenge the load balancing capacity of the power system, distance between wind farms does not help.

"Ontario has made a policy commitment to encourage extensive wind power development supported by only a preliminary understanding of the potential power system impacts of a large wind power fleet. Wind power's consumer impacts – incremental transmission, energy storage, ramping generation requirements, and grid reliability service costs such as automatic generation control and operating reserve – may be insignificant at low wind penetration of the overall electricity supply but will rise as wind capacity rises and may become significant. Additional research on the output variability of wind power, grid reliability mitigation measures, and the load carrying capacity of wind power is thus necessary."

Adam's Keynote Address for the Professional Engineers of Ontario Annual General Meeting May 9, 2009 *"Transforming Ontario's Electricity Paradigm: Lessons Arising from Wind Power Integration"* also reports on this Canadian research :

"Advocates and sometimes even government engineers assure us that wind power is decentralized energy, that wind power can help replace coal, that wind volatility is smoothed by distance, and that wind can supply a large fraction of our electricity needs without imposing significant indirect costs on consumers. Although I wish it were otherwise, the data is uncomplimentary to this loose talk."

"Getting wind power to consumers when they want it will be a challenge. Unfortunately wind and load are out of sync across several dimensions."

"Other researchers have identified that Ontario tends to get most of our wind output at the wrong time of day and that the daily wind pattern tends to decline in morning when load is rising and ramp up in evening when load is declining."

"Unfortunately distance provides little smoothing benefit:

Considering hourly correlation coefficients, 250 km cuts the cross correlation by only 50%. No matter how far apart they are, wind farms in Ontario east of Wawa will be positively correlated. This means that the more wind capacity we add, the more output volatility the aggregate fleet will yield. Adding a distant wind farm fills the valleys of average output and drops the standard deviation of output a little but also increases the peaks of output. If output swings or peaks are challenging the system, distance doesn't help."

"Some of these factors are also significant in terms of wind power's ultimate environmental footprint. No one in Ontario can realistically estimate these factors right now, in part because the commercial impact of the GEA [Green Energy Act] *is still very difficult to estimate but also in part because much more technical homework is needed."*

4.3 USA NATIONAL ACADEMY OF SCIENCES STUDY

The National Academies (Science, Engineering and Medicine) in the USA published a recent study relating to the mid-Atlantic region in 2007 *"Environmental Impacts of Wind-*

Energy Projects" available at : http://books.nap.edu/catalog/11935.html which is a 394 page report and a 33 page executive summary. On page 5 of the executive summary regarding the issue of displacement of coal power stations it states :

"However, because current and upcoming regulatory controls on emissions of NOx and SO2 from electricity generation in the eastern United States involve total caps on emissions, the committee concludes that development of wind-powered electricity generation using current technology probably will not result in a significant reduction in total emission of these pollutants from the electricity sector in the mid-Atlantic region."

On page 8 of the executive summary is a section regarding ecological impacts :

"The construction and maintenance of wind-energy facilities also alter ecosystem structure through vegetation clearing, soil disruption and potential for erosion, and noise. Alteration of vegetation, including forest clearing, represents perhaps the most significant potential change through fragmentation and loss of habitat for some species."

A selection of quotes from the Preface of the report on page ix states :

"The generation of electricity from wind energy is surprisingly controversial. At first glance, obtaining electricity from a free source of energy—the wind—seems to be an optimum contribution to the nation's goal of energy independence and to solving the problem of climate warming due to greenhouse gas emissions. As with many first glances, however, a deeper inspection results in a more complicated story."

"Building wind-energy installations with large numbers of turbines can disrupt landscapes and habitats, and the rotating turbine blades sometimes kill birds and bats. Calculating how much wind energy currently displaces other, presumably less-desirable, energy sources is complicated, and predicting future displacements is surrounded by uncertainties."

And from Preface page x :

"The benefits of wind energy depend on the degree to which the adverse effects of other energy sources can be reduced by using wind energy instead of the other sources. Assessing those benefits is complicated. The generation of electricity by wind energy can itself have adverse effects, and projecting the amount of wind-generated electricity available in the future is quite uncertain."

4.4 TYNDALL CENTRE FOR CLIMATE CHANGE RESEARCH STUDY

The Tyndall Centre for Climate Change Research published a report as part of their research project "*Ensuring new and renewable energy can meet electricity demand: security of decarbonised electricity systems*". The final report is, Nedic, D. P., Shakoor, A. A., Strbac, G., Black, M., Watson, J., and Mitchell, C. (2005) "*Security assessment of futures electricity scenarios*", Tyndall Centre Technical Report 30 available at : http://www.tyndall.ac.uk/research/theme2/project_overviews/t2_24.shtml A discussion of the results are also presented on the web page, and of specific note is :

"The performed capacity adequacy studies for the mid-term future UK electricity scenarios clearly show that the capacity value of wind generation plant is limited.

Analysis was carried out for a wide range of wind penetrations to examine the generating capacity of conventional plant that can be displaced by wind, while maintaining a specified security level. We observed that wind generation only displaces a relatively modest amount of conventional plant, which means that in order to maintain the same level of security, a significant capacity of conventional plant will still be required."

"Due to a disproportion between the conventional capacity and the energy substitution by the wind source, a considerable number of thermal plants will be running at low output levels over a significant proportion of their operational time in order to accommodate wind energy. Consequently these plants will have to compromise on their efficiency, resulting in increased levels of fuel consumption as well as emissions per unit of electricity produced."

4.5 CARNEGIE MELLON UNIVERSITY STUDY

The recent research and testimony to US House of Representatives of Professor Jay Apt, the executive director of the Electricity Industry Center at Carnegie Mellon University's Tepper School of Business and Distinguished Service Professor in the Department of Engineering and Public Policy, addresses the issues of lack of emissions reduction by gas power stations used to mitigate the variability of industrial wind power stations. In a research paper co-authored with Warren Katzenstein, "Air Emissions Due To Wind and Solar Power", *Environmental Science & Technology* (2009) Vol 43 No 2 pages 253-258, their research shows :

"Renewable energy emissions studies have not accounted for the change in emissions from power sources that must be paired with variable renewable generators"

"In many locations, natural gas turbines will be used to compensate for variable renewables. When turbines are quickly ramped up and down, their fuel use (and thus CO2 emissions) may be larger than when they are operated at a steady power level. Systems that mitigate other emissions such as NOx may not operate optimally when the turbines' power level is rapidly changed."

"Carbon dioxide emissions reductions from a wind (or solar PV) plus natural gas system are likely to be 75-80% of those presently assumed by policy makers. Nitrous oxide reduction from such a system depends strongly on the type of NOx control and how it is dispatched. For the best system we examined, NOx reductions with 20% wind or solar PV penetration are 30-50% of those expected. For the worst, emissions are increased by 2-4 times the expected reductions with a 20% RPS [Renewables Portfolio Standards] *using wind or solar PV."*

"We have shown that the conventional method used to calculate displaced emissions is inaccurate, particularly for NOx emissions. A region-specific analysis can be performed with knowledge of displaced generators, dispatched compensating generators, and the transient emissions performance of the dispatched compensating generators. The results shown here indicate that at large scale variable renewable generators may require that careful attention be paid to the emissions of compensating generators to minimize additional pollution."

In Apt's testimony to U.S. House of Representatives Committee on Energy and

Commerce Subcommittee on Energy and Environment's Hearing on The American Clean Energy Security Act of 2009 "Panel on Low Carbon Electricity, Carbon Capture and Storage, Renewables and Grid Modernization" of April 23, 2009 he states :

"Even in good areas, the wind doesn't blow all the time. Looking at all the wind power plants in Texas in 2008, we find that in a quarter of the hours during the year Texas wind production was less than 10% of its rated capacity. That means that when a wind farm is built, some other power source of the same size must be built to provide power during those calm hours. Our research shows that natural gas turbines, that are often used to provide this fill-in power, produce more CO2 and much more nitrous oxide (as they quickly spin up and then slow down to counter the variability of wind than) than they do when they are run steadily."

"The point is that wind and solar can lower the amount of fossil fuels used for generation, but they don't lessen the need for spending money on always-available generation capacity, nor do we get all the air emissions benefits we once expected."

"Wind farms can affect climate downwind, reducing precipitation. Massive reliance on wind energy would take energy out of the wind, changing the Earth's climate. All power generation options have feet of clay. There is no generation utopia. But just because there is no free lunch doesn't mean we can't eat: we just have to acknowledge the issues honestly so that we are not faced with a public backlash later on."

Apt and colleagues have recently published in the American National Academies of Science Fall 2008 on-line journal "Issues in Science and Technology" a paper titled *"A National Renewable Portfolio Standard? Not Practical"* covering issues regarding problems with wind energy :

"Producing sufficient wind turbines would require a major increase in manufacturing capacity. Demand (driven by state RPSs and the federal renewable production tax credit) has already stretched supplies thin, creating an 18-month delivery delay for wind machines. It has also emboldened manufactures to reduce wind turbine warranties from five years to two."

"Among the disadvantages of wind systems are that they produce power only when the wind is strong and that they are most productive at night and during spring and fall, when electricity demand is low. The capacity factor (the percent of maximum generation potential actually generated) of the best sites for wind turbines is about 40%, and the average capacity of all the wind turbines used to generate utility power in the United States was 25% in 2007."

"...if wind supplied 15% of the electricity, it would save less than 15% of fuel because other generators backing up the wind must often run at idle even when the wind is blowing and because their fuel economy suffers when they have to ramp up and slow down to compensate for variability in wind."

