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NATIONAL ENERGY EMISSIONS AUDIT

National Energy Emissions Audit
Electricity Update

March 2018

Providing a comprehensive, up-to-date indication of key electricity trends in Australia

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Introduction

Welcome to the march 2018 issue of the *NEEA Electricity Update*, the companion publication to the *National Energy Emissions Audit Report*, for which there is also a March 2018 issue The *Electricity Update* presents data on electricity demand, electricity supply, and electricity generation emissions in the National Electricity Market (NEM). This month's issue covers data to the end of February 2018.

Each issue of *Electricity Update* contains a more detailed discussion of one or two particular issues relating to the electricity system.

In this issue, we discuss trends in emissions from electricity generation , and provide the results of some modelling on possible future emissions and renewable generation shares, between now and 2030.

Key points

+ ***Electricity generation emissions in the NEM fell again***

February 2018 was the ninth successive month in which annual emissions from NEM electricity generation decreased.

+ ***NEM electricity consumption keeps going down***

Annual electricity consumption continues its gradual decline in the NEM as a whole, and in Western Australia.

+ ***The National Energy Guarantee (NEG) is not needed for its emissions reduction target for the NEM to be achieved***

Modelling shows that if Victoria achieves its VRET target by 2025, emissions will by then already be below the reduction target of 26% below 2005 levels it has set for 2030. If Queensland also achieves its QRET target by 2030, the reduction could be as much as 36% below 2005 levels. The NEG target would therefore inhibit, rather than boost investment in new renewable electricity generation.

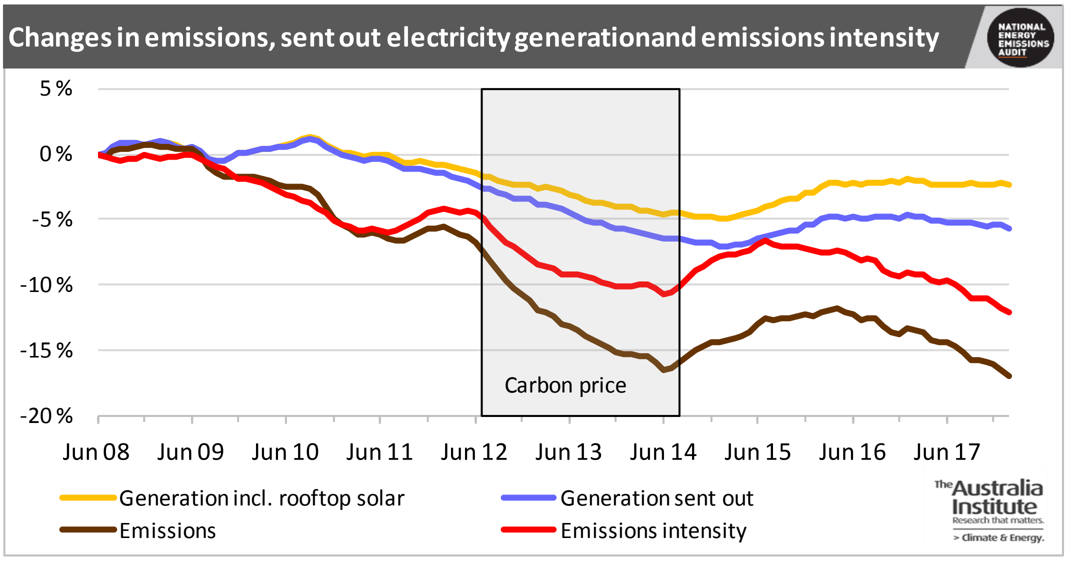
+ ***These results confirm that Australia could readily reduce its electricity emissions by more than 26%***

It is hard to see what point is served by the emissions reduction target in the NEG, unless it is intended to actively prevent the states from pursuing their own targets.

