Australian Government
Department of Climate Change
and Energy Efficiency

AUSTRALIAN NATIONAL GREENHOUSE ACCOUNTS

National Inventory by Economic Sector

2009–10

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PART A – DIRECT EMISSIONS (SCOPE 1 EMISSIONS)

Emissions at a Glance

The *National Inventory by Economic Sector* provides information on national emissions on a Kyoto accounting basis, disaggregated by Australia-New Zealand Standard Industry Classifications (ANZSIC). It complements the quarterly updates to the *National Greenhouse Gas Inventory* and the *State and Territory Greenhouse Gas Inventory*, which provides estimates of emissions classified according to process-based emission categories. This edition of the report has transitioned to the 2006 ANZSIC framework and made improvements to the allocation of emissions from road transport (see notes of details).

In 2009/10 the major emission sources were electricity, gas and water and primary industries (agriculture, forestry, fishing and mining) accounting for 37.0% and 30.4% of direct emissions respectively.

Table 1:
Australia's Direct Greenhouse Gas Emissions by Economic Sector 2009/10[(a)]

	Emissions (Mt CO_2-e)	Share of total emissions (%)
All Sectors	**560.6**	
Primary Industries	**170.3**	**30.4**
Agriculture, Forestry and Fishing	105.2	18.8
Mining	65.1	11.6
Manufacturing	**71.6**	**12.8**
Electricity, Gas and Water	**207.2**	**37.0**
Services, Construction and Transport	**59.7**	**10.7**
Residential	**51.9**	**9.3**

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/
(a) Estimated in accordance with the Kyoto Protocol accounting provisions and including Article 3.3 Land Use, Land Use Change and Forestry activities.

Trends in Direct Emissions

For the first time in the time-series, emissions from the electricity, gas and water sector decreased between 2008/09 and 2009/10 (2.9% or 6.1 Mt CO_2-e). Demand and supply side effects contributed to the decrease. In particular, there was a decrease in black coal electricity generation and increases in natural gas and hydroelectric generation in 2009/10.

Partially offsetting this decrease, emissions from metal products increased 11.0% or 3.3 Mt CO_2-e between 2008/09 and 2009/10. This was largely a result of the resumption of normal operations in the iron and steel industry following maintenance to blast furnaces and facility upgrades which occurred during the economic slowdown.

Over the longer term, direct emissions have increased since 1989/90 in mining (76.4% or 28.2 Mt CO_2-e), electricity, gas and water (52.2% or 71.0 Mt CO_2-e), services, construction and transport (29.6% or 13.6 Mt CO_2-e) residential (27.5% or 11.2 Mt CO_2-e) and manufacturing (6.3% or 4.2 Mt CO_2-e) sectors.

Emissions from agriculture, forestry and fishing have declined by 52.7% (117.2 Mt CO_2-e) since 1989/90. This strong decline reflects the impacts of declining emissions from the clearing of forest cover and increased removals from afforestation/ reforestation activities.

Table 2:
Detailed Direct Greenhouse Gas Emissions Estimates by Economic Classification: Australia 1989/90, 2008/09 and 2009/10(a)

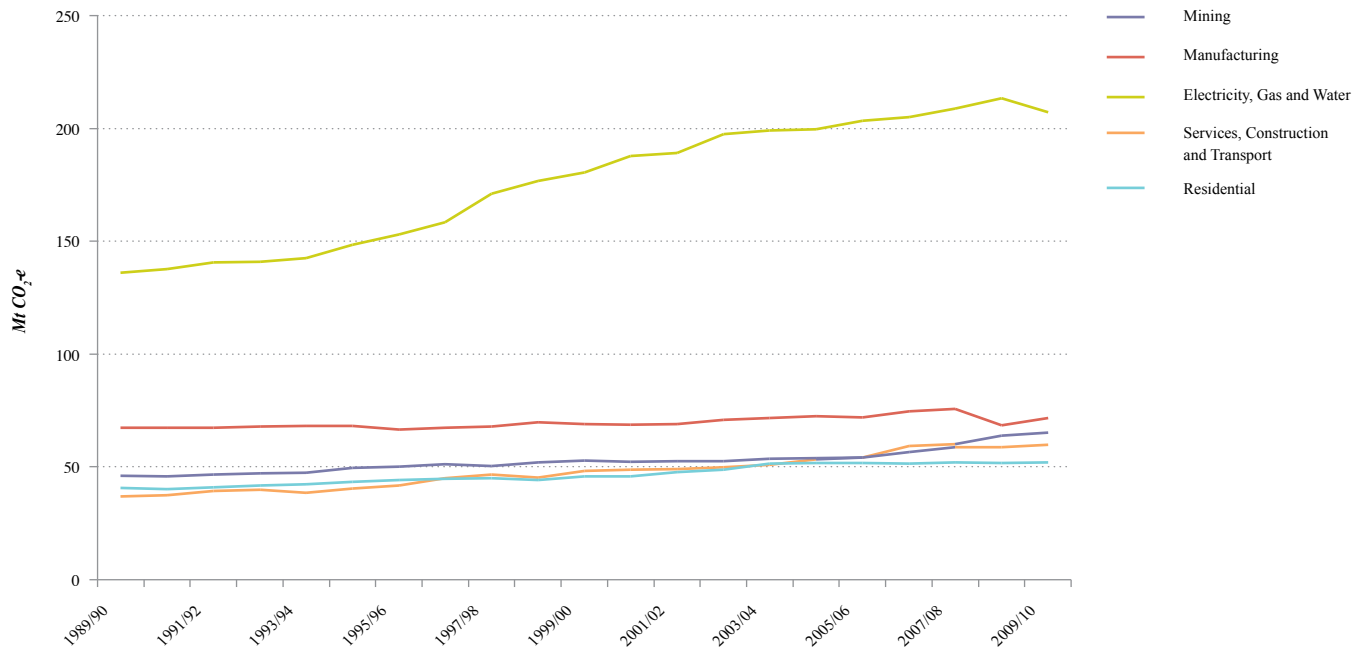
ANZSIC code	Industry Classification	Emissions (Mt CO_2-e)			Change in emissions (%)	
		1989/90	2008/09	2009/10	1989/90 to 2009/10	2008/09 to 2009/10
Div A	**Agriculture, forestry and fishing**	**222.4**	**117.3**	**105.2**	**-52.7**	**-10.3**
Div B	**Mining**	**36.9**	**63.7**	**65.1**	**76.4**	**2.1**
06	Coal mining	20.2	33.4	33.1	63.7	-1.0
07	Oil and gas extraction	12.8	23.4	25.0	96.0	7.1
08-10	Metal ore and non-metallic mineral mining and quarrying	3.9	7.0	7.0	77.5	0.2
Div C	**Manufacturing**	**67.4**	**68.5**	**71.6**	**6.3**	**4.5**
11-12	Food, beverages, tobacco	4.8	4.6	4.5	-6.1	-1.1
13	Textile, clothing, footwear and leather	0.6	0.5	0.4	-26.1	-8.2
14-16	Wood, paper and printing	2.0	2.3	2.3	18.1	1.3
17-19	Petroleum, coal and chemical	15.5	18.7	18.6	19.9	-0.6
20	Non-metallic mineral products	10.0	11.7	11.8	17.8	0.4
21-22	Metal products	33.6	29.7	33.0	-1.9	11.0
24	Machinery and equipment	0.8	0.9	0.9	12.3	0.8
25	Other manufacturing	0.1	0.2	0.1	30.1	-36.2
Div D	**Electricity, gas and water**	**136.1**	**213.3**	**207.2**	**52.2**	**-2.9**
Div E-H, J-Q	**Commercial services and construction**	**32.9**	**35.3**	**35.8**	**8.8**	**0.9**
Div I	**Transport and storage**	**13.1**	**23.0**	**23.9**	**81.5**	**3.6**
	Residential	**40.7**	**51.8**	**51.9**	**27.5**	**0.1**
	Residential (non transport)	8.1	10.4	10.6	31.0	1.7
	Residential (transport)	32.6	41.4	41.3	26.7	-0.3

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) These estimates are reported on a Kyoto Protocol accounting basis and include emissions from Article 3.3 LULUCF activities.

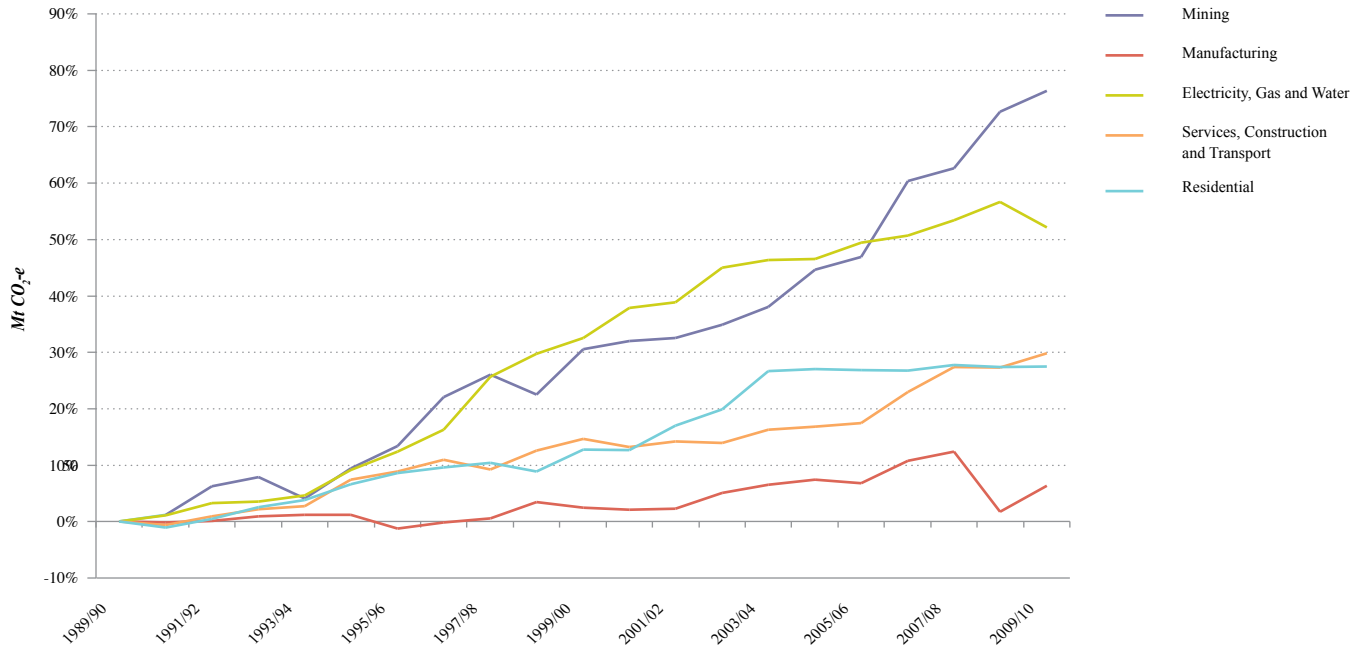
(b) Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only available for 1989/90 and for the commitment period (2008-2012). Therefore, it is not possible to present a consistent time-series of emissions and removals for Division A Agriculture, Fisheries and Forestry.

Figure 1:
Direct Emissions by Economic Sectors 1989/90 – 2009/10



Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/
Note:
– Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only available for 1989/90 and for the commitment period (2008-2012). Therefore, it is not possible to present a consistent time-series of emissions and removals for Division A Agriculture, Forestry and Fishing.

Figure 2:
Percentage Change in Direct Emissions by Economic Sectors 1989/90-2009/10



Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/
Note:
– Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only available for 1989/90 and for the commitment period (2008-2012). Therefore, it is not possible to present a consistent time-series of emissions and removals for Division A Agriculture, Forestry and Fishing.

State and Territory Direct Emissions by Economic Sector

The profile of emissions by economic sector in each state and territory reflect the diverse circumstances of individual states (see Table 4). For example, in 2009/10:

- The largest quantity of net emissions from the agriculture, forestry and fishing sector was attributed to Queensland (52.2 Mt CO_2-e);
- The largest quantity of direct emissions from the electricity, gas and water sector was attributed to Victoria (66.8 Mt CO_2-e);
- The largest quantity of direct emissions from the manufacturing sector was attributed to New South Wales (23.9 Mt CO_2-e); and
- The largest quantity of direct emissions from the mining sector was attributed to New South Wales (20.8 Mt CO_2-e).

