cedex® CARBON EMISSIONS INDEX PLUS

Providing a comprehensive and early indication of key greenhouse gas and energy trends in Australia.

Combining: Full report, data to September 2015 and National Electricity Market update, data to November 2015.

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Full reports available at www.pittsh.com.au/cedex and http://theaus.in/CEDEXOctober15

Introduction

This CEDEX® report contains data for emissions from all fuels up to the end of September 2015. The *Electricity Update*, at the end of the main report, shows emissions from generators in the National Electricity Market (NEM) up to the end of November 2015.

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.

Full reports are published on a quarterly basis; *Electricity Updates* are published monthly.

Full report: total energy emissions to September 2015

As all readers will know, publication of this report comes during the first week of the crucial UN Climate Change Conference (COP21 under the UNFCCC) in Paris. For that reason, we devote most of the full report to looking at overall trends in Australia's energy combustion emissions, including changes since 2004-05, the reference year chosen by the Australian government for its official 2030 emissions reduction target.

Energy combustion emissions covered by CEDEX® include all emissions arising from the generation of electricity in the National Electricity Market (NEM), all emissions from the combustion of petroleum products within Australia, i.e. excluding international ship and aircraft bunkers, and all emissions from the combustion of natural gas by gas consumers (i.e. not including emissions from the gas industry's own use of gas – see below) in NSW, Victoria, SA and Tasmania. All data are reported as moving annual totals, so as to remove seasonal effects on consumption of relevant products, and in terms of the changes since June 2009. The emissions reported by CEDEX® reached their historical maximum in December 2008, i.e. in the calendar year 2008. By June 2009 the annualised total, i.e. total for financial year 2008-09, had fallen by 0.7%. The financial year 2008-09 is also the year in which Australia's total emissions from fossil fuel combustion, as reported in Australia's National Greenhouse Gas Inventory, reached their historic maximum.

Changes in the total of these emissions are shown in Figure 1. As the last four CEDEX® reports have described, total emissions have been increasing strongly since July 2014, largely driven by increases from electricity generation. The increase in electricity emissions has been caused by increased supply from black and brown coal generators, and reduced supply from hydro and gas generators, as discussed in almost every issue of CEDEX® *Electricity Update* over the past twelve months.

But Figure 1 also shows that petroleum emissions continue to grow, though more slowly than they did before 2013, and natural gas emissions also appear to be increasing. As Figure 3 shows, continuing growth in emissions from petroleum is mainly driven by increased consumption of diesel fuel. Diesel consumption has also been regularly examined in previous CEDEX® Reports; we discuss both diesel and aviation fuel again, later in this *Report*. We also briefly discuss the rather intriguing increase in emissions from gas consumption.

Stepping back from this detail we see that, while the Prime Minister has told the world that Australia will reduce its emissions by 26 to 28 per cent by 2030, the energy emissions reported by CEDEX® have increased by 3.5 per cent per cent in the 15 months since June 2014 alone. In 2012-13, the most recent year for which the national emissions inventory has been completed, emissions reported by CEDEX® were 58% of the national total. Assuming as an approximation that this proportion still applies then, in just 15 months, Australia's emissions have increased by 2 per cent.

FIGURE 1

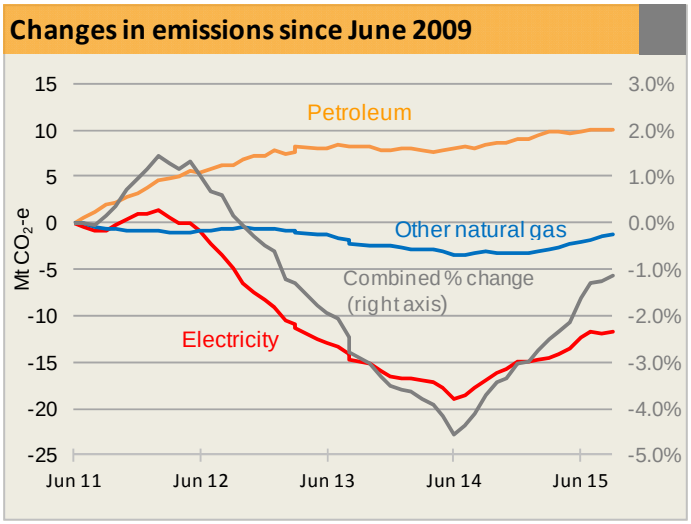
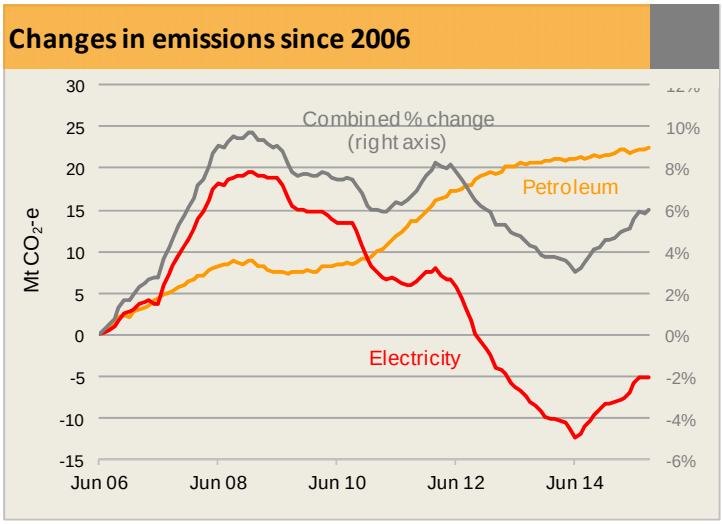


FIGURE 2



A somewhat longer term perspective on what Australia's emissions reduction target means is provided by Figure 2. It starts from 2005-06, not 2004-05, the reference year for the reductions target, because most of the data on which CEDEX® is based were not publicly available until a year later. (Note that the small difference in petroleum emissions trends between the two Figures is caused by different treatments of aviation fuel data, also imposed by input data limitations.) Even so, natural gas data were not available, but that does not greatly affect the conclusion. In summary, CEDEX® emissions were 6 per cent less in 2005-06 than in the year to September 2015. Moreover, as national emissions inventory data show that the emissions which CEDEX® reports increased between 2004-05 and 2005-06, 6 per cent is an underestimate of the increase which has occurred since 2004-05.

What is worse, CEDEX® cannot report what is probably Australia's fastest growing source of emissions – those associated with processing natural gas for export as LNG, because none of the required data are publicly available.

Making a rough estimate, in the absence of a full national inventory, the Prime Minister's emission reduction target will require Australia's emissions to fall from current levels by an amount which is around 160 Mt CO_2-e, possibly slightly more. This would require an average annual reduction of about 11 Mt CO_2-e every year from now until 2030. Almost all of this will have to come from energy; all other sources accounted for only 177 Mt CO_2-e or 32 per cent of the total in 2012-13. Yet energy related emissions are at this moment increasing, rather than decreasing, by about 10 Mt CO_2-e each year. Australia's energy emissions are changing at about the rate required, but going away from the target, not towards it!

Australia will need fundamental changes in not only in the way to generates and consumes electricity, but also in its use of petroleum products for transport and mobile equipment, if it is to have any chance of meeting its 2030 emissions reduction target.

Petroleum

As already mentioned, Figure 3 shows that growing diesel consumption has for any years been the main driver of growth in emissions from petroleum product consumption. Limitations of available data make it rather difficult to identify the factors behind increased diesel consumption. It is probable, however, that a consumer shift towards diesel engine passenger vehicles, increased road freight and increased off-road consumption, particularly by the mining industry, have all contributed.

FIGURE 3

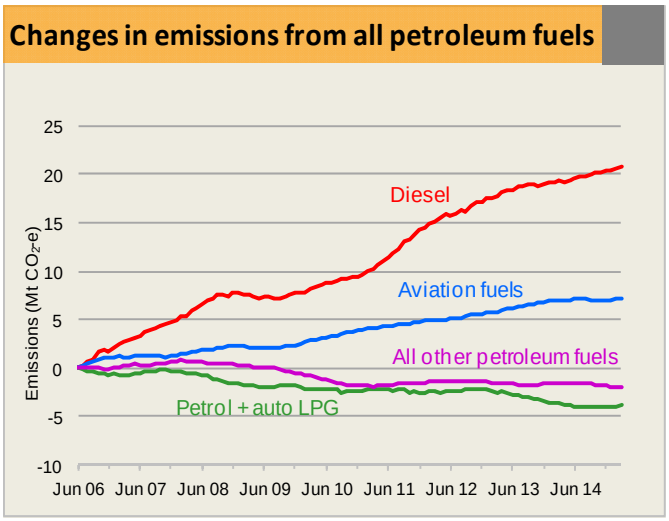
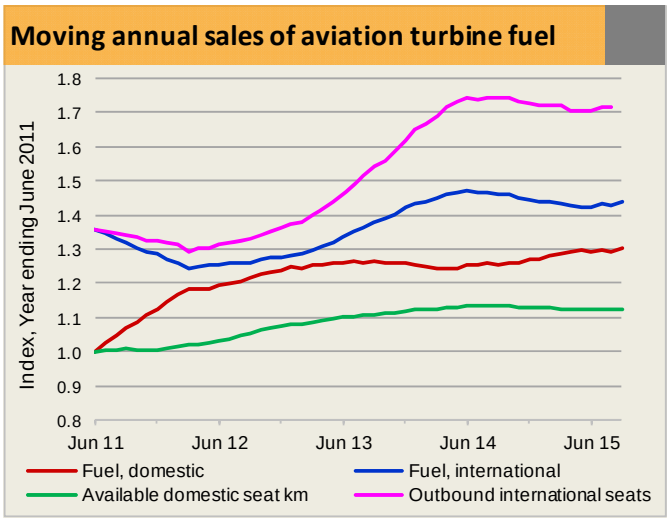