"Variability also requires constant attention, lest it threaten the reliability of the electric system. On February 26, 2008, the power system in Texas narrowly avoided a breakdown. At 3 p.m., wind power was supplying a bit more than 5% of demand. But over the course of the next 3.5 hours, an unforecast lull caused wind power to fall from

2,000 MW to 350 MW, just as evening demand was peaking. Grid operators declared an emergency and blacked out 1,100 MW of load in a successful attempt to avoid a system collapse. According to the Electric Reliability Council of Texas, "This was not the first or even the worst such incident in ERCOT's area. Of 82 alerts in 2007, 27 were 'strongly correlated to the drop in wind'.""

"Finally, wind energy is a finite resource. At large scale, slowing down the wind by using its energy to turn turbines has environmental consequences. A group of researchers at Princeton University found that wind farms may change the mixing of air near the surface, drying the soil near the site. At planetary scales, David Keith (then at Carnegie Mellon) and coworkers found that if wind supplied 10% of expected global electricity demand in 2100, the resulting change in the atmosphere's energy might cause some regions of the world to experience temperature changes of approximately 1°C."

In the July 2009 edition of Power Engineering Thomas Hewson Jr. and David Pressman's paper "Calculating wind power's environmental benefits" also presents negative conclusions regarding emissions reduction of industrial wind energy :

"Finally, proponents who suggest that wind is able to entirely displace CO2 overlook a fact fundamental to energy generation: wind's unpredictability means it truly has no generating capacity value and its construction will not displace building any new coal or natural gas generating capacity. Grid reserve margins require wind back up and the inefficiency of quickly firing up a natural gas unit to meet erratic wind generation output means any emissions displacement is minimal. Wind is simply an additional capital cost which proves to be more than twice as expensive for the ratepayer."

"Creating a federal renewable portfolio standard would create a nationwide closed market for renewables, meaning wind projects would again offer no incremental emissions benefits given their direct competition with other renewables and not coal or natural gas. Unfortunately, many of the claims made regarding wind's supposed avoided air benefits are overstated."

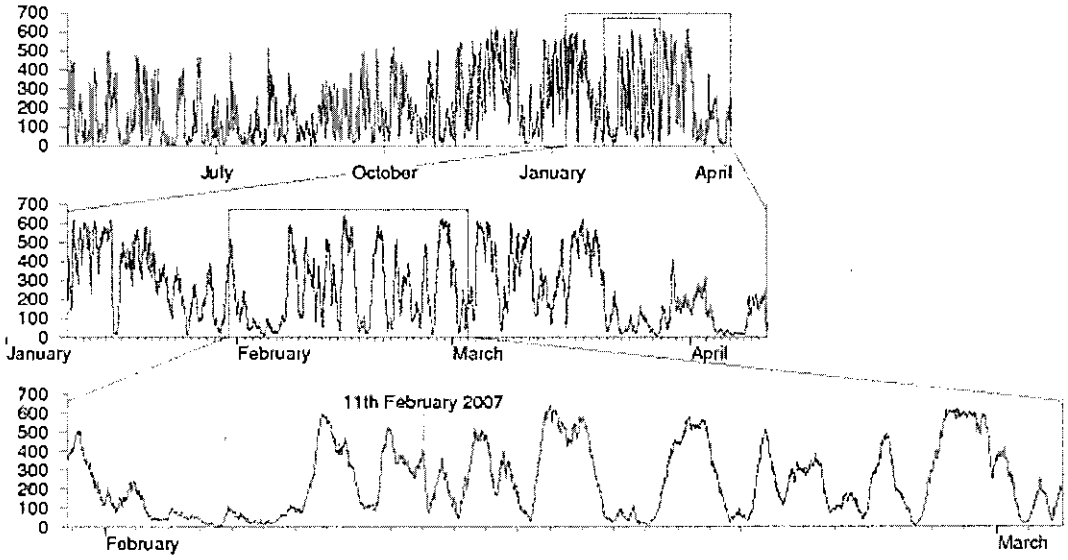
4.6 OTHER STUDIES

Professor David JC MacKay in the Department of Physics at the University of Cambridge and member of the World Economic Forum Global Agenda Council on Climate Change in his book (2008) "*Sustainable Energy — without the hot air*", UIT Cambridge Ltd discusses the problems of fluctuation and storage of wind energy. On page 187-188 he states :

"However much we love renewables, we must not kid ourselves about the fact that wind does fluctuate.

Critics of wind power say: "Wind power is intermittent and unpredictable, so it can make no contribution to security of supply; if we create lots of wind power, we'll have to maintain lots of fossil-fuel power plant to replace the wind when it drops." Headlines such as "Loss of wind causes Texas power grid emergency" reinforce this view. Supporters of wind energy play down this problem: "Don't worry – individual wind farms may be intermittent, but taken together, the sum of all wind farms in different locations is much less intermittent."

Let's look at real data and try to figure out a balanced viewpoint. Figure 26.2 shows the summed output of the wind fleet of the Republic of Ireland from April 2006 to April 2007. Clearly wind is intermittent, even if we add up lots of turbines covering a whole country. The UK is a bit larger than Ireland, but the same problem holds there too. Between October 2006 and February 2007 there were 17 days when the output from Britain's 1632 windmills was less than 10% of their capacity. During that period there were five days when output was less than 5% and one day when it was only 2%."

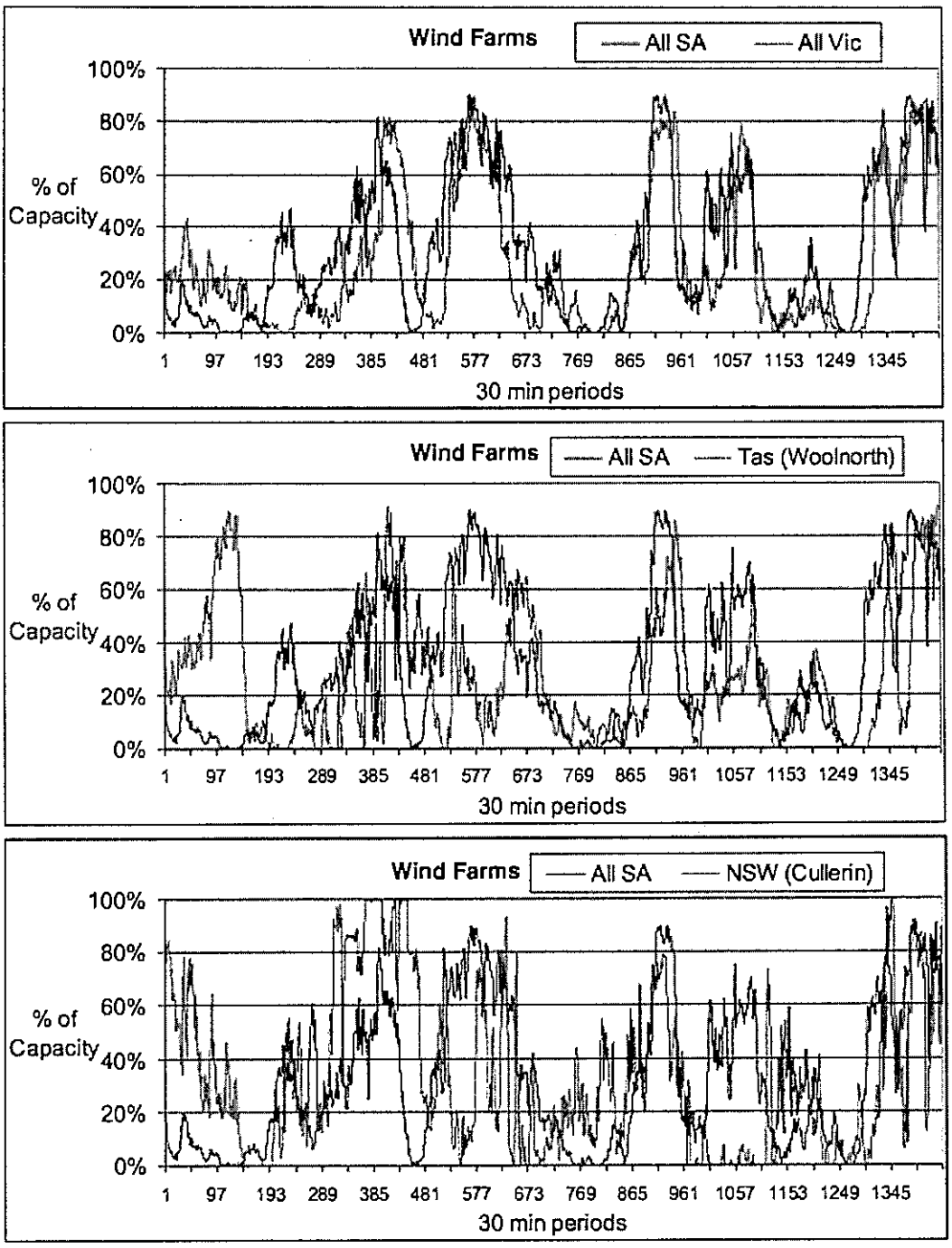


Total output, in MW, of all wind farms of the Republic of Ireland, from April 2006 to April 2007 (top), and detail from January 2007 to April 2007 (middle), and February 2007 (bottom). Peak electricity demand in Ireland is about 5000 MW. Its wind "capacity" in 2007 is 745 MW, dispersed in about 60 wind farms. Data are provided every 15 minutes by www.eirgrid.com. (Figure 26.2 from MacKay, D. (2008) "*Sustainable Energy — without the hot air*" UIT Cambridge Ltd : http://withouthotair.com)

A preliminary study in Australia on existing industrial wind power stations by Andrew Miskelly and Tom Quirk shows that this intermittency is happening in Australia. Their analysis is based on 11 industrial wind power stations spread across 900km in South Australia, New South Wales, Victoria and Tasmania for the month June 2009. The data is obtained from the publically available *Non-Scheduled Generation Data* at the AEMO website (http://www.aemo.com.au/data/csv.html). They state :

"South Australian wind power generation has been used as the standard as it is the largest sample and despite having 6 wind farms added together performs as if it were one farm despite a spread of some 500 km.

