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Wind Generation and the South Australian Economy

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Director's Note

Welcome to the fifteenth issue of *Economic Issues*, a series published by the South Australian Centre for Economic Studies as part of its Corporate Membership Program. The scope of *Economic Issues* is intended to be broad, limited only to topical, applied economic issues of relevance to South Australia and Australia. Within this scope, the intention is to focus on key economic issues — public policy issues, economic trends, economic events — and present an authoritative, expert analysis which contributes to both public understanding and public debate. Papers will be published on a continuing basis, as topics present themselves and as resources allow.

The author of this paper is Stephen Nelson, Senior Research Economist, SA Centre for Economic Studies.

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Michael O'Neil
Director
SA Centre for Economic Studies
April 2005

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This scheme has seen the rapid growth of wind farm capacity in South Australia over the past 2 years. With an even greater number of licenses waiting to be approved, South Australia is set to lead the nation in installed wind farm capacity by 2007. This is mainly a consequence of the large amount of recorded wind data available to potential investors.

Various studies espouse the benefits of wind farms to this State in terms of investment and jobs created. But South Australia is already one of the 'cleanest' States in Australia in terms of carbon emission because a large amount of our electricity is generated using gas as the source of fuel.

While it cannot be denied that wind farms will bring about a reduction in carbon emissions, this needs to be balanced off against other, potentially less beneficial consequences such as, the impact on our existing electricity infrastructure, the effect on future investment levels, and the potential impact of higher energy prices on our industrial sector.

To a degree the danger exists in believing that wind farms (and other renewable energy sources) offer the only solution to reducing emission levels. In parallel we need other measures to reduce carbon emissions. In this context other State and Federal Government programs that target demand management and educate consumers to the effects of energy consumption remain important.

1. Introduction

Australians spend over \$50 billion on energy¹ every year with the demand for energy expected to increase by 50 per cent by the year 2020. This equates to an investment demand of \$37 billion to meet future energy needs. Energy is also the single largest contributor to global emissions of greenhouse gases. Australia is one of the world's largest greenhouse gas emitter per capita nations with annual emissions of 1.6 per cent but with a population of only 0.32 per cent, of respective world totals. Australia produces more greenhouse emissions than both Mexico and Brazil with populations of 105 million and 184 million respectively.

... Australia produces more greenhouse emissions than both Brazil and Mexico ...

The recent interest in renewable and sustainable energy in Australia has come about for a number of reasons. One of the main reasons is that

... the environmental costs of fossil fuels are rarely factored into their prices.

... Federal Government initiatives to reduce emissions include promoting wind farm investment.

of up to 1,000MW (or more if installed network capacity were capable) of electricity could be generated through the use of wind. This represents

The location of wind farms depends on three main factors:

... the main capital cost of a wind farm is the generators.

... the long run cost of operation for wind are almost double that of fossil fuel.

- The European Union has set a directive that the percentage of renewable electricity production be increased from 14 per cent in 1997 to 22.1 per cent in 2010;
- China has committed to a 10 per cent increase in renewable energy by 2010, and 12 per cent by 2020; and
- India has committed to a 10 per cent increase in capacity of new renewable energy by 2012.

Mainly as a consequence of hydro electricity generation, Australia

... Australia currently generates 10.5 per cent of its electricity from clean sources.

... electricity generation from clean sources is expected to increase to 12.5 per cent by 2010.

The Federal Government is currently considering these recommendations.

5. Wind Farms in Australia and Overseas

Wind farms are being built in Australia at a rapid pace, which follows the trend overseas. Denmark, Germany, Spain, the UK and the US all have a large number of operating wind farms. Germany, Spain and Denmark together account for 60 per cent of the world's total installed wind generation capacity. Table 1 below lists the top 10 countries in the world for installed generation capacity.

Table 1
Installed Wind Generation Capacity for 10 Leading Nations, 2004 and 2005

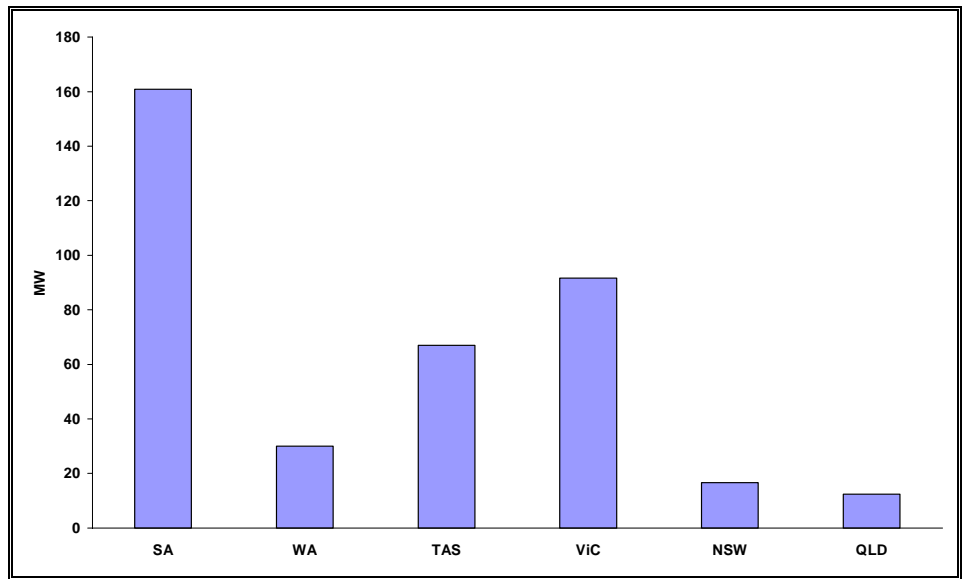
Rank	Country	Installed: Start 2004 (MW)	Installed: Start 2005 (MW)
1	Germany	14,609	16,626
2	Spain	6,202	8,263
3	North America	6,374	6,740
4	Denmark	3,110	3,117
5	India	2,110	2,800
6	Netherlands	912	1,078
7	UK	704	888
8	Japan	644	740
9	China	568	700
10	Austria	415	606
23	Australia	210	379
-	World	39,294	46,853

Source: New Zealand Wind Energy Association.

In Australia, the Australian Wind Energy Association lists Australia's installed capacity for wind generation at approximately 380 MW placing it about level with France and Ireland but below Portugal and Greece.

Figure 2 shows how much installed wind generation capacity exists by State and Territory as at March 2005.

Figure 2
Built Wind Farm Capacity - March 2005 by State



Source: Australian Wind Energy Association.

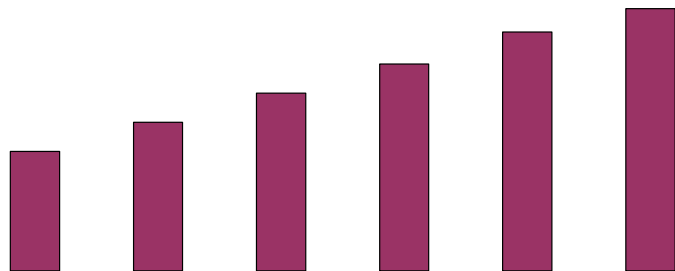
*... wind farms are included
in the National Electricity
Market.*

Table 2
Short Run Marginal Costs of National Electricity Market Generators in
South Australia

*... when operating, a wind
farm may displace a fossil
fuel generator.*

The displacement of Torrens Island A for wind generation will reduce carbon emissions, with estimates of between 0.49 – 0.52 million tonnes per annum for every 1MW reduction in gas generation. However, decreased fossil fuel outputs and the resultant increased variability of operation of gas generators in this State may affect the predicability and hence transport costs of gas deliveries through introduced complexities in scheduling of production and transport. Variability in generator operation may also have an effect on generator efficiency, which will negatively impact on the overall level of carbon emission savings.

Figure 3B
Generation: Electricity Price for a Half-Hour Interval
With Wind Farm Bid



7. Renewable Electricity Certificates and the Mandated Renewable Energy Targets

Government policy has stimulated investment in wind farms.

... electricity prices may increase as more wind farm output is used.

8. Wind Farms and Carbon Emissions

The Kyoto Protocol is the only international agreement that commits nations to control their greenhouse pollution. To date more than 140 nations have ratified. Only 2 developed countries - Australia and the USA have not. Australia has not signed the Kyoto Protocol due to the absence of emission commitments for developing countries under the Protocol which means that countries such as India and China, with almost half of the world's population are not required to reduce emission levels by 2012. Further, no internationally agreed global regime to contain emissions exists for the period after 2012, or is currently in prospect. Therefore the Federal Government has stated that it may be premature to commit to specific long-term targets that would affect our international competitiveness given our high dependence on coal as a source of generation, and would not greatly contribute to the reduction in global greenhouse gas levels.

Disagreement exists whether Australia is on target to meet its Kyoto protocols.

While Australia has not ratified the protocol it has declared its intention to meet Kyoto targets of 2008-2012 emission levels that are 8 per cent higher than 1990 levels.¹⁸ This will still require a cut of more than 30 per cent in our emissions growth from a 'business-as-usual' case.

In terms of current progress towards these emission targets, the Australian Greenhouse Office states:

“Australia is on track to achieve its target of limiting greenhouse emissions to 108 per cent of 1990 emissions over the period 2008-12, as agreed to at Kyoto”¹⁹ (p. 1).

In contrast, some academics and environmental groups have claimed that that it is only the so-called 'Australia Clause', (which allows Australia to claim pollution reductions from stopping land clearing) that is allowing

... calls have been made for environmental policy instruments to help reduce emissions.

supply and demand. They can make sense economically and environmentally because they tax the carbon externality directly depending on the level of emissions. Coal generates the greatest amount of carbon emissions and would therefore be taxed in greater proportion than oil and natural gas, which have lower carbon concentrations.

However, because Australia is an economy highly dependent on coal as a source of energy, there are many groups, including the Federal Government and the Coal Industry (a powerful Federal lobby group), opposed to carbon taxes. Critics of a carbon tax point to its potential negative impact on GDP with estimated reductions of about 0.8 per cent of GDP²⁰ and its regressive nature, with the longer-term burden likely to fall disproportionately on low-income households.²¹

Despite domestic opposition to a coal tax, we are also one of the world's largest coal exporting countries and as a consequence of the Kyoto Protocol becoming international law on February 16th 2005 attitudes towards Australia's energy exports, especially coal exports, may now change as other countries strive to *reduce* their emission levels *below*

“Australia will not impose significant new economy wide costs such as emission trading in its green house response at this stage. Such action is premature in the absence of effective longer-term global action on climate change” (p. 25).

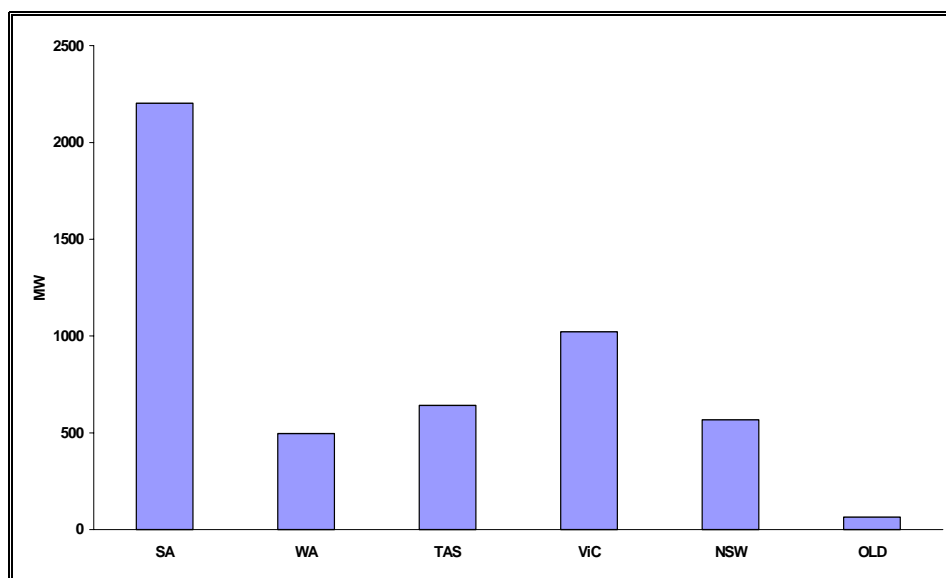
9. Outlook for Wind Farm Investment in South Australia

The Australian Wind Energy Association (AusWEA) and the Australian Business Council for Sustainable Energy estimate that the MRET target of 9,500 GWh requires a total of 1,400 MW of wind generation, Australia wide, by 2010.

Over the next couple of years, as the South Australia Government strives to meet its own 15 per cent renewable energy target, we are likely to see a large increase in the amount of installed wind farm capacity approaching that required to fulfill the current MRETs targets. However, we can expect this rapid growth phase to be exhausted by 2007, and future capacity to then be dependent on higher levels of policy support.

Indeed, as Figure 4 below shows, if all wind farms Australia-wide currently being 'proposed' or undertaking a 'feasibility study' were added to already installed capacity over the remainder of this decade, South Australia would have double the wind farm capacity by 2010 than any other State in Australia.

Figure 4
Installed 2004, plus Proposed: Wind Farm Capacity in Australia in 2001



Source: AusWea and SACES.

South Australia has the largest wind farm investment of any State.

Wind Farm capacity in South Australia of between 2,000 MW and 2,500 MW is unlikely to emerge, as it would not be supported by the current MRET targets, and the cost of connecting that level of capacity to the network would be prohibitive. Despite this, wind farms are still the 'flavour of the month' and with close to 400MW in place or under

construction, predictions from informed bodies such as, ElectraNet, and Energy SA see a potential of 800MW - 1,000MW of installed wind generation capacity within the next 2 years. In support of these estimates, Table 3, below, shows the number of licences issued for wind farms in

but also diversify our heavy reliance on gas which makes our State vulnerable to supply interruptions.

Critics of wind farms have pointed to the intermittent nature of wind and the need to have back up fuel generators. Although wind energy forecasting is never an exact science, forecasting has improved in recent years and the Federal Government is now providing \$14m to develop and install systems to provide accurate long term forecasts for wind output. As well, with wind farms being spread throughout the State the impact of reduced wind in one area has the potential to be offset by other areas. Finally, many local communities are still divided on the visual and environmental impact of the towers as highlighted by recent debates in State and local newspapers.

11. Impact of Wind Farms on South Australia's Existing Electricity Infrastructure

... the aggregate impact of wind farms is currently being investigated.

The Essential Services Commission of South Australia (ESCOSA) and the Electricity Supply Industry Planning Council (ESIPC) are currently investigating the aggregate impact of current wind farms and future applications on South Australia's electricity infrastructure. With a report due in March/April 2005 relating to maximum wind farm capacity the State's electricity infrastructure can handle, ESCOSA is currently delaying decisions on new licence application detailed in Table 3.

Perhaps as a precursor to this forthcoming report, in its Annual Planning Report of June 2004 ESIPC stated

“If the level of wind penetration was to increase [above 600MW] than the resultant change in market share between scheduled and non-scheduled generation could delay the development of more conventional new generation in the state” (p. 43).

Currently there are no new scheduled power station projects committed to go ahead in South Australia.

... wind farms may help ease the growth in peak-load demand in South Australia.

In this State, we have 3,450MW of 'name plate' electricity generation from fossil fuels of which about 3,140MW²⁷ can be made available on a hot summers day. With peak load demand currently growing at an average of 2.8 per cent per year (peak load under extreme conditions drives the need for future capacity) without additional investment, demand may outstrip supply by 2007-08.²⁸

In this context the sustainable level of wind farm capacity in South Australia becomes critical. While modelling on 3 levels (low, medium and high) of wind generation capacity by ESIPC²⁹ found that for all levels the:

“volumes of installed wind power ... were able to be accommodated [by the States' electricity infrastructure] without significant operational impact” (p. 4).

It also went further to say that:

Critics of wind farms point to their intermittent nature of operation, as wind is never guaranteed. In reality, with diversification of sites throughout the state, large amount of available wind forecasting data and increased accuracy in wind pattern predictions, the level of intermittency of wind farm input into the network is likely to be reduced. With the level of capacity of wind farms likely to be anywhere up to 1000Mw there is potential to have a substantial impact on South Australia's average daily usage of 1600Mw.

Wind generation will not replace fossil fuel generation, however, if we can balance the number of installed wind farms with the level the network infrastructure can support, without requiring large-scale upgrades or reducing the required level of conventional investment to meet expanding demand, then the State will have an electricity generation technology that has the potential to reduce our emissions and smooth our 'needle point' peak-load profile.

Over the past year, descriptions of wind farms have contrasted between the only solution to reducing our carbon emissions to environmental and ecological disasters. In reality the balance falls somewhere in between. Notwithstanding, it is important that South Australia continues to promote other measures aimed at reducing electricity demand and more efficiently managing our network infrastructure.

- ²¹ Most models of carbon tax incidence show that in the short run the burden of the tax will fall on capital stocks such as coal-fired power stations. In the longer run capital is mobile and distributional effects will result in a move out of these high taxed industries and a shift of the incidence of the tax onto consumers.
- ²² It may be significant that carbon prices fell by 25 per cent in the first 10 days of operating of the tradable permits market in Europe. This has been suggested as being a consequence of emission quotas being set too high.
- ²³ Sustainable Energy Authority of Victoria, *Policy and Planning Guidelines for*