



# The Economic, Technological and Regulatory Impact of Wind Turbines

Submission to the Senate inquiry on Wind Turbines

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## About the Author

**Michael Petrut** is a Mannkal Scholar from Perth, Western Australia. He completed a Master of International Affairs from Murdoch University in 2014 and was based at the Institute of Public Affairs as a Researcher until February 2015 by the Mannkal Economic Education Foundation. Michael has assisted with research projects on the cost of employment, GST reform and renewable energy targets. Prior to interning at the IPA, he interned at Perth based think tank Future Directions International, working on the Indian Ocean Research Programme. He previously received a Bachelor of Arts in Politics and International Studies, also from Murdoch University.

## Executive summary

Contrary to the claims of the renewable energy industry, wind power is not an efficient or effective source of clean energy. This submission argues:

- Wind power has been shown to drive up the cost of electricity. The tax dollars required to pay for state investments and subsidies mean that households will end up having to pay more for electricity.
- Wind power puts stability in the energy market at risk due to low capacity and uncertain inputs.
- Wind power lacks a controllable input variable, therefore making demand-supply matching an impossible option for larger suggested projects.
- Broadening the responsibilities of the Clean Energy Regulator will weaken democratic accountability and legal rights.

## Low capacity and high fluctuations

The foremost problem with wind turbines as a share of the grid feed-in power, is the dynamic intermittent supply that comes from the low capacity rate of turbines, and the unpredictability of wind supply. This is the key reason that wind systems are not suitable or reliable, as grid systems require a consistent and manageable supply to meet demand at all times. As le Pair, Udo and de Groot argue:

Wind energy is only available if the wind blows strongly enough. This is expressed by saying that wind energy is supply driven: it is not available on demand. This feature makes wind energy as such unsuitable as a power source for an electricity grid where supply and demand must be balanced at all times. In order to stabilise the power of the grid we need either storage or conventional generators as backup. This has important consequences, as it reduces the fuel savings promised by the wind industry, while it doubles the costs of the power systems.<sup>1</sup>

Stable capacity and sound grid management is central to modern energy supply networks, as the former director of the deregulation unit at the Institute of Public Affairs, Alan Moran, stated in a Submission to the Victorian government's issues paper *'Driving Investment in Renewable Energy in Victoria'*:

Wind power has a level of firm reliability variously estimated at between 4% and 10% of its capacity. This means that additional back-up is required from other energy sources if aggregate grid reliability is not to be impaired. The best way of quantifying this is to model the increased wind with additional idle back-up capacity. Such capacity, say in the form of fast start gas plant, is estimated to cost some \$10 per MWh.<sup>2</sup>

A Reason Foundation study conducted by William Korchinski in 2012, found that wind power, due to the lack of a supply-side controllable variable, is unfeasible and impractical:

There are many periods when there is insufficient wind to satisfy the grid demand. Over 50% of the time, there is not enough wind to meet demand. There are many periods when there is no wind at all. This means that no matter how many wind turbines there are, there will be significant periods of time when wind cannot supply all of the power needed.

There are also times when there is too much wind for the demand. It is possible to store this wind power. When storage is full however, dumping the excess wind is necessary. Both storing and dumping are expensive.<sup>3</sup>

In another report by the Reason Foundation, Thomas Tanton expands on the issue of intermittent supply and the inefficiency of compensatory mechanisms:

When wind speed increases (but remains below the maximum speed allowed by the turbines), generation companies curtail generation from other sources, known as "intermediate load units,"

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<sup>1</sup> C. Le Pair, F. Udo and K. De Groot, "Wind turbines as yet unsuitable as electricity providers" *European Physics News*, Volume 33, No.2, p23-25.

<sup>2</sup> Alan Moran, 'Regulatory Subsidies to Renewable Energy in Victoria', *Institute of Public Affairs*, Energy Issues Paper 40, February 2006.

