Australian Government
Department of Climate Change
and Energy Efficiency

AUSTRALIAN NