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> Climate & Energy.

NATIONAL ENERGY EMISSIONS AUDIT

National Energy Emissions Audit Report

November 2020

Providing a comprehensive, up-to-date indication of trends in Australia's energy combustion emissions

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Key points

- ***2020 shows a sharp fall in emissions from petroleum which was caused by Covid-19 reducing transport use***
- ***Victoria had the largest reduction in road transport emissions, of about 2.4 Mt for the calendar year to Sept, which is 12% lower than 2018-19 (Figs 5, 6)***
- ***Up to June 2020, the economic slowdown will be found to have reduced annual petroleum emissions by about 5.4 Mt CO2-e below trend, with a further reduction of about 4.2 Mt CO2-e from July to September 2020 - mostly from aviation fuels, petrol and auto LPG (Fig 4).***
- ***The largest medium term reduction in emissions has been the drop in brown coal use from the closure of five coal power stations in Victoria and South Australia between 2012 and 2017 (Figs 1, 2).***
- ***Renewable energy set new records in October 2020;*** *the highest daily share of total supply on 2 October of 38.3%; the following day saw the highest 30 minute share of 53.8%, with wind and solar accounting for 51.4%.*
- ***Electricity consumption in Victoria remained steady over the lockdown period (Fig 5).***
- ***In October renewable energy generation hit a new annualised high of 26.9% of all electricity sent out from generators (Figs 6, 7).***
- ***In October electricity emissions reached a record of 26% lower than the record high of 2008 (Fig 8).***

INTRODUCTION

Welcome to the November 2020 issue of the NEEA Report, presenting electricity related data updated to the end of October 2020 and data on petroleum fuels and gas consumption to the end of August. Details on data sources and methods are included in the appendix.

Overall trends in energy emissions

Figure 1 shows total annual energy combustion emissions, by major source, as estimated by the NEEA, and Figure 2 shows each of the five sources separately. Recall that the energy combustion emissions reported by the NEEA are about 80 per cent of total national energy combustion emissions. Emissions sources excluded are electricity generation and all other gas use in Western Australia and the Northern Territory, and coal use throughout Australia in all industries other than electricity generation.

