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> Climate & Energy.

National Energy Emissions Audit
December 2017

Providing a comprehensive, up-to-date indication of key greenhouse gas and energy trends in Australia

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Key points

+ ***Australia's energy emissions continue to increase, though more slowly***

Australia's annual energy combustion emissions reached what is almost certainly a record level in July 2017, and then fell slightly in August and September.

+ ***Petroleum consumption continues to be is the main driver of emission increases***

Large increases in consumption of petroleum fuels, particularly diesel, continue to more than offset gradually falling electricity generation emissions and near constant emissions from gas consumption.

Very large reductions in emissions from petroleum and natural gas consumption will be required to meet the Paris Agreement target

Because emissions from petroleum fuels and, to a lesser extent, natural gas have increased so much since 2005, a pro rata reduction from these sources by 2030 will require very much larger relative reductions from present levels.

+ ***Growth in emissions from road transport fuels is growing at twice the rate of GDP***

Consumption and emissions from use of road transport fuels (petrol, retail diesel and auto LPG) has grown at twice the rate of GDP over the past two years, meaning that the energy productivity of rod transport has deteriorated by 5%.

+ ***By contrast, the energy productivity of domestic aviation has increased strongly***

While domestic consumption of jet fuel has remained constant, aviation activity has increased, so that energy productivity has increased by 3% over the past two years.

Introduction

Welcome to the December 2017 issue of The Australia Institute's *National Energy Emissions Audit* (the *Emissions Audit*). The *Emissions Audit* tracks Australia's emissions of greenhouse gases from the combustion of fossil fuels – this issue contains data up to the end of September 2017. The *Emissions Audit* will therefore give readers the most up to date possible advice on how Australia is tracking towards meeting its emissions reduction commitment under the Paris Agreement.

Fossil fuel combustion accounts for the majority of Australia's emissions – 71% in Australia's most recent *National Greenhouse Gas Inventory*, which was for the year 2014-15. Fossil fuel combustion emissions also account for most of the year on year change in Australia's emissions. Over the last few years the change is an increase.

The *National Energy Emissions Audit* is published on a quarterly basis, in September, December, March and June each year, with data to the end of the preceding quarter. Each month the *Electricity Update* of the *Emissions Audit* is produced, reporting on changes to emissions from electricity generation in the National Electricity Market (NEM), and including commentary on other issues relating to the extraordinarily dramatic changes happening in Australia's electricity supply system.

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 consumption. Annualised data 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.

Total energy combustion emissions to June 2017

The September 2017 *NEEA Report* recorded a sudden upsurge in consumption of petroleum fuels, and consequent upsurge in emissions, starting from around April 2017. This *Report* records that emissions from consumption of petroleum fuels continued to grow strongly up to the end of September (Figure 1). A decline in emissions from electricity generation is largely offsetting the growth in petroleum emissions, with the result that total energy combustion emissions are growing, but only slowly. Emissions from other use of natural gas in eastern Australia, i.e. excluding electricity generation, have stabilised, after a period of growth largely caused by growing gas consumption at the three LNG plants in Gladstone, all now operating at steady state capacity.

Figure 1

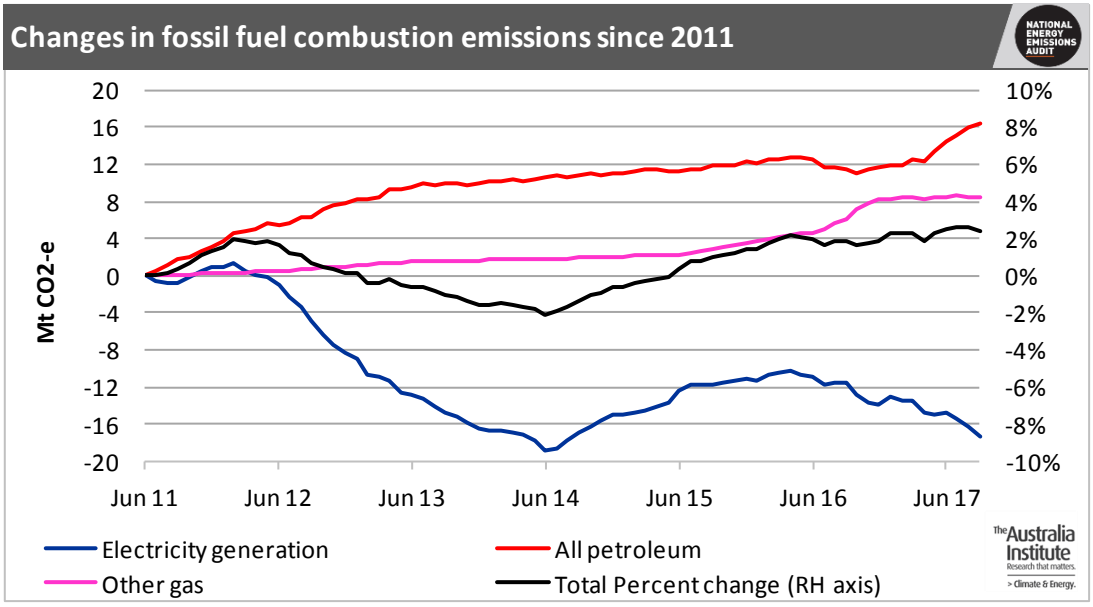
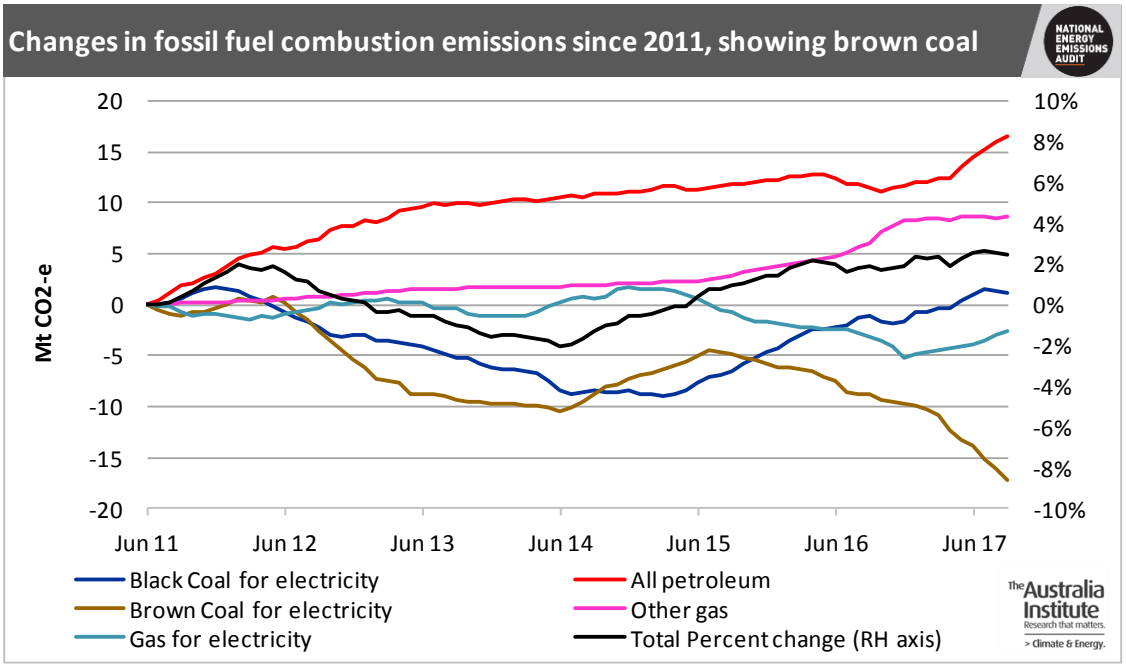


Figure 2



When emissions from the three different fossil fuels used to generate electricity – black coal, brown coal and gas – are separated, Figure 2 shows that it is reduced brown coal emissions which are entirely responsible for the reduction in electricity generation emissions. Lower emissions from brown coal are the consequence of the closure of Hazelwood power station, at the end of March this year. Once that effect is fully included in the annualised data, which will occur at the end of March next year, brown coal emissions are likely to stay constant, at a new, lower level. Electricity emissions will only start to fall again when the new wind and solar projects now being built start to come on line. Even then, will any emissions reduction from electricity be enough to stop growing petroleum emissions?

What will happen to electricity generation emissions, and therefore to energy combustion emissions as a whole, after next March? If petroleum emissions are still increasing, what will stop total energy emissions also increasing? Perhaps the answers to these questions will emerge from the review of Australia's climate change policies. This review is being undertaken by the Department of Environment and Energy, which says on its website that the review "will conclude by the end of 2017". In the meanwhile, it is illuminating to examine the implications of current trends.

