# cedex®

## CARBON EMISSIONS INDEX PLUS

*Providing a comprehensive and early indication of key greenhouse gas and energy trends in Australia.*

National Electricity Market update, data to December 2015.

PRESENTED BY

pitt&sherry

The Australia Institute
Research that matters.

pitt&sherry
The Australia Institute
Research that matters.
cedex® CARBON EMISSIONS INDEX PLUS

*cedex® provides an early indication of key greenhouse gas emission trends in Australia.*
*Full reports available at www.pittsh.com.au/cedex and http://www.tai.org.au/*

## Introduction

This *CEDEX® Electricity Update* contains data for emissions from electricity generation in the National Electricity Market (NEM) up to the end of December 2015. All emissions data are reported as annual moving averages. This approach removes the impact on the reported data of seasonal changes, which particularly influence electricity and gas. Annualised data reported in CEDEX® will show a month on month increase if the most recent monthly quantity is greater than the quantity in the corresponding month one year previously.

## Electricity emissions update - data to 31 December 2015

### Emissions and demand continue to climb.

#### Key points

The year to December saw continued growth in total electricity generated in the NEM and also a modest increase in total emissions.

The total coal share of generation fell very slightly, with a small increase in black coal offset by a fall in brown coal; the small emissions increase was cause by increased supply from some of the less efficient black coal stations.

For the first time since 2010, total electricity demand in the year to December was higher than in the year to November in every NEM state. There was also an increase in WA in November, compared with October.

There was a particularly large (relative) demand increase in SA, caused by the two spells of very hot weather in that state during December 2015. By contrast, the state experienced mild summer conditions throughout December 2014. This issue of *CEDEX® Electricity Update* concludes with a detailed analysis of electricity supply and demand in SA during the heatwave week of 14 to 20 December 2015.

The analysis leads to two important conclusions:

- Rooftop solar PV installations in the state made a valuable contribution to meeting both peak demand for electricity and the increased total daily demand for electrical energy during the heatwave period, and
- The size of the increased demand for electrical energy during the heatwave (70% above the same period in 2014) suggests that increasing the energy efficiency of buildings, air conditioning and refrigeration systems should be a high priority of the recently announced National Energy Productivity Plan.

#### Generation

Total electricity generation in the NEM in the year to December 2015 continued the growth seen now for nearly a year. Emissions also recorded a modest increase, but the total coal share of generation decreased slightly (Figure 1), as a small increase in black coal generation was offset by a slightly larger, though still small fall in brown coal generation. The total coal share of generation (excluding rooftop solar) in the year to December 2015 was 75.9%. The gas share of generation fell to 11.2%, the lowest level since July 2010, while wind generation was almost unchanged, at 11.2%. The hydro share showed a small increase, from just under to just over 5.6%, with small additions to output from both Hydro Tasmania and Snowy Hydro. Tasmania, however, is now facing a significant challenge, as energy storage levels fell to below 24% at the end of December, as a consequence of an abnormally dry winter. In addition, Basslink, which at times over recent months was providing nearly half the electricity consumed in Tasmania, has been out of action since 22 December. We plan to look more closely at electricity supply and demand in Tasmania in the February 2016 *Electricity Update.*

pitt&sherry

The Australia Institute
Research that matters.

cedex® CARBON EMISSIONS INDEX PLUS

*cedex® provides an early indication of key greenhouse gas emission trends in Australia.*
*Full reports available at www.pittsh.com.au/cedex and http://www.tai.org.au/*

