The Wind Farm Scam
– An Ecologist's Evaluation

Etherington, J. (2009). The Wind Farm Scam – An Ecologist's Evaluation. London, UK: Stacey International.

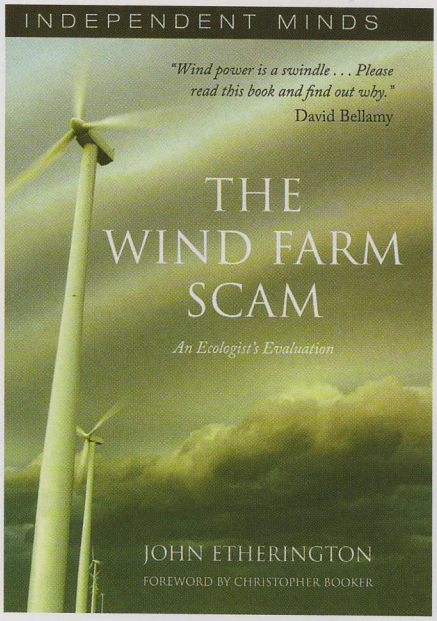
Reviewed by Paul Bouloudas.

"The paradox of building windmills is that you have to build a lot of ordinary power stations to back them up..." (pg. 188).

"There are many natural resources that are intermittent, wind is one and water is another. All life depends on water. Water can be stored. Electricity cannot be stored in economically large quantities. A result of this is that every kilowatt hour of electricity produced must be instantaneously used or spilled back into the earth. This has dire consequences for our already expensive (and low yielding) wind turbines, as you cannot simply turn them on and off as needed to balance supply. In context, we build wind turbines to generate electricity not to cut CO_2 emissions. The former is a requirement that is highly inefficient, the latter an added benefit" (p. 59).

When it comes to wind farms, I would think that most of us either like them or hate them, much like telecommunications towers; NIMBY (not in my backyard). Etherington does a marvellous job of tackling the swindles underlying wind power. To understand why wind power is nowhere near the 'saviour' it has been advertised to be, one must possess a little knowledge on thermodynamic efficiency, the Beitz Limit, energy conversion, current electricity generation and transmission methods. Being an ecologist, Etherington does a superb job of simplifying the theory needed to follow his argument, and so with this in mind, the book is an enjoyable easy read, perfectly suited for a mass audience including geologists. Being a geophysicist, I would have preferred a few equations to back up certain statements and arguments, but not including these certainly does not detract from a very well written and superbly researched text.

Setting up a single turbine and letting it run may seem like a simple enough task. However, trying to do this for a wind farm with many turbines poses some unique and complex issues. To understand these issues, we must first appreciate the nature of the current electricity distribution grids in modern industrial societies. Chapter 2 on Wind Generated Energy handles this along with other issues such as a brief



history of wind generated power, wind speed energy and height (including vertical shear), the geography of wind speed, wind energy electricity generation, limitations on produced energy, growth of wind turbines (size and output), issues of balance and spare capacity and a summary of alternating current. The remaining chapters examine these issues in detail. Chapter 2 does a great job at whetting ones appetite on the issues raised.

A former Reader in Ecology at the University of Wales at Cardiff, Etherington's many examples relate to the UK electricity grid. In the UK, power station alternators are bonded such that their transmission voltage into the Supergrid is set to 400 kV or 275 kV (plus 132 kV in Scotland). Long distance transmission lines in Australia are also operated at large voltages to assist with minimising transmission losses over long distances. A simple equation showing how voltages are stepped up and down would have helped here, however, equations are not used within the text.

Why is AC important? Well, the alternators of our grid connected system are run at 3000 rpm, giving 50 Hz frequency alternation (3000/60). This is an important fact because grid operators have no control over any events within their distribution networks. Increases or decreases in consumption, or injected power from 'embedded' generation (wind farms) are seen as load changes at the feeder sub-stations supplying the distribution network. Linking to the distribution network is not as simple as "flicking-a-switch" as Etherington points out. Generators need to be synchronised, and to do this five conditions must be met. The generators must have equal line voltage, frequency, phase sequence, phase angle and waveform. Not adhering to these conditions could result in damage to the distribution system.

Now assume you can do all of that, great. Wait for the wind, start producing synchronised electricity and watch the dollars grow. Wrong. Turbines do not just start to turn in any wind. They begin to operate from about 5 m/s to 25 m/s (56 mph – gale force). In high wind you need to shut down to avoid damage to the turbines (ie. you lose synchronisation). In low wind you also need to shut down, as there is no point in incurring wear and tear on bearings and equipment that is not producing any energy. Remember that the energy carried by the wind is proportional to the cube of its speed. Low speeds – low energy. Etherington describes the optimum wind speed to be in the order of 15 m/s (34 mph; Near Gale on the Beaufort scale). Differences in wind speed of even 1 m/s (which cannot be forecast) are shown to have differences of up to 1–2 MW of power. This amount of power going into or out of a distribution grid makes for difficult balancing techniques for conventional electricity production – which is charged with supplying us a regulated base load electricity supply.

A point I did not know about, was that turbines need electricity to start – much like your vehicle. A car can operate without an alternator, but as soon as you switch off the engine, you need an alternator to start up again. Much like the beleaguered wind turbine, as soon as you shut down, (low or high wind speed), you need an alternator (draws power from the electricity grid) to begin turbine rotation. Quite ironic really!