It is clear that the responses in each area are correlated. The correlation of South Australia with Victoria is the clearest example."

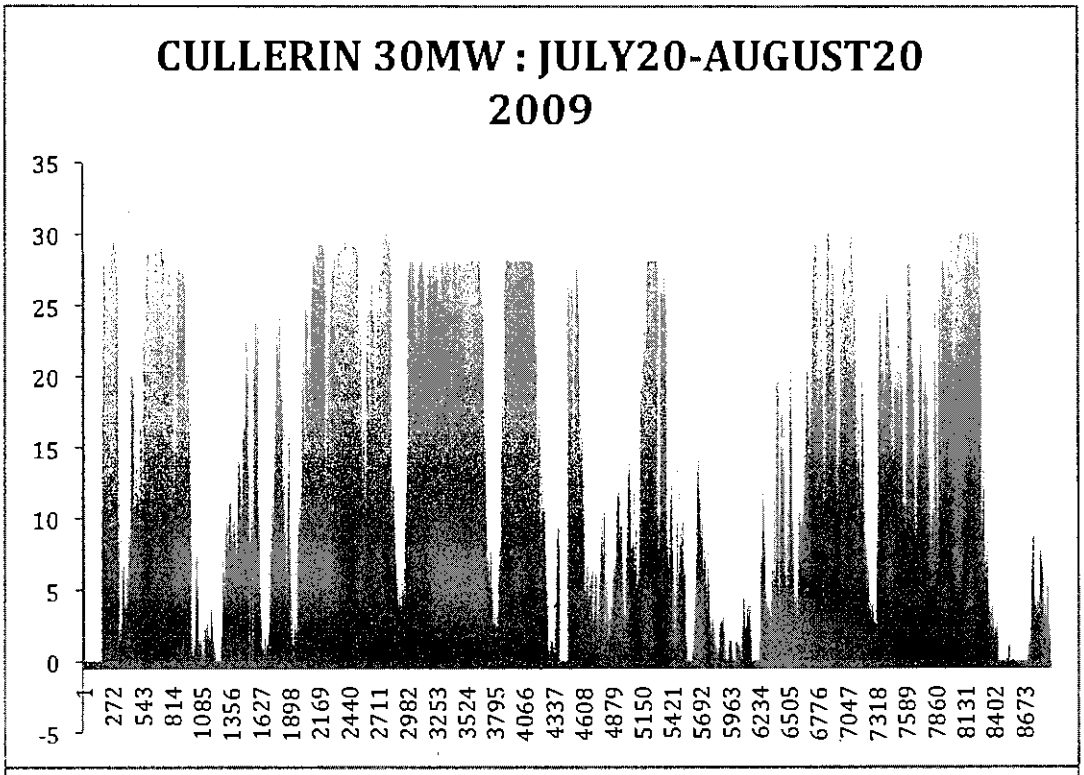


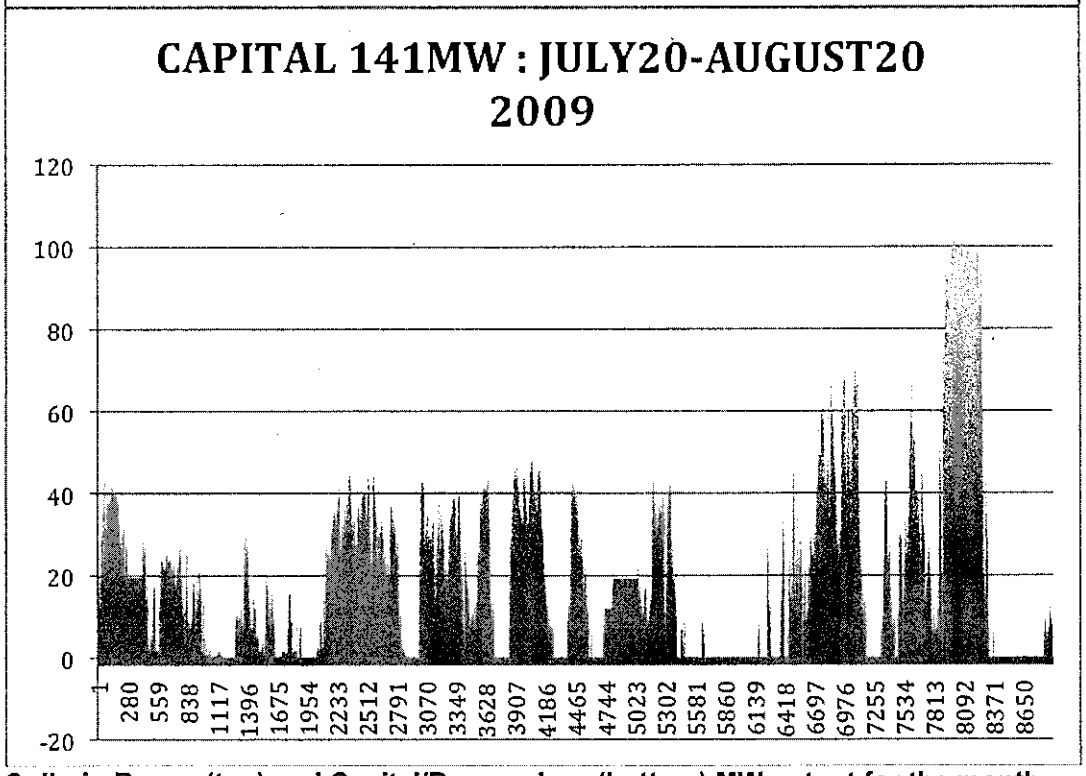
June 2009 performance of the wind farms in NSW, Victoria and Tasmania compared to that of South Australia. (From Miskelly, A and Quirk, T. (2009) Wind Farming in South East Australia)

All of these studies show that significant smoothing does not occur from such correlation, and that more industrial wind power stations result even greater fluctuations in electrical output. The fact that the electricity outputs from large geographical distributions of industrial wind power station are *correlated* means that they tend to act as one power station, because weather fronts cover vast distances. This can result in simultaneous lulls affecting multiple wind power stations.

The AEMO data for a number of wind power stations can be obtained selectively through the Australian Landscape Guardians website : http://www.landscapeguardians.org.au/data/aemo/ We have computed the graph for the output of the 30MW Cullerin Range Wind Farm and the 141MW Capital Wind Farm at Bungendore for the month from 20th July to 20th August, data sampled at 5 minute intervals. The output is seen to be highly variable, with very extreme shifts in output noticeable.The output is again seen to be highly variable, with very extreme shifts in output noticeable.

It is also easily seen that in the July 20 to August 20 data sets for both Cullerin Range and Capital/Bungendore there are simultaneous dips in power output.





Cullerin Range (top) and Capital/Bungendore (bottom) MW output for the month July 20 to August 20 2009 from AEMO 5 minute data

Peter Lang is a retired engineer with 40 years experience on a wide range of energy projects throughout the world, including managing energy R&D and providing policy advice for government and opposition. His experience includes: coal, oil, gas, hydro, geothermal, nuclear power plants and nuclear waste disposal (6.5 years managing a component of the Canadian Nuclear Fuel Waste Management Program). In 2009 he self published the paper "*Cost and Quantity of Greenhouse Gas Emissions Avoided by Wind Generation*" and provided a simple analysis of the amount of greenhouse gas emissions avoided by wind power and its associated cost. In agreement with the other studies cited above he concludes :

"These calculations suggest that wind generation saves little greenhouse gas emissions when the emissions from the back-up are taken into account.

1. Wind power does not avoid significant amounts of greenhouse gas emissions.

2. Wind power is a very high cost way to avoid greenhouse gas emissions.

3. Wind power, even with high capacity penetration, can not make a significant contribution to reducing greenhouse gas emissions."

It is clear from all these studies just cited in this section that **industrial wind power fails to deliver any significant savings in greenhouse gas reduction. No independent scientific study has ever shown that industrial wind energy saves a significant amount of greenhouse gases.**

This fact has been well known for many years, the REF study was published in Dec 2004, over four and a half years ago. Despite the repeated claims the wind industry may make about any recent improvements the most recent 2009 study by Carnegie Mellon University states that **emissions can actually be increased by industrial wind power.** Industrial wind power stations are therefore of no environmental benefit and should not be built.

5. PROJECT LIFESPANS

Wind industry developers suggest a 20 to 25 year lifespan for an industrial wind turbine, which involves continuous monitoring and maintenance requiring unlimited 24 hour / 7 days per week / 365 days per year access to the leased land. However, due to the majority of these installations being new developments, few turbines have been around to test these lifespan assumptions under real world conditions. Regarding wind turbine warranties Apt and colleagues state in the American National Academies of Science Fall 2008 on-line journal "Issues in Science and Technology" in a paper titled *"A National Renewable Portfolio Standard? Not Practical"* that :

"Demand (driven by state RPSs and the federal renewable production tax credit) has already stretched supplies thin, creating an 18-month delivery delay for wind machines. It has also emboldened manufactures to reduce wind turbine warranties from five years to two."

