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National Energy Emissions Audit

October 2019

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

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Key points

+ ***Meeting the Paris emissions target will need much larger than pro rata (26%) reductions in electricity generation emissions***

There is no evidence that emissions from consumption of petroleum fuels will stop increasing, meaning that pro rate emissions reduction from energy combustion as a whole will require much larger than pro rata reduction from the electricity sector.

+ ***The rise in diesel combustion emissions wipes out cuts to electricity emissions***

The increase in diesel combustion emissions (mainly from Road transport and mining) from FY11 to FY18, at 21.7 Mt CO_2-e, almost completely erodes the decrease in emissions from electricity generation in the NEM over the same period, at 22.1 Mt CO_2-e.

+ ***Growing consumption of diesel in road transport continues to drive growth in emissions from consumption of petroleum fuels***

New and improved data shows that almost all the growth in diesel consumption is coming from increased retail sales of diesel, meaning diesel consumption by passenger and commercial vehicles, rather than mining, agriculture or public transport.

+ **In the last decade, the share of diesel light commercial vehicles (like utes) has doubled and diesel passenger vehicles has tripled**

The share of registered light commercial vehicles using diesel fuel increased from 34% in 2008 to 66% in 2018 and diesel fuelled passenger vehicles increased from 4.3% to 12.8% over the same period. Diesel vehicles tend to be driven for longer distances than petrol vehicles.

+ **Trends in transport energy efficiency show big gains for heavy freight and big losses for light commercial vehicles (like utes)**

Between 2004 and 2016 there was a small reduction in the emissions intensity of passenger motor vehicles, no change in the emissions intensity of articulated trucks, and a marked deterioration in the emissions intensity of light commercial vehicles

While Governments have taken an active role to improve the fuel efficiency of heavy road freight vehicles, they have done nothing to improve the efficiency of light vehicles, with the issue placed in the purgatory of a Ministerial Forum for the last five years.

+ ***Australia's energy emissions were almost unchanged between March and June 2018***

During the second quarter of 2018, continuing gradual reductions in electricity generation emissions were almost precisely offset by continuing growth in emissions from use of petroleum fuels.

Introduction

Welcome to the October 2019 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 every quarter; this issue contains data up to the end of June 2018. 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 – 72 per cent in the most recent *National Greenhouse Gas Inventory* for financial year 2015-16. Fossil fuel combustion emissions also account for most of the year-on-year change in Australia's emissions.

The *National Energy Emissions Audit* is usually published on a quarterly basis, in September, December, March and June each year, with data to the end of the preceding quarter, though this quarter the report has been delayed by one month. 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. On overlapping months, the *Electricity Update* and *Emissions Audit* are combined.

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 December 2012, i.e. with the year ending December 2012.

Overview of total energy combustion emissions to August 2019

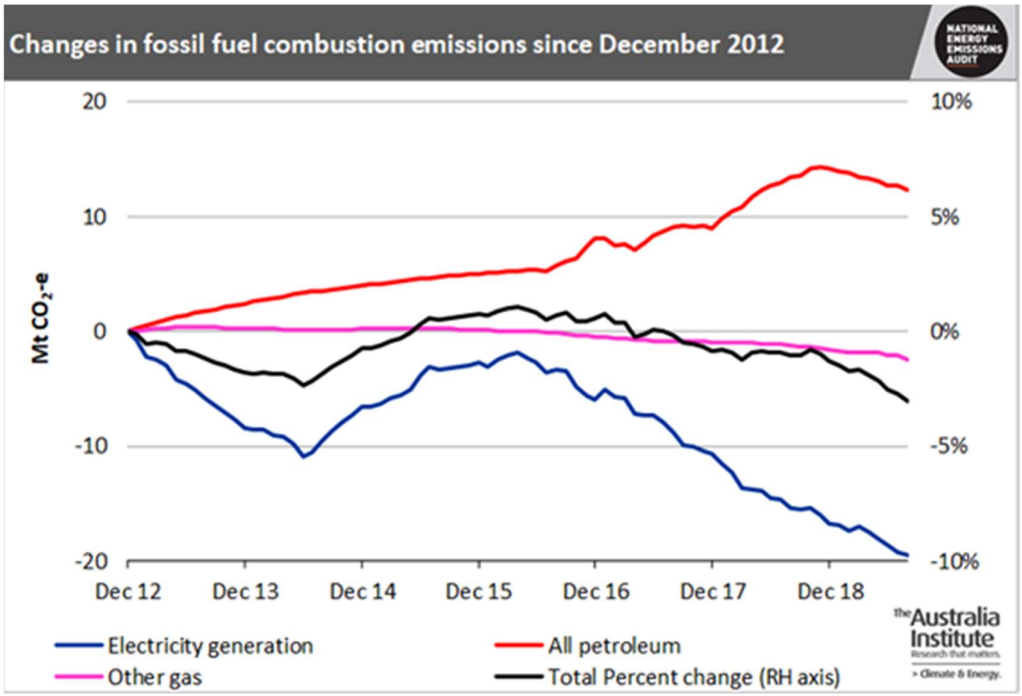
Figure 1 shows that moving annual energy combustion emissions as reported by the NEEA have been in a steadily falling trend since December 2018. Readers are reminded that the coverage of NEEA is not complete because the availability of energy consumption data covering periods of less than a year is incomplete. Emissions covered are those arising from:

- consumption of coal, gas and petroleum products for electricity generation in the NEM, i.e. excluding Western Australia and the Northern Territory;,
- consumption of petroleum products throughout Australia, with the exception of petroleum products consumed in oil refining and the production and processing of crude oil and natural gas;
- gas, including both conventional natural gas and coal seam gas, except in Western Australia and the Northern Territory, and also excluding gas used in the production and processing of gas to produce both pipeline gas and LNG in eastern Australia.

A comparison of NEEA data with the National Greenhouse Gas Inventory for 2016-17 shows that the NEEA reports 81% of total national energy combustion emissions for that year.

The trend in total energy combustion emissions to the end of August 2019 confirm the trend noted in the *NEEA Report* for last June. From the beginning of this year, reported sales of petroleum products, the source data used to calculate emissions, have stopped growing, and, indeed, have started to fall.

Figure 1



This almost unprecedented change in trend has been primarily caused by an apparent cessation of growth in consumption of diesel fuel. Figure 2 shows trends since 2011 in emissions from each of the main groups of petroleum products. It can be seen that, although the rise in consumption of diesel is the most dramatic change, the gradual long term decline in consumption of petrol and auto-LPG has accelerated over the past year. Note that, as previous *NEEA Reports* have explained, sales data for diesel prior to 2017 were incomplete and hence unreliable, so a smoothed trend has been constructed from annual national consumption data as reported in *Australian Energy Statistics*. Sales data for the other petroleum products is more reliable and has been used throughout.

Figure 2

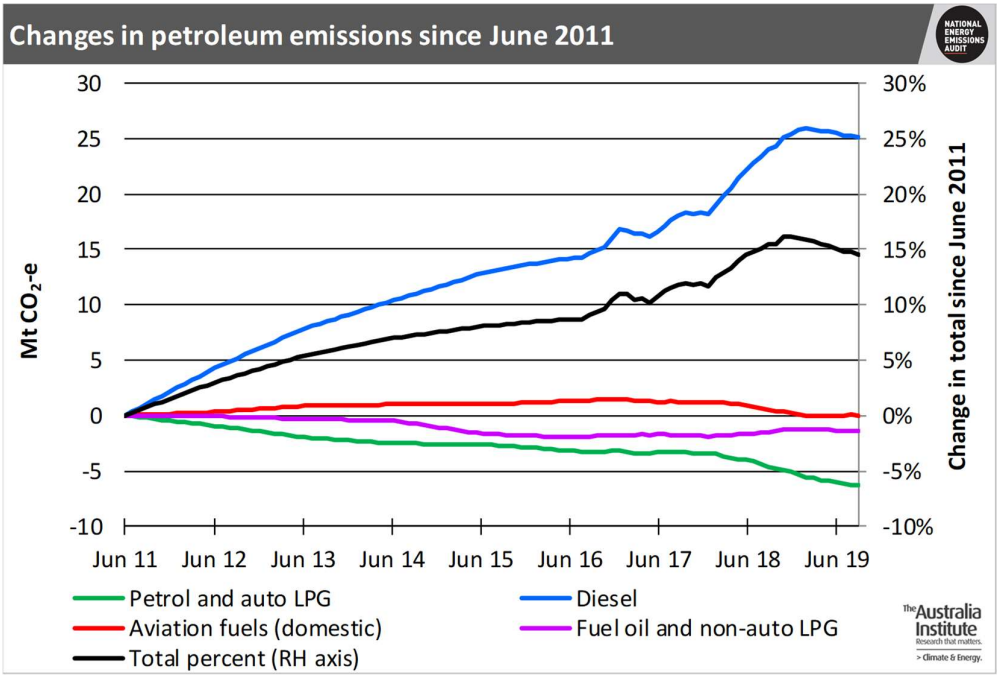
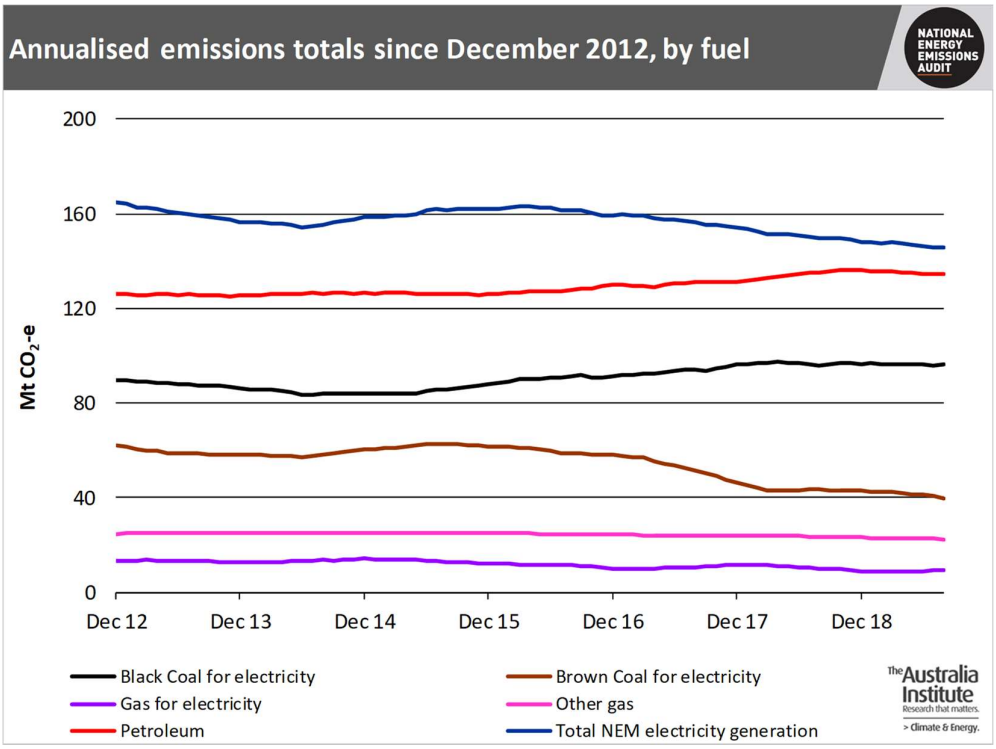


Figure 3 shows total energy combustion emissions reported by NEEA since December 2012. It clearly shows how important petroleum emissions have been in driving the growth in Australia's greenhouse gas emissions. Over the past seven years, the emissions gap between NEM electricity generation and consumption of petroleum fuels has steadily narrowed. Much of the public debate about climate and energy policy fails to recognise the importance of emissions from use of petroleum fuels, especially diesel, to the extent that comments often seem to suggest that energy is synonymous with electricity.

The remainder of this issue of *NEEA Report* aims to redress this imbalance by focussing exclusively on diesel fuel – how much is being used, what it is used for, and what factors may be affecting changes in how much is being used.

Figure 3



Special focus on emissions from diesel consumption

Overview

In this Section of the report, all the data, from which the various Figures have been constructed, are annual consumption as published in Table f of *Australian Energy Statistics*. The most recent year for which data are available is 2017-18. Figure 4 shows that diesel is used right across the economy in a wide range of sectors, but two sectors – *Road Transport* and *Mining* – dominate. This is in line with the *Liquid Fuel Security Review Interim Report* by the Department of Energy and the Environment early this year, which found:

> Diesel demand is growing faster than the economy, driven by growth in mining and agriculture and growth in diesel vehicle use.[1]

Other sectors using smaller volumes of diesel are visible in Figure 4 and 5 below and include 'All other transport' which includes rail transport and domestic shipping, 'Agriculture etc.' which includes forestry and fishing, and 'All other sectors' which include Construction, Manufacturing, Commercial and Services, and Residential.