Generation, demand and emissions trends

The year to February 2018 in the National Electricity Market (NEM) saw a further continuation of the trends which *Electricity Update* has been reporting for many months. It seems likely that these will continue to the end of March, the anniversary of the Hazelwood closure. Last month's *Electricity Update* noted that total emissions in the year to January were very slightly lower than in the year to June 2014, meaning that they were at their lowest level since 2004. One month on and annual electricity generation emissions decreased by a further 0.9 Mt CO_2-e, equivalent to 0.6%, to 152.8 Mt CO_2-e.[1], as seen in Figure 1. The size of the reduction from just one more month without electricity from Hazelwood power station shows how extremely emissions intensive Hazelwood was. The key question now is: What will happen to NEM emissions after the end of March? Possible answers are discussed later in this report.

Figure 1



Figures 2 and 3 show the changes in the mix of generation supplying the NEM. Again, most changes continue the trends of recent months, with the possible exception of gas generation. Reduced gas generation in Queensland and New South Wales in February more than offset continuing increases in Victoria and South Australia. It is of course too early to judge whether this might be the start of a shift in trend. Annual wind generation increased slightly, but is still affected by the very low generation in June 2017.

[1] As calculated by the National Energy Emissions Audit model

Figure 2

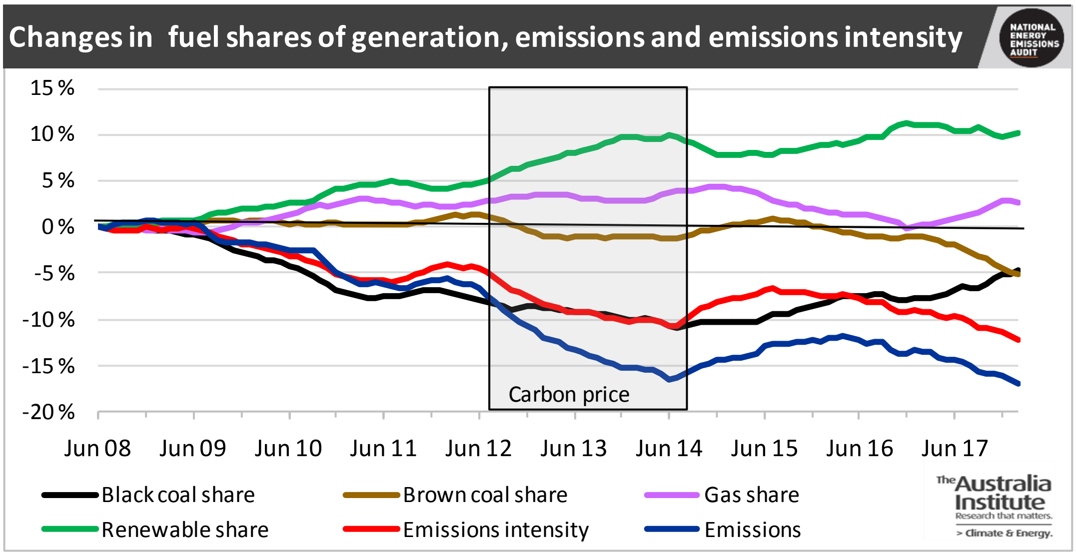
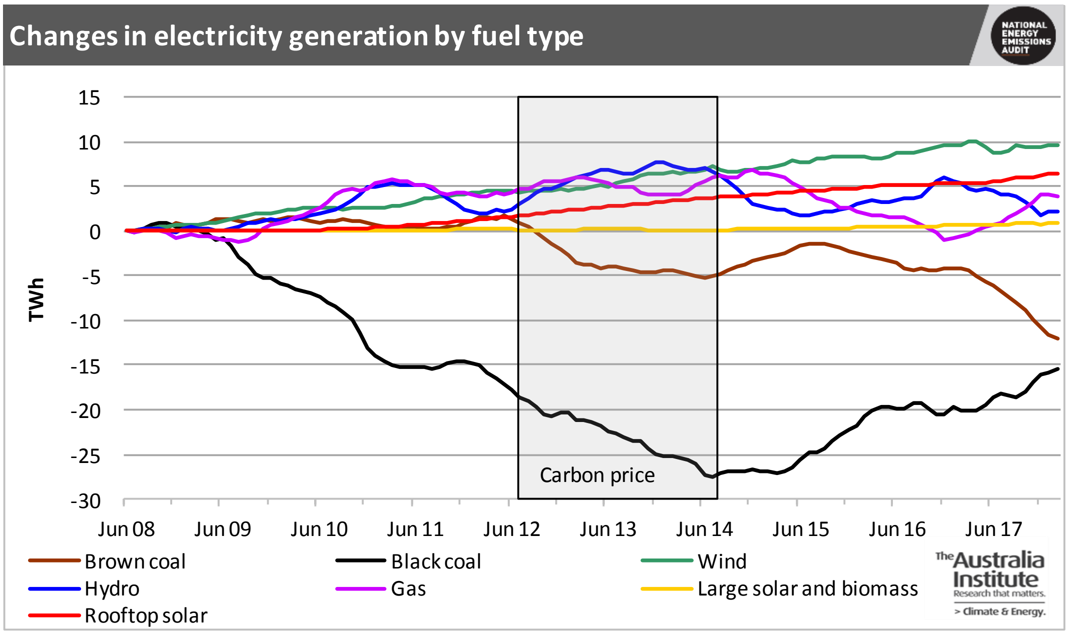


Figure 3



Figures 4 and 5 show, respectively, absolute and relative changes in demand for electricity supplied from the grid in each of the five state regions of the NEM and in the South West Interconnected system in Western Australia. The two graphs again show a continuation of recent trends. Total NEM annual consumption has now being decreasing very slowly for over a year. Consumption increased in Victoria, South Australia and Tasmania, and decreased in New South Wales, Queensland, and Western Australia. The largest change, in both absolute and relative terms, is in Victoria, but it remains difficult to understand what might be causing this increase, other than, perhaps, an increase in rooftop solar output which is smaller, relative to total consumption, than in Queensland.

Figure 4

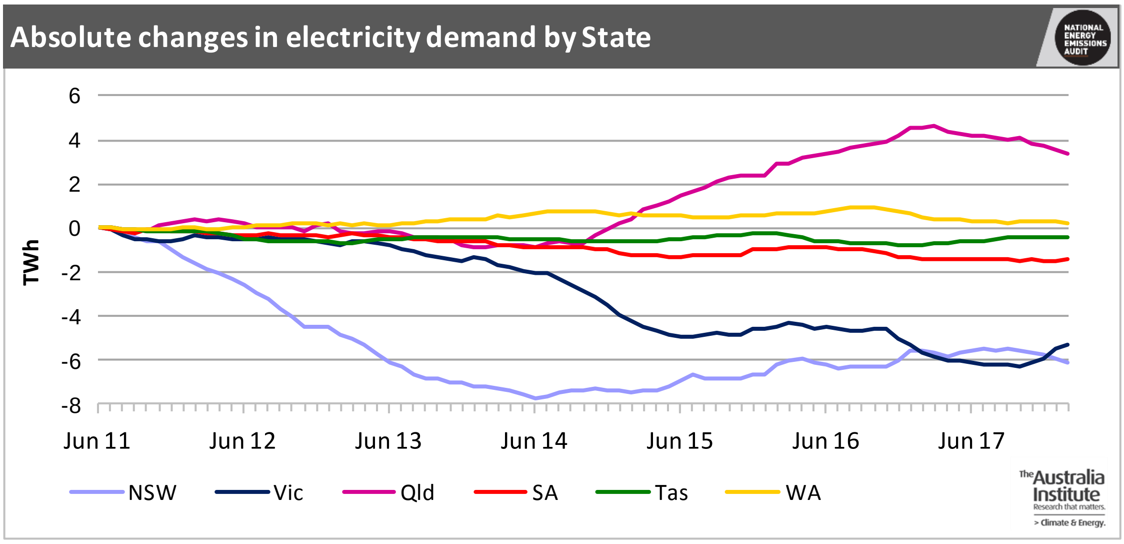
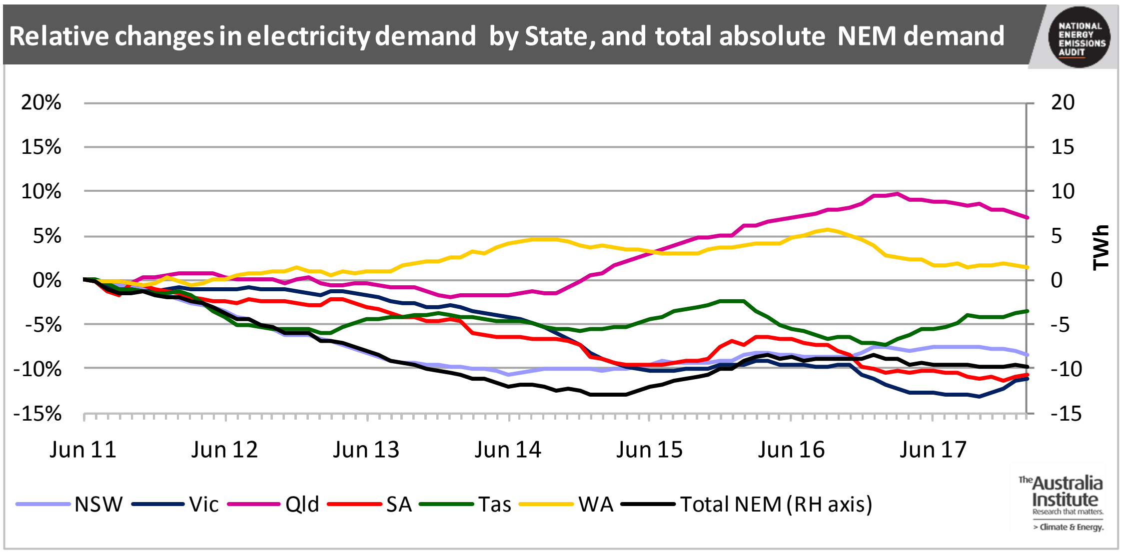


Figure 5



Emissions from NEM generation between now and 2030

In mid February the Energy Security Board released its Draft Consultation Paper for the proposed National Energy Guarantee (NEG) scheme. Chapter 4 of the paper sets out the Commonwealth government's views on the emissions reduction requirement for 2030, suggesting that it should be 26 % below the 2005 emissions level. We have calculated NEM emissions in 2005 from official sources, by using the National Greenhouse Gas Inventory.[2] This shows that total electricity generation emissions in the five NEM states in 2005 were 177.8 Mt

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[2] Australian Greenhouse Emissions Information System http://www.environment.gov.au/climate-change/climate-science-data/greenhouse-gas-measurement/ageis

CO_2-e. From this it is necessary to subtract emissions from electricity generation located in these states (mostly in Queensland) but not connected to the NEM. These were estimated in 2013 to be 2.1 Mt CO_2-e,[3] and unlikely to have changed greatly over the preceding seven years. NEM emissions in 2005 were therefore 175.7 Mt CO_2-e. A reduction of 26% would be 140.6 Mt CO_2-e.

The NEEA model of NEM generation, which contains emissions intensity and other relevant operating data on every generator participating in the NEM, has been used to estimate what future NEM emissions might be under various scenarios. The starting point was to estimate future annual electricity consumption in each state in each year between now and 2030, net of electricity supplied by rooftop PV and consumed behind the meter. The "Neutral" scenario of AEMO's 2017 National Electricity Forecasting Report was used as the source for these numbers.[4] On the electricity supply side the following assumptions were applied:

- The full Large Renewable Energy Target (LRET) will be met in 2020, with the NEM target being a pro-rata share of the total national target of 33 TWh, i.e. allocating some of the Target to Western Australia and the Northern Territory, which makes the NEM target, after allowing for landfill gas and other small LRET generators embedded in distribution networks, equal to 28.4 TWh.
- A further 2.2 TWh of renewable electricity will be supplied under contracts with the ACT government.
- AGL will close Liddell power station in 2022 and replace it with a package including 1,600 MW of wind and grid scale solar generation, 750 MW of new gas peaking generators, 100 MW upgrade of Bayswater power station capacity, 250 MW of battery storage at Liddell, and demand response.[5]
- The Victorian Renewable Energy Target (VRET) of 40% renewable generation in the state by 2025 will be achieved.