Turbine failures and engineering problems are an occurrence that has also affected our decision not to host wind turbines. For example, TrustPower's Snowtown installation was built and is maintained by India's industrial wind turbine manufacturer Suzlon Energy Ltd. Suzlon have experienced problems with blade failure which has impacted on their share price recently. The 25th October 2008 Wall Street Journal article "Windmill Mishap Weighs on Suzlon" at (http://online.wsj.com/article/SB122485006026866321.html) reported on a blade failure incident which drove down the Suzlon shares by 39%. This report tells of a 140ft (42.67m) long turbine blade snapping off and being thrown 150ft (45.72m) from the tower. This is a known problem with Suzlon's turbine blades *: "Earlier this year, Suzlon, of Pune, India, said it would strengthen or replace 1,251 blades -- almost the entire number it has sold to date in the U.S. -- after cracks were found on more than 60 blades on turbines run by Deere and Edison International's Edison Mission Energy."* Suzlon has been in further trouble as seen in a recent Bloomberg news report on 16th April 2009 "Suzlon Falls Most in 3 Months on Faulty Blade Report" (http://www.bloomberg.com/apps/news?pid=20601091&sid=aEEY_nocEVzo). Suzlon shares fell 84% last year, with further losses already in 2009. These technical problems are experienced across the whole wind industry and are not just limited to Suzlon. An article in Business Week, 24th August 2007, " The Dangers of Wind Power" discusses the global rise in the number of accidents and failures (http://www.businessweek.com/globalbiz/content/aug2007/gb20070824_562452.htm?chan=globalbiz_europe+index+page_top+stories). Gearboxes in wind turbines are often replaced within the first 5 years. Wind turbines can stand idle for up to 18 months waiting for replacement parts. Also in this report Jan Pohl of insurance firm Allianz in Munich, who faced about 1000 claims in 2006 stated : "an operator has to expect damage to his facility every four years, not including malfunctions and uninsured breakdowns."

Land leases also commonly have options to renew for a further term, meaning that leases can be tied up for up to 50 or more years. This is similar to the contracts that the wind industry are currently urging landholders to sign. Leases are often on-sold to other companies, bearing in mind that a wind energy company will expect to have profited from their investment well before the lease expires.

For the landholder attempting to judge the lifetime of an industrial wind plant it is also vital to consider research on the effects of climate change on energy infrastructure. In

Chapter 11 (Australia and New Zealand) of the IPCC Working Group II Contribution to the 4th Assessment Report *"Climate Change 2007 – Impacts, Adaptation and Vulnerability"* it is worth noting the following in Section 11.4.10 Energy on page 523 : "*Climate change is likely to affect energy infrastructure in Australia and New Zealand through impacts of severe weather events on wind power stations, electricity transmission and distribution networks*". Later in the same section an assessment of potential risks for Australia found, among other risks, that : "*increased peak and average temperatures are likely to reduce electricity generation efficiency, transmission line capacity, transformer capacity and the life of switchgear and other components*". This potential for future failures coupled with the known unreliability of wind energy further diminishes the financial returns of industrial wind turbines for the landholder.

Other studies have shown that there is also the potential for climate change to impact directly on wind resource : Sailor, D.J., M. Smith, and M. Hart, 2008. "Climate change implications for wind power resources in the Northwest United States," *Renewable Energy*, 33 (11), pages 2393-2406. This paper concludes that wind generated electricity in the area studied could be reduced by up to 40% through climate change. This research builds on their earlier study Breslow, P., and D.J. Sailor, (2002) "Vulnerability of Wind Power Resources to Climate Change in the Continental United States", *Renewable Energy*, 27 (4), pages 585-598. In this work they estimate a 1% to 3.2% reduction in wind speeds in the area studied over the next 50 years, and a 1.4% to 4.5% reduction over the next 100 years. As mentioned in Section 3 of this submission, turbine power output is greatly affected by any small change in wind speed on the power curve, so even small reductions in future wind speeds can have a significant effect on maintaining industrial wind turbine power station viability.

6. DECOMMISSIONING WIND TURBINES AND INFRASTRUCTURE

From our meetings with other NSW landholders who are or have been coerced by industrial wind energy companies it is evident that they are under the impression that they will benefit from the "scrap value" for turbines when they are no longer in service. Governments, on the other hand, are being given the false impression by the wind industries project application documents that decommissioning costs will be covered by scrap value. **This is not true and represents a significant problem for the future and further demonstrates that industrial wind energy developments are NOT environmentally responsible.**

For example, the false assumption of scrap value covering decommissioning costs is stated by the developer Epuron (http://www.epuron.com.au) in the current Harden / Yass Preliminary Assessment document Chapter 4, Page 13, Section 4.5.3 available at (http://majorprojects.planning.nsw.gov.au/page/project-sectors/transport--communications--energy---water/generation-of-electricity-or-heat-or-co-generation/?action=view_job&job_id=2765) :

"It should be noted that the scrap value of turbines and other equipment is expected to be sufficient to cover the majority of the costs of their dismantling and site rehabilitation."

The final Environmental Assessment document for the now approved Conroy's Gap site, Chapter 1, Page 42, Section 3.4.3 available at (http://www.epuron.com.au/desktopdefault.aspx/tabid-786/) :

"The scrap value of turbines and other equipment is expected to be sufficient to cover the majority of the costs of their dismantling and site restoration."

These are incorrect assumptions and highlight that decommissioning plans are a more recent problem the wind industry and the NSW Government should now be addressing. **All industrial wind energy developers are making exactly these same claims in their planning applications which are being systematically approved in NSW without question.**

Decommissioning is a very expensive, industrially intensive process. The decommissioning process outweighs potential scrap value and currently requires adherence to State Government legislation in the form of a Decommissioning Management Plan, which currently includes, but is not limited to: disposal of non-recyclable components, removal within 18 months of any wind turbine that is continuously inoperable for 12 months (which may occur through a fault or economics), restoration of land and vegetation, removal of infrastructure and access roads within 12 months, procedures for notification of surrounding landholders of decommissioning activities as this will again be intrusive to the surrounding community. For an example of this requirement see Page 6 of the Project Approval document for Conroy's Gap at (http://majorprojects.planning.nsw.gov.au/page/project-sectors/transport--communications--energy---water/generation-of-electricity-or-heat-or-co-generation/?action=view_job&job_id=140).

A recent USA study on public record was independently commissioned regarding realistic decommissioning costs for a currently proposed 124 turbine project in West

Virginia. This study, by Energy Ventures Analysis Inc (EVA), found that the wind energy companies engineering decommissioning report stating that costs would be covered by scrap were incorrect. **EVA found that the decommissioning costs for that particular 124 wind turbine development were underestimated by US$10million.** The final decommissioning estimate was US$100,000 per turbine, resulting in an up front bond estimate of US$12+million at the start of the project. It is becoming more likely that future industrial wind energy projects will now require an up front bond, without inclusion of any scrap value due to the fluctuating nature of the scrap metal market. Should such large bonds be required by any future government legislation, these would be an additional financial burden that may halt a project after a lease has been signed, potentially leaving the landholder tied to an onerous long term lease agreement without income. The potential problem should decommissioning not be underwritten is that this financial burden reverts to the landholder and/or the community. **However, nowhere in the project approval documents for Conroy's Gap is there any requirement for a bond to cover decommissioning costs.**

7. HEALTH PROBLEMS AND WIND TURBINE NOISE POLLUTION

A further example of the environmentally negative impacts is the many health problems caused by industrial wind turbine power stations. Among the increasing worldwide reports of negative health effects of industrial wind turbines we draw particular attention to the work of many health professionals who have produced papers and studies on this issue. The National Academy of Medicine of France in their March 2006 report "Repercussions of the Operation of Wind Turbines on the Health of Man" requested the necessity of epidemiological studies, these issues have been systematically ignored and denied by the industrial wind industry and governments :

http://www.academie-medecine.fr/detailPublication.cfm?idRub=26&idLigne=294

The following is brief summary of just some of the reports currently published, further references are given in these reports.

7.1 WIND TURBINE SYNDROME

Dr Nina Pierpont MD, PhD (www.windturbinesyndrome.com), who has recently published a book and several articles on the detrimental health effects. Dr Pierponts research and observations are reiterated in the press release by the Medical Staff of Northern Maine Medical Center (http://www.windaction.org/documents/20306). These issues of are of considerable concern for landholders, neighbours, residents, the general public and particularly for young children and the elderly. According to Dr Pierpont the symptoms of Wind Turbine Syndrome include :

1) Sleep problems: noise or physical sensations of pulsation or pressure make it hard to go to sleep and cause frequent awakening.
2) Headaches which are increased in frequency or severity.
3) Dizziness, unsteadiness, and nausea.
4) Exhaustion, anxiety, anger, irritability, and depression.
5) Problems with concentration and learning.
6) Tinnitus (ringing in the ears).

A very recent paper has demonstrated new results on human sensitivity to low frequency vibration, offering substantial support for Dr Pierpont's work : Neil P. McAngus Todd, Sally M. Rosengren, James G. Colebatch, "*Tuning and sensitivity of the human vestibular system to low-frequency vibration*", Neuroscience Letters 444 (2008) pages 36-41.

7.2 DR HANNING'S REPORT

One of the most recent reports (June 2009) is by Dr Christopher Hanning MD on "Sleep Disturbance and Wind Turbine Noise". Hanning founded, and until retirement, ran the Leicester Sleep Disorders Service, one of the longest standing and largest services in the United Kingdom, and he has 30 years of experience in the field. Hanning's report is very comprehensive and some points are mentioned here :

"There can be no doubt that groups of industrial wind turbines ("wind farms") generate sufficient noise to disturb the sleep and impair the health of those living nearby." **Section 2.1.1**

"The swishing or thumping noise associated with wind turbines seems to be particularly annoying as the frequency and loudness varies with changes in wind speed and local atmospheric conditions. While there is no doubt of the occurrence of these noises and their audibility over long distances, up to 3-4km in some reports, the actual cause [of the wind turbine noise] *has not yet been fully elucidated."* **Section 2.2.4**

*"Unfortunately **all** government and industry sponsored research in this area has used **reported awakenings** from sleep as an index of the effects of turbine noise and dismisses the subjective symptoms. Because most of the sleep disturbance is not recalled, this approach seriously **underestimates** the effects of wind turbine noise on sleep."* **Section 3.1.2** (Bold emphasis by Hanning)

Hanning later refers to this issue in Section 3.5 in relation to a 2006 UK DTI report :

"The lack of physiological expertise in the investigators in not recognising that noise can disturb sleep without actual recalled awakening is a major methodological flaw rendering the conclusions unreliable, as is the short recording period. It is well recognised also that not every resident affected by a nuisance such as noise will actually register a complaint. Many will not be sufficiently literate or confident so to do and others may wish to avoid drawing attention to the problem to protect property prices. They may assume also that protest is futile, which seems to be the experience of many with wind turbine noise. Recorded complaints are thus the tip of the iceberg."

"In my expert opinion, from my knowledge of sleep physiology and a review of the available research, I have no doubt that wind turbine noise emissions cause sleep disturbance and ill health. " **Section 3.8.3** (Bold emphasis by Hanning)

7.3 ONTARIO HEALTH SURVEY

A recent study, the Ontario Health Survey, was made public on 22nd April 2009 by Wind Concerns Ontario. Of the 76 respondents, 53 people living near industrial wind turbine generators have reported significant negative impact and adverse health effects. The Ontario Health Survey reports problems associated with both humans and animals such as birds, cats, dogs, farming livestock, horses, ponies and wildlife, as well as stress related problems due to decline in property values. In conjunction with this study is a Deputation to the Standing Committee on General Government by Dr. Robert McMurtry M.D., F.R.C.S (C), F.A.C.S. Both documents are available at :

http://www.windaction.org/documents/22261

7.4 PHOTOSENSITIVE EPILEPSY AND FLICKER

The flicker effect of wind turbines blades are also known to precipitate seizures in people with photosensitive epilepsy. This research was published in Graham Harding, Pamela Harding, and Arnold Wilkins, (2008) "Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them" *Epilepsia* 49(6) pages 1095-1098. Some key points made by this paper are :

"Rotating blades interrupt the sunlight producing unavoidable flicker bright enough to

pass through closed eyelids, and moving shadows cast by the blades on windows can affect illumination inside buildings."

"Planning permission for wind farms often consider flicker, but guidelines relate to annoyance and are based on physical or engineering considerations rather than the danger to people who may be photosensitive."

"Two examples of seizures induced by wind turbines on small wind turbine farms in the UK have been reported to the authors in 2007."

"Note that the risk of seizures does not decrease appreciably until the viewing distance exceeds 100 times the height of the hub, a distance typically more than 4 km."

7.5 VIBROACOUSTIC DISEASE

Pathologist Nuno Castelo Branco MD has been conducting extensive research on Vibroacoustic Disease (VAD) since 1980, including in relation to wind turbine generators. VAD is detailed in Castelo Branco NAA, Alves-Pereira M. (2004) "Vibroacoustic disease", *Noise & Health* 2004; 6(23): pages 3-20. VAD specifically related to industrial wind turbines is reported in Castelo Branco NAA, Alves-Pereira M. (2007) "In-Home Wind Turbine Noise Is Conducive to Vibroacoustic Disease", *Second International Conference on Wind Turbine Noise, Lyon, France.* The VAD study in relation to wind turbines discusses a rural property in an agricultural area occupied by 2 adults and a 10 year old child, with four 2MW wind turbines which began operation in Nov 2006. A section from the paper follows, note that ILFN stands for Infrasound and Low Frequency Noise, and WT stands for Wind Turbines :

"ILFN levels contaminating the home of Case 2 are amply sufficient to cause VAD. This family has already received standard diagnostic tests to monitor clinical evolution of VAD. Safe distances from residences have not yet been scientifically established, despite statements by other authors claiming to possess this knowledge. Acceptance, as fact, of statements or assertions not supported by any type of valid scientific data, defeats all principles on which true scientific endeavor is founded. Thus, widespread statements claiming no harm is caused by in-home ILFN produced by WT are fallacies that cannot, in good conscience, continue to be perpetuated. In-home ILFN generated by WT can lead to severe health problems, specifically, VAD. Therefore, real and efficient zoning for WT must be scientifically determined, and quickly adopted, in order to competently and responsibly protect Public Health."

7.6 WIND TURBINE NOISE

Contrary to statements by wind industry proponents, industrial wind turbines are noisy. A major issue with industrial wind turbines is noise pollution and the ongoing setting of standards to mitigate these effects. There has been much independent research indicating the failure of current legislation and the potential for this to be changed in the future. This will have a direct effect on the number and location of any wind turbines near residential homes and property boundaries, or their operation and potential for being shut down once built. **It will also impact upon and limit any future land use within the vicinity of wind turbines once they are erected.** Noise pollution is also directly linked to the adverse health effects described by Dr Pierpont and others in the previous section of this submission.

Noise measurements are an important part of an industrial wind turbine power station development. These are conducted before, during and after construction at residential properties in the local area, as well as at properties hosting turbines. A recent paper by community noise experts George Kamperman and Richard R. James, was presented at the 2008 International Noise Conference held in Dearborn, Michigan "Simple guidelines for siting wind turbines to prevent health risks" available at (http://www.windaction.org/documents/17095). This paper reviews wind turbine noise studies to determine a set of safe guidelines. Also noted are the unique aspects of wind turbine noise, which are different from other common forms of noise such as traffic and industrial factories. Their review shows that residents as far away as 3km can experience sleep disturbance. The study specifically makes note of wind industry claims that turbine noise is masked by background noise. However this is not the case and due to atmospheric effects, particularly at night, the wind speed at the turbine hub height can be high but almost no wind can be experienced at nearby dwellings : *"This is the heart of the wind turbine noise problem for residents within 3 km (approx. two miles) of a wind farm."* This was first noted by G. P van den Berg in his PhD thesis "*The Sounds of High Winds: the effect of atmospheric stability on wind turbine sound and microphone noise*" and associated papers. G. P van den Berg's thesis is freely available online (http://dissertations.ub.rug.nl/faculties/science/2006/g.p.van.den.berg/). The research of van den Berg shows that there are significantly higher levels of noise pollution at night than are experienced in the daytime, and the effects of complex terrain such as hills are different to flat terrain. This research was first published in : Van den Berg G.P. (2004) "Effects of the wind profile at night on wind turbine sound", *Journal of Sound and Vibration* 277 (4-5), pages 955-970. More recent research relating to complex terrains as opposed to flat terrains is discussed in : Van den Berg G.P. (2007) "Wind profiles over complex terrain." *Second International Conference on Wind Turbine Noise, Lyon, France.*

On the 29th Feb 2009, the REF obtained data under the Freedom of Information Act relating to work conducted in 2007 by the University of Salford who were under contract to the Department of Business, Enterprise and Regulatory Reform: *Research into aerodynamic modulation of wind turbine noise* (www.ref.org.uk/PublicationDetails/49). This work indicates that current UK regulations on noise pollution relating to wind turbines *"(ETSU-R-97) is not fit for purpose, is failing to protect the amenity of neighbours and is urgently in need of revision."* A summary of wind turbine noise studies with links to articles is also available at (www.windaction.org/faqs/12759).

The Acoustic Ecology Institute produced a special report in January 2009 on Wind Energy Noise Impacts (www.acousticecology.org/srwind.html). More recent research was presented at the 3rd International Conference on Wind Turbine Noise held in Denmark in June 2009 (www.windturbinenoise2009.org), and the previous two conferences also contain research documents relating to negative impacts of wind turbine noise (www.confweb.org/wtn2005/) and (www.confweb.org/wtn2007/). The 4th International Conference on Wind Turbine Noise is scheduled for 2011.

8. PROPERTY DEVALUATION

It is worth noting that the negative environmental effects of industrial wind turbine power stations on property values are not just purely based on visual amenity. As mentioned above in the excerpt from Section 3.5 of Dr Hannings report "Sleep Disturbance and Wind Turbine Noise" he states in relation to complaints about noise pollution that "*others may wish to avoid drawing attention to the problem to protect property prices.*" The Ontario Health Survey, and other health reports have mentioned the issue of stress related problems due to decline in property values.