In 2005, as recorded in the National Greenhouse Gas Inventory (NGGI), electricity generation in the NEM states (which includes a small quantity of generation outside the NEM) emitted 177.8 Mt CO_2-e. By 2015 this had fallen by 14.7 Mt CO_2-e, to 163.1 Mt CO_2-e, a reduction of 8.3%. Since 2015 it has fallen another 5.0 Mt CO_2-e, and so is now 11.1 % below the 2005 level. To achieve a reduction of 28% by 2030 would require a further reduction of 30 Mt CO_2-e. To put it another way, the *pro rata* emissions reduction task for the NEM is already 40%

achieved. But will a *pro rata* reduction from electricity generation enable Australia to meet its Paris Agreement commitment?

As discussed in the June 2017 *NEEA Report*, Australia is very fortunate in that dramatic reductions since 2015 in emissions from land use change and forestry have (or at least, in 2015, had) contributed about 70 Mt CO_2-e of the nearly 170 Mt CO_2-e reduction needed for an overall 28% reduction. A *pro rata* reduction in electricity emissions would add another 50 Mt CO_2-e. But where is the other 50 Mt CO_2-e to come from (assuming no rebound in land clearing emissions)? A reduction of 50 Mt CO_2-e from all sectors other than electricity generation and land use change is equivalent to about 15% relative to 2005 levels. But by 2015 emissions from these sectors had increased significantly, so that the required reduction, relative to 2015 levels, had become 20%. The recent dramatic increases in petroleum consumption will have again increased the required reductions, as the time available has shrunk from fifteen years to not much more than twelve.

Most of these emissions come from transport, mining activities, manufacturing processes requiring high temperature heat, agricultural livestock and fugitive emissions associated with coal mining and gas production. In most of these sectors emissions are currently increasing, not decreasing. In none are there new, but technically mature, low emission options for achieving dramatic emission reductions at reasonable cost. Such options are of course available for electricity generation. The new technologies are continuing to demonstrate technical improvement, they are being widely deployed and their costs are comparable to, if not lower than the higher emitting technologies they can and are replacing. Only the wilfully ignorant or blind could pretend that Australia will be able to achieve its emissions reduction target under the Paris Agreement with no more than a *pro rata* reduction in emissions from electricity generation.

Finally, note that, despite the steady fall in electricity generation emissions, driven, until next March by the effect of the Hazelwood closure, as well as the steadily growing share of renewable generation, the falling electricity emissions are only just keeping pace with the rising emissions from petroleum. If these trends continue, there will be no further fall in Australia's emissions at all.

Petroleum emissions

Figures 3 and 4 show, respectively, changes in emissions, and changes in total emissions since 2011 from the four main groups of petroleum products: road transport fuel, bulk diesel, aviation fuels, fuel oil and non-auto LPG. Each of these four was discussed at some length in the September *NEEA Report*; that discussion will not be repeated here.

