

# **Any way the wind blows: Power generation in South Australia**

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## Introduction

South Australia leads the country in several aspects of renewable energy development. The state has the highest installed capacity of wind generation – more than 1,200 megawatts. In 2013-14, 37 per cent of electricity generated in the state came from wind and rooftop solar, more than any other state in the country.

South Australia's wind generation has a direct influence on wholesale electricity prices in the state. When wind generation is high, wind can satisfy the entire demand of the state and export a surplus to Victoria. Unfortunately, wholesale price savings are rarely passed on to retail consumers – retail prices in Adelaide have followed Australia-wide trends over the last ten years.

Relatively high retail electricity costs have contributed to South Australia having the highest rate of rooftop solar adoption in the country. More than 20 per cent of South Australian households now have installed solar systems.

A large expansion in wind generation is planned for South Australia – more than 3,000 megawatts are currently proposed, almost three times current capacity. This expansion is being placed in doubt by uncertainty relating to the federal government's Renewable Energy Target (RET).

The RET brings considerable economic benefit to South Australia. The state is the largest producer of the scheme's Renewable Energy Certificates (RECs), generating \$136 million worth of the certificates in 2013. This benefit to the state's economy is also placed at risk by uncertainty over the future of the RET.

The large increases in renewable energy generation in South Australia have resulted in decreased generation from coal and gas-fired generators. This shows that large increases in wind generation do not require increases in fossil fuel capacity as a 'back up' for when the wind does not blow, as is sometimes suggested by critics of renewable energy.

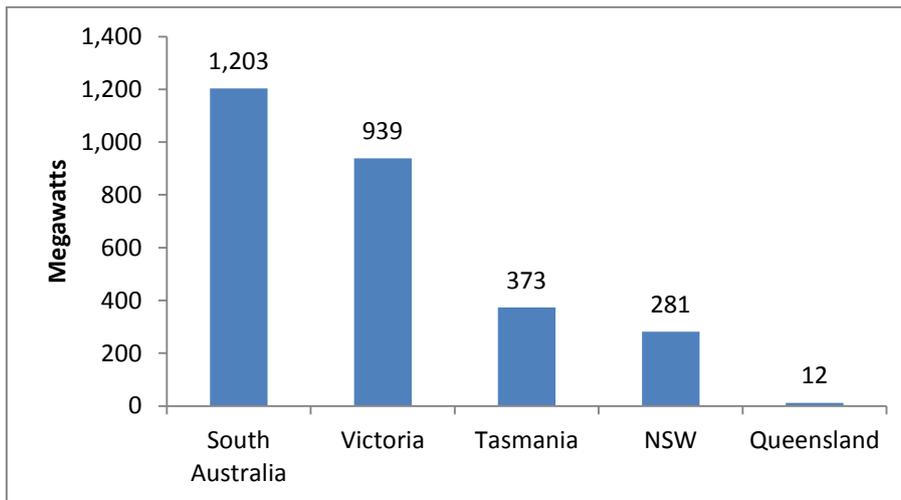
## Electricity in South Australia

South Australia leads the country in several aspects of renewable energy development. The state has the highest number of rooftop solar panels per household<sup>1</sup> as well as the most installed wind generation in the National Electricity Market (NEM), as shown in Figure 1 below:

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<sup>1</sup> (AEMO 2014b)

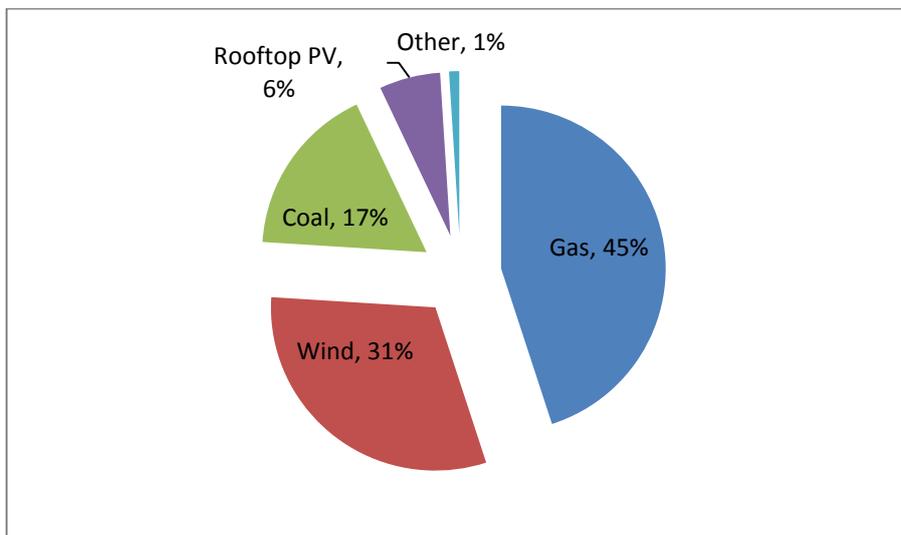
**Figure 1: Existing installed wind generation capacity**