<sup>3</sup> William Korchinski, "The Limits of Wind Power", *Reason Foundation*, Policy Study 403, February 2013

sufficient to accommodate the wind power. Intermediate load units are usually natural gas powered generators, but, as discussed below, must on occasion be slow-to-respond coal-fired units. When the wind subsequently slows, generation from the intermediate load units is increased or otherwise brought back on line as needed. The process by which generation is ramped up and down at a plant due to wind or any other factor is called cycling. Integrating erratic and unpredictable wind resources with established coal and natural gas generation resources requires the electricity generators to cycle their intermediate load coal and natural gas-fired units. This wind-energy-caused cycling results in significantly less efficient performance of fossil fuel facilities.<sup>4</sup>

A key concern for the development of wind turbines is the transportation losses associated with connecting the turbines with the grid. Because areas where wind is abundant – offshore, highlands and rural areas – are often located at significant distance from the electricity grid, wind farms either lose much of their generated supply during transportation, or require an endless costing scheme to accommodate wind power into the grid. As Moran argues:

Electricity that is generated close to markets is more valuable than that which relies on long distance transmission. Transmission lines themselves are expensive and power is lost in the course of transmission. The delivered value of the product itself is reduced further when the supply justifies only a low capacity transmission line with consequent low scale economies and increased average losses in the transport process.<sup>5</sup>

Wind enthusiasts often emphasise the “free” input value of wind power, whilst neglecting the additional cost of getting that power to consumers. Wind power transportation costs can range from \$80 to \$1620/MW-km and storage costs from \$20 to \$800/kWh, according to the Chicago Policy Review.<sup>6</sup> Not only are these costs high, but the disparity is large - leaving the actual costs difficult to estimate.

It should be a red flag to policy makers that the potential costs of electricity transportation to the consumer cannot be accurately accounted for in wind power projects.

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<sup>4</sup> Thomas Tanton, “Assessing the Costs and Benefits of Renewable Portfolio Standards: A Guide for Policymakers”, *Reason Foundation*, Policy Study No.443, January 2015, [http://reason.org/files/renewable\\_portfolio\\_standards\\_costs\\_benefits.pdf](http://reason.org/files/renewable_portfolio_standards_costs_benefits.pdf)

<sup>5</sup> Alan Moran, ‘Wind Power and Other Renewables’, *Institute of Public Affairs*. Available at <http://www.ipa.org.au/library/amemretsub.pdf>

<sup>6</sup> Yu Xu, ‘The Cost of Wind Energy: Tradeoffs between Energy Storage and Transmission’, *Chicago Policy Review*, 27 May 2014. Available at <http://chicagopolicyreview.org/2014/05/27/the-cost-of-wind-energy-tradeoffs-between-energy-storage-and-transmission/>

## Subsidies are not the answer

A common argument from wind power proponents is that wind power will promote local jobs and innovation. However, as Dr Alan Moran argued in his 2006 Submission to the Victorian Government, jobs created for wind farms will cost between \$600,000 and \$1,000,000 per job, far outweighing the economic benefit that the creation of those jobs will bring:

The capital investment in wind energy would be significant. Current costs are estimated at \$1.6m per MW installed. On the basis of the government's target of 1000 MW of capacity by 2006, this translates into \$1.6 billion.

Job opportunities from wind are a prime motivator given by some parties in promoting the technology. No major offshore manufacturer has yet made a significant long-term investment in Australian production facilities. Investments made to date have been limited to lesser-skilled operations such as blade and nacelle manufacture and there have been multiple announcements of new facilities being opened in Asian markets. Thus we can comfortably assume that long-term jobs will be limited to maintenance. The 35-turbine Challicum Hills facility employs one full-time person and this can be used as a benchmark for long-term rural employment from turbines.

To achieve their 1,000MW target the government will need to provide financial support for a further 450 2 MW turbines. Assuming long-term regional employment of 1 person per 20 turbines this could result in 23 jobs. The effective cost of the subsidy per job per annum thus ranges between \$599,565 and \$999,782.

Short-term jobs are harder to calculate. Pacific Hydro in the construction of the 30-turbine Yambuk facility claims that 60 construction employees were used at the peak, comfortably translating into two per turbine. The 450 further turbines required to meet the 1,000 MW target would suggest 900 short-term (3 months?) jobs will result. Using the lower ongoing annual subsidy figure of \$137,970,000 this crudely translates into \$153,300 p.a. per job or a startling \$613,200 subsidy per job if one assumes a 3-month employment period.

Whatever the estimates of new jobs that are apparently created by subsidies, it is no longer seriously maintained in policy or economists' circles that any such jobs will eventuate in net terms. For decades, Australia sought to secure jobs through tariff protection on manufactures only to see rising unemployment and a mounting need of protection. The brutal facts are that a subsidy for one job means a tax on existing jobs. The net outcome is, at best, no effect on employment but a negative effect on competitiveness and overall wage and income levels. For this reason, Australia over the past 30 years has dismantled its industry assistance programs and has immensely benefited from this.<sup>7</sup>

When a particular industry claims subsidies are a necessity for its growth, it is a vindication that the particular business or industry is failing the test of basic economic efficiency, as Ray Harvey from the Mises Institute notes:

As with ethanol and recycling and a host of other issues, you must ask yourself again, *if these things are so efficient, why do they need to be subsidized?* Answer: they're not so efficient.

Energies that require massive subsidization benefit absolutely no one; the only reason they need to be subsidized is that they cannot compete on the open market.

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<sup>7</sup> Alan Moran, 'Regulatory Subsidies to Renewable Energy in Victoria', *Institute of Public Affairs*, Energy Issues Paper 40, February 2006.

That fact alone tells you everything you need to know about them: they're simply not good enough yet.

When they are, the free market will adopt them naturally.<sup>8</sup>

Harvey argued that the market will adapt to energy demand naturally. Robert L. Bradley Jr. discussed in a 1997 Cato Institute paper how, without subsidies, resources would not be allocated by decree, and therefore be efficiently allocated elsewhere in the economy – saving energy consumers money:

The high-cost propensity of wind power is a negative, not a positive, aspect of the industry. Prices reflect relative scarcity, and the price of wind-power energy is substantially higher than the price of electricity from other sources. Resources devoted to wind power are thus wasted in an economy where wants are greater than the resources available to meet them, and better alternatives are forgone. Without subsidies, less renewable energy infrastructure would have been built and consumers would have had lower cost electricity. The saved resources (land, labor, and capital) would have gone to a more competitive source of electricity or, more likely, given electricity-generation overcapacity, to a different endeavor entirely. Electricity consumers, in turn, would have incremental savings to spend elsewhere in the economy.<sup>9</sup>

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<sup>8</sup> Ray Harvey, "Wind or Nuclear?", *Mises Institute*, 8 July 2009, <http://mises.org/library/wind-or-nuclear>.

<sup>9</sup> Robert L. Bradley Jr, "Renewable Energy: Not Cheap, Not "Green"", *Cato Policy Analysis*, No. 280, 27 August 1997.

## Costs to households and businesses

A study conducted by the UK based Centre for Policy Studies found significant household costs from the implementation of bold renewable schemes. Additionally, as most renewable portfolios (in Europe especially) are wind-heavy, this places a large onus on proponents to prove wind power reduces costs:

In March 2008, the cost for the UK for meeting its 2020 target has been estimated in a government-commissioned report at between £4 billion a year and £5.4 billion a year until 2020.

This would imply a total cost of between £47 billion and £74 billion up to 2020 (with all costs discounted to 2006). With 24.7 million households in the UK, that is the equivalent to between £1,900 and £3,000 per household. By June, the Government is expected to announce that this figure will have risen to £100 billion. With wind power representing 89% of all renewable electricity in 2020, the great majority of this figure would be covering the cost of wind power.<sup>10</sup>

Dr Moran added to the commonly acknowledged effect of renewable portfolios on Australian household and business costs in the January 2014 *IPA Review*:

Wind generation costs are at least \$100 per megawatt hour (MWh), compared with less than \$40 for coal, the predominant electricity supply source. Wind also involves some increased network and back-up costs.

....

In raising the wholesale cost of electricity by 40 per cent, the effect of the legislated 45,000 GWh of subsidised renewable energy means a direct increase in households' electricity bills by about 12 per cent. Of course, the effect on living standards is far higher than this since the costs are incorporated in all goods and services. The price effect on major energy users is far greater than this—in some cases double the 12 per cent increase that households directly incur.

And for businesses, especially those with options of relocating overseas or in competition with foreign suppliers, even a minor increase in energy costs has massive repercussions. This is because business decisions are conditioned by profitable opportunities and risks. Profit is the residual after all other costs are met. If it comprises 10 per cent of sales value and if electricity costs are 6 per cent of total costs, a 20 per cent cost increase adds only 1.2 per cent to overall costs. But it also reduces profit by 12 per cent and, as evidenced by recent announcements to close or mothball aluminium smelter capacity, that is more than enough to dictate locational decisions.<sup>11</sup>

David W. Kreutzer, Ph.D., Karen Campbell, Ph.D., William W. Beach, Ben Lieberman and Nicolas Loris from the Heritage Foundation, found wind power to cost significantly more than conventional fuels in the United States:

The EIA levelized costs per megawatt hour are \$78.10 for conventional coal power, \$149.30 for onshore wind power, \$191.10 for offshore wind power, \$396.10 for photo-voltaic solar power,

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<sup>10</sup> Tony Lodge, "Why wind energy will not fill the UK's energy gap", *Centre For Policy Studies*, 2008, <http://www.cps.org.uk/files/reports/original/111104123249-windchill.pdf>

<sup>11</sup> Alan Moran, "The heavy cost of renewable energy requirements" *IPA Review*, Volume 65, p18-23.



\$256.60 for thermal solar power, and \$139.50 for power generated by natural-gas conventional turbines.

Even though the \$149.30 for the cheapest renewable power is already well above the cost of conventional power sources, it does not include any adjustment for reliability or additional transmission costs.

Wind cannot be turned on and off to match changes in demand. There are no feasible energy storage options for most wind farms. So, unlike power from conventional sources, wind power must be used when the wind is actually blowing.

Geography puts wind at another disadvantage. To keep the cost of wind power as low as possible, it is necessary to locate the wind farms in areas with the strongest and steadiest winds. As is the case with solar power, many of the best areas for wind power are located far from the major population centers. This requires construction of new, high-capacity transmission lines. A review of transmission costs suggests a median cost of \$15 per megawatt hour.<sup>12</sup>

The report added:

After making these adjustments for transmission costs and additional gas-turbine generation, the cost of an additional megawatt of onshore wind power is \$177 per hour. This is 126 percent above the cost of a megawatt of coal power per hour.

Put another way, the electric bill for a typical family of four would be \$189 per month if it was powered entirely by coal, but it would rise to \$340 per month if it was supplied entirely by onshore wind power.

Since onshore wind is the least expensive of the renewable electricity sources (ruling out conventional hydro and nuclear power), any plan that uses the more expensive renewable sources—such as offshore wind (\$218 per megawatt hour); thermal solar power (\$284 per megawatt hour); or photovoltaic solar power (\$423 per megawatt hour)— would have even greater costs. As the mandated renewable-fraction of electric power rises, so does the average cost of electricity.

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<sup>12</sup> David W. Kreutzer, Ph.D., Karen Campbell, Ph.D., William W. Beach, Ben Lieberman and Nicolas Loris, "A Renewable Electricity Standard: What It Will Really Cost Americans", *Heritage Foundation*, No. 10-03, May 5, 2010, <http://www.heritage.org/research/reports/2010/05/a-renewable-electricity-standard-what-it-will-really-cost-americans>

## Expanding the powers of the Clean Energy Regulator will hinder legal rights

The Clean Energy Regulator is the independent statutory authority that administers the Renewable Energy Climate Scheme, and is an instrumental agency established by the Gillard government in 2012. As IPA Senior Fellow Chris Berg wrote in 2011:

The climate body will be able to enter and search workplaces and compel people to provide self-incriminating evidence - a clear breach of the basic right to silence. Those powers are counter to the Western liberal legal tradition, which should provide protection against self-incrimination, and defend the sanctity of private property against state intrusion. But, that said, the Clean Energy Regulator's powers are not at all surprising. They're not even unusual.<sup>13</sup>

The CER is a perfect example of government engaging in “emergency measures” to broaden its powers. It becomes a natural tendency of government departments to expand, as Berg continues:

After all, does anybody believe the Clean Energy Regulator won't have its powers extended over time? Every regulator pesters Parliament to have its jurisdiction expanded, its funds increased, and its scope widened. This is the inexorable logic of the regulatory state.<sup>14</sup>

The powers that were granted to the administrative arms of Gillard's climate framework were well known at the time, as Greg Hunt noted whilst Shadow Minister for Climate Action, Environment and Heritage:

Provisions under the draft Carbon Tax laws on the powers of inspectors provide for an extraordinary breadth of powers for these inspectors. For any business which falls within the remit of the draft laws, these provisions effectively allow the government almost unfettered access to huge quantities of commercially sensitive information.

But if you think that sounds bad, it gets worse.

Once in the job, “inspectors” are then free to appoint anyone they like as deputy carbon cops. That's right, anyone.

The draft laws provide no guidelines or restrictions on who these people should be. This means that anyone, including the unqualified, the disreputable, the ill-intentioned, even business competitors, can enter another business premises so long as they are a deputised carbon cop.

Once inside, deputy carbon cops have the same sweeping powers the power to search anything they like, take copies of anything they like, photograph, record and examine anything they like, and insist on access to everywhere and everything in the business.<sup>15</sup>

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<sup>13</sup> Chris Berg, “Carbon cops’ destined to join mega-regulators club’ *The Drum*, 3 August 2011. Available at <http://www.abc.net.au/news/2011-08-03/berg---27carbon-cops27-set-to-join-mega-regulators-club/2821952>.

<sup>14</sup> Ibid, Chris Berg 2011

<sup>15</sup> Hon. Greg Hunt MP, “Real Power to go to Carbon Cops” *Herald Sun*, 22 August 2011, <http://greghunt.com.au/Media/OpinionPieces/tabid/88/articleType/ArticleView/articleId/1637/categoryId/4/Real-Power-to-go-to-Carbon-Cops.aspx>

## Conclusion

This submission focuses on four key arguments:

Wind power does not have a fixed supply variable; it therefore cannot be relied upon to consistently meet the fluctuating energy demands of modern developed economies. Backup gas-powered generators and electricity storage units are expensive, complex, and reinforce the overall unfeasibility of large wind power projects. Additionally, the transportation costs to supply the electricity to the grid are far greater than that of conventional fuels, due to the sparse nature of wind supply.

Subsidies of wind turbines should be wholly rejected. Intervention in energy markets creates friction between suppliers, grid management and consumers, which inevitably leads to the misallocation of resources, shortfalls in supply, and additional costs to households and businesses.

Reports that have studied the household burden of wind power in the UK, US and Australia, have all found that with increased shares of wind power, household costs increase. Wind power has a twofold effect on the public: Initial costs borne through the increase in retail electricity costs, and secondly the tax burden of subsidies to prop up and sustain the industry.

The Clean Energy Regulator is an arbitrary and illiberal administrative body, which is still carrying the torch from the costly, failed, Labor climate change legislation package. The powers of the CER defy the founding principles of Western legal systems, that persons must not be compelled so self-incriminate and that private property must not be compromised by state decree without reasonable evidence. Due to the expansive nature of independent statutory authorises, the committee ought to reject any calls to broaden the powers of the CER.

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