Figure 3:
Direct State and Territory Emissions by Economic Sector, 2009/10

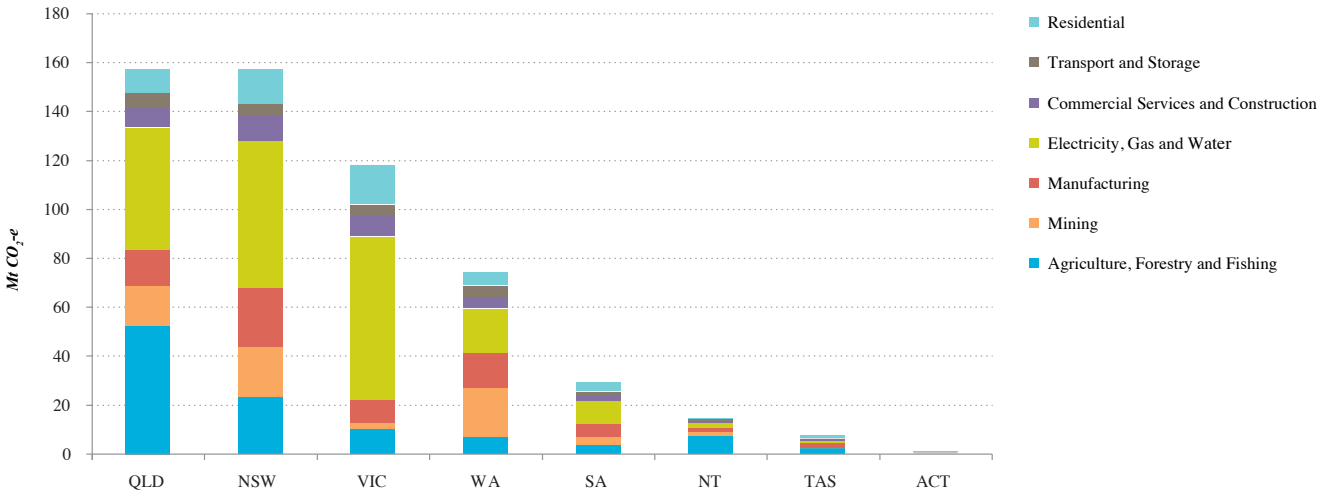


Table 3:
State and Territory Emissions by Economic Classification 1989/90

ANZSIC code	Industry Classification	NSW[(a)]	VIC	QLD	WA
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**165.1**	**105.2**	**165.1**	**58.6**
Div A	Agriculture, forestry and fishing	48.4	20.0	110.9	23.5
Div B	Mining	17.8	4.2	4.0	5.1
Div C	Manufacturing	25.9	10.4	11.4	10.0
Div D	Electricity gas and water	47.1	46.0	23.3	11.0
Div E-H, J-Q	Commercial services and construction	10.7	8.5	6.2	3.1
Div I	Transport and storage	3.6	2.9	2.8	1.9
	Residential	11.5	13.3	6.5	3.9

ANZSIC code	Industry Classification	SA	TAS	NT	ACT (partial inventory)[(a)]
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**31.6**	**11.3**	**11.1**	**1.1**
Div A	Agriculture, forestry and fishing	7.5	5.9	6.1	0.1
Div B	Mining	4.9	0.2	0.6	0.0
Div C	Manufacturing	5.0	2.3	2.2	0.1
Div D	Electricity gas and water	7.1	0.6	0.9	0.0
Div E-H, J-Q	Commercial services and construction	2.4	0.8	0.4	0.3
Div I	Transport and storage	1.2	0.3	0.4	0.1
	Residential	3.4	1.2	0.4	0.6

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) The NSW inventory includes ACT emissions from the stationary energy sector.

Notes:

– These State and Territory estimates are reported on a Kyoto Protocol accounting basis and include emissions from Article 3.3 LULUCF activities.

– The difference between the national and the sum of the state and territory emissions reflects the inclusion of military transport and external territories in the national inventory and a small balancing item.

– Uncertainty estimates at a sectoral level are reported in the national inventory. While no quantitative estimates have been produced, the Department of Climate Change & Energy Efficiency assesses that the uncertainties for emission estimates for the inventory, particularly the smaller states and territories, will be somewhat higher than for the national inventory.

Table 4:
State and Territory Emissions by Economic Classification 2009/10

ANZSIC code	Industry Classification	NSW[(a)]	VIC	QLD	WA
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**157.4**	**117.9**	**157.3**	**74.3**
Div A	Agriculture, forestry and fishing	22.9	10.1	52.2	6.7
Div B	Mining	20.8	2.7	16.4	20.2
Div C	Manufacturing	23.9	9.2	14.7	14.4
Div D	Electricity, gas and water	60.1	66.8	50.0	18.0
Div E-H, J-Q	Commercial services and construction	10.2	8.4	7.9	4.4
Div I	Transport and storage	5.2	4.6	6.2	5.1
	Residential	14.3	16.1	9.8	5.5

ANZSIC code	Industry Classification	SA	TAS	NT	ACT (partial inventory)[(a)]
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**29.3**	**7.6**	**14.7**	**1.2**
Div A	Agriculture, forestry and Fishing	3.8	2.2	7.2	0.0
Div B	Mining	3.2	0.2	1.6	0.0
Div C	Manufacturing	5.3	2.3	1.8	0.0
Div D	Electricity, gas and water	9.2	0.7	2.2	0.1
Div E-H, J-Q	Commercial services and construction	2.4	0.8	0.5	0.3
Div I	Transport and storage	1.5	0.4	0.8	0.1
	Residential	3.8	1.1	0.5	0.7

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) The NSW inventory includes ACT emissions from the stationary energy sector.

Notes:

– These State and Territory estimates are reported on a Kyoto Protocol accounting basis and include emissions from Article 3.3 LULUCF activities.

– The difference between the national and the sum of the state and territory emissions reflects the inclusion of military transport and external territories in the national inventory and a small balancing item.

– Uncertainty estimates at a sectoral level are reported in the national inventory. While no quantitative estimates have been produced, the Department of Climate Change & Energy Efficiency assesses that the uncertainties for emission estimates for the inventory, particularly the smaller states and territories, will be somewhat higher than for the national inventory.

PART B – INDIRECT EMISSIONS FROM THE GENERATION OF PURCHASED ELECTRICITY (SCOPE 2 EMISSIONS)

- Emissions from the generation of electricity may be allocated to electricity consumers according to the share of electricity consumption of each economic sector. These estimates are known as "indirect" emissions from the generation of purchased electricity, or scope 2 emissions, and are defined in the *National Greenhouse Accounts Factors Workbook (NGA 2011)*, with reference to the World Resources Institute and World Business Council for Sustainable Development (WRI-WBCSD), *The Greenhouse Gas Protocol: A corporate accounting and reporting standard (Revised edition), 2004 (WRI/WBCSD 2004)*.
- Indirect emissions estimate the impact of emissions generated offsite (in this case in the electricity industry) as a result of economic activity in particular other sectors and reflects the interdependence of economic sectors across the Australian economy.