[1] Department of Energy and Environment (2019) *Liquid Fuel Security Review Interim Report* https://www.energy.gov.au/government-priorities/energy-security/energy-security-assessments/liquid-fuel-security-review

Electricity generation excluding the NEM includes some grid scale generation in Western Australia (both the South West Interconnected System and the North West Interconnected System) and the Northern Territory. It also includes diesel generators supplying a large number of small isolated communities, mainly in Northern Australia, and remotely located mines. It can be seen that Road transport and Mining account for almost all the changes in diesel consumption over the seven years to 2017-18.

Annual increases are shown more clearly, in two different presentation formats, in Figures 5 and 6. They show that most of the increase in diesel consumption since 2010-11 has arisen from the Road transport and Mining sectors. However, consumption has also increased in every other sector which uses diesel. It is noteworthy that the increase in diesel combustion emissions from 2010-11 to 2017-18 was 21.7 Mt CO_2-e, while the decrease in emissions from electricity generation in the NEM over the same period was almost equal and opposite, at 22.1 Mt CO_2-e. On the basis of this stark relationship, consumption of diesel should be receiving far more attention than it has done to date in discussions of how to reduce Australia's greenhouse gas emissions. Figure 6 makes it easier to see that diesel use in road transport presents the largest challenge, because it increased steadily every year up to 2017-18.

Figure 4

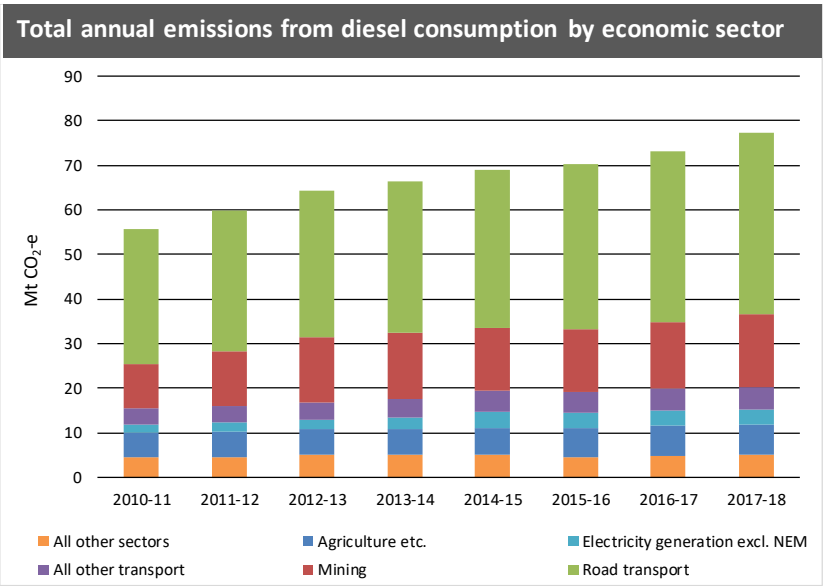
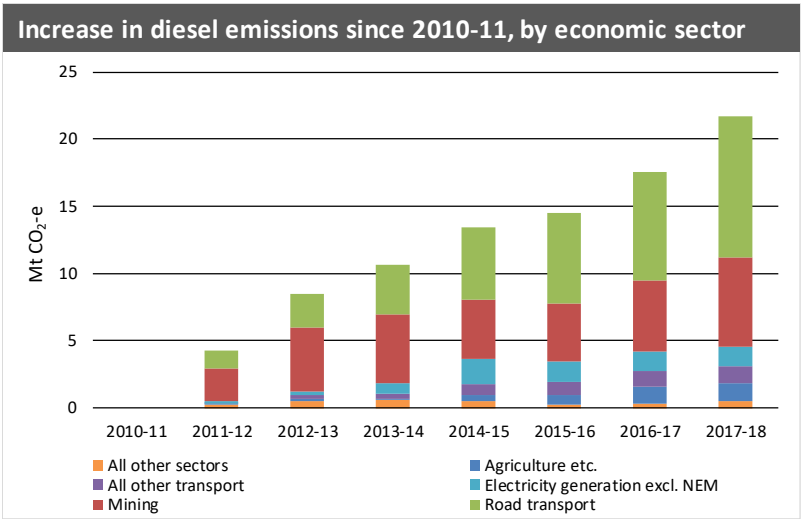
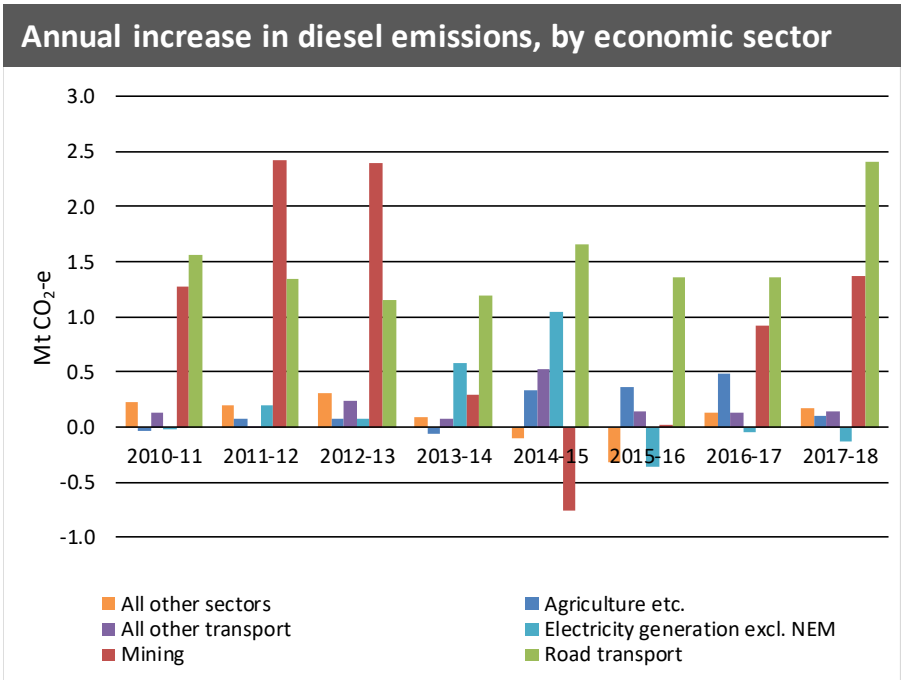


Figure 5



The dominance of Road transport and Mining in terms of both year on year growth and the total level of diesel consumption means that it is virtually certain that these two consuming sectors are responsible for the apparent cessation of growth in consumption over the past nine months. Separate examination of the volumes of diesel sold through retail outlets and other sales, meaning, effectively, bulk sales delivered into consumers' storage tanks, shows that growth in both sales categories has ceased. Moving annual retail sales, which accounted for 34% of total sales in the year ending January 2019, the month in which total sales peaked, then fell by 1.7% to the year ending August. The larger moving annual volume of bulk sales fell by 0.4% over the same seven-month period. Since virtually all retail sales are to the road transport sector, this comparison indicates that it is road transport which has been responsible for most of the drop-in sales, in absolute as well as relative terms. Furthermore, some sales to the road transport sector, particularly sales to consumers which operate fleets of commercial vehicles, are also made in bulk; road transport may therefore be responsible for almost all the reduction in consumption.

Figure 6

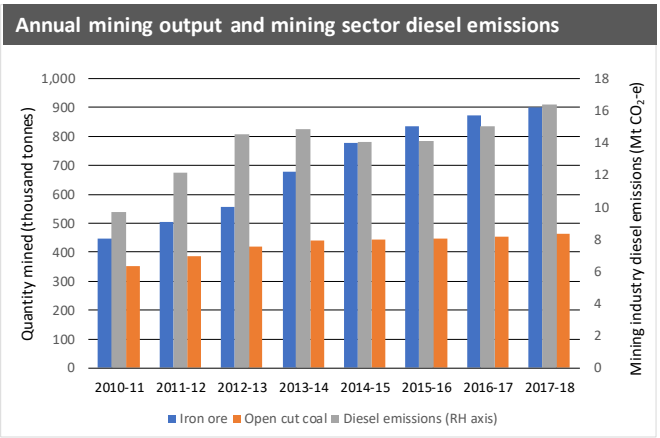


Review of individual sectors

Mining

The major use of diesel in mining is in the machinery used in open cut mining to excavate and move millions of tonnes of rock. The two minerals produced in the largest quantities in Australia are iron ore and coal. Figure 7 shows the relationship between annual production of each of these mineral products and total emissions from diesel used in the mining industry. Clearly, all increase together, but the relationship is not particularly close, for the obvious reason that diesel is also used in the extraction of many other mineral products, such as gold and various metal ores, and in quarrying. Diesel is also used for activities other than excavating and moving rock, such as crushing and beneficiation of metal ores, especially if the mine is remotely located and does not have access to external supplies of either electricity or gas.

