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National Electricity Market update, data to April 2016.

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Introduction

This *CEDEX® Electricity Update* contains data for emissions from electricity generation in the National Electricity Market (NEM) up to the end of April 2016. 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 30 April 2016

Emissions and demand continue to climb

Key points

The year to March 2016 saw increases in electricity demand, electricity generation and emissions from generation in the NEM. This continued the general pattern of the past seventeen months.

Total electricity demand increased for the fourteenth successive month in the NEM and the eighth successive month in WA. There can be little doubt that the period of falling demand for electricity across Australia has now ended. Total annual demand in the NEM is now 2.8% higher than the low point recorded in the year to February 2015. Sustained demand growth at this sort of rate was considered normal in the electricity industry up to about 2004, but until now had not been seen since then.

Total emissions from electricity generation in the NEM increased again in the year to April 2016. Annual emissions were 5.7% higher than in the year to June 2014.

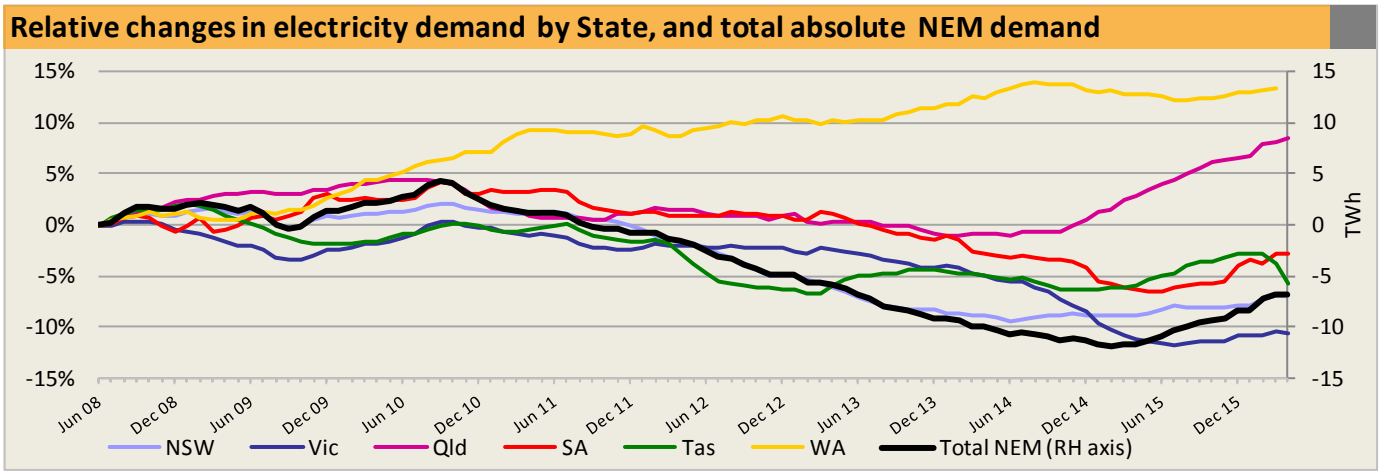
Total coal generation was 76.2%, compared with a minimum of 72.3% in the year to July 2014. Gas generation recorded another small reduction, to 10.6%, notwithstanding an increase in Tasmania to meet the supply shortfall caused by the failure of Basslink. Total renewable generation was 13.1%.

This issue of *CEDEX® Electricity Update* concludes with an examination of the rooftop solar contribution to the total supply of electricity to consumers. Other small renewable generation sources are also considered. When these individually small sources are included alongside large scale renewable, such as wind farms and hydro, the renewable share of total supply increases to 16.4% for the NEM as a whole. It is much higher in South Australia and also, of course, Tasmania.

Demand

Total demand in the year to April 2016 in Australia's two main electricity systems, the NEM and the WA South West Interconnected System (SWIS), continued the trends reported in the last few issues of *CEDEX® Electricity Update.* Demand increased in the NEM as a whole and the SWIS. Among individual NEM regions (states) the main exception was Tasmania, where demand reductions by major industrial consumers form part of the response to the supply crisis (Figure 1). The major driver of demand growth overall is growing electricity consumption in the Queensland coal seam gas fields. However, it is most important to appreciate that demand is also growing everywhere else, just not so fast.

FIGURE 1



In each of the other four NEM states the change from decreasing to increasing demand appears to have happened around March 2015. From then until April 2016, annual demand has increased by 2.2% in NSW and 3.2% in SA. In Tasmania, had demand stayed at the level recorded in the year to last December, just before the Basslink failure, the increase would have been 3.1%; had demand growth continued at the sort of rate recorded in the months prior to last December, the increase would have been even larger. Victoria appears to be the exception, but only when the progressive effect on moving annual demand levels of the Point Henry aluminium smelter closure in July 2014 is ignored. The smelter consumed about 0.25 TWh per month, meaning that annual demand recorded by *CEDEX®* up to June 2015 is reduced by this amount each month. Adjusting for this effect reveals that all other Victorian electricity consumers increased their annual demand between March 2015 and April 2016 by 2.5%, i.e. more than NSW but less than SA and Tasmania. In WA the increases in annual demand did not start until August 2015 and have totalled 1.0% in the seven months to March 2016.

Some of this increase may be weather related. For example large demand increases were recorded in December 2015 in both Victoria and SA, and both states recorded much hotter weather in December 2015 than in December 2014. In NSW bursts of abnormally hot weather were experienced in February and March this year, as discussed in the last *CEDEX® Electricity Update*, and particularly large demand increases occurred in those months. But weather alone cannot explain the increases in most other months.

Generation and emissions

As with demand, generation and emissions in the year to April 2016 showed a continuation of the trends seen in the previous month. Emissions from electricity generation in the NEM increased again, to be 5.7% higher than in the year to June 2014 (Figure 2). Strong growth in black coal generation in Queensland, to meet surging demand, more than offset a fall in Victorian brown coal generation with the continuing absence of exports to Tasmania (Figure 3). As noted in previous issues, when Basslink is eventually restored, a sharp increase in brown coal generation is certain. The total share of coal generation in the NEM for the year was 76.2%, up from 72.3% in the year to July 2014. Queensland also continues to drive the overall decline in gas generation, though in SA, NSW and Victoria it is flat or slightly increasing. The emergency situation in Tasmania has of course seen a sharp increase in gas generation there. The total share of gas generation was 10.6% in the year to April 2016, the lowest share since June 2010. Hydro generation was roughly constant, with small falls in Tasmania and Victoria and an increase in NSW. Wind generation stagnated, as the prolonged spells of warm, calm weather experienced across south east Australia in March continued into April.