Table 5:
Australia's Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) by Economic Sector 1989/90, 2009/10[(a)(b)(c)(d)]

	Emissions (Mt CO_2-e)		Change in emissions (%)
	1989/90	2009/10	1989/90 – 2009/10
All Electricity Generation	**129.6**	**201.5**	**55.5**
Primary Industries	**9.2**	**15.3**	**66.0**
Agriculture, Forestry and Fishing	1.6	1.9	23.1
Mining	7.7	13.4	74.8
Manufacturing	**42.2**	**54.8**	**29.7**
Services, Construction and Transport	**24.6**	**52.3**	**112.6**
Residential	**33.9**	**50.1**	**48.1**

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) Estimated in accordance with the Kyoto Protocol accounting provisions.

(b) Scope 2 emissions account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGA 2011).

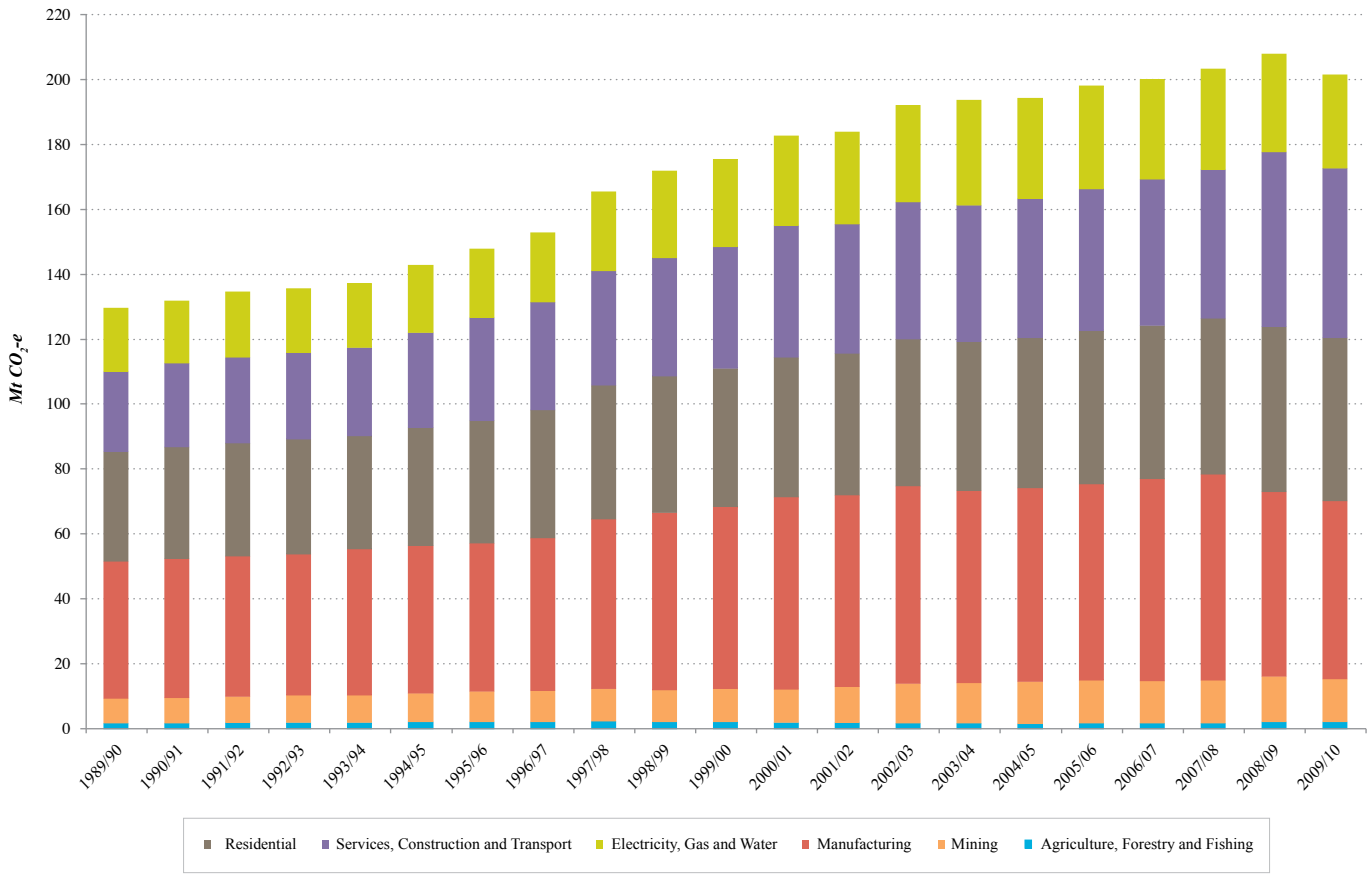
(c) The estimate of scope two emissions from electricity generation consumed within the electricity, gas and water sector includes own use of electricity by generators and is not necessarily purchased electricity. As these emissions do not necessarily meet the definition outlined at (b) they have been omitted from sectoral rows of the table above but included in the total. Electricity generation emissions attributed to the electricity, gas and water sector were 19.6 Mt CO_2-e in 1989/90 and 29.0 Mt CO_2-e in 2009/10.

(d) Sectoral emission totals do not sum to all electricity generation emissions as the electricity, gas and water sector is not included in the above table as outlined at (c).

Trends in Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions)

Emissions from electricity generation across all sectors have increased by 56.9% since 1989/90 (see Table 5). The largest driver of increased indirect emissions from the generation of purchased electricity is the services, construction and transport sector which has recorded an increase of 27.7 Mt CO_2-e.

Figure 4:
Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity Trends by Economic Sector: 1989/90 – 2009/10



Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

Note:

– Scope 2 emissions account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGA 2011). Emissions from electricity generation consumed within the electricity, gas and water sector are included in the above graph for completeness although this electricity use includes own use of generators and does not necessarily meet the NGA 2011 definition of scope 2 emissions.

Table 6

Indirect Emissions from the Generation of Purchased Electricity (Scope 2 Emissions), Australia, 1989/90, 2008/09, 2009/10[(a)(b)]

ANZSIC code	Industry Classification	Emissions (Mt CO_2-e)		
		1989/90	2008/09	2009/10
Div A	Agriculture, forestry and fishing	1.6	1.9	1.9
Div B	Mining	7.7	14.2	13.4
Div C	Manufacturing	42.2	56.8	54.8
Div E-H, J-Q	Commercial services and construction	23.0	50.1	48.9
Div I	Transport and storage	1.6	3.7	3.3
	Residential	33.9	50.8	50.1

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) Scope 2 emissions are account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGA 2011).

(b) The estimate of scope two emissions from electricity generation consumed within the electricity, gas and water sector includes own use of electricity by generators and is not necessarily purchased electricity. As these emissions do not necessarily meet the definition outlined at (b) they have been omitted from the table above. Electricity generation emissions attributed to the electricity, gas and water sector were approximately equal to 19.6 Mt CO_2-e in 1989/90, 30.3 Mt CO_2-e in 2008/09 and 29.0 Mt CO_2-e in 2009/10.

Table 7

1989/90 State and Territory Emissions from the Generation of Purchased Electricity (Scope 2 Emissions)[(a)(b)(c)]

ANZSIC code	Industry Classification	NSW[(c)]	VIC	QLD	WA
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Div A	Agriculture, forestry and fishing	0.5	0.5	0.3	0.2
Div B	Mining	1.6	0.9	2.1	2.6
Div C	Manufacturing	14.4	17.8	6.4	1.5
Div E-H, J-Q	Commercial services and construction	7.0	7.4	4.1	2.5
Div I	Transport and storage	0.7	0.4	0.6	0.0
	Residential	13.3	10.2	5.5	2.3

ANZSIC code	Industry Classification	SA	TAS	NT
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Div A	Agriculture, forestry and Fishing	0.1	0.0	0.0
Div B	Mining	0.2	0.0	0.2
Div C	Manufacturing	1.8	0.3	0.0
Div E-H, J-Q	Commercial services and construction	1.5	0.1	0.4
Div I	Transport and storage	0.0	0.0	0.0
	Residential	2.4	0.1	0.2

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) Scope 2 emissions account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGA 2011).

(b) The estimate of scope two emissions from electricity generation consumed within the electricity, gas and water sector includes own use of electricity by generators and is not necessarily purchased electricity. As these emissions do not necessarily meet the definition outlined at (b) they have been omitted from the table above. Electricity generation emissions attributed to the electricity, gas and water sector were approximately equal to 6.3 Mt CO_2-e in NSW, 6.7 Mt CO_2-e in VIC, 3.9 Mt CO_2-e in QLD, 1.4 Mt CO_2-e in WA, 1.1 Mt CO_2-e in SA, 0.05 Mt CO_2-e in TAS and 0.1 Mt CO_2-e in NT.

(c) The NSW inventory includes ACT emissions from the Stationary Energy sector.

Table 8

2009/10 State and Territory Emissions from the Generation of Purchased Electricity (Scope 2 Emissions)[(a)(b)]

ANZSIC code	Industry Classification	NSW[(c)]	VIC	QLD	WA
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Div A	Agriculture, forestry and fishing	0.5	0.7	0.3	0.1
Div B	Mining	3.1	0.8	3.5	4.8
Div C	Manufacturing	18.6	17.2	12.4	3.2
Div E-H, J-Q	Commercial services and construction	15.2	16.4	10.0	3.3
Div I	Transport and storage	1.1	0.9	1.1	0.2
	Residential	19.5	13.1	9.7	3.7

ANZSIC code	Industry Classification	SA	TAS	NT
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Div A	Agriculture, forestry and Fishing	0.2	0.0	0.0
Div B	Mining	0.8	0.1	0.2
Div C	Manufacturing	1.9	1.5	0.0
Div E-H, J-Q	Commercial services and construction	2.5	0.4	1.1
Div I	Transport and storage	0.0	0.0	0.0
	Residential	3.1	0.6	0.5

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

(a) Scope 2 emissions account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGA 2011).

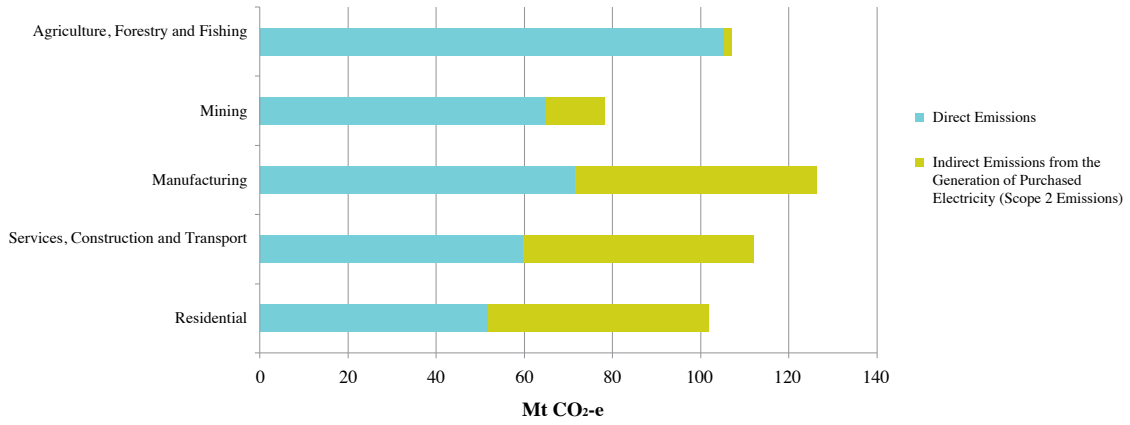
(b) The estimate of scope two emissions from electricity generation consumed within the electricity, gas and water sector includes own use of electricity by generators and is not necessarily purchased electricity. As these emissions do not necessarily meet the definition outlined at (b) they have been omitted from the table above. Electricity generation emissions attributed to the electricity, gas and water sector were approximately equal to 8.7 Mt CO_2-e in NSW, 9.7 Mt CO_2-e in VIC, 7.4 Mt CO_2-e in QLD, 1.5 Mt CO_2-e in WA, 1.2 Mt CO_2-e in SA, 0.2 Mt CO_2-e in TAS and 0.3 Mt CO_2-e in NT.

(c) The NSW inventory includes ACT emissions from the Stationary Energy sector.

PART C – COMBINED DIRECT EMISSIONS AND INDIRECT EMISSIONS FROM THE GENERATION OF PURCHASED ELECTRICITY

In this part of the report, the direct and scope 2 emissions have been combined to provide a broader understanding of the emissions resulting across the economy from activity within each economic sector. The direct emissions associated with electricity generation have been removed to avoid double counting as they are already embodied within the indirect scope 2 emissions from purchased electricity. Caution should be taken when analysing combined emissions due to the different conceptual bases of the emission estimate components. Direct emissions are allocated to individual sectors at the point of emissions while indirect emissions from the generation of purchased electricity (scope 2 emissions) are not produced within the bounds of the industry to which they are attributed.

Figure 5:
Australia's Combined Direct and Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) by Major Economic Sector, 2009/10



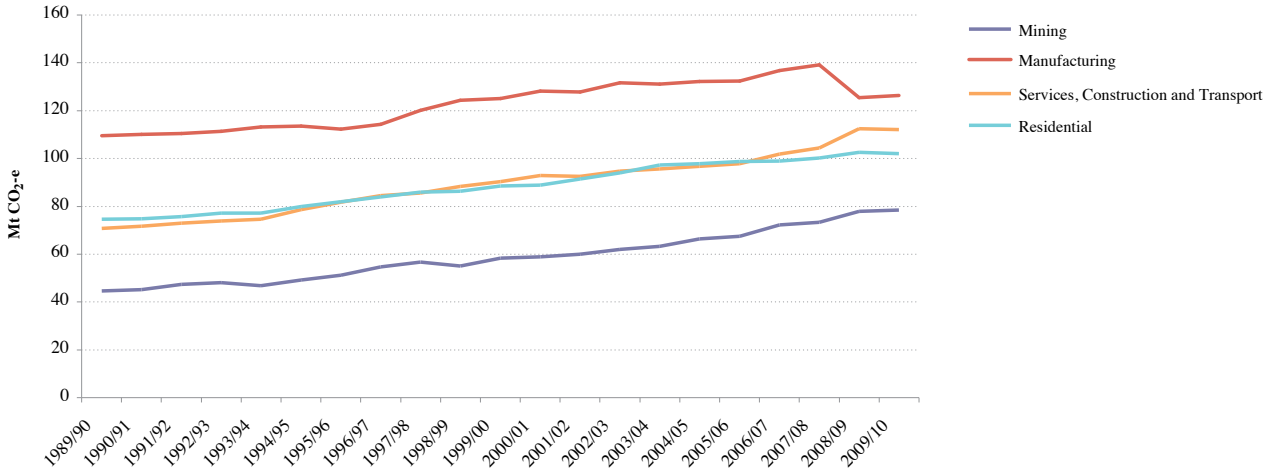
Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

Note:

– Scope 2 emissions account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGA 2011). Emissions from electricity generation consumed within the electricity, gas and water sector are not included in the figure above as this electricity use includes own use of generators and does not necessarily meet the NGA 2011 definition of scope 2 emissions.

Figure 6:

Combined Direct and Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) by Major Economic Sectors, 1989/90-2009/10



Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/

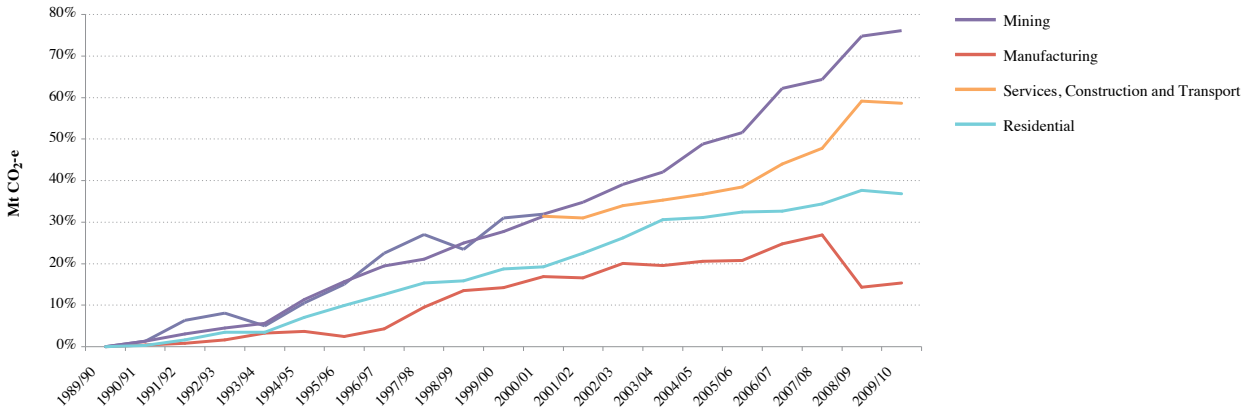
(a) Direct emissions and indirect greenhouse gas emissions from the generation of purchased electricity (Scope 2 Emissions) have been combined in the figure above to provide a broader understanding of the emissions resulting across the economy from activity within each economic sector. Caution should be taken when analysing combined emissions due to the different conceptual bases of the emission estimates.

(b) Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only available for 1989/90 and for the commitment period (2008-2012). Therefore, it is not possible to present a consistent time-series of emissions and removals for Division A Agriculture, Forestry and Fishing.

Figure 7:

Percentage Change in Combined Direct and Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) by Major Economic Sectors, 1989/90-2009/10

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/



(a) Direct emissions and indirect greenhouse gas emissions from the generation of purchased electricity (Scope 2 Emissions) have been combined in the figure above to provide a broader understanding of the emissions resulting across the economy from activity within each economic sector. Caution should be taken when analysing combined emissions due to the different conceptual bases of the emission estimates.

(b) Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only available for 1989/90 and for the commitment period (2008-2012). Therefore, it is not possible to present a consistent time-series of emissions and removals for Division A Agriculture, Forestry and Fishing.

APPENDIX 1 – NOTES

Australian National Greenhouse Accounts

The Australian National Greenhouse Accounts comprise the:

- The *Quarterly Update of Australia's National Greenhouse Gas Inventory – December Quarter 2011*;
- *State and Territory Greenhouse Gas Inventories 2009/10*;
- the *National Inventory by Economic Sector 2009/10; and*
- the *National Inventory Report 2010,* prepared under the reporting provisions applicable to the United Nations Framework Convention on Climate Change (UNFCCC).

Detailed emission estimates for each of these accounts are available online on the Australian Greenhouse Emissions Information System (AGEIS).

The emission estimates for these inventories are prepared in accordance with international guidelines and are subject to annual review by international experts. The methodologies for the estimation of emissions are documented and available online at http://www.climatechange.gov.au/en/climate-change/emissions.aspx

National Inventory by Economic Sector Accounts

The *National Inventory by Economic Sector* provides information on emissions on a Kyoto accounting basis, disaggregated by Australia-New Zealand Standard Industry Classifications (ANZSIC - details available from the Australian Bureau of Statistics). It complements the *National Greenhouse Gas Inventory*, based on Intergovernmental Panel on Climate Change (IPCC) classifications, which provides estimates of emissions classified according to process-based emission categories.

Emissions estimates presented in this document have been mapped from the National Greenhouse Gas Inventory using the Australian Greenhouse Emissions Information System (AGEIS). Emissions for any particular ANZSIC classification will include estimates from all relevant IPCC sectors. For example, the *Division A Agriculture, Forestry and Fishing sector* includes emissions from the I*PCC Energy sector* (fuel combustion from Division A industries); the *IPCC Agriculture* sector (processes such as enteric fermentation); and Land use, land use change and forestry activities (deforestation, afforestation and reforestation).

Direct emissions are allocated to individual sectors at the point of emissions. For example, direct emissions from the combustion of fuel for electricity generation are accounted for at the power station where the electricity is produced.

Scope 2 emissions are indirect greenhouse gas emissions produced offsite in the generation of electricity, subsequently purchased and consumed within a sector and attributed to the sector consuming the electricity.

Updates since the previous report

The economic categories used in this publication have been updated to align with the ANZSIC 2006 classification. Previous publications have used the 1993 ANZSIC framework so caution should be taken when comparing with earlier publications. The ABS website has more details on the ANZSIC framework (www.abs.gov.au).

Emissions from on-road transport have been allocated from the IPCC transport category to the residential sector and various industry classifications in which the transport activity takes place. The ABS Survey of Motor Vehicle Use data (ABS 9208.0) formed the basis for disaggregating the consumption of petrol, diesel and LPG by residential and industry use. Data was sourced from ABS Energy, Water and Environment Management (ABS 4660.0) and Bureau of Resources and Energy Economics (BREE) Australian Energy Statistics to apportion the industry component into ANZSIC economic divisions.

Kyoto Accounting

'Kyoto accounting' is relevant to Australia's target under the Kyoto Protocol. See the Department of Climate Change and Energy Efficiency web site at http://www.climatechange.gov.au/government/national-targets.aspx for more detail.

Under the Kyoto Protocol, the national inventory comprises four sources of emissions – the IPCC sectors *Energy, Industrial Processes, Agriculture* and *Waste* (Annex A sectors). Within the *Energy* sector, there are *Stationary*

Energy, Transport and *Fugitive emissions* (mainly from the extraction fuels) sources. In addition, countries must account for Article 3.3 *Land Use, Land Use Change and Forestry* activities – these are deforestation, afforestation and reforestation.

- 'Stationary Energy' is mainly greenhouse gas emissions from the production of electricity and other direct combustion of fossil fuels in industry such as manufacturing and construction.
- 'Transport' comprises greenhouse gas emissions from air, road, rail and shipping transportation.
- 'Fugitive Emissions from Fuels' comprises the greenhouse gas emissions from the extraction and distribution of coal, oil and natural gas.
- 'Industrial Processes' comprises the direct greenhouse gas emissions from the chemical and or physical transformation of materials and the consumption of synthetic greenhouse gases.
- 'Agriculture' comprises the emissions of methane and nitrous oxide only (that is, non-carbon dioxide gases) from livestock, crops, agricultural and forest soils, and agricultural burning including the prescribed burning of savannas.
- 'Waste' comprises the greenhouse gas emissions from the disposal of solid waste to land, the treatment of domestic and industrial wastewater, the incineration of municipal and clinical waste and the biological treatment of solid waste.
- 'Afforestation and reforestation' comprises emissions and removals (that is sinks) from forests established on agricultural land since 1990.
- 'Deforestation' comprised emissions and removals from the direct human-induced removal of forest and replacement with pasture, crops or other uses on land that was forest on 1 January 1990.

Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only provided for the 'base year' 1990 and for the commitment period (2008-2012). Unlike other sectors, the accounting rules for Article 3.3 LULUCF activities differ between the initial assigned amount calculations and the commitment period. It is, therefore, not possible to present a consistent time-series of emissions and removals for these activities.

The 1990 estimate presented here for LULUCF, is the 'base year' estimate used to calculate the initial assigned amount. This includes land use change (or forest conversion) as reported under the UNFCCC inventory and no emissions or removals due to forestry.

The estimates presented here for afforestation/reforestation are the accounting quantity taking into consideration the harvested forest sub-rule of the Kyoto Protocol. Under this accounting rule "debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than credits accounted for on that unit of land". In other words, whenever emissions on harvested land units are greater than the removals on those land units, a net balance of zero is assumed for those units of land.

Australian Greenhouse Emissions Information System

The Australian Greenhouse Emissions Information System (AGEIS) provides on-line public access to emission estimates, background supporting data and time-series analyses that support the *National Greenhouse Accounts*. The dynamic interface allows users to select emissions data of interest and download the results in a format which allows for further analysis of the data on their own desktop. The AGEIS can be accessed at http://ageis.climatechange.gov.au/.

International Guidelines and Review

The *National Inventory by Economic Sector* have been prepared in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 Guidelines for National Greenhouse Gas Inventories* and the principles of the IPCC *(2000) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC (2003) *Good Practice Guidance for Land Use, Land Use Change and Forestry*. Where appropriate, elements of the 2006 *IPCC Guidelines for National Greenhouse Gas Inventories* are being progressively implemented. The national inventory undergoes annual independent international review.

Greenhouse Gases

Consistent with the requirements of the Kyoto Protocol, the *National Inventory by Economic Sector* cover sources of greenhouse gas emissions and removals by sinks resulting from human (anthropogenic) activities for the major greenhouse gases – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6).

Global Warming Potentials (GWPs) have been used for each of the major greenhouse gases to convert them to carbon dioxide equivalents (CO_2-e). As greenhouse gases vary in their radiative activity and in their atmospheric residence time, converting emissions into CO_2-e allows the integrated effect of emissions of the various gases to be compared.

The GWPs used in this report were the 100-year GWPs contained in the 1995 IPCC Second Assessment Report (IPCC 1996), as agreed for use under the first commitment period of the Kyoto Protocol. The *National Greenhouse Accounts* to be published in 2015, including the *National Inventory by Economic Sector*, will adopt the GWPs contained in the 2007 *IPCC Fourth* Assessment Report (IPCC 2007), by international agreement.

External Territories

The geographical coverage of the *National Inventory by Economic Sector* also includes emissions from the Australian Antarctic Territory, Norfolk Island, Christmas Island, Cocos (Keeling) Islands, and Heard and McDonald Islands. The following external territories are also covered but are included in the respective state statistical territories by the Australian Bureau of Statistics: Coral Sea Islands (Queensland), and Ashmore and Cartier Islands (Northern Territory).