Figure 1

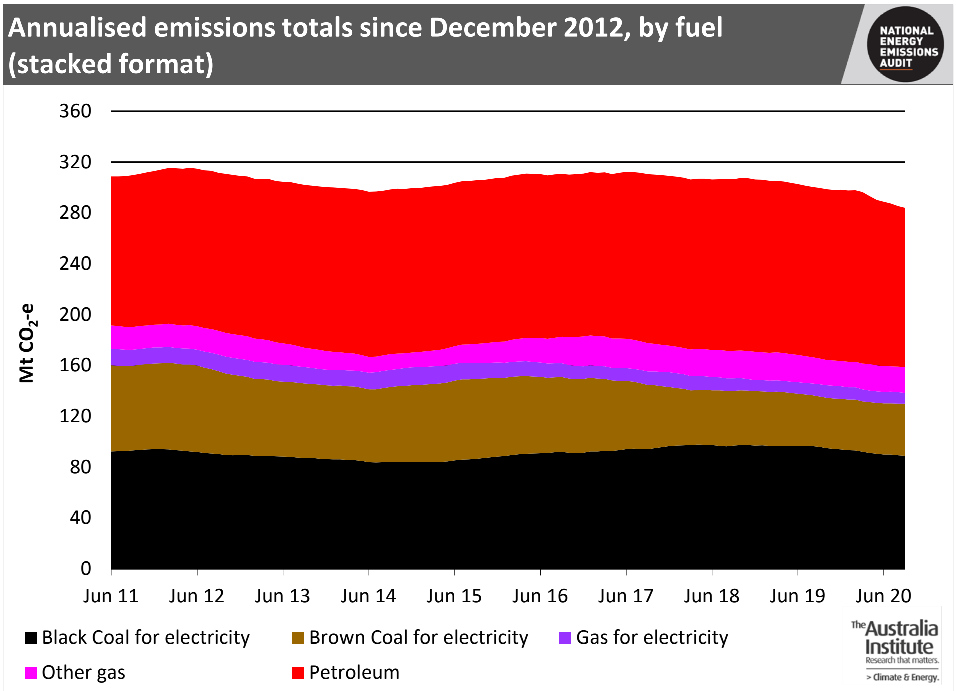


Figure 1 shows how the various sources contribute to total emissions, while Figure 2 shows each source separately. It can be seen that the largest emissions reduction comes from use of brown coal for electricity generation in Victoria and South Australia, as five power stations were closed between 2012 and 2017. During 2020, following years of almost continuous growth, the pandemic has caused a sharp fall in emissions from use of petroleum emissions. Gas emissions increased strongly during 2015 and 2016, with the commissioning of the three LNG plants in Queensland.

Figure 3 shows just the changes in emissions, making them much easier to see. Between the end of February, just before lock-downs were introduced, and the end of September this year, annual energy combustion emissions reported by NEEA fell by about 4.6 per cent. This fall is equivalent to about 13.8 Mt CO_2-e, of which about 9.6 Mt CO_2-e relate to emissions from use of petroleum fuels and the remaining 4.2 Mt CO_2-e to the ongoing fall in electricity generation emissions, as the NEM transitions away from coal and gas generation and towards wind and solar. The next section of this report looks in more detail at the changes attributable to the pandemic.

Figure 2

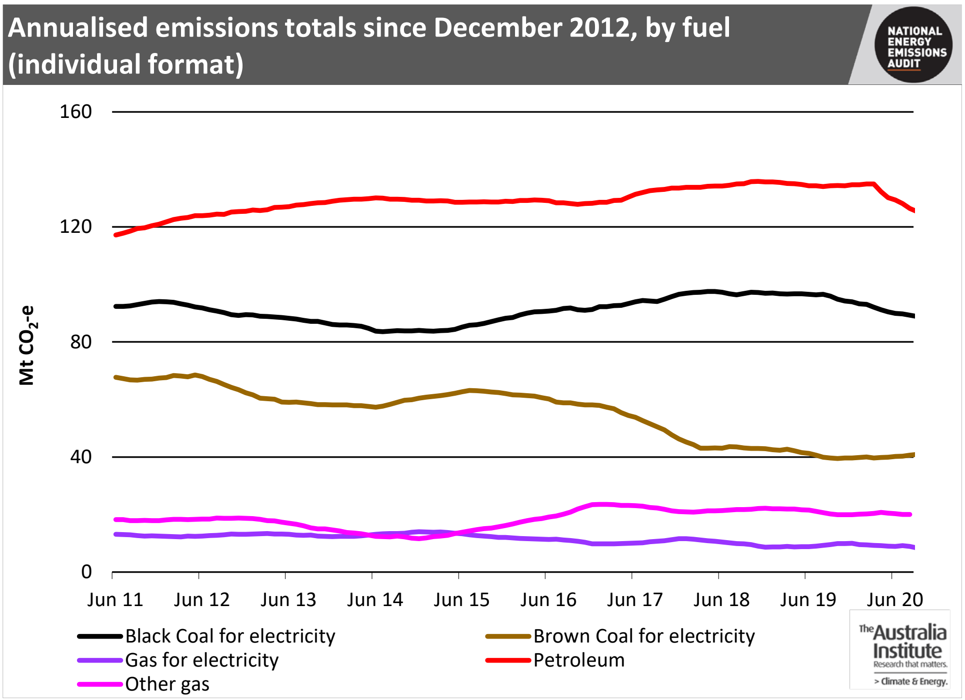
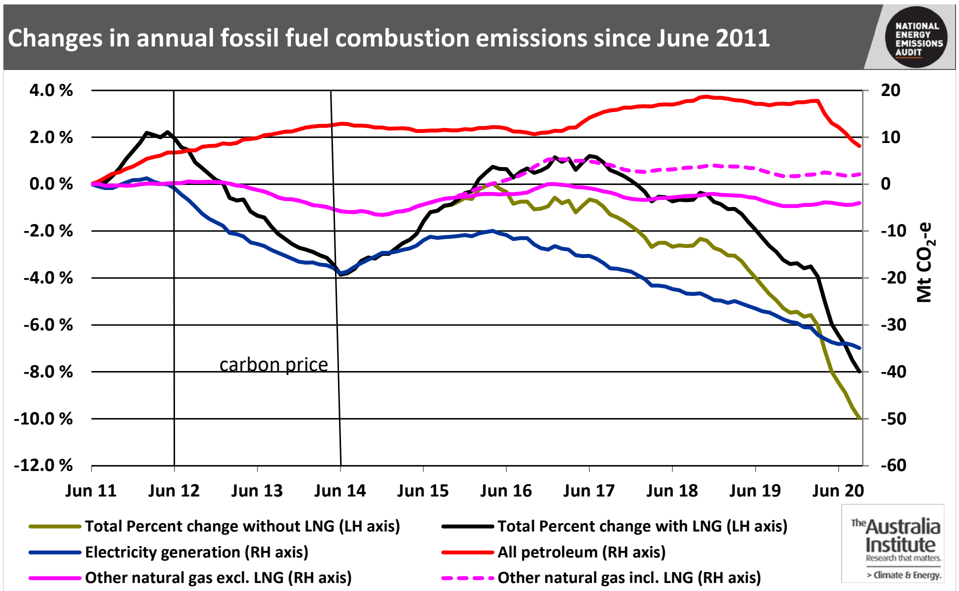


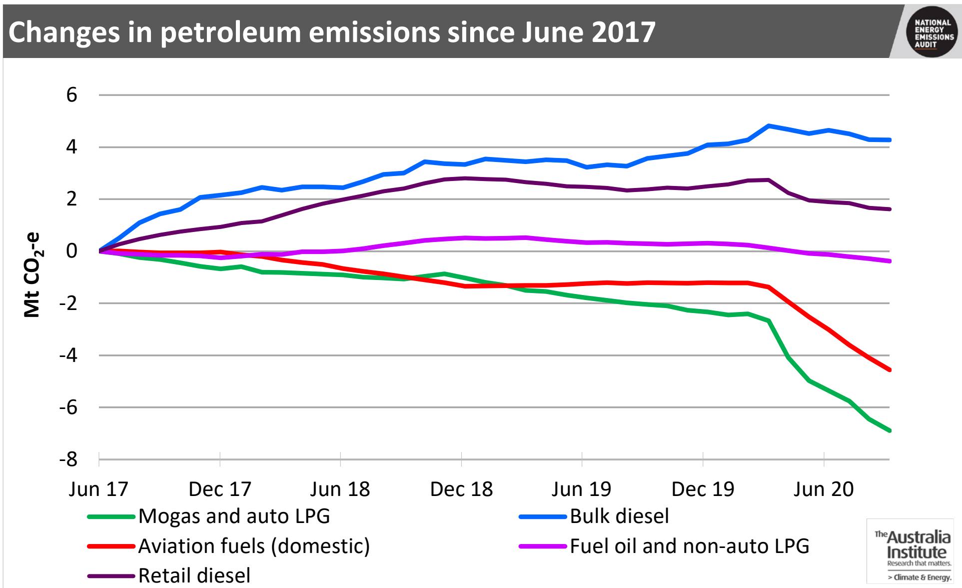
Figure 3



The effect on energy emissions of the pandemic

As explained in previous NEEA reports this year, by far the largest impact of the pandemic on energy consumption has fallen on petroleum products. Figure 4 breaks this impact out by the main petroleum product fuel types. It can be seen that the major impacts have been on aviation fuels and on mogas (petrol). There has also been a very clear impact on retail sales of diesel. Almost all sales of these fuels are for use by passenger and light commercial motor vehicles, i.e. for road transport. A significant share of bulk diesel sales are also for use by road vehicles, mostly heavier freight vehicles and buses. The mining, construction and agricultural industries also use large volumes of diesel supplied in bulk. Overall, these data suggest that up to June 2020, the economic slowdown will be found to have reduced annual petroleum emissions by about 5.4 Mt CO_2-e below trend, with a further reduction of about 4.2 Mt CO_2-e in the first three months of 2020-21.