**FIGURE 1**

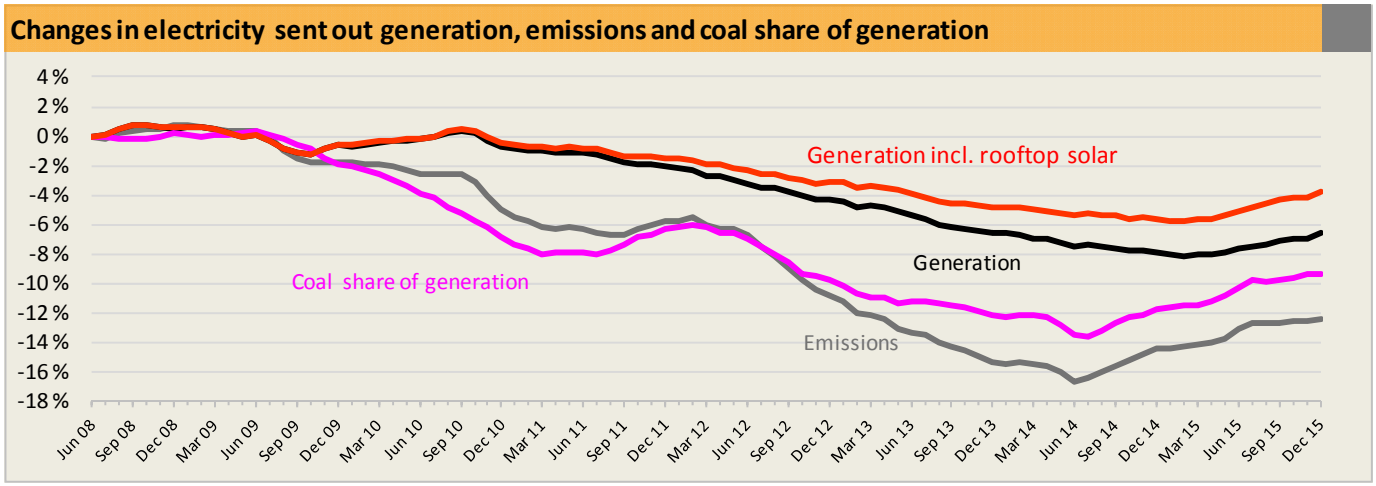



**FIGURE 2**

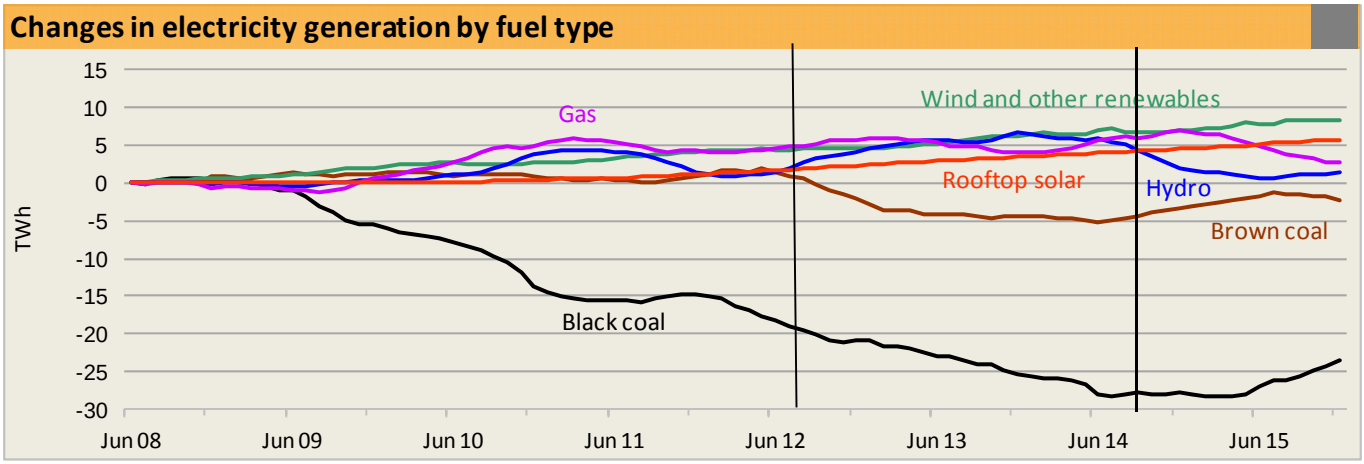