Uncertainty Analysis

Uncertainty is inherent within any kind of estimation. Uncertainty assessments at a sectoral level are reported in the *National Inventory Report*. Overall, at the national inventory level including LULUCF, the uncertainty of the emissions estimates level has been assessed at ±3.6%. While no quantitative estimates have been produced, the Department assesses that the uncertainties for emission estimates for these inventories, particularly the smaller States and Territories, will be somewhat higher than for the national inventory.

Ongoing Improvements of estimates

Due to refinements to the emissions estimation methodologies, which have been applied to all years for which emissions have been estimated, the estimates presented in this document supersede all previously published estimates for the *National Inventory by Economic Sector* and caution should be exercised before comparing directly with the estimates of previous publications.

Copies of the other *Australian National Greenhouse Accounts* documents:

- *Quarterly Update of Australia's National Greenhouse Gas Inventory – December Quarter 2011*
- *National Inventory by Economic Sector 2009/10*
- *National Inventory Report 2010*

can be obtained from the Department of Climate Change and Energy Efficiency website http://www.climatechange.gov.au/en/climate-change/emissions.aspx.

On-line access to emissions data - Australian Greenhouse Emissions Information System (AGEIS) – available at http://ageis.climatechange.gov.au/

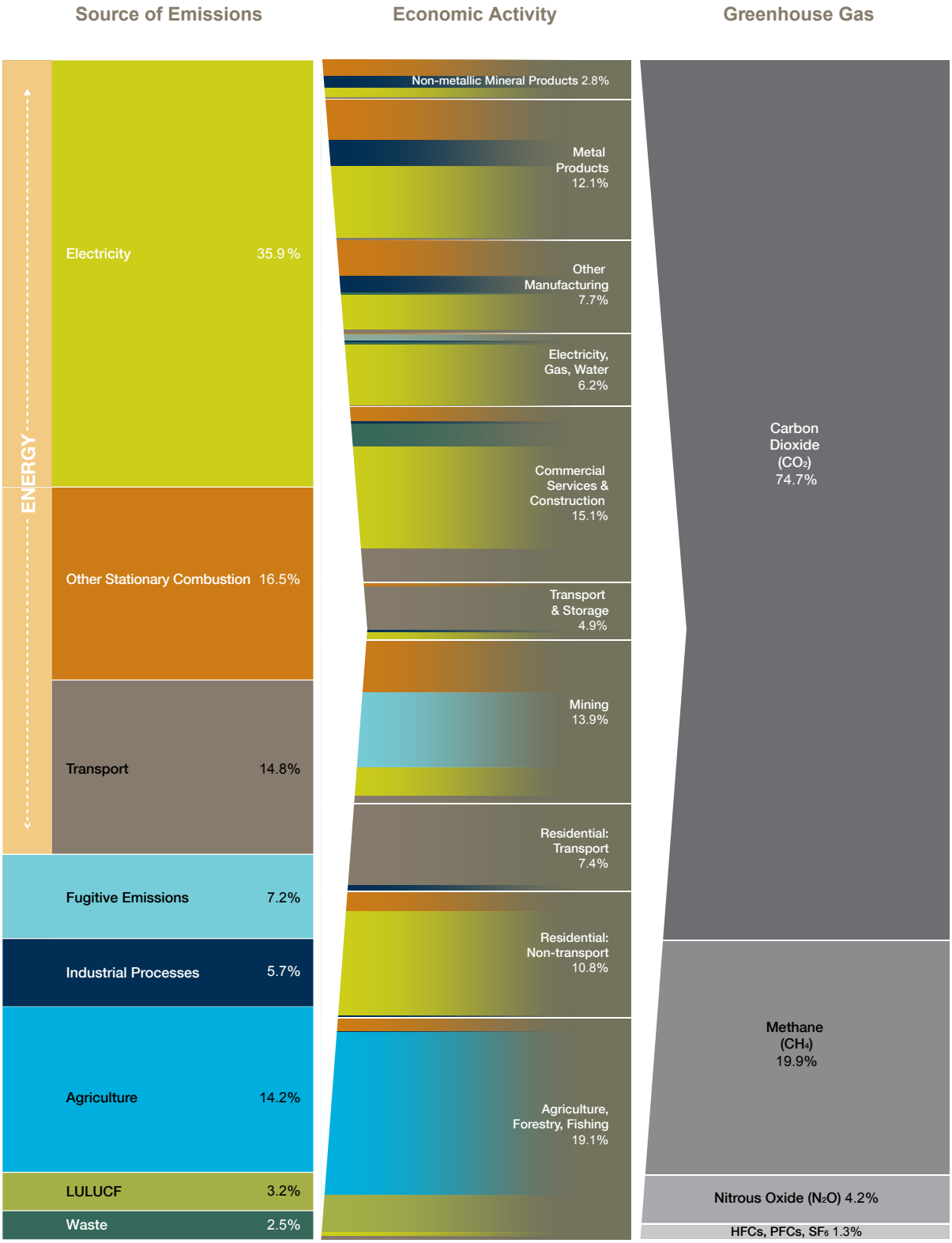
APPENDIX 2 – ALLOCATION OF GREENHOUSE GAS EMISSIONS BY SOURCE, ECONOMIC ACTIVITY AND GAS

The allocation of greenhouse gas emissions by source, economic activity and greenhouse gas is displayed at Figure 6.

- Column A lists the sources of direct emissions by IPCC sector as reported in the *Quarterly Update of Australia's National Greenhouse Gas Inventory – December Quarter 2011*.
- Column B lists the direct emissions and indirect greenhouse gas emissions from the generation of purchased electricity (scope 2 emissions) attributable to the activity of each economic sector.
- Column C lists the contribution of greenhouse gases to Australia's total net CO_2-e emissions.

Emissions from the processes listed in column A are distributed to the economic sectors listed in column B based on the activity of each sector. The source of combined direct and indirect (scope 2) emissions is represented by the colour and the magnitude of emissions by the width of the lines within column B. For example, the mining sector comprises of emissions from three sources (other stationary combustion (orange), fugitive emissions (light blue), electricity production (green) and Transport (brown)).

Figure 8:
Allocation of Greenhouse Gas Emissions by Source, Economic Activity and Greenhouse Gas, Australia, 2009/10



Note:

– Direct emissions and indirect greenhouse gas emissions from the generation of purchased electricity (Scope 2 Emissions) have been combined in the figure above to provide a broader understanding of the emissions resulting across the economy from activity within each economic sector. Caution should be taken when analysing combined emissions due to the different conceptual bases of the emission estimates.