Figure 3

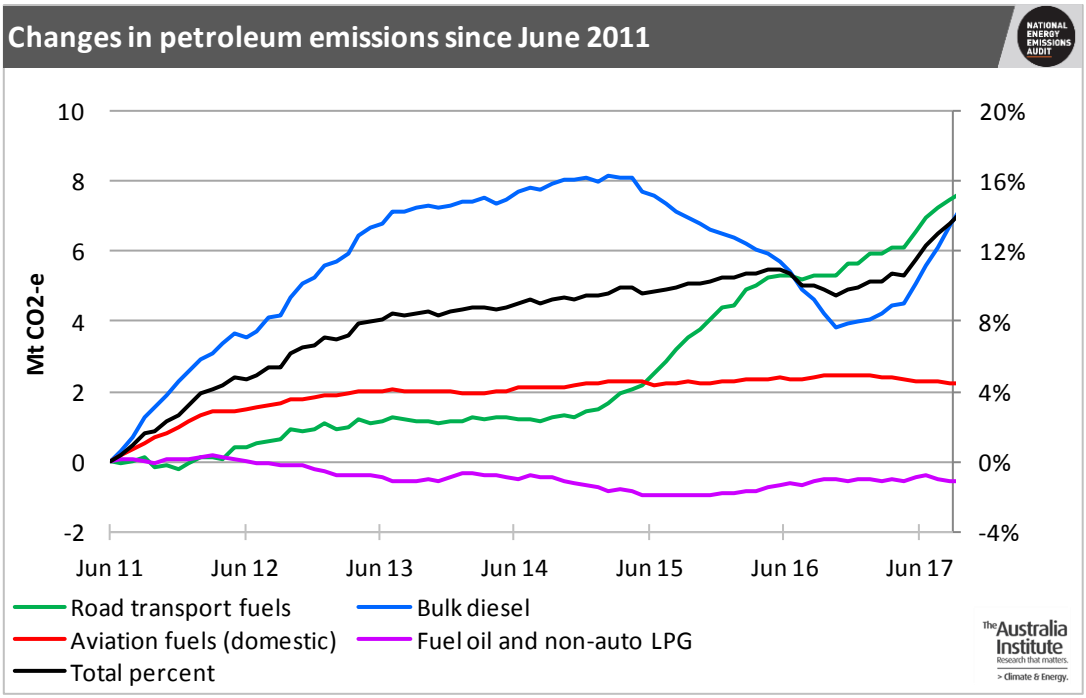
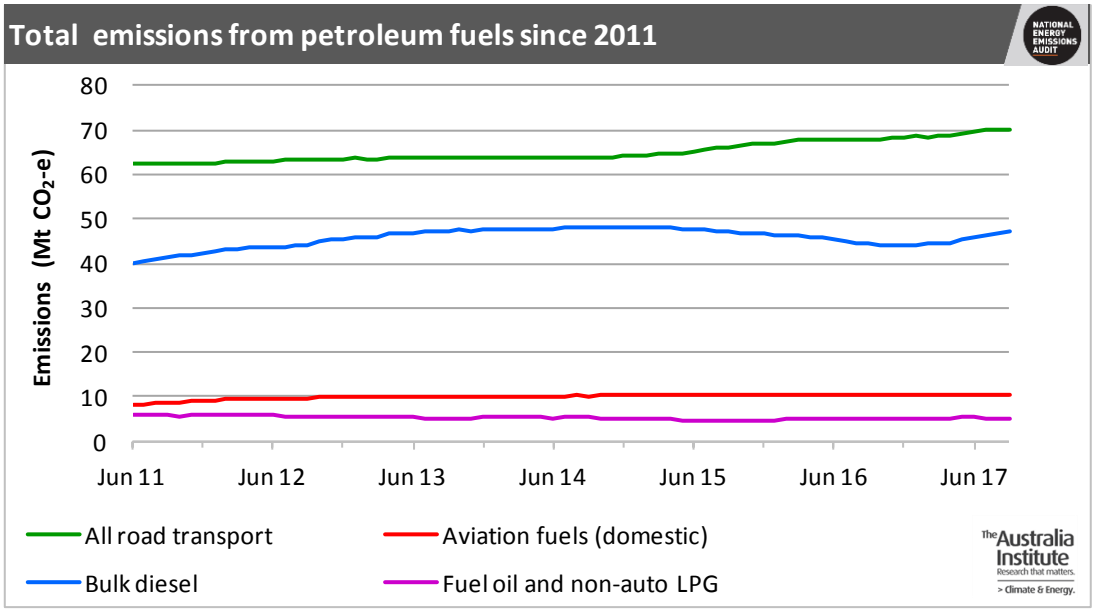