A recent presentation by Gardner Appraisal Group Inc. given at the South Plains Agriculture Wind & Wildlife Conference in Lubbock, Texas, USA on February 13, 2009 titled "*Impact of wind turbines on market value of Texas rural land*" which discusses the **reduction of property values for landholders hosting turbines, as well as properties in the surrounding areas of such developments** : (www.windaction.org/documents/20145). Their appraisal research showed :

- A view adds value to rural property
- Take away view – added value goes away
- Brokers in rural areas confirm that property values in areas of wind facilities are 10% - 30% less than property not in areas of wind facilities
- Wind energy development creates an income stream for a property but this does not necessarily result in increased market value
- Previous studies funded by wind power proponents declaring no loss of property value are flawed due to built in bias and poor methodology

Two case studies are presented in this presentation. Case Study 1 is a 350 acre property with 27 turbines within 1.5 miles on the market in 2007. A prospective buyer agreed a purchase price but on disclosure of the wind turbine project the buyer backed out. The seller discounted the property by 25% but the buyer declined and little interest remains in the property. Case Study 2 is an analysis of seven properties with varying proximity to wind turbines, with two properties hosting turbines. **Loss in property value was reported as :**

- turbines on property = 37% loss on average
- turbines within .2 to .4 miles (0.32km to 0.64km) = 26% loss on average
- turbines within 1.8 miles (2.89km) = 25% loss on average

Further potential for loss in property value can occur due to

- wind turbine infrastructure
- high power transmission lines
- substations
- additional traffic for service of wind turbines and power lines
- additional roads

Gardner states that *"Market data and common sense tell us property values are negatively impacted by the presence of wind turbines."*

Land value issues are also addressed in many of the invited submissions to the Australian Federal Government's 2007 *"Inquiry into developing Australia's non-fossil fuel energy industry in Australia: Case study into selected renewable energy sectors"*. is available online and this report mentions some of the problems and issues with wind energy. The report also outlines other fast advancing renewable energy sources such as solar thermal and geothermal :

http://www.aph.gov.au/house/committee/isr/renewables/report.htm

This inquiry invited numerous Parliamentary Submissions from individuals and organizations, many of which address the negative impacts of industrial wind turbine developments :

http://www.aph.gov.au/house/committee/isr/renewables/subs.htm

Many of the invited submissions address the decline of property values. Submission 90 by the Molonglo Landscape Guardians is also recommended reading for an overview of issues of concern such as wind industry motivations, property value decline, questionable sustainability, and dubious economic benefits. The Tarwin Valley Coastal Guardians submission 7 and 7_1 presents, among others, some of the issues surrounding jobs that never appeared, variability of wind energy supply, noise levels and land value decline.

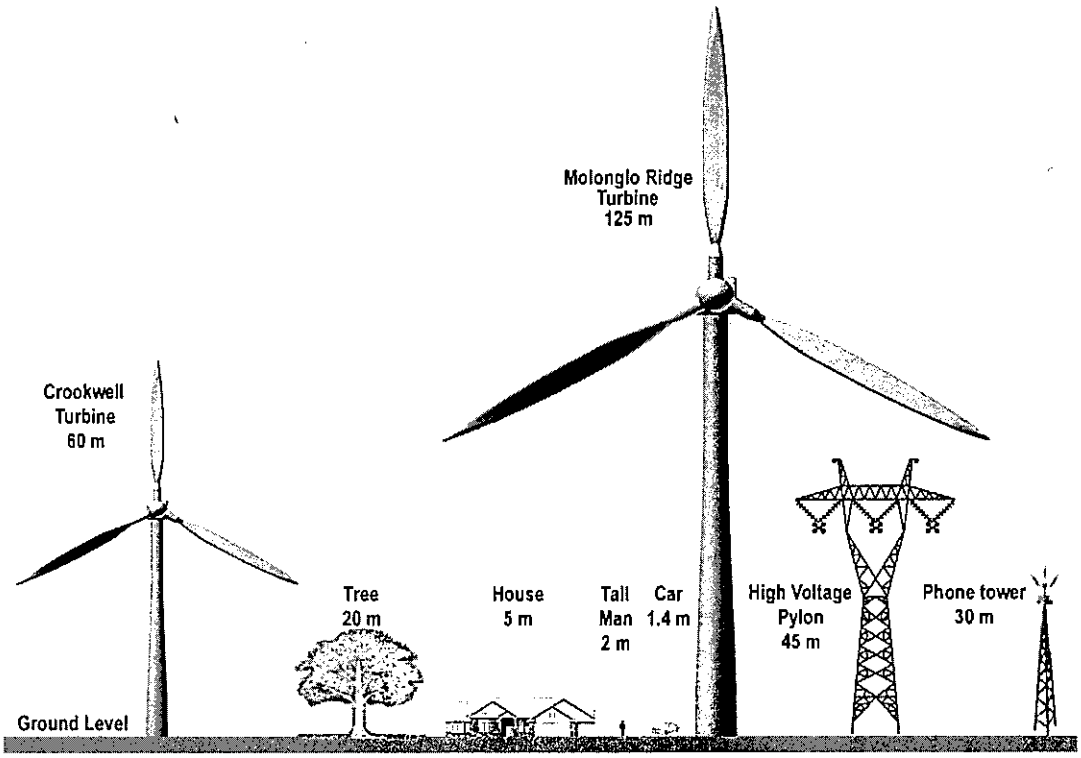
We are also aware of farmers experiencing negative effects on the value of their properties in NSW and Victoria where industrial wind energy developments have been proposed or established in their communities. It should also be noted that property value decline has occurred both during the proposal and contract phase, as well as once turbines are constructed. Decline of property values are noted throughout the 2007 Parliamentary submissions. In pages 14 to 16 of Submission 90 e.g. *"Bruce Richards, managing director of PBE Real Estate in South Gippsland, said that it was nearly impossible to sell a property within one kilometer of a wind turbine or a proposed wind turbine."*

9. VISUAL IMPACT

In terms of the visual impact of industrial wind turbines their size is increasing rapidly, and this has also been part of our decision not to host turbines on our property. As confirmed by our meeting with wind industry developers attempting to sign up land holders, and our knowledge of other industrial wind turbine developments, the areas of leased land hosting turbines and associated infrastructure, access roads, powerlines and substations, cannot be specified with certainty until after the lease agreement has been signed, monitoring has taken place and planning permission granted.

Many NSW landholders are under the impression they know the amount and location of turbines on their properties before monitoring takes place or planning permission sought, **which is clearly incorrect**. Any communication by wind power companies that is not in writing regarding specific siting (or any aspect) is unlikely to be legally binding. Wind industry representatives clearly stated during our meetings that even after the monitoring phase they would not be able to confirm exactly where the developments would be located.

Industrial wind turbine heights have risen from 60m, such as those seen at the original Crookwell site, to the now common height of 125m for 2MW turbines, almost the same height as Sydney Harbour Bridge, with a rotor diameter roughly the size of a 747 jumbo jet. A picture showing the scale of a 2MW 125m turbine is shown below obtained from the Molonglo Ridge Landscape Guardians site (http://www.mlg.org.au).



The current REPower 5MW turbines available for onshore sighting are much larger at 180m tall, almost the height of Canberra's Black Mountain Tower which is 195m, with rotor diameters of 126m. The 5MW turbines have been in use since 2005. Wind industry representatives stated in meetings that they would not be able, nor are they obliged, to stipulate to the landholder the type / size of turbines they may use in the developments.

According to the Zervous paper (mentioned in Section 2 of this submission) on "*Status and Perspectives of Wind Energy*" on page 105 of the IPCC 2008 report *Scoping Meeting on Renewable Energy Sources* and other wind industry documents, turbine heights and diameters continue to grow in size. For 8MW to 10MW turbines rotor diameters alone are estimated to reach 160m, twice the wingspan of an Airbus A380. As every increase in rotor diameter requires an increase in tower (hub) height, these newer turbines will be taller than Canberra's Black Mountain Tower. **How are NSW Government planning regulations addressing these new turbines to protect public health and amenity?**

The rapidly expanding size of wind turbines to obtain higher power outputs clearly demonstrates that as a minimum landholders should expect 125m high 2MW turbines in any development proposal that is currently in progress. For landholders still with contracts in the wind monitoring phase they could be in for a very tall shock. Again this is indicative of the enormous scale and visual impact industrial wind turbines will have in the rural NSW and surrounds. The approved Conroy's Gap development is to contain 15 x 2MW turbines, and the currently under submission Harden / Yass Valley (Coppabella Hills, Marilba Hills, Carrolls Ridge) proposal is for up to 200 turbines of 1.75MW to 3.3MW each.

10. THE GREEN JOBS MYTH & THE RENEWABLES BUBBLE

It is often stated that "green jobs" will be created by industrial wind energy developments. Two important recent studies from the USA and Spain have reported on problems with the strategy to support so-called "green jobs". The recent report "*Study of the effects on employment of public aid to renewable energy sources*" by Dr. Gabriel Calzada, an economics professor at Juan Carlos University in Madrid, demonstrates that for Spain the "green job" has proven elusive and unsustainable. This study is available from : http://www.juandemariana.org/pdf/090327-employment-public-aid-renewable.pdf Some important points from the executive summary are :

"This study is important for several reasons. First is that the Spanish experience is considered a leading example to be followed by many policy advocates and politicians. This study marks the very first time a critical analysis of the actual performance and impact has been made. Most important, it demonstrates that the Spanish/EU-style "green jobs" agenda now being promoted in the U.S. in fact destroys jobs, detailing this in terms of jobs destroyed per job created and the net destruction per installed MW."

"Optimistically treating European Commission partially funded data, we find that for every renewable energy job that the State manages to finance, Spain's experience cited by President Obama as a model reveals with high confidence, by two different methods, that the U.S. should expect a loss of at least 2.2 jobs on average, or about 9 jobs lost for every 4 created, to which we have to add those jobs that non-subsidized investments with the same resources would have created."