**FIGURE 3**

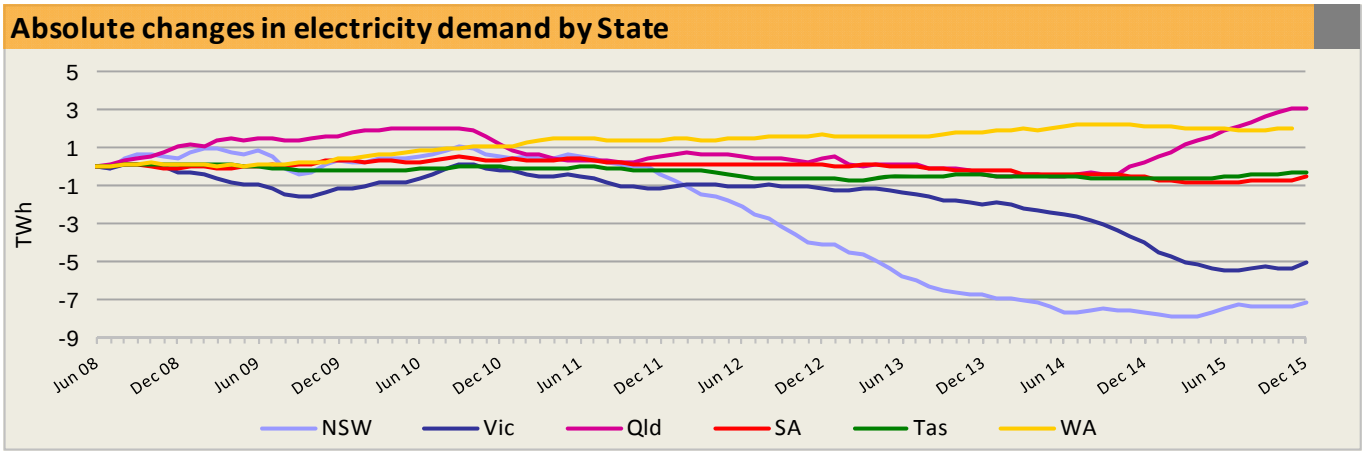
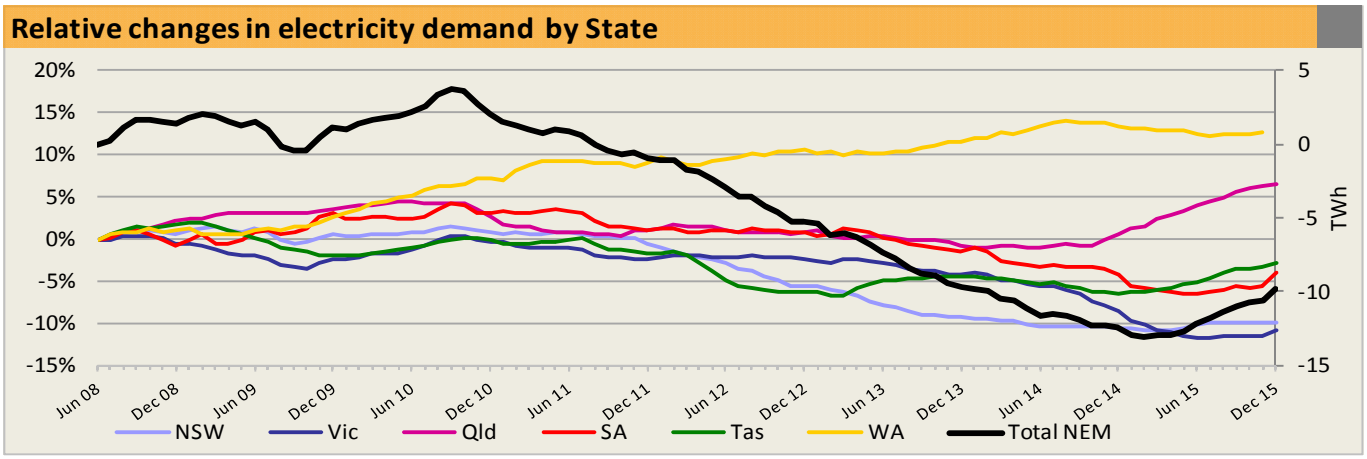