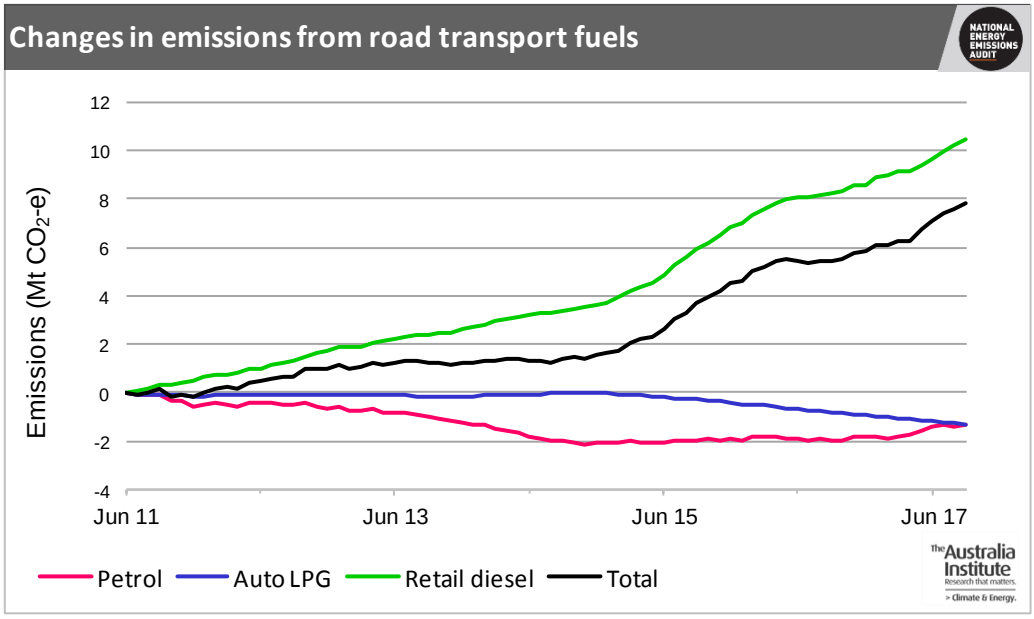
Figure 4



Road transport fuels

Firstly, the rate of growth in emissions from road transport fuels has, if anything, accelerated over three months from June to September. This means that since the start of 2015 emissions from use of these fuels has been growing at a rate of about 5% per annum. This is more than twice the rate of growth of GDP over the same period. This means that over this period the productivity of road transport fuel use, i.e. the ratio of fuel use to GDP, has deteriorated by nearly 5%. In December 2015 COAG adopted the National Energy Productivity Plan, which called for national energy productivity to improve by 40% between 2015 and 2030. Road transport, both public and private, is a large and crucial part of national economic activity. More productive use of fuel by road transport is essential if national energy productivity is to improve. At present, however, it is getting worse; in fact, to deploy a clichéd metaphor, going in reverse at high speed.

Figure 5

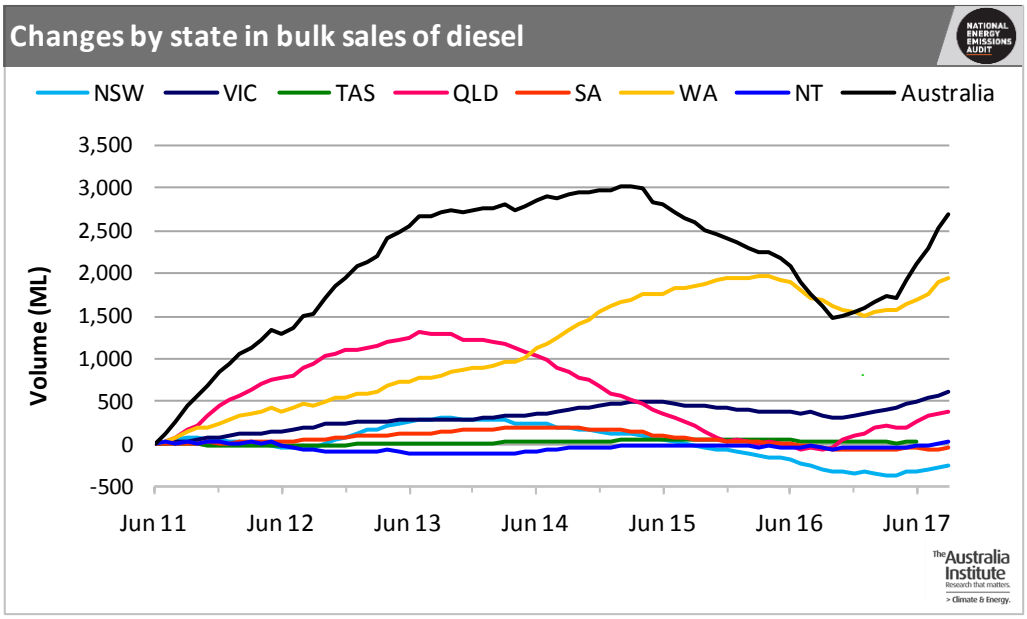


The data in Figure 5 show that, when examined in detail, the problem with road transport fuel consumption is even worse than consideration of total emissions and consumption would suggest. This is because, as Figure 5 shows, diesel accounts for almost all the growth. The adoption of diesel engines around the world arises, of course, because it is much more efficient than petrol, when efficiency is measured in terms of litres per 100 kilometres travelled. In terms of greenhouse emissions, however, this efficiency advantage is largely offset by the fact that burning diesel emits 16% more CO_2 per litre used than burning petrol, because diesel fuel molecules contain a higher proportion of carbon atoms, and a lower proportion of hydrogen atoms, than petrol molecules. Consumption of diesel, moreover, emits much more particulate emissions than consumption of petrol, which is the main reason why cities across China, India and most of Europe are taking steps to reduce diesel consumption in urban areas.