FIGURE 4



Starting from July 2015, the Industry Department publication, from which the fuel sales data used by CEDEX® is sourced, upgraded the quality of data on aviation fuel sales, making it possible to do an accurate monthly separation of domestic from international sales, going back to 2010. Emissions from fuel consumed by international aviation are not reported in national inventories, but are reported under the UNFCC in a separate category. Figure 4 uses these new data to compare trends in domestic and international consumption of jet fuel on an index number basis. It will be seen that international sales account for well over half the total. Each is then plotted with the most appropriate indicator of activity available in the statistics published by the Bureau of Infrastructure, Transport and Regional Economics.

A somewhat contrasting pair of trends can be seen. International aviation appears to have made gradual improvements in its fuel use efficiency up to about June 2014, and been steady since then. By contrast, domestic aviation showed a rather dramatic deterioration during the first few months of the period covered, but since then has also been fairly steady. We would be interested to hear of possible explanations for these trends from any readers who may have more knowledge of the airline industry.

Natural gas

In the two previous CEDEX® *Reports* the somewhat unexpected increase in gas consumption in Victoria has been noted. Data in this *Report*, to September 2015, confirms that trend, as seen in Figures 5 and 6. The data also confirm that there has been no similar change in any of the other three states shown. (As previously explained, it is no longer possible to obtain reliable data for Queensland.)

FIGURE 5

Consumption of natural gas by state

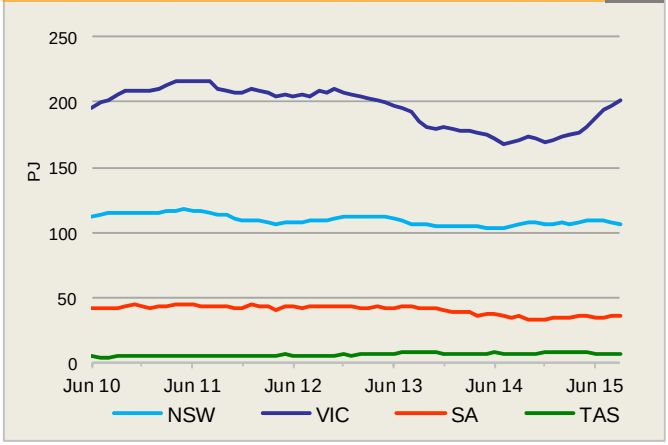
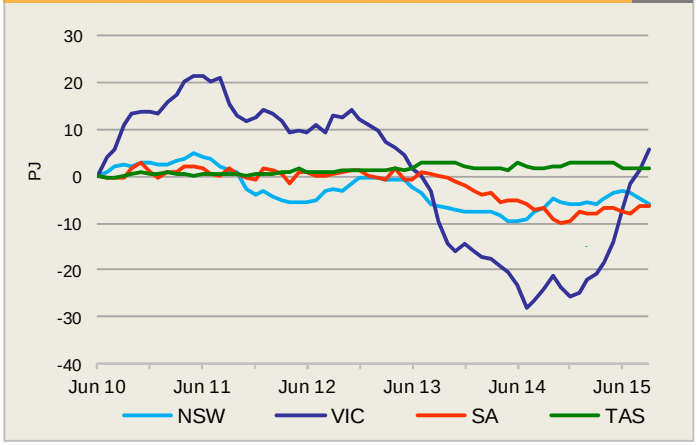


FIGURE 6

Changes in consumption of natural gas by state



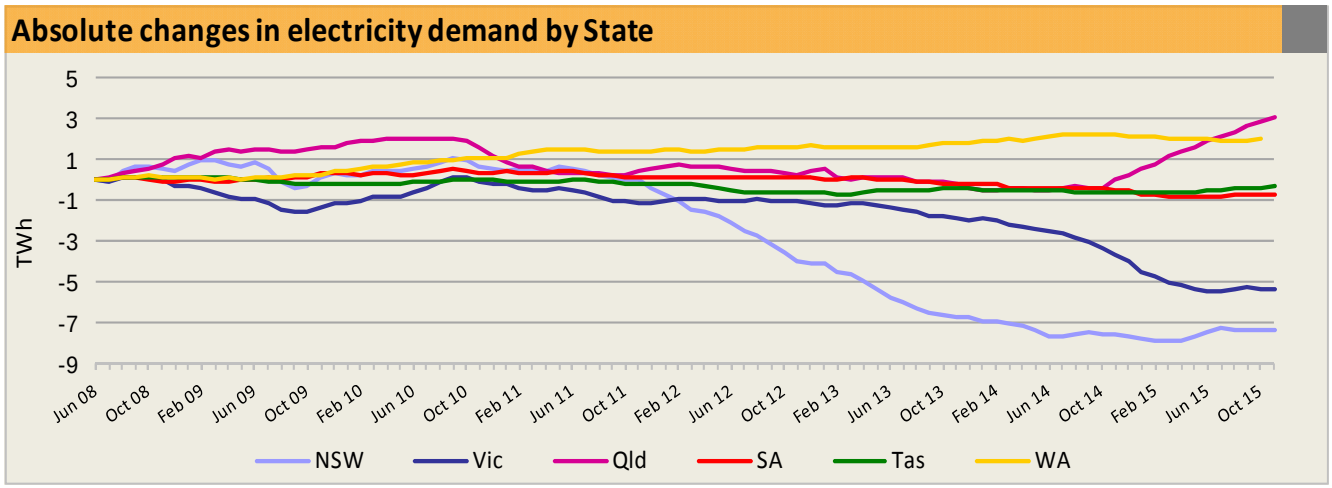
Residential consumption, mainly for water and space heating, accounts for about half of total annual gas consumption in Victoria. The winter months of July and August were definitely colder than average, which could explain some of the observed increase. However, for reasons explained in the June *Report*, it cannot explain all of the increase. It will probably not be clear for some months whether the remainder of the observed increase is a permanent or a temporary phenomenon. If permanent, it would add about 1.5 Mt CO_2-e to Australia's annual emissions.

National Electricity Market update to November 2015

Only one story: strong demand growth for Queensland gas production

NEM data to the end of November 2015 show that the only significant changes since last month are those being driven by the ramp up of electricity consumption to support gas seam gas production in Queensland, which has been discussed in previous CEDEX® *Electricity Updates*. There has been virtually no change in demand in any other state, with the exception of a small increase in Tasmania (Figure 7).

FIGURE 7



Increased demand in Queensland has been served by an increase in output from black coal generators in that state (Figure 8). The position of the coal generators has been strengthened by the continuing fall in gas generation, as the gas is now going to the LNG plants, the second of which made its first shipment in October. Increased Queensland demand has also meant that the lower cost Queensland coal generators have reduced exports to NSW, allowing the NSW coal generators to achieve a modest gain in market share. Meanwhile, there was a small drop in output from the Victorian brown coal generators. The overall outcome was virtually no increase in emissions, despite an increase in the coal share of generation, as black coal substituted for brown, i.e. the reverse of the trend which has been seen for some months past (Figure 9).

There was a modest increase in wind generation, all in NSW, as the Taralga wind farm reaches full capacity. As previously explained, little or no additional output is likely for at least a year, as the effect of the construction freeze of the past two years flows through.

Looking to the future, the absence of any demand growth other than for gas production is the only hopeful sign in the otherwise gloomy outlook for Australia's prospects of achieving significant emissions reductions. It is ironic, to say the least, that production of coal seam gas for export as LNG, may increase Australia's emissions from coal fired electricity by as much a 9 Mt CO_2-e annually by 2020.

FIGURE 8

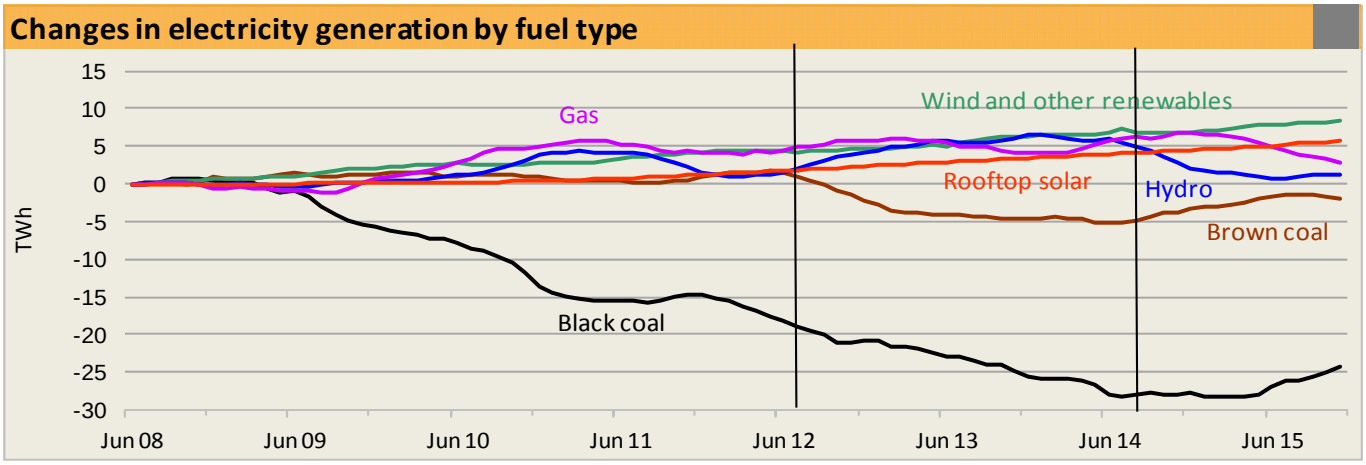
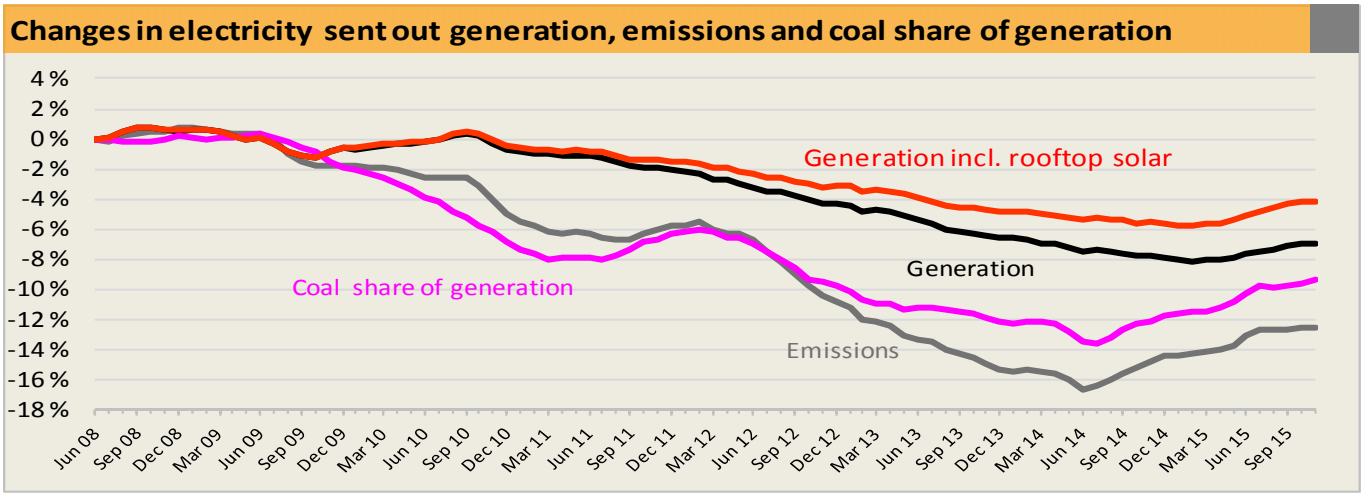


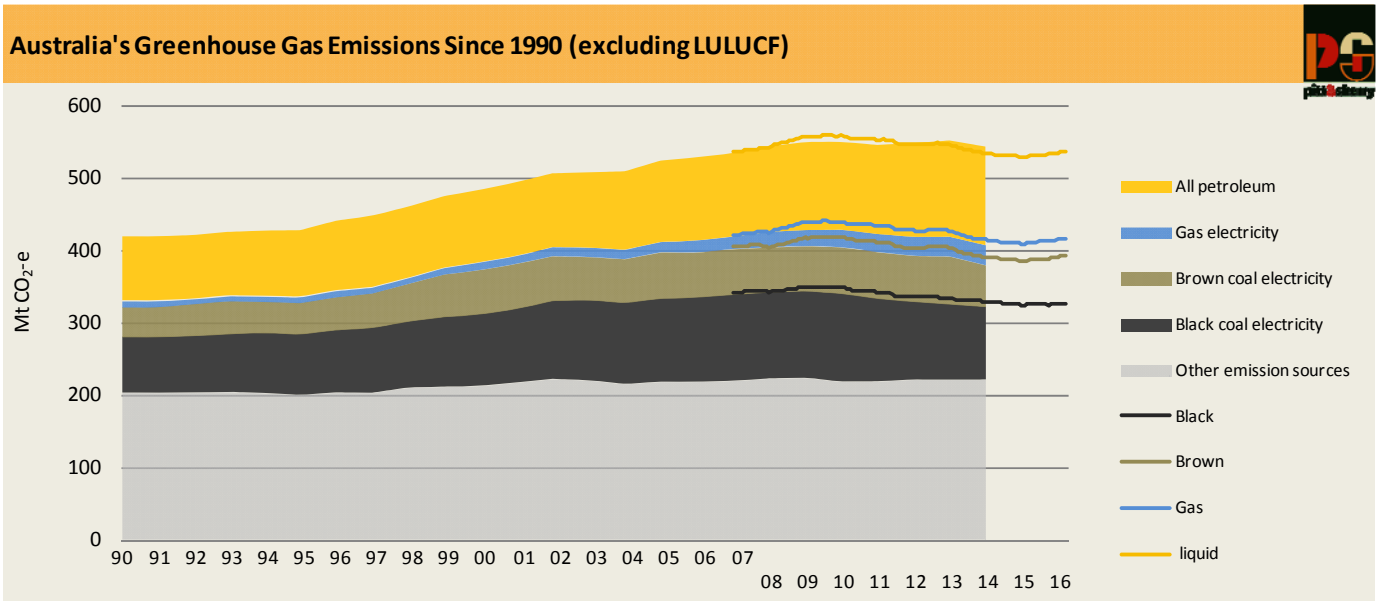
FIGURE 9



About pitt&sherry's carbon emissions index CEDEX®

The Energy Sector is the largest source of Australia's greenhouse gas emissions. The energy use covered by the CEDEX® accounted in 2012-13 for about 85% of Australia's total energy combustion emissions, and 58% of total emissions (excluding land use change and forestry), as reported in the National Greenhouse Gas Inventory. Figure 13 below illustrates the growth in energy sector emissions, with the lines at the right showing the period and emission sources covered in the CEDEX®.

FIGURE 10



Data sourced from Department of the Environment and CEDEX®.

Between 1990 and 2013 Australia's total emissions, excluding land use change and forestry, Increased by 113.6 Mt CO_2-e, while energy combustion emissions increased by 116.0 Mt CO_2-e, i.e. 2 % more than the total net increase. Hence trends in energy emissions are the key indicator of Australia's ability to achieve significant reductions in total emissions.

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carbon emissions index

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The CEDEX® is calculated monthly from three industry resources:

1 Emissions from coal, petroleum and natural gas consumed at all fossil fuel fired power stations in the National Electricity Market (NEM): Data on sent out electricity is sourced from the Australian Energy Market Operator (AEMO), using the service provided by NEM-Review. Sent out electricity data is multiplied by the emission factor (combustion emissions per MWh sent out) for the power station, sourced from a report published by AEMO.

2 Emissions from total national sales of petroleum products: Data on petroleum sales are available from the Department of Industry and Science. Emission factors are from the Department of the Environment.

3 Emissions from natural gas from the National Gas Market (south eastern states). These data were not available prior to 2009.

The main sources not covered, which account for about 19% of other energy combustion emissions, are:

- Consumption of natural gas in WA and NT
- Consumption of fossil fuels for electricity generation in WA and the NT
- Consumption of coal in uses other than electricity generation (such as in steel, cement and alumina production)
- Petroleum products used as fuel at oil refineries
- Combustion related emissions of CH_4 and N_2O, other than from NEM power stations.

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NEM-Review, www.nem-review.info

Data analysis, text and graphs:
Hugh Saddler, Elena Tinch, Mark Johnston

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