Figure 7

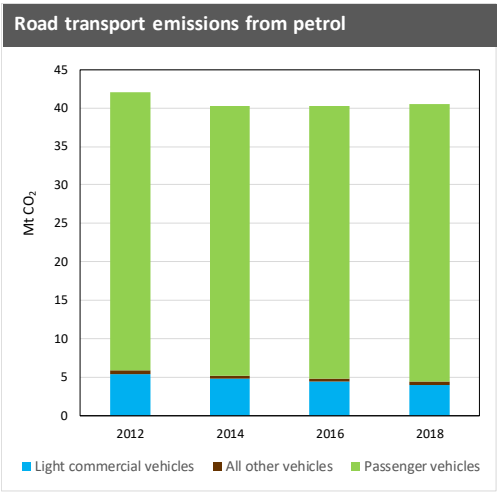


Road transport

The ABS *Survey of Motor Vehicle Use*, conducted every two years since 2010, has been used to examine trends in consumption, and associated emissions, arising from the various vehicle classes. Note that all these data are based on extrapolating from a sample survey, and are thus subject to sampling error, which the ABS always publishes. Total consumption data estimated from the survey will therefore not necessarily reconcile exactly with the totals shown elsewhere in this Report, but are certainly able to be used to show trends.

Figure 8 shows estimated annual emissions from petrol use by vehicle class, and Figure 9 presents the same information for diesel. It can be seen that diesel is steadily displacing petrol as a fuel for both passenger and light commercial vehicles. Heavier vehicles use almost exclusively diesel.

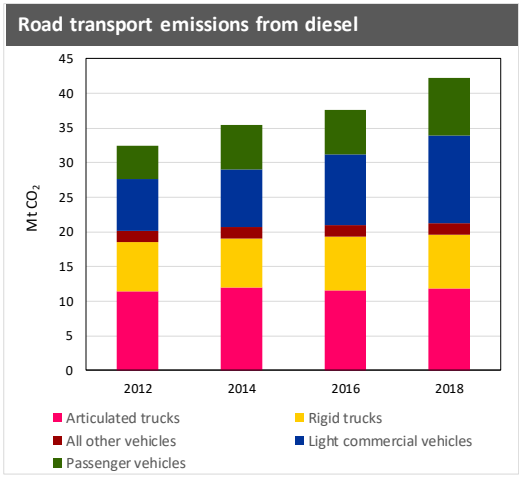
Figure 8



The data shown in Figures 8 and 9 make it obvious that the growth in road transport emissions from diesel use arises almost entirely from the rapid growth of diesel consumption in passenger and light commercial vehicles. Emissions from diesel consumption by heavier

vehicles, including rigid trucks, articulated trucks and buses (not shown separately here), grew more slowly, because total annual distance travelled has increased relatively slowly and, in the case of articulated trucks in particular, has been significantly offset by improved fuel efficiency. It is not coincidental that over many years, indeed decades, governments have taken an active role, working with and supporting industry on a range of program and activities directed towards improving the fuel efficiency of heavy road freight vehicles, particularly, articulated freight vehicles.

Figure 9



By contrast, successive governments have done almost nothing to encourage or require increased fuel efficiency from passenger and light commercial vehicles. It should therefore be no surprise that emissions from both passenger and light commercial vehicles have grown very rapidly.

Another very important consideration is that, while the total distance travelled each year by all passenger vehicles has grown quite slowly, at an average annual rate between 2007 and 2018 of 1.2% per year, total distance travelled by light commercial vehicles has grown at an average annual rate of 3.1% over the same period. At the same time, the share of registered light commercial vehicles using diesel fuel increased from 34% in 2008 to 66% in 2018. The share of diesel fuelled passenger vehicles increased from 4.3% to 12.8% over the same period.