Diesel fuel bulk sales

Figure 3 shows that, since the start of 2017, bulk sales of diesel have made the largest contribution to the total increase in emissions from petroleum fuels. Figure 5 shows that the largest increase has been fastest in Western Australia, which suggests that growth in iron ore mining (2.7% increase in gross value added from December 2016 to June 2017 according to the ABS National Accounts[1]) may be a factor. However, there have also been significant increases in Queensland and Victoria. It may be some time before data about economic activity in the industries which use bulk diesel is available; until then, it hard to explain these increases.

Figure 6



Aviation and other fuels

Figure 3 shows that emissions from domestic aviation fuels have hardly changed for three years. During the first part of this period, up to about November 2015, there was almost no change in domestic air transport activity, as measured in revenue passenger kilometres, which adequately explains why there was also no increase in emissions from fuel use[2]. Since then, however, activity has increased by 2.8%, while emissions have remained constant, or even slightly declined. This can be explained by the fact that the average load factor has increased by 3.0%. This means that the energy productivity of domestic aviation, defined as the ratio of jet fuel consumption to revenue passenger kilometres, has increased by 3.1% over 22 months.

Finally, there has been no significant change in combined emissions from use of LPG in non-transport applications and fuel oil. They remain a small part (3.8%) of total emissions from petroleum fuel consumption.

[1] Australian Bureau of Statistics, Cat. No. 5206.6

[2] Australian Bureau of Infrastructure, Transport and Regional Economics, *Australian domestic airline activity time series.* https://bitre.gov.au/publications/ongoing/domestic_airline_activity-time_series.aspx

Appendix: Notes on methodology

The quarterly NEEA Report ("the Audit") reports greenhouse gas emissions arising from the use of fossil fuels to provide useful energy. The format in which data are presented in the Audit is determined by the data sources available. This means that the Audit has three major components: electricity generation, consumption of petroleum products and consumption of gas for purposes other than electricity generation.

For electricity generation, the data are those presented monthly in the NEEA Electricity Update. This means that they include all emissions from electricity generators supplying electricity within the National Electricity Market (NEM). The Audit does not include emissions arising from off-grid generation located in the five eastern states. It also excludes all emissions from electricity generation, both grid and off-grid, in Western Australia and the Northern Territory.

For emissions from consumption of petroleum products, the key data source is the monthly government publication, Australian Petroleum Statistics. The specific figures used are monthly sales of petroleum products, published in Tables 3A and 3B. This means that the emissions cover the whole of Australia, not just the eastern states. The emissions calculated are adjusted to net out emissions arising from the small quantities of diesel used at power stations supplying the NEM. It is important to note that earlier this year the Department of Environment and Energy applied a rigorous quality audit and upgrade process to Australian Petroleum Statistics. The outcome was changes to some previously published, i e. "historic", data and a new starting date of July 2010 for the improved data series. This new starting date is one reason that many graphs start with annual emissions for the year to June 2011.

The estimates of emissions from natural gas are, like electricity emissions, confined to the eastern states. Two separate sources are used. For the period to June 2016, annual gas consumption data by industry and state (Table f) of Australian Energy Statistics is used to provide total gas consumption, net of gas used to generate electricity, in the five eastern states. Linear interpolation is used to estimate moving annual gas consumption for each intermediate month. From July 2016 onward the source data are constructed from the pipeline gas flow data published in the weekly Gas Market Report of the Australian Energy Regulator (AER). The NEEA estimates of emissions from gas used for electricity generation in the NEM are subtracted from these totals. The Gas Market Report explains that some gas consumption may not show up in its reported pipeline flow data, i.e. that these data may somewhat underestimate total gas consumption. Comparison with the Australian Energy Statistics data confirms that to be the case, which is why the latter data have been used for all periods up to June 2016.

All data are reported as annual moving averages. This approach removes the impact of seasonal changes on the reported data. Annualised data reported in the quarterly NEEA Report ("the Audit") 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.