FIGURE 2

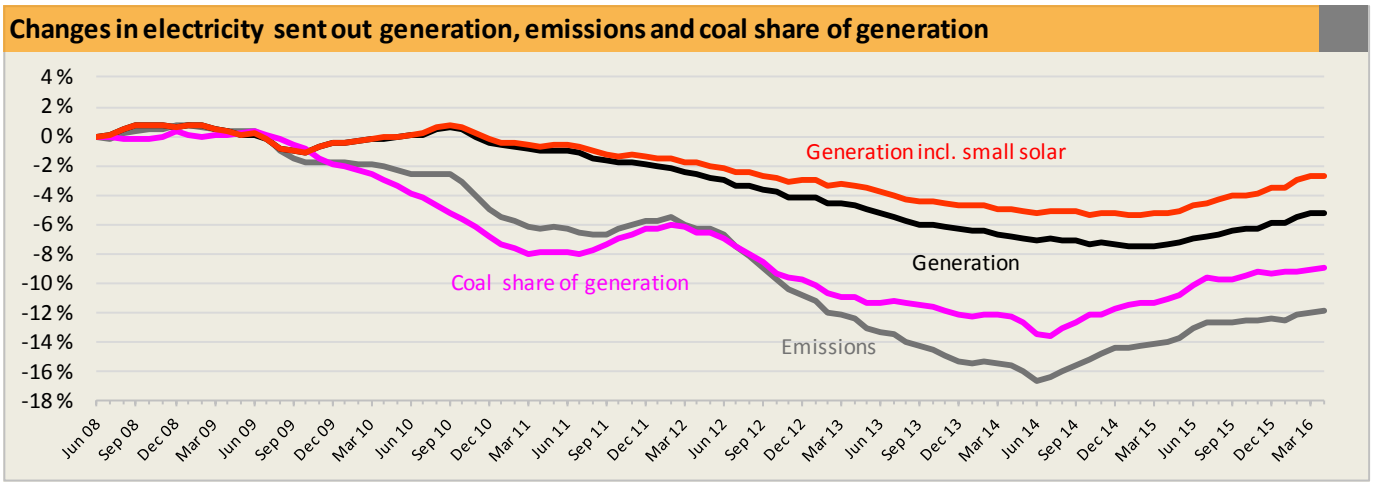
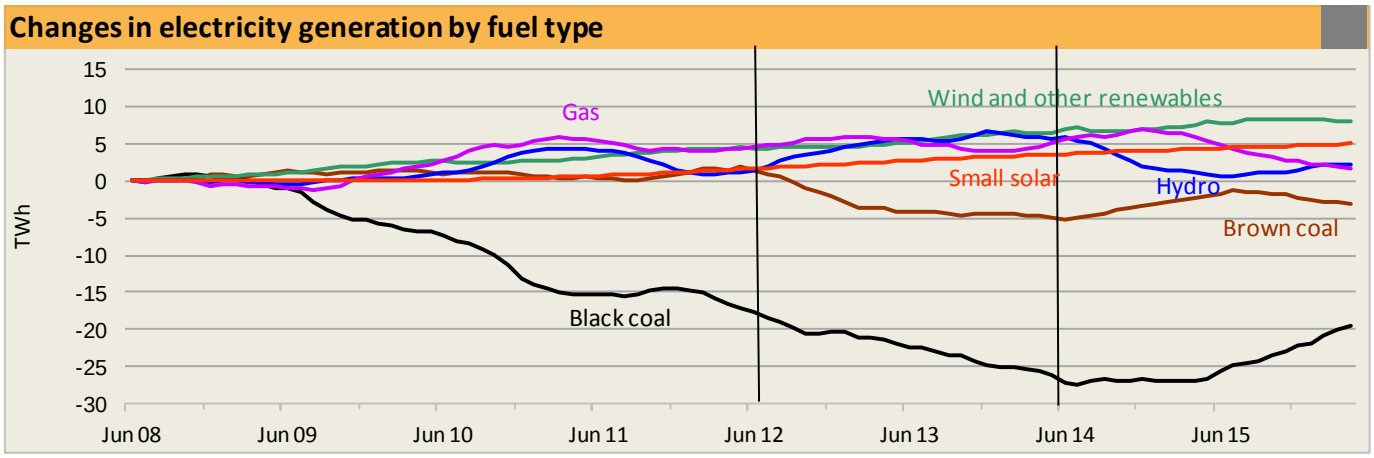


FIGURE 3



A closer look at solar and other small renewable generation

The April 2016 issue of *CEDEX® Electricity Update* reported on the three large new solar farms in NSW – Nyngan, Broken Hill and Moree. In the year to April their combined total output was 0.32 TWh; when all three have been operational for a year this should rise to about 0.5 TWh. In common with all generators with capacity of 30 MW or more, they are required to participate in the NEM. Also, in common with all large wind farms, they are classified by AEMO as semi-scheduled generators. This means that "AEMO can limit a semi-scheduled generator's output in response to network constraints, but at other times the generator can supply up to its maximum registered capacity [which it normally does]". AEMO's electricity system operation procedures are able to categorise wind and solar generators in this way because of their ability to make quite accurate forecasts of the output from these generators a day ahead, thanks to great improvements in short term wind and cloud forecasting methods. Output from these three solar generators is included in total NEM generation (the black line) in Figure 2 and is included with Wind and other renewable (the green line) in Figure3.

Much larger quantities of electricity are generated by small scale or rooftop solar embedded within distribution networks and thus, by definition, not participating in the NEM. Since last July the Australian Photovoltaic institute (APVI) has been providing *CEDEX*® with total monthly output (in GWh) from all these small systems, by state, starting from April 2015. These data cover all systems eligible to participate in the Small Renewable Energy Scheme, which means not only the small, residential scale systems, but also larger, commercial building scale systems up to 100 kW. The sum of these APVI figures has been combined with estimates for earlier years, prepared from other data sources, to produce the red lines in Figures 2 and 3.

All these small systems are embedded within distribution networks. To properly assess the contribution they make to total electricity supply, relative to large generators, it is necessary to adjust the quantity of generation sent out from large generators participating in the NEM by subtracting energy lost in the transmission system. AEMO publishes transmission losses on an annual basis and in recent years these have averaged about 2.6% of electricity sent out from NEM power stations. Applying this percentage to the *CEDEX*® estimate of 185.9 TWh sent out in the year to April 2016, gives a figure of 181.1 TWh as the quantity of electricity supplied by NEM generators to distribution networks across the NEM (together with a handful of very large users directly connected to transmission networks).