Source: (AEMO 2014a)

This large amount of installed wind generation, combined with South Australia's relatively small part in the NEM, means it has the highest proportion of wind generation. In 2013-14 nearly a third of electricity generated in South Australia came from wind, as shown in Figure 2 below:

**Figure 2: South Australia electricity generation 2013-14**



Source: (AEMO 2014b)

When rooftop solar generation is included, the most recent figures show that South Australia generates around 40 per cent of its electricity from renewable sources.<sup>2</sup> So while the rest of Australia argues about 20 per cent by 2020, South Australia has achieved 40 per cent in 2014. This is expected to rise, with a new wind farm about to commence operation and others in the pipeline.

Other states have a far lower proportion of their electricity generated by wind. While Victoria has the second-highest installed capacity, this represents only two per cent of the state's

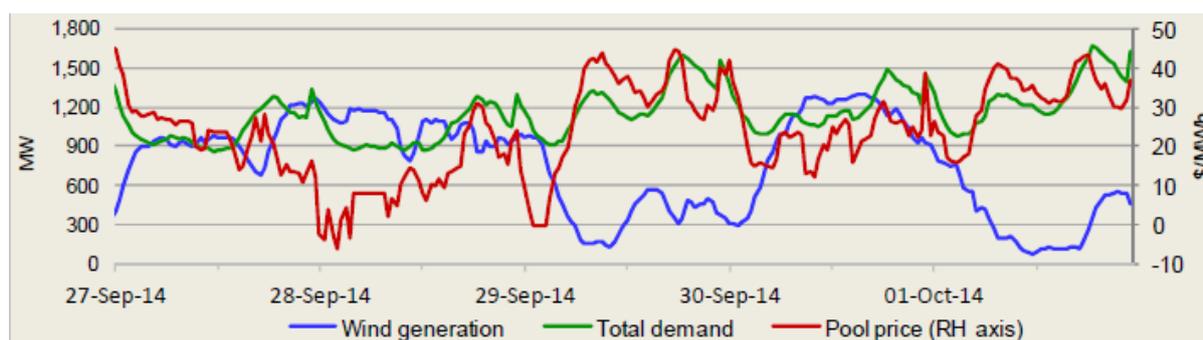
<sup>2</sup> (Vorrath 2014)

generation capacity. Tasmania has smaller overall generation capacity – 3,045MW – meaning its 373MW of installed wind makes up 12 per cent of capacity.

## Renewables and electricity prices

Because wind generation is such a significant part of South Australia’s electricity generation, wind generation has a significant impact on the wholesale price of electricity in the state. When wind conditions are good, more wind generation comes into the market, pushing down prices, as shown in Figure 3 below:

**Figure 3: Wind generation and wholesale electricity prices in South Australia September and October 2014**

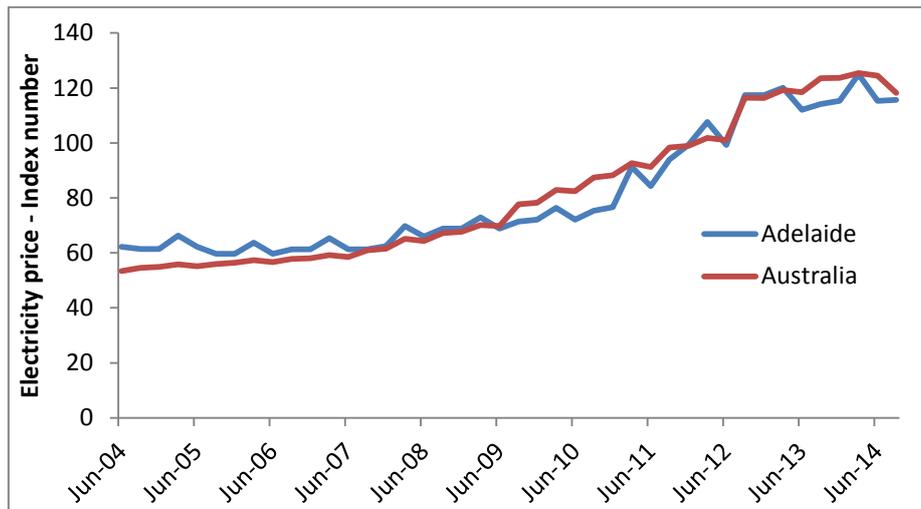


Source: (Pitt & Sherry 2014)

In Figure 3 the blue line shows the amount of wind generation in the South Australian part of the NEM. The red line shows the wholesale price. The two lines are inversely correlated – when wind generation is high, price is low and vice versa. The green line represents South Australian electricity demand. Figure 3 shows that for much of 28 September and part of 30 September this year, South Australia’s wind generation was greater than the state’s entire demand for electricity. When this occurs, the excess electricity is on-sold to Victoria through interconnecting parts of the NEM.

While wind energy is able to push down wholesale prices, not much of these savings seem to be passed on to South Australian retail consumers. Figure 4 below shows changes to electricity costs within the Consumer Price Index (CPI) as measured by the Australian Bureau of Statistics (ABS) for Adelaide and Australia as a whole.

**Figure 4: Electricity within the Consumer Price Index – Adelaide and Australia**



Source: ABS 2014 6401.0 - Consumer Price Index, Australia, Sep 2014

Figure 4 shows that prices paid by Adelaide retail electricity consumers have been similar to those in the rest of Australia. This reflects the differences between prices paid on the wholesale and retail electricity markets.

A University of New South Wales study<sup>3</sup> looked at the effects of wind generation from 2011 to 2013 and found that it lowered wholesale electricity prices by five to eight per cent. It also found that these cost savings were not passed onto households and small businesses.

Sinclair Knight Merz<sup>4</sup> studied the effect of renewable energy generation in South Australia and Victoria during heatwaves in 2014. They found that electricity prices were at least 20 per cent lower because of wind generation.

## Investment in renewables

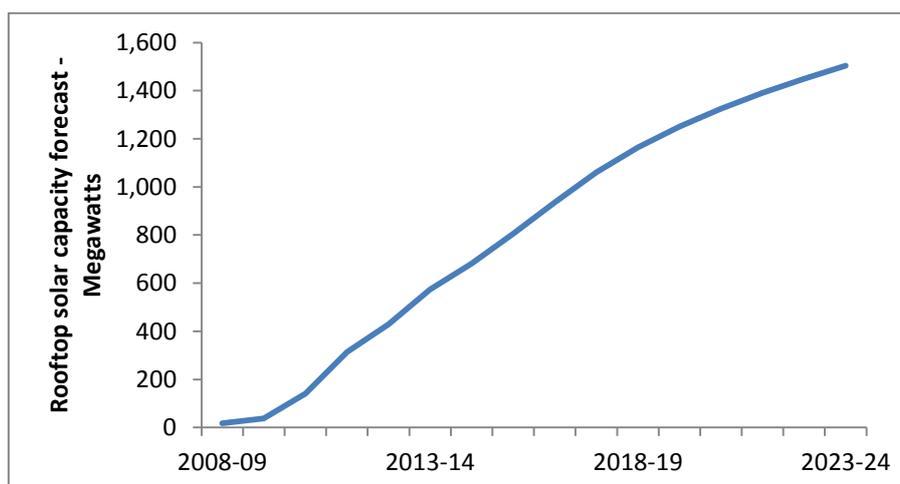
Relatively high retail prices in South Australia have contributed to households investing in rooftop solar systems. The state now has the highest penetration of solar in Australia, with 21.2 per cent of households and 548 MW installed.<sup>5</sup> The Australian Energy Market Operator (AEMO) predicts that the adoption of rooftop solar in South Australia will continue. Historical growth and AEMO's central estimate under a 'moderate uptake scenario' is shown in Figure 5 below:

<sup>3</sup> (Cludius et al 2014)

<sup>4</sup> (SKM 2014)

<sup>5</sup> (Parkinson 2014)

**Figure 5: AEMO forecast of rooftop solar capacity in South Australia**

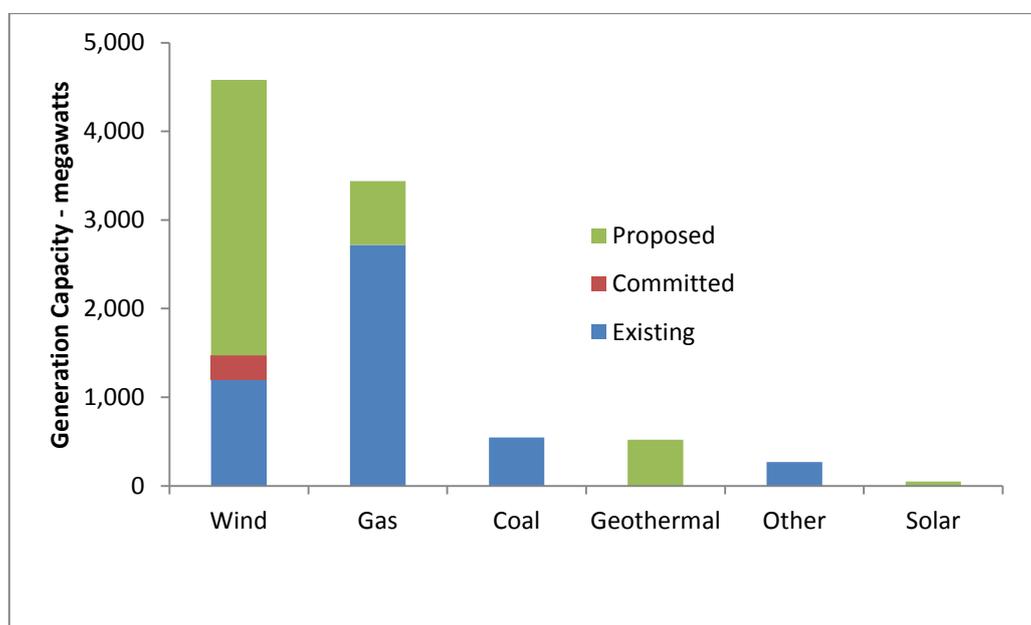


Source: (AEMO 2014b)

Figure 5 shows that the energy market operator expects rooftop solar installations to triple in South Australia over the coming decade.

South Australian wind generation is likely to continue to expand. The vast bulk of proposed and committed projects for further generation capacity in the state are wind projects, as shown in Figure 6 below:

**Figure 6: Existing, proposed and committed generation in South Australia**



Source: (AEMO 2014b)

With the RET being threatened by the federal government, investment in proposed renewable energy projects have been put on hold. This could dramatically reduce the amount of additional wind generation currently being proposed in South Australia.

This has the potential to reduce investment and jobs in a state hit hard by the recent contraction of manufacturing, including the announced closure of several car manufacturers.

South Australia is in a unique position to become a future electricity hub. If the proposed wind generation is built then South Australia could potentially export large amounts of electricity to Victoria.

In Figure 6, solar generation is very small in comparison to other forms of generation. This is because rooftop solar is excluded from AEMO's data in this chart. The project proposed in Figure 6 is for a solar thermal plant.

## Renewable Energy Certificates

Under the RET scheme, electricity retailers must purchase RECs from renewable energy generators. Because of its large wind energy sector, South Australia produces more RECs than any other state. In 2013 it produced 3.5 million RECs, worth \$136 million.<sup>6</sup> This excludes those RECs created by rooftop solar.

This figure – \$136 million – represents a significant benefit to the South Australian economy. It's a benefit that could grow if the uncertainty around the RET were resolved and the proposed renewable energy projects shown in Figure 6 able to proceed.

## Peaking power has not increased

One of the arguments made against renewable energy is that it is intermittent and cannot be relied upon. Large amounts of renewable electricity generation, it is argued, require large amounts of peaking capacity in case the wind doesn't blow and the sun doesn't shine. Peaking capacity refers to generation facilities that can quickly be turned on and off in response to changes in supply and demand. In South Australia this is provided by Open Cycle Gas Turbines (OCGT).