**FIGURE 4**




**Demand**

In the year to December 2015, electricity demand increased in the NEM as a whole and in every individual state, and also in WA for the year to November 2015 (Figures 3 and 4), the first time such a conjunction of demand increases has been seen since 2010. Queensland led the way as it has for some months. With all three LNG plants now operational, steady demand growth should continue in that state for several years.

The very sharp increase in relative demand in SA in December provides a particularly striking illustration of the effect of demand for air conditioning and refrigeration on electricity demand in that state. In the month as a whole, total demand for electricity (excluding supply from rooftop PV) was 20% higher than in the whole of December 2014. There were two heatwaves in SA during December 2015. The first, running from 4 to 7 December saw maximum temperatures in Adelaide over 30 degrees on 4 and 7 December and over 40 degrees on 5 and 6 December. The second heatwave ran for seven days, from Sunday 13 December to Saturday 19 December. The maximum temperature in Adelaide was above 30 degrees on the first day, above 35 degrees on the next two days, and above 40 degrees on the remaining four days. By contrast, in December 2014 there were no heatwaves, and only two days with maximum temperatures above 35 degrees.

Comparing SA region electricity demand over this period with the corresponding period in 2014 (Sunday 14 December to Saturday 20 December) shows the massive effect of higher temperature on demand for electricity, in terms of both total daily energy demand and daily peak demand (Figure 5). On the Wednesday, Thursday and Friday of the week, maximum temperatures were above 40 degrees in 2015 but below 25 degrees in 2014. On the Saturday the maximum rose to 30.3 degrees in 2014, while it was 43.2 degrees in 2015. It can be seen that maximum temperatures above 40 degrees almost double peak system demand in SA, compared with days having maxima below 25 degrees. Moreover, the heatwave conditions resulted in total electrical energy consumption over the four hottest days (Wednesday to Saturday) which was 69% higher than over the corresponding four days in 2014. Note that on the last day in the graph (Sunday 20th in 2015 and 21st in 2014), the maximum temperature in Adelaide was 23.5 degrees in 2015, but 36.1 degrees in 2014 (the hottest day in the whole month).

The data graphed in Figure 5 exclude the contribution of rooftop PV to total demand for electricity in SA. Data provided for CEDEX® by the Australian Photovoltaic Institute (APVI) indicate that on the hottest day (Thursday 17 December), maximum demand including rooftop PV occurred at 16.00 local time (16.30 NEM time), at which time

PV contributed 10.5% of the total. System peak, i.e. excluding the contribution of rooftop PV, occurred over two hours later, at 18.15 local time; PV was still contributing 5.0% of total demand at this time.

However, the difference between maximum demand, including the PV contribution, at 16.00 and system peak, excluding PV, at 18.15, is the more appropriate measure of the contribution of rooftop PV to peak demand, and this is 6.5%. In other words, rooftop PV reduced peak demand in the SA region by 6.5% below what it would have been in the absence of PV. This has obvious implications for demands placed on the generation and transmission system on heatwave days. It is relevant to note that the contribution of PV at this time of the year, almost precisely coinciding with the summer solstice, is larger than it would be during a heatwave occurring in late summer. Taken together, these observations suggest that, as others have pointed out, providing incentives for rooftop PV to be installed with a more westerly orientation may provide economic benefits to the electricity system as a whole.