Figure 4



As the only state with two major lock-down periods, Victoria is most likely to be where any change in emissions from either electricity or gas consumption, as well as petroleum product consumption, is most likely to be seen. Figure 6 shows index numbers, based on values in the month of July 2017, of month by month consumption (not moving annual totals) for all major sources of energy consumption in Victoria.

These most recent data are consistent with previous observations that the changed economic conditions have had no significant effect on consumption of either electricity or gas, even with an economic slow-down as prolonged as that in Victoria. The data also show a very clear and strong effect on consumption of diesel and petrol. The effect of the two pandemic waves in Victoria is easy to see in Figure 6 which shows emissions from all transport fuels used in Victoria.

Figure 5

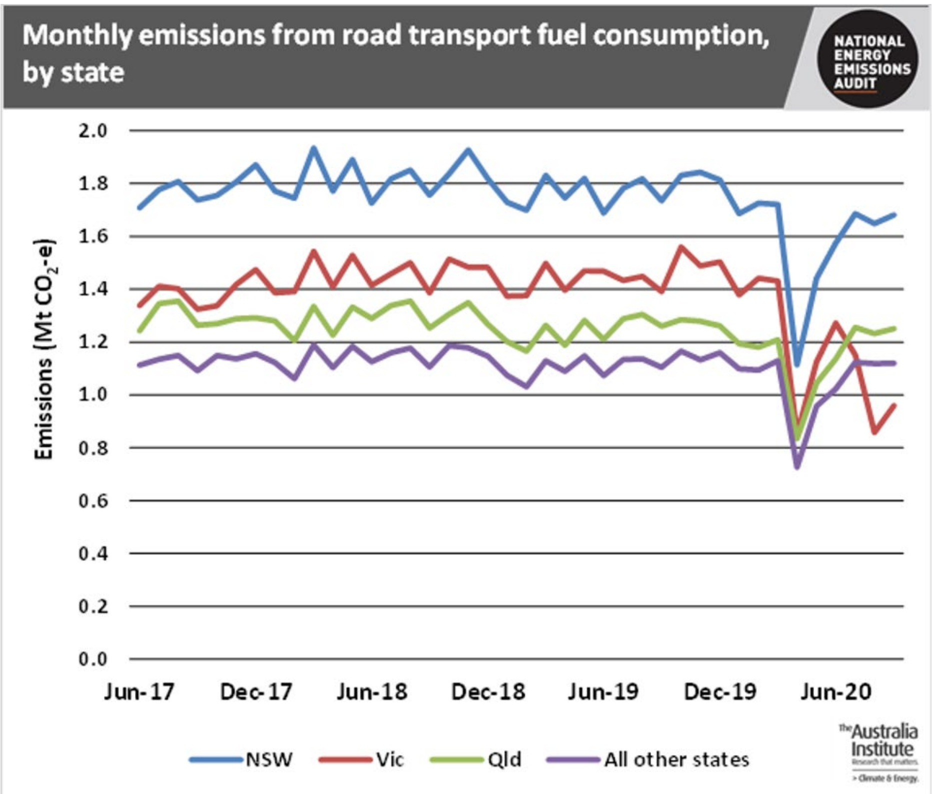
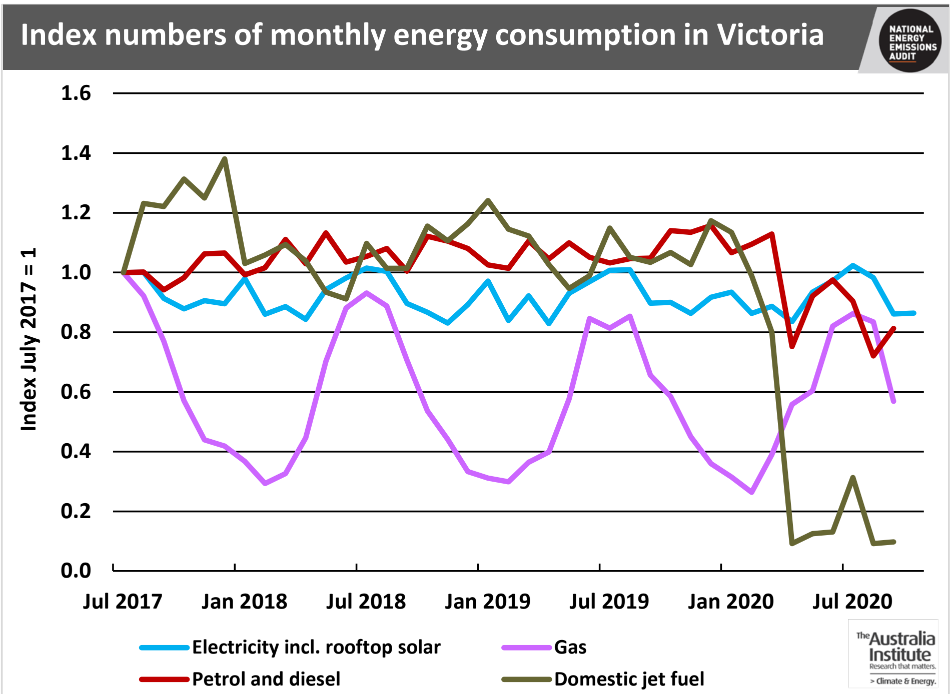


Figure 6



Australian Energy Statistics show that in 2018-19 over 91 per cent of all consumption of diesel, petrol and auto LPG in Victoria was used for road transport. In this respect, Victoria differs from other states, all of which use a higher proportion of diesel fuel in other industries, such as mining and agriculture. The drop in consumption in April, and again in August, therefore reflects the impact of the economic shut-downs on road transport in both the first and second wave lock-downs. As expected, the fall in domestic consumption of jet fuel is even more dramatic, and also made a modest recovery in July, before being hit by the second wave. We estimate that the total reduction in emissions from road transport in Victoria the first nine months of calendar year 2020 has been about 2.5 Mt CO_2-e, which equals about 12% of annual road transport emissions in the state in the 2018 inventory year (the most recent for which detailed figures have been finalised), equivalent to a drop of roughly 16% on a nine month *pro rata* basis.

Update on electricity generation, demand and emissions

As expected, Figure 7 shows that annualised total renewable generation, including generation by small solar, continued its steady increase during October, reaching a total of 26.9% of all electricity sent out from generators. Figure 8 shows that annual black and brown coal generation both fell slightly, together contributing 65.8% of all electricity. Seen in the context of the entire history of the electricity supply industry in Australia, dominated, except in Tasmania, by coal generation by well over a hundred years, every reduction in the share of coal generation is also a fall to a new record low level. Gas generation also fell, more sharply than coal generation, on the back of falls in every state. The gas share of total annual generation in the year to the end of October was 7.4%, which was the lowest level, in terms of both generation for the year and share of total NEM generation, since the early months of 2007.

Figure 7

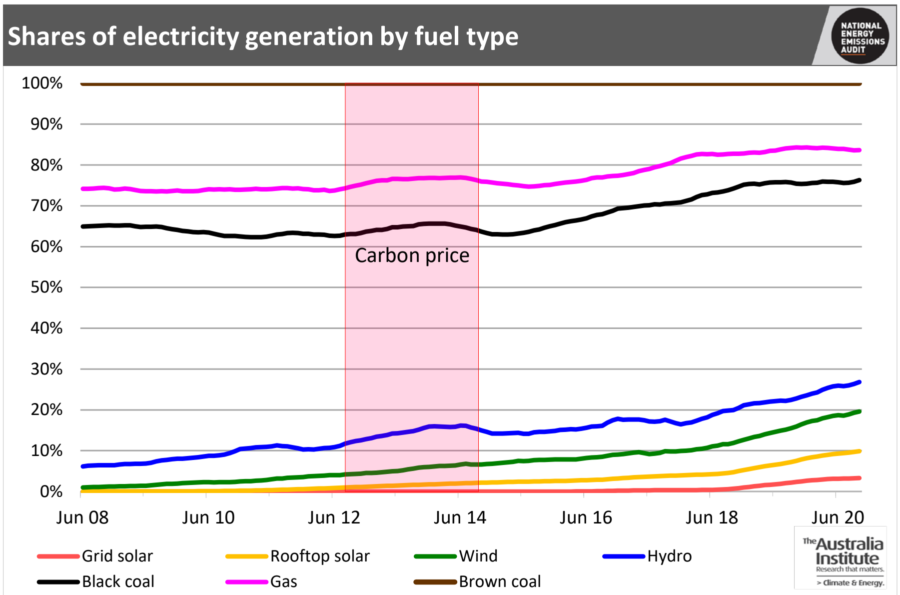


Figure 8

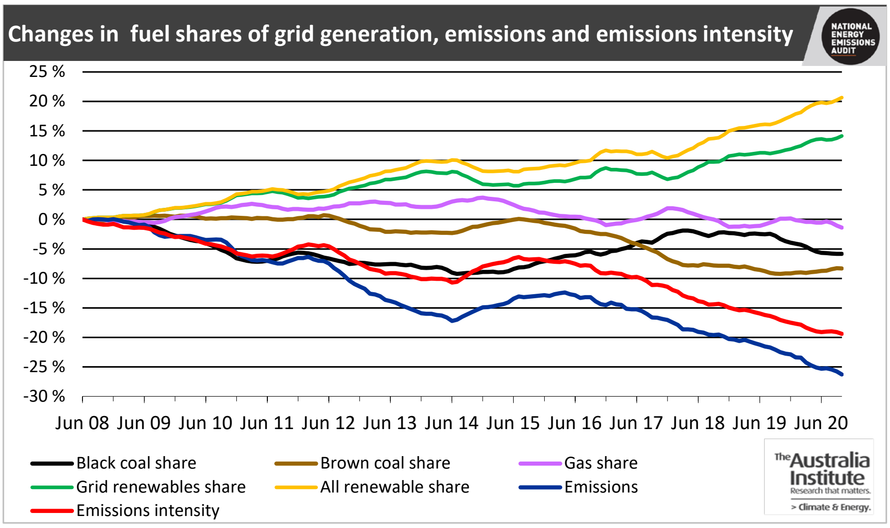


Figure 9

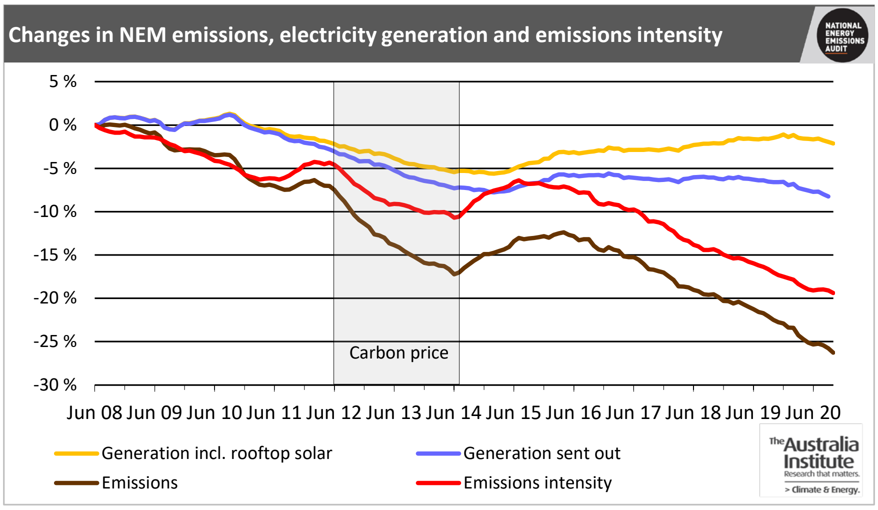
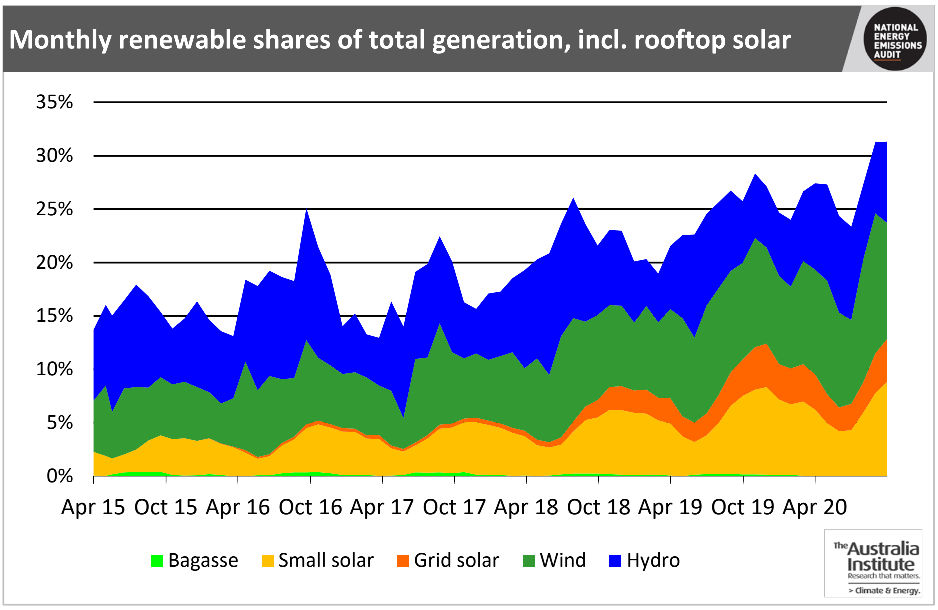


Figure 8 shows that total annual sent out generation, which of course matches total electricity consumption, including losses in transmission and distribution, has been falling gradually for most of this year. This could be construed as a consequence of the economic slow-down, but, if so, it is a vey small effect, as already noted above. The continued growth in renewable generation, combined with gradually falling consumption, means that total emissions continue to fall, and are now more than 26% below the level in 2008, which was the historic maximum.

Figure 10 shows that month by month renewable generation reached a new record level in October of just over 31.5%, as a share of total generation. The absolute average monthly level of renewable generation in October was just below the record level of 6.4 TWh, reached in September.

Figure 10



Daily renewable generation share of total supply in the NEM also reached a new record in October – 38.3% on 2 October. On the following day, during the 30 minute trading interval between 11.30 and 12.00 Eastern Summer Time, another new record was set: renewable generators supplied 53.8% of all electricity consumed in the NEM during the trading interval. Wind and solar only, i.e. excluding hydro, supplied 51.4%.

However, it is also important to recognise the variable nature of wind and solar resources by recording that the lowest wind and solar trading interval share of total supply was 3.1% during early evening on 11 October. It is a truism to observe that "firming" supply from variable renewable generation sources is key to achieving a successful transition to a zero emission electricity supply system. Many different types of new investment will be needed, not to mention co-ordination between them. AEMO's Integrated System Plan provides essential general guidance to the timing and direction required. Fortunately, despite the policy black hole at the Commonwealth government level, a number of decisions by state and territory governments over recent months give grounds for hope that progress is being made. The integrated approach embodied in the NSW Government's Electricity Infrastructure Roadmap, published in early November, is a particularly welcome development.

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.