Etherington also describes the engineering and safety designs behind passive (stall controlled wind turbines), active (pitch controlled wind

turbines), and active (stall controlled wind turbines). Turbine design and optimum operating efficiency and control are quite detailed, leading the reader to appreciate that wind farm electricity production is not something that is simply turned on and forgotten. Active operation and maintenance (ie. cost) are quite high. You can see where this leads to. Since wind power is so expensive, governments around the world have opted to subsidise the cost of wind produced electricity, making wind farms 'competitive' with other forms of renewable energy. Take away the subsidies and – there you go – a very expensive power source. An important point: do NOT equate renewable energy sources with free sources. Energy comes at both an economic, environmental and thermodynamic cost. Etherington provides for an excellent discussion of all costs, and does not blindly accept the environmental argument. Remember, turbines, and towers are constructed from high grade steel, an energy intensive process to say the least.

Chapter 4 provides quite a complex analysis of the financial aspects of wind power generation. Many readers would be surprised that "there is probably no country in the world where grid connected grid power is deployed without it receiving a very large subsidy in some form or other, usually paid by all electricity consumers or by all taxpayers and often both." Much of the justification is drawn from the UK economy, but there are also brief mentions of the US and Australian systems. Maybe Australian electrical consumers would want to check if a wind levy is part of the government's re-election campaign.

Chapter 5 provides an insightful analysis on whether wind turbines really abate carbon emissions. You may need your calculator to follow some of the numerical calculations in this short chapter. After reading this chapter go to www.yes2wind.com and see if you still agree with some of the statements on the website.

Chapter 6 covers the topic of landscape degradation and wildlife. Although most examples are drawn from UK data, the US also gets a brief mention. An interesting point raised is that wind turbines are not simply static objects. They are dynamic moving objects whose effects are more than simply aesthetic. Etherington draws his examples on birds and bats killed by rotor blades by using statistics from larger, rather than smaller, turbines. Considering the dynamic of rotor blade motion, the blade tip velocity could be in excess of 150 mph on a large turbine. "A bird which just avoids a blade tip has just over a second to dodge the next blade, approaching from about 80 to 90 yards [70-80 m] away on a curved path and probably outside the range at which many birds would perceive a moving hazard..." (p. 103). Of course, smaller turbines would be less of a hazard, but still possess enough energy through their wind tip velocity to kill a bird. Sadly, wildlife victims are not limited to small birds, but all birds, eg. Golden Eagles in Sweden, Sea Eagles in Norway and Golden Eagles in California's Altamont Pass Wind Factory. Etherington also discusses the danger to bats and other wildlife. On a more 'scientific' basis, Etherington argues that CO_2 payback on wind farms needs to also account for the additional carbon released to the atmosphere when drainage and other construction damage allows for sequestered carbon (in peat bogs) to oxidise. This last example may be more applicable to the UK, where many wind farms are built over peat bogs.

Chapter 7 is probably the most interesting from a layman's perspective, as it discusses the more dynamic effects of noise, shadows and flicker. The chapter includes a good introductory discussion on the decibel scale and the measurement of noise. References are made to the dB(A) and dB(C) noise scales with little explanation of what they are. I would refer the reader to the University of New South Wales PhysClips site (www.animations.physics.unsw.edu.au/jw/dB.htm) that includes an excellent explanation of the theory behind decibel scales measuring pressure or power differences and also includes some great videos to enhance the explanations. There are many quotations cited and discussed so the chapter does appear a little heavy in content, but the underlying message is clear. Proponents of wind turbines are seen to be using 'devious' techniques and less than exacting science to gain planning approvals and paying little attention to the damaging effects on the local communities. The last sentence in the chapter is an excellent summary of the arguments presented: "They [wind turbines] are money factories which industrialise the landscape for no other significant purpose" (p. 127).

Chapter 8 discusses the dangers of wind farms. Most land based wind farms are easily accessible to the general public, and they need to be given their excessively large footprint. With the rotor blades of larger turbines weighing in excess of 30 t, free roaming individuals or even farmers working the land amongst these turbines could be placed under enormous risk in adverse weather conditions. These risks will only increase as the age of most wind farms, worldwide, approach their original engineering design life. The author describes a number of accidents that have already occurred such as fire, rotor blade burn through and even ice chunks thrown large distances from a 260 ft high turbine. Other hazards to aircraft safety, lighting, civilian and military radar and television communications are all discussed.

A very brief Chapter 9 discusses property, tourism and employment. The arguments may appear a little weak at this point, but with more wind farms under construction, the correlations to lowering housing value drops in tourism and employment may hold up with time. The examples cited in the text are drawn from experiences in the UK.

Chapter 10 discusses misrepresentation and manipulation. Initially the reader would be quite shocked upon digesting the material presented. However, when placed in context of the information presented in previous chapters, one would not be surprised that false information is being spoon-fed to an ill-informed public. Etherington does a superb job in describing the false claims of CO_2 mitigation justifying wind power. With a discussion of the successes of wind power in Denmark, the analysis is given credit by discussing both sides of the wind power debate.

For those readers who require a summary discussion on the wind power debate, I would suggest beginning the book by reading the last chapter on Climate Change and Kyoto – is it all necessary? It is quite a long discussion but includes more scientific analysis of temperature rises and falls in Earth's history and an excellent discussion on whether CO_2 drives temperature, or whether temperature rise drives CO_2. Cyclic changes in solar radiant flux are also noted as contributors to any climate change or global warming discussion.

The Epilogue begins with two quotations, one of which I think is quite significant when listening to politicians and misinformed promoters of wind power as a source of intermittent and unreliable electricity production as a global warming mitigation tool; and that is: "It is hard to believe that a man is telling the truth when you know that you would lie if you were in his place" (p. 186).

The book is easily digestible at 198 pages and has been excellently edited with no notable grammar or obvious typesetting issues. I would more than recommend this book to all individuals on either side of the wind power debate, to politicians and the general informed community citizen. We all need to find and accept a new source of energy supply to continue our current lifestyles and living standards. Renewable energy sourced from wind power was a good idea, but as the book shows, falls short on delivering the benefits upon which it is promoted and sold. ■