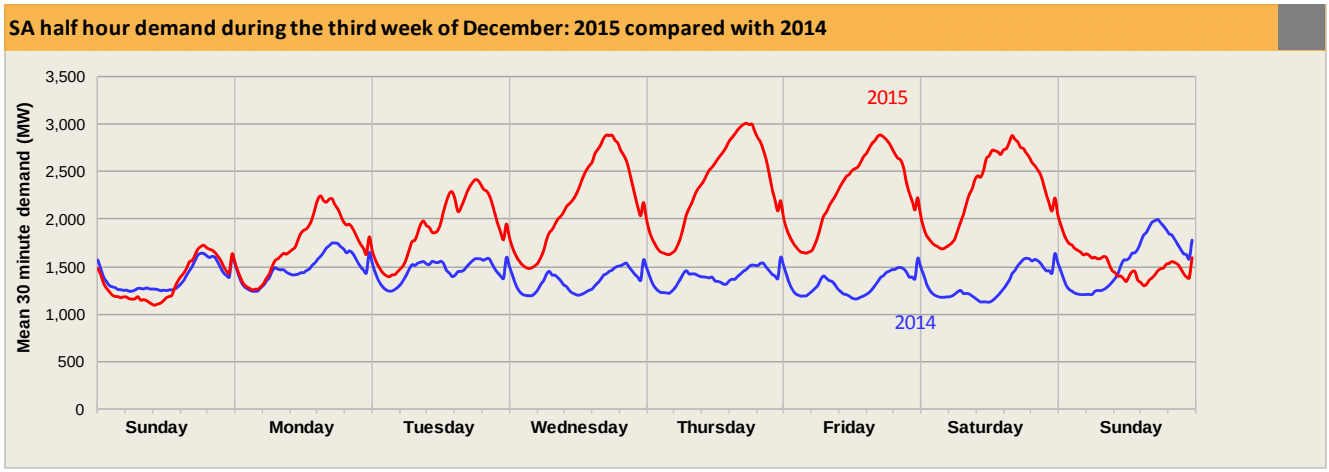
System electrical energy over the whole of the four days, Wednesday to Saturday, with maximum temperatures above 40 degrees, was supplied from the following sources: gas 46%, local coal 21%, wind 19%, imports from Victoria 14%. The high demand during the hot daylight hours was mainly supplied by AGL's ageing Torrens Island A and B gas burning steam power stations. Significantly, AGL announced just over a year ago that it would mothball the 480 MW Torrens Island A station, but keep the 800 MW Torrens Island B station in operation. In mid-2015, Alinta, the owner of the 530 MW Northern power station, SA's only coal fired station, that it would close the station, and its associated coal mine by early 2018.

Rooftop PV also made a useful contribution to total energy, in addition to its contribution to lessening peak demand. APVI data show that energy consumption over the four hottest days was 5.4% higher than system consumption over this period. When the contribution of rooftop PV is included, the shares of the various supply sources become: gas 43.2%, local coal 20.2%, wind 18.5%, imports 12.8%, and rooftop solar 5.1%.

It is interesting to note in Figure 5 that the effect of rooftop PV in reducing system demand during the middle of the day can be clearly seen in the 2014 data, whereas in 2015 this effect is apparently swamped by the surging demand for cooling. (The small demand spikes occurring at midnight on every day are caused by the simultaneous switching on of off-peak electric water heaters.)

It is hard to avoid the conclusion that the enormous increase in electrical energy consumption on very hot days could be reduced, with considerable economic benefits, by improved energy use efficiency. Specifically, improving the design, construction and operation of both commercial and residential buildings, air conditioning and refrigeration systems should be a priority of the recently announced National Energy Productivity Plan. Also as noted, continued or enhanced support for solar energy installations, including those with more westerly orientations, would further reduce system costs.

**FIGURE 5**




Data analysis, text and graphs: Hugh Saddler, Elena Tinch and Mark Johnston.