Figures 10 and 11 show the average annual distance travelled per registered vehicle for passenger and light commercial vehicles respectively. The most notable feature of both graphs is that diesel fuelled vehicles travelled further each year than petrol fuelled vehicles. This is unsurprising, because one of the main factors encouraging vehicle owners choose diesel in preference to petrol fuelled vehicles is the lower fuel cost, because of the greater volumetric fuel use efficiency of diesel vehicles, all else being equal. Owners who drive greater distances each year are therefore more likely to prefer diesel to petrol. As would be expected, from the arithmetic involved, this shift from petrol to diesel fuelled vehicles caused the average annual distance travelled by vehicles of both fuel types to decrease somewhat, while the average

distance travelled by the fleet of vehicles as a whole changed only very slightly, over the period from 2012 to 2018.

Figure 10

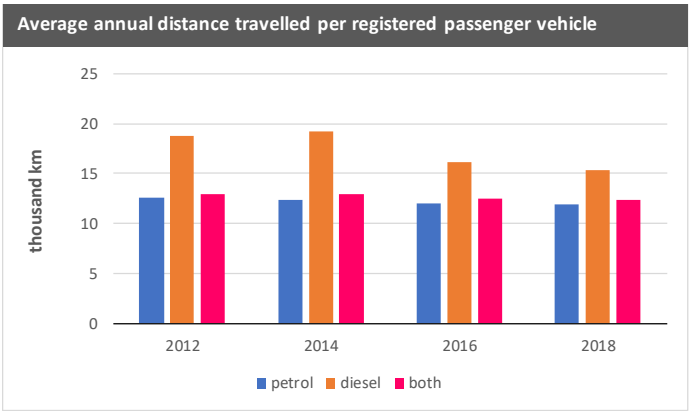
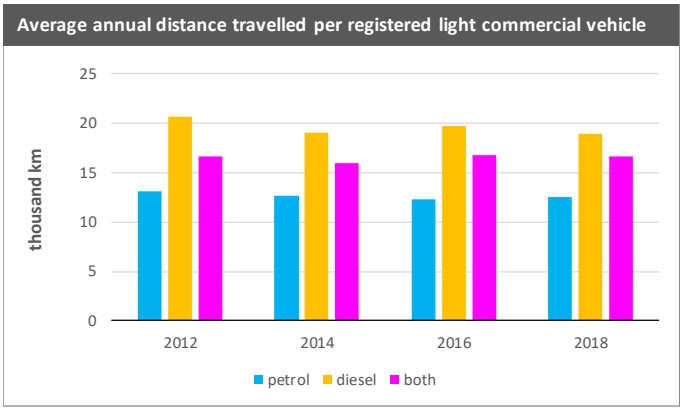


Figure 11



The final pair of graphs, Figures 12 and 13, shows the trend in emissions efficiency (fuel combustion emissions per 100 km) for passenger and light commercial vehicles respectively. Clearly, diesel fuelled vehicles of both types have lower emissions efficiency (higher emissions intensity) than petrol fuelled vehicles. This difference may not, however, indicate that diesel vehicles are more emissions intensive than petrol vehicles of either equal vehicle mass of engine power. It is probably more likely that drivers who prefer to drive heavier or more powerful vehicles choose diesel rather than petrol because of the higher volumetric fuel efficiency of diesel fuelled vehicles on a like for like basis.

What both graphs do indisputably show is that there has been virtually no change in the average emissions efficiency of either passenger or light commercial vehicles, whether fuelled by petrol or diesel. This means of course that an increase in total distance travelled will flow through directly to higher emissions. Indeed, if the data from the most recent (2018) *Survey of Motor Vehicle Use* are to be believed, average efficiency deteriorated in 2018, for both passenger and light commercial vehicles.