If the theory about renewable energy being heavily dependent on peaking capacity is true, South Australia should have seen an increase in the use of OCGT generation as renewable generation has increased. South Australia might also have seen an increase in OCGT generation capacity as new peaking plants needed to be built to cope with the increase in required electricity generation from peaking sources.

The evidence does not support this theory. South Australian OCGT generation capacity as a proportion of maximum historical demand has not changed from 2005-06 to 2012-13. It has stayed steady at about 25 per cent. At the same time wind generation has increased seven per cent to 27 per cent. Over this same period, OEGT generation has fallen from 501 GWh in 2005-06 to 321 GWh in 2012-13.<sup>7</sup>

This would seem to indicate that a large expansion of wind generation does not require an expansion of peaking capacity. It is also important to consider that the South Australian electricity grid is connected to Victoria, so it is possible that the peaking power was imported to South Australia from Victoria. Again the evidence does not support this. Since 2005-06, imports to South Australia from Victoria have fallen and exports to Victoria have increased.<sup>8</sup>

The evidence from South Australia shows that large increases in wind generation do not require increases in peaking capacity to 'back up' wind generation. In fact, in South Australia there appears to have been a drop in peak generation.

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<sup>6</sup> (Clean Energy Regulator 2014)

<sup>7</sup> (Osmond 2014)

<sup>8</sup> (Parkinson, 2014)

## Conclusion

South Australia leads the country in installation of large scale wind generation and rooftop solar. Renewable energy now generates almost 40 per cent of the state's electricity and contributes to lower wholesale prices. South Australia receives considerable economic benefit from existing renewable energy assets.

Further expansion of renewable energy in the state is forecast, particularly for rooftop solar and wind. Much of this investment in wind energy is currently being placed at risk by uncertainty about whether the federal government plans to dismantle the RET.

## References

- AEMO, 2014a. *Generation Information*, Available at: <http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information>
- AEMO, 2014b. *South Australian electricity report*, Available at: <http://www.aemo.com.au/Electricity/Planning/South-Australian-Advisory-Functions/South-Australian-Electricity-Report>.
- Clean Energy Regulator, 2014. REC Registry, Available at: <https://www.rec-registry.gov.au/rec-registry/app/public/lgc-register>
- Cludius J, Forrest S and MacGill I, 2014. *Distributional effects of the Australian Renewable Energy Target through Wholesale and Retail Electricity Price Impacts*, Available at: [http://ceem.unsw.edu.au/sites/default/files/documents/RET\\_Distribution\\_JEPO\\_forthcoming.pdf](http://ceem.unsw.edu.au/sites/default/files/documents/RET_Distribution_JEPO_forthcoming.pdf)
- Osmond D and Osborne L, 2014. *Peaking Capacity, CO<sub>2</sub>-e Emissions and Pricing in the South Australian Electricity Grid with High Wind Penetration 2005-2013*, Available at: [http://www.windlab.com/sites/default/files/South\\_Australian\\_Wind\\_Power\\_Study\\_2014\\_Windlab.pdf](http://www.windlab.com/sites/default/files/South_Australian_Wind_Power_Study_2014_Windlab.pdf)
- Parkinson, G. 2014, *Uptake of rooftop solar PV surges in South Australia in 2nd half 2013*, Available at: <http://reneweconomy.com.au/2014/uptake-of-rooftop-solar-pv-surges-in-south-australia-in-2nd-half-2013-2013>
- Pitt & Sherry, 2014. *Cedex - carbon emissions index*, Available at: [http://www.pittsh.com.au/assets/files/Cedex/CEDEX Electricity Update October 2014.pdf](http://www.pittsh.com.au/assets/files/Cedex/CEDEX_Electricity_Update_October_2014.pdf).
- SKM, 2014. *Impact of Wind Generation on Spot Prices in Victoria and South Australia*, Available at: <http://blog.powershop.com.au/wp-content/uploads/2014/02/SKM-2014-02-SKM-MMA-Heatwave-Report-final.pdf>
- Vorrath, S. 2014, *South Australia's 270MW Snowtown takes wind energy to new highs*, Available at: <http://reneweconomy.com.au/2014/south-australias-270mw-snowtown-takes-wind-energy-to-new-highs-43971>