Small solar systems supplied 5.0 TWh in the year to April 2016. Electricity is also supplied directly into distribution networks by a variety of other small generators, including landfill gas, small hydro, bagasse fuelled cogeneration at sugar mills, some small windfarms and some small diesel and gas fuelled generators, all having capacity of less than 30 MW. AEMO uses the collective term Small Non-Scheduled Generators (SNSGs) for these plants. It estimates that they supplied 4.4 TWh across the NEM in 2014-15, some but not all of which was renewable. The great majority of the renewable generators in this category are registered as generators under the Large Renewable Energy Target, meaning that certificates registered under that program, and reported in the REC Registry, provide a means to estimate the total quantity of renewable electricity supplied. REC Registry data are reported on a calendar year basis. Total generation, excluding LRET eligible output by large wind, hydro and bagasse generators participating in the NEM, was 2.5 TWh in 2015. It is likely that some certificates earned by generation during 2015 have yet to be registered, meaning that this is probably a small under-estimate of total renewable generation. Ignoring this possibility, and using the calendar year 2015 total as the total for the year to April 2016, the total electricity supply mix in the NEM states is as shown in the table over the page.

These data show that, when account is taken of electricity supplied by small embedded generators, the share of renewables in total supply is appreciably higher than when only large NEM generation is considered: renewables supply 13.1% of electricity sent out by NEM generators but 16.4% of total electricity available to consumers. For South Australia, which has the largest amount of “new” renewable generation (renewable generation excluding legacy hydro generation), in both relative and absolute terms, the renewable share is much larger. Including net imports of brown coal generated electricity through the interconnectors with Victoria, the renewable share in NEM generation supplied to South Australia is 29.5% and the total share available to consumers is 35.3%. Small scale solar accounts for most of this difference, supplying 5.6% of total electricity in the year to April 2016. Large (NEM participant) wind generators supplied 29.5%.

ELECTRICITY SUPPLIED TO DISTRIBUTION NETWORKS IN THE NEM, BY SOURCE, YEAR ENDING APRIL 2016

			Electricity supplied (TWh)	Shares of total
Fossil fuel	NEM generators	Coal	138.0	72.5%
		Gas	19.2	10.1%
	Small generators	Fossil fuel various	1.9	1.0%
	Total fossil fuel		159.2	83.6%
Renewable	NEM generators		23.7	12.5%
	Small (rooftop) solar		5.0	2.6%
	Other small generators		2.5	1.3%
	Total renewable		30.7	16.4%

Patterns in so-called "behind the meter" consumption are also interesting. This term refers to electricity which is both generated and consumed on the premises of an electricity consumer, without ever passing through the electricity distribution network. It includes the majority of electricity produced by (typically natural gas fuelled) co/tri-generation facilities, which is not included in the data set out above. But it also includes some of the electricity produced by small solar PV installations. This behind the meter consumption is included in the figures for small solar generation, because these figures are total solar generation. Lack of data precludes reliable estimation of the share of behind the meter consumption of solar generation. The share is very strongly influenced by the policies and attitudes of the electricity distribution and retailer electricity supply industry businesses. Present arrangements for most consumers make exporting surplus solar generation very financially unattractive, compared with behind the meter consumption. Most estimates put the current share of behind the meter consumption at below 50%. However, the volume of exports from residential solar installations is largely a legacy of the diverse array of feed in tariff schemes introduced by state governments in past years. The general expectation is that, as these arrangements come to an end and, particularly, as larger installations on commercial buildings account for a growing share of new solar installations, behind the meter consumption will account for a steadily growing share of total small scale solar generation.

The overall conclusion is that, while the above figures are the best that can be prepared from available data they slightly overstate (by perhaps around 2 TWh) the quantity of electricity supplied through distribution networks. They also exclude electricity which consumers produce and consume on-site using gas fuelled co/tri-generation installations. That said, it is important to understand that the changes over time in these figures (as opposed to the total size) are much too small to explain the changes in demand for NEM generation discussed earlier in the *Electricity Update*. Rising demand is reflecting real change in the quantities of electricity used by consumers.

Data analysis, text and graphs: Hugh Saddler.