The modelling analyses the potential mix of generation plant which could supply annual electricity consumption in each of the five NEM regions in each year between now and 2030. It is assumed that new renewable capacity displaces supply from older coal generators and that all existing gas generators remain available, with the exception of the change at Torrens Island A announced by AGL. Current interconnector capacity constraints are retained. No

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[3] ACIL Allen Consulting, 2013. *Beyond the NEM and the SWIS 2011–12 Regional and Remote Electricity in Australia.* *https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Beyond-the-NEM-and-the-SWIS-2011%E2%80%9312-regional-and-remote-electricity-in-Australia.aspx*

[4] http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Electricity-Forecasting-Report

[5] https://www.agl.com.au/-/media/AGL/About-AGL/Documents/Media-Center/ASX-and-Media-Releases/2017/171209NSWGenerationPlanDecember2017.pdf?la=en&hash=529E1A89370A33DA8F378D761CEEF1D919C9C91D

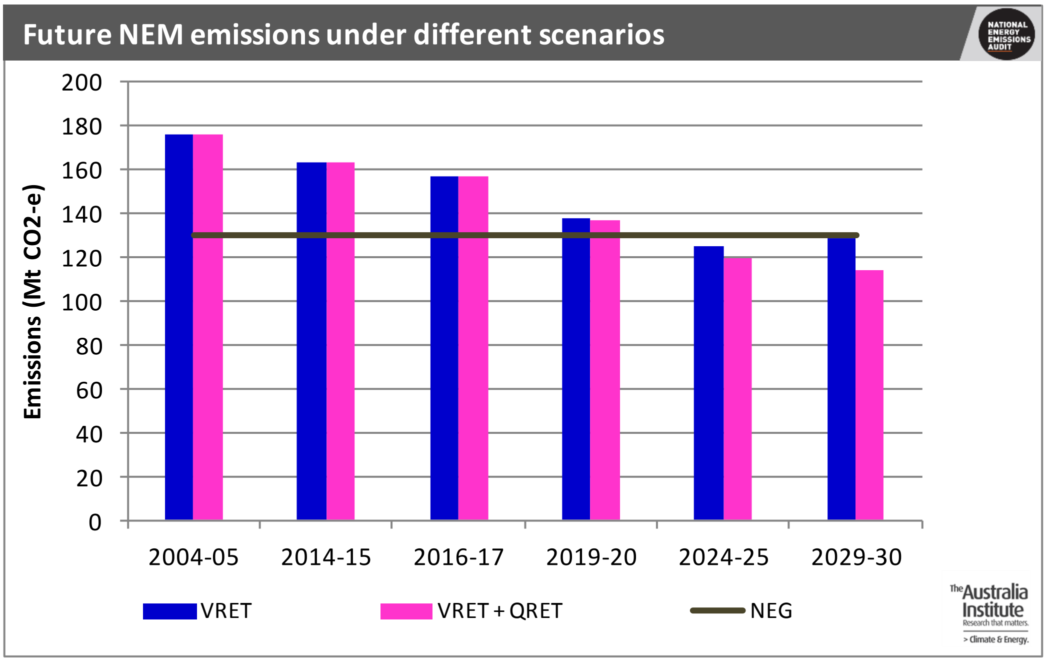
allowance is made for additional electricity consumption required to cover round trip losses in the operation of either pumped hydro or battery storage systems.

As at the year ending February 2018, NEM emissions, as calculated by NEEA, are 14% below the 2005 level. It was concluded from the modelling that by 2025, using AEMO's Neutral demand projection, total NEM emissions fall to 29% below the level in 2005, and remain at about that level thereafter, assuming no further growth of renewable generation.

If it is further assumed that the Queensland Renewable Energy Target (QRET) for 50% renewable generation by 2030 is also achieved, NEM emissions in that year are estimated to be 35% below the 2005 level.

To summarise, if, as the Clean Energy Regulator has said will certainly occur, the LRET is fully achieved, and, in addition, the VRET, for which responses to the first reverse auction tranche are currently being evaluated, is also achieved, the government's 2030 NEM emissions reduction target of 26% by 2030 will already be achieved by 2025. If it is assumed that the QRET will also be achieved, then emissions in 2030 will be 35% below the 2005 level, exceeding the government's target by a wide margin. These outcomes are summarised graphically in Figure 6.