Figure 12

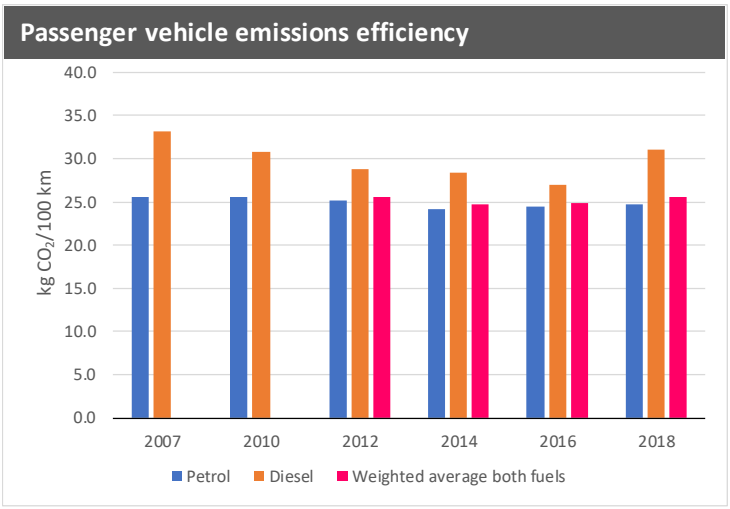
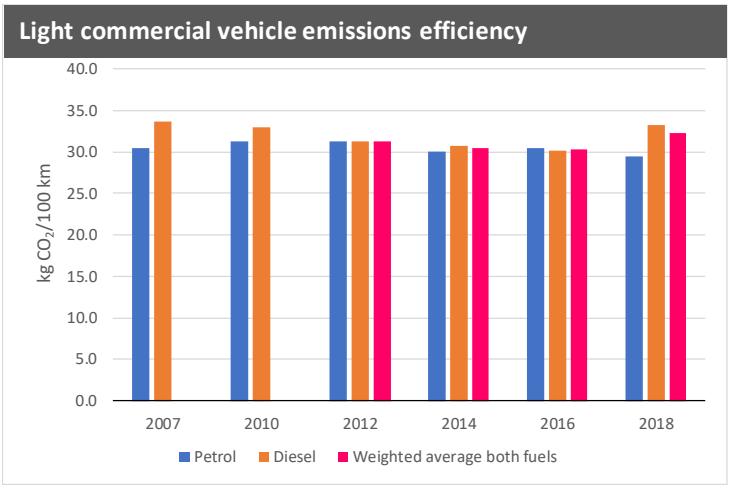


Figure 13



In conclusion, the preceding analysis of data extracted from the *Survey of Motor Vehicle Use*, and other ABS series provides a clear account of the factors driving the increase in diesel consumption for road transport, and the resultant increase in emissions over the past ten or more years. As would be expected, given that the apparent downturn in diesel consumption is so recent, the analysis provides no direct evidence of the reasons for this downturn, other than to confirm that road transport is the main sector causing diesel consumption to increase so strongly over recent years.

One explanatory factor could be a sudden cessation of the shift from petrol to diesel in new vehicle purchases. However, there is no evidence of any such shift in the most recent (2019) ABS *Motor Vehicle Census* and, even if there were, it is hard to see how it would cause such a sudden change in fuel consumption patterns. Fairly obviously, the direct cause of lower vehicle fuel consumption is most likely to be a reduction in the distance travelled. However, it is by no means obvious why any such reduction should suddenly be occurring now. The fact

that the reduction has affected mainly diesel may suggest that heavy freight vehicles are also seeing less use.

We know of no evidence available as yet which would support, or otherwise, any of these speculations. Underlying all the preceding discussion, however, is the stark fact that growing diesel consumption for road transport, particularly light passenger and freight vehicle transport, has been driving up Australia's greenhouse gas emissions for many years. As has been emphasised in the NEEA Report on many previous occasions, the average fuel consumption by light vehicles in Australia is higher than in almost all other countries and also, unlike most other comparable countries, Australia has no fuel efficiency or emissions performance standards which would require new vehicles to achieve lower fuel efficiency performance. It is past time that the government's refusal to give serious attention to road transport emissions received the same level of public scrutiny as its failure to seriously engage with the electricity supply system transition.

Such public scrutiny should extend also to the consumption of petrol. As Figures 12 and 13 show, the emissions efficiency of petrol consumption in light vehicles has scarcely changed in over ten years. Petrol consumption is decreasing only because fewer vehicles are using petrol, not because it is being used more efficiently. Were petrol use efficiency increasing, the reduction in consumption would be considerably larger.

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. In 2017 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. However, this upgrade was unable to correct under-reporting in past years, under the voluntary reporting arrangements then applying. For this reason, emissions calculated from *Australian Petroleum Statistics* sales data have been replaced by the *National Greenhouse Gas Inventory* emissions data for the years 2011 to 2016 inclusive.

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.