"Despite its hyper-aggressive (expensive and extensive) "green jobs" policies it appears that Spain likely has created a surprisingly low number of jobs, two thirds of which came in construction, fabrication and installation, one quarter in administrative positions, marketing and projects engineering, and just one out of ten jobs has been created at the more permanent level of actual operation and maintenance of the renewable sources of electricity."

"This came at great financial cost as well as cost in terms of jobs destroyed elsewhere in the economy."

"The study calculates that since 2000 Spain spent €571,138 to create each "green job", including subsidies of more than €1 million per wind industry job."

"The study calculates that the programs creating those jobs also resulted in the destruction of nearly 110,000 jobs elsewhere in the economy, or 2.2 jobs destroyed for every "green job" created."

"Each "green" megawatt installed destroys 5.28 jobs on average elsewhere in the economy: 8.99 by photovoltaics, 4.27 by wind energy, 5.05 by mini-hydro."

"These costs do not appear to be unique to Spain's approach but instead are largely inherent in schemes to promote renewable energy sources."

"The high cost of electricity due to the green job policy tends to drive the relatively most

energy-intensive companies and industries away, seeking areas where costs are lower."

"The study offers a caution against a certain form of green energy mandate. Minimum guaranteed prices generate surpluses that are difficult to manage. In Spain's case, the minimum electricity prices for renewable-generated electricity, far above market prices, wasted a vast amount of capital that could have been otherwise economically allocated in other sectors. Arbitrary, state-established price systems inherent in "green energy" schemes leave the subsidized renewable industry hanging by a very weak thread and, it appears, doomed to dramatic adjustments that will include massive unemployment, loss of capital, dismantlement of productive facilities and perpetuation of inefficient ones."

"The energy future has been jeopardized by the current state of wind or photovoltaic technology (more expensive and less efficient than conventional energy sources). These policies will leave Spain saddled with and further artificially perpetuating obsolete fixed assets, far less productive than cutting-edge technologies, the soaring rates for which soon-to-be obsolete assets the government has committed to maintain at high levels during their lifetime."

The 97 page University of Illinois Law & Economics Research Paper published in March 2009 authored by Professor Andrew P. Morriss, Professor William T. Bogart, Andrew Dorchak and Distinguished Professor Roger E. Meiners titled *Green Jobs Myths* contains an extensive survey and analysis. They show how the special interest groups promoting the idea of green jobs have embedded dubious assumptions and techniques within their analyses. The paper can be downloaded at : http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1358423

Their abstract states the main points of the study :

"A rapidly growing literature promises that a massive program of government mandates, subsidies, and forced technological interventions will reward the nation with an economy brimming with green jobs. Not only will these jobs improve the environment, but they will be high paying, interesting, and provide collective rights. This literature is built on mythologies about economics, forecasting, and technology.

***Myth**: Everyone understands what a green job is.*

***Reality**: No standard definition of a green job exists.*

***Myth**: Creating green jobs will boost productive employment.*

***Reality**: Green jobs estimates include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption.*

***Myth**: Green jobs forecasts are reliable.*

***Reality**: The green jobs studies made estimates using poor economic models based on dubious assumptions.*

***Myth**: Green jobs promote employment growth.*

***Reality**: By promoting more jobs instead of more productivity, the green jobs described*

in the literature encourage low-paying jobs in less desirable conditions. Economic growth cannot be ordered by Congress or by the United Nations. Government interference - such as restricting successful technologies in favor of speculative technologies favored by special interests - will generate stagnation.

***Myth**: The world economy can be remade by reducing trade and relying on local production and reduced consumption without dramatically decreasing our standard of living.*

***Reality**: History shows that nations cannot produce everything their citizens need or desire. People and firms have talents that allow specialization that make goods and services ever more efficient and lower-cost, thereby enriching society.*

***Myth**: Government mandates are a substitute for free markets.*

***Reality**: Companies react more swiftly and efficiently to the demands of their customers and markets, than to cumbersome government mandates.*

***Myth**: Imposing technological progress by regulation is desirable.*

***Reality**: Some technologies preferred by the green jobs studies are not capable of efficiently reaching the scale necessary to meet today's demands and could be counterproductive to environmental quality.*

11. MORE SUSTAINABLE & RELIABLE CONSIDERATIONS

The first chapter of the Proceedings of the 2008 Intergovernmental Panel on Climate Change (IPCC) *"Scoping Meeting on Renewable Energy Sources"* mentioned in Section 2 of this submission, *"Renewable Energy and Climate Change An Overview"* by William Moomaw, discusses and identifies the 3 primary categories of renewable energy sources. The 3 categories are solar, geothermal, and gravitational energy. Solar energy directly provides heat for ocean and land surfaces, drives wind and wave resources, produces biomass and fuels via photosynthesis, and provides energy for the hydrological cycle. Table 1 on page 6 of that paper gives a good overview of the potential of renewable energy sources. The annual flux of global energy use is roughly between 450 and 500 EJ per year. 1EJ = 10^{18} joules. To put this in perspective, the amount of renewable energy available from solar is 3,900,000 EJ per year, for wind it is 6,000 EJ per year and for geothermal it is 140,000,000 EJ per year.

Some important points to consider with electric power, particularly in light of potential climate change effects on infrastructure (as discussed in Section 5 of this submission), are noted on pages 7 and 8 of the IPCC chapter :

"Another important aspect of the cost of electric power production is the transmission and distribution systems. According to IEA, approximately 55% of the capital cost of electric power systems is in the "wires" and only 45% is invested in the generation technology. Hence if on-site, distributed generation is utilized (whether fossil fueled or building integrated solar or renewable technology), the transmission costs are generally zero, and the marginal cost of distribution if grid connected is much lower since most of the electricity is utilized where it is generated. This fact needs to be taken into account when comparing costs of alternatives. There are few studies to date that account for this sizable cost component."

The Fenner School of Environment and Society at ANU has, among many other research areas, an excellent online resource *Sustainable Farms: Pathways for Rural Landscapes* at (http://fennerschool-research.anu.edu.au/sustfarms/).

The Australian Government Department of Resources, Energy and Tourism (www.ret.gov.au/energy/Pages/index.aspx) has recently announced its $500 million Renewable Energy Fund and the $150 million Energy Innovation Fund, $100 million of which is allocated to the establishment of the Australian Solar Institute. There is also an Energy White Paper scheduled for release at the end of 2009 to announce Australian energy policy (www.ret.gov.au/energy/facts/white_paper/Pages/default.aspx).

Australian funding in renewable energy is undergoing rapid change, with the majority of renewable energy funds being directed to solar (photovoltaic panels, solar hot water and concentrating solar thermal power stations). For the latest research in solar see the ARC Centre for Solar Energy Systems at ANU (http://solararc.anu.edu.au/), Solar Energy at ANU (http://solar.anu.edu.au/) and the Centre for Sustainable Energy Systems (http://solar.anu.edu.au/cses.php). The most recent research supported by the Australian Government Department of Resources, Energy and Tourism for storage technologies for solar power stations are $7.4million (www.wizardpower.com.au/) and $5million (www.lloydenergy.com). For the Australian solar industry it is anticipated that this funding will continue to increase in the future.

Recent advances in photovoltaic solar panels in Australia are Sliver Cells (http://solar.anu.edu.au/research/sliver.php), which have been licensed by Origin Energy (www.originenergy.com.au/1233/SLIVER-technology). Other research in solar technology are the flexible printable organic cells being developed at Monash University (http://www.chem.monash.edu.au/solar/index.html) and the Victorian Organic Solar Cell Consortium (http://www.vicosc.unimelb.edu.au/index.html) also reported by ABC TV Catalyst program 23rd April 2009 (http://www.abc.net.au/catalyst/stories/2550612.htm).

Overseas MIT is developing solar concentrators (http://web.mit.edu/newsoffice/2008/solarcells-faq-0710.html). One of the most recent developments in the commercial sector for photovoltaics is from Morgan Solar Inc (http://www.morgansolar.com).

As mentioned earlier in this section the global wind resource of 600 EJ/year demonstrates the paucity of resource globally for wind. Solar thermal and geothermal resources are greater, more cost effective, have less negative impacts and better reliability and predictability. Solar energy advances clearly demonstrate the practicalities of managing Australian electricity resources locally and reliably. Landholders have the opportunity to empower themselves to create their own projects and sell electricity directly into the standard 240v ac mains supply. This enables them to manage their own projects, at their own pace, with minimum stress and negative impacts, without giving up control of their land, without dividing rural communities, whilst making a positive contribution to the environment, creating a new and sustainable industry.

12. CONCLUSIONS

The short and long term problems of industrial wind turbines for the landholder, and surrounding communities is a subject of great concern. We have investigated these issues in order to come to a decision regarding leasing our land for industrial wind turbine developments. We ask that this inquiry make particular note of the destruction of the local environment and communities, and the loss of ours and others future livelihood and land use, when considering industrial wind turbine development in NSW.

12.1 SUMMARY OF KEY PROBLEMS

A summary of some of the key problems for NSW include :

- wind is a poor, highly variable, intermittent and unreliable resource for electricity generation
- potential landholder liability to 3rd party claims e.g. from neighbouring properties, local community and wind industry contractors / investors
- ongoing legislative changes e.g. planning, tax, emissions trading schemes, carbon credits etc.
- uncertainty regarding number, type and location of turbines
- uncertainty of associated access and infrastructure
- uncertainty of essential future infrastructure requirements, such as wind turbine energy storage devices, maintenance and access issues
- uncertainty of landholder income and the tax liabilities for the landholder
- considerable decommissioning expenses for abandoned projects and turbines, coupled with state regulations regarding decommissioning
- on-selling of leases by power companies
- electricity generated will be fed into the grid and is unlikely to be used by the surrounding community
- uncertainty of construction duration, which may be at least 18 months, 2 years or even longer
- uncertainty of length of time before wind turbine income stream begins, project could easily take 5 years before installation is complete
- meager income from onerous lease before and after wind turbines installed
- construction phase is a period of intense industrial development involving significant disruption to all landholders, neighbouring properties, the environment, local communities and surrounding towns
- ongoing access requirements for wind turbine security, monitoring, maintenance and upgrading
- destruction of environment and environmental monitoring required pre, during and post construction
- ongoing environmental and ecological monitoring of bird and bat fatalities necessitating further access to land, potentially with dog handler teams for carcass recovery without requiring owners permission
- ongoing environmental and ecological monitoring of flora and fauna necessitating further access to land without requiring owners permission
- noise pollution and the need for ongoing monitoring of noise pollution without requiring owners permission
- increased potential for trespassers and vandalism
- increased risk of theft for owners and neighbouring properties

- loss of privacy
- landholders loss of rights of complaint after signing lease agreement
- landholders loss of rights of disclosing any negative impacts after signing lease agreement
- loss of rural night sky views and sleep due to high visibility aviation warning lights for entire local community
- additional structures specifically to warn aviation of true height of turbines blade tip because height has to be indicated by stationary structures
- loss of ability for light aircraft to fly in vicinity of turbines for safety reasons, resulting in a diminished service for rural communities
- reduction in rights for landholder regarding wind turbine sighting after signing lease agreements e.g. participating properties have to tolerate higher noise levels from wind turbines than non-participating properties, which equates to closer sighting of turbines to dwellings
- restrictions on landholder and neighbours future land use with or without turbines being erected
- decline in property values for wind turbine hosts, neighbouring properties and wider community in vicinity of development
- irreparable destruction of environment and ecology through destruction and fragmentation of wildlife habitat
- unnecessary community divisions and loss of amenity for stakeholders and non-stakeholders
- loss and destruction of environmental, familial and cultural heritage

These are just some of the many concerns we have considered from a landholders point of view when considering industrial turbine wind energy lease agreements, irrespective of our more detailed environmental and other areas of concern.

Our conclusion is that there are far too many financial, legal, health and environmental risks for the landholder, for surrounding communities and for NSW to make industrial wind turbine development worthwhile. The only certainty from such a development within rural communities is the bitter and counter productive divisions of those rural communities. To commit unknown parts of our property to an onerous lease, drawn up by an uninvited tenant in a tenant oriented manner seems unwise. Such a lease with its intended development would restrict both our and our neighbours future rural land use. In addition, the rapidly advancing technology of other renewables, climate change predictions, volatile economic climate, ongoing debate of "true" carbon costs for wind energy and other variable / intermittent renewables requiring fossil fuel backup, and shifting government policies surrounding these issues, produces more uncertainty. Committing to a long term agreement with the wind industry would therefore be a bad business decision for us, our neighbours and our community.

Further large scale industrial wind turbine power plant developments in our rural NSW communities would have a major detrimental impact to our current and future business, research, lifestyle and investment activities.

The issues surrounding industrial wind energy development are broad and wide ranging. We have only briefly covered some of the issues of concern in this submission, **in particular the failure of industrial wind to have any significant impact on greenhouse gas reduction as evidenced by numerous studies, and their inability**

to replace any fossil fuel power stations. Other issues such as flora and fauna biodiversity, community consultation, land use, archeological, traffic / transportation, cultural heritage and fire risk due to industrial wind power station development are therefore issues of significant concern. **Is this really the legacy we want to leave for our children?**

12.2 SOME UNANSWERED QUESTIONS

There are many unanswered questions that industrial wind energy poses for Australia. For example :

- **What watchdog or committee is continually assessing whether wind power stations are living up to their promises?**
- **Who is assessing the ongoing environmental impacts on flora and fauna once these installations are built?**
- **Why are industrial wind turbine power station developments being allowed in vulnerable and endangered ecosystems in NSW, such as Box Gum Grassy Woodlands? (As noted in recent Federal Government "Caring for Country" publications conventional farming is already putting significant stress on such ecosystems.**
- **Who is assessing whether the electricity output of these wind power stations is living up to the original claims of the developers?**
- **How many fossil fuel power stations have been decommissioned in Australia as a direct result of displacement by existing wind power stations?**
- **How many fossil fuel power stations are expected to be decommissioned in Australia as a direct result of the currently proposed wind power station developments?**
- **Who is assessing what, if any, greenhouse gas reduction benefit wind power stations are producing and how close are they to the developers claims?**
- **What studies are to be conducted in Australia to assess whether peoples health have been affected by wind power stations?**

These unanswered questions must be addressed prior to any further rubber stamping and fast tracking of industrial wind turbine power station developments in NSW.

12.2 INDEPENDENT WEB RESOURCE ON INDUSTRIAL WIND ENERGY

We recommend visiting the Industrial Wind Action (IWA) Group website (www.windaction.org) which is a quality worldwide resource on industrial wind energy issues. As well as providing a continually updated web based resource the IWA are considered professionals who advise officials at federal, state and local levels to counteract misleading information from the wind energy industry.

The recent invited presentation by IWA Executive Director Ms Lisa Linowes at the 2009 Midwest Energy Conference in Chicago, USA (March 4-5) is an informative overview of the technical problems of large-scale wind turbine integration into the electricity grid : (http://www.windaction.org/documents/20337)

A subscription to the IWA news feed (www.windaction.org/subscribe) is a particularly constructive resource, as it compiles news stories and opinion from around the world. These news stories and academic research papers demonstrate that there are many

negative impacts from industrial wind turbine developments, and around the world these detrimental impacts consistently outweigh the very few (if any) positive impacts.

IWA's *Important Docs* section (http://www.windaction.org/?tab=topdocs) contains a number of peer reviewed documents from internationally recognised journals and conferences, as well as working papers by academics, medical doctors and industry professionals. These documents address many concerns regarding industrial wind energy and also provide cautionary information on lease agreements / easements between landholders, neighbouring / nearby properties and industrial wind energy companies.

12.3 RENEWABLE ENERGY STRATEGIES

The governments renewable strategy is based on targets for quantities of energy that are unknown. Again the REF in the UK makes this quite clear and in a briefing note in response to the UK governments 2009 strategy the issues are made quite plain. This briefing note, published on 27-07-09 is available from http://www.ref.org.uk/PublicationDetails/54

This briefing note is highly relevant to this inquiry and some selected comments are included below (bold emphasis is theirs) :

"It should be noted this target is focused specifically on obtaining quantities of energy and does not bear directly on green house gas emissions reductions targets, though it is related at one remove with climate change policy.

"In the following discussion we show that, regrettably, the UK Government is probably mistaken with regard to the size of the target. This error arises since the target is 15% of an unknown quantity, namely Final Energy Consumption in 2020. In our view Government estimates of FEC in 2020 are overly optimistic. The potential error is large, and ***the target will probably be around 20% greater than that for which the government is planning****. This has significant implications for feasibility and cost."*

"REF noted that since energy consumption would probably increase Government was almost certainly underestimating the target magnitude. REF pointed out that in some EU data sets Final Energy Consumption was predicted to rise to around 185 mtoe, an increase of over 23% on current levels. This scenario is not addressed in the Renewable Energy Strategy."

At the lower levels Government admits that these targets will be very difficult to achieve. At the higher levels they are almost certainly infeasible. Indeed, there are reasonable doubts about the attainability of the lower quantities. For example, the levels of wind currently suggested (upwards of 25 GW) as necessary for the lower target would confront the UK with unprecedented balancing and grid management problems..."

"REF concludes that ***the Government's Renewable Energy Strategy is extremely and heroically optimistic about the scale of the targets, and so almost certainly underestimates the risks, the difficulties and the costs facing the UK.****"*

"So the Renewable Energy Strategy would deliver annual savings of 7% of UK

emissions and just 0.1% of current world emissions at extreme costs, and additional fiscal strain on already fragile economy. Clearly, this is not a good bargain, and reinforces the point we have often made that renewables are poor emissions reducers, whatever other virtues they might have."

"This is particularly disappointing since the UK's role in global climate change policy is to provide an economically compelling example, rather than any quantitatively significant contribution. At present our policy is unlikely to provide a constructive lead to any state in either the developing or developed world."

"For example, subsidised and mandated wind power on the scales currently contemplated by government will impair the economics of other plant but fail to provide compensating value. Investors in the still indispensable firm capacity needed to meet peak load (60 GW at 5.30 on a winter's day) will have no option but to minimise their risk by seeking the least capital intensive generation, which is gas-fired."

"...in the electricity sector ***the very aggressive wind policy (26GW of installed capacity) will ensure that for economic and technical reasons no other generation capacity except gas can be built, thus deepening and compounding UK gas dependency rather than alleviating it."***

"In other words, the Renewable Energy Strategy effectively makes capital intensive but high efficiency coal and nuclear infinitely too risky for investors, who will reduce their exposure by selecting the least capital intensive plant available, namely gas-fired generators, or, as is already apparent, scaling back investment in the UK altogether."

"It must be emphasised that ***contrary to Government assertions the renewables policy is a gas policy in disguise****."*

"... ***renewables on the irrational and politically driven scale outlined in the Renewable Energy Strategy will become a dangerous liability****. Distressed and painful policy corrections are inevitable."*

We thank you for taking the time to consider our submission.

Sarah Last and David Burraston