Figure 6



While the assumptions used in this modelling allow for state and territory government programs, they make no allowance for additional renewable generation financed by direct power purchase agreements with individual large consumers, or aggregated buying groups of large consumers, such as banks, universities and large commercial property owners. Agreements of this kind are booming in the USA. They are beginning to take off in Australia, and most, if not all, are additional to the LRET. For example, a recent report by PwC[6] lists eleven organisations, including Telstra, various manufacturing businesses and three universities, which have recently made such agreements. The Melbourne Renewable Energy Project[7] brings together Australia Post, several banks, two universities, local government authorities and cultural institutions in a consortium to purchase the output from a new windfarm in Victoria. Whether all such renewable generation would also be additional to the VRET and/or the QRET is less clear. While such agreements are most readily arranged through a retailer, they do not have to be, and large, sophisticated electricity consumers may choose not to do so. The NEG Consultation paper completely ignores the possibility of such agreements being negotiated without the involvement of a retailer, and therefore says nothing about how they might be incorporated into the design it proposes for the scheme.

In conclusion, the results of this modelling confirm what this newsletter, and many other commentators, have repeatedly pointed out. The quickest and lowest cost way for Australia to achieve its Paris Agreement emissions reduction target will be to focus on achieving most of those emissions from electricity generation, by supporting, rather than obstructing, the transition of Australia's electricity supply system away from dependence on coal and towards dependence on new renewable generation technologies, drawing on Australia's abundant wind and solar energy resources.

[6] https://www.pwc.com.au/publications/pdf/optimising-energy-corporate-ppas-nov17.pdf

[7] https://www.melbourne.vic.gov.au/sitecollectiondocuments/mrep-guide-01-corporate-power-purchasing-agreements.pdf

Appendix: Notes on methodology

Data on annual consumption of electricity, and seasonal peak demand, are for each of the six states. All other data are for the states constituting the National Electricity Market (NEM) only, i.e. they exclude Western Australia. All data are reported as annual moving averages. This approach removes the impact of seasonal changes on the reported data. Annualised data reported in *NEEA Electricity Update* 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. Most data are presented in the form of time series graphs, starting in June 2011, i.e. with the year ending June 2011. Some graphs start in June 2008. These starting dates have been chosen to highlight important trends, while enhancing presentational clarity.

Defining the particular meaning of the various terms used to describe the operation of the electricity supply system will help in understanding the data discussed.

Demand, as defined for the purpose of system operation, includes all the electricity required to be supplied through the grid level dispatch process, operated by AEMO. This includes all the electricity delivered through the transmission grid to distribution network businesses, for subsequent delivery to consumers. It also includes energy losses in the transmission system and auxiliary loads, which are the quantities of electricity consumed by the power stations themselves, mostly in electric motors which power such equipment as pumps, fans, compressors and fuel conveyors. Auxiliary loads are very large: in 2011 they amounted to 6.3% of total electricity generated and currently about 5.6%. Most of this load is at coal fired power stations, where it can be as high as 10% of electricity generated at an old brown coal power station and 7% at a black coal fired power station. Auxiliary loads are much lower at gas fired power stations, and close to zero at hydro, wind and solar power stations. Both demand and generation, as shown in the *Electricity Update* graphs, are adjusted by subtracting estimates of auxiliary loads. Thus demand, as shown, is equal to electricity supplied to distribution networks (and a handful of very large users that are connected directly to the transmission grid) plus transmission losses.

Generation is similarly defined to include only electricity supplied by large generators connected to the transmission grid. It does not include electricity generated by rooftop PV installed by electricity consumers, irrespective of whether that electricity is used on-site ("behind the meter") by the consumer, or exported into the local distribution network. From the perspective of the supply system as a whole, the effect of this generation, usually termed either "embedded" or "distributed" generation, is to reduce the demand for grid supplied electricity below the level it would reach without such distributed generation. That effect can be clearly seen in the regular total generation graph; the gap between the red line – electricity sent out to the grid from large grid connected power stations – and the yellow line – that electricity plus estimated electricity generated by distributed solar systems – is the electricity supplied by those systems, which for the year ending September 2017 was about 5.9 TWh p.a., equivalent to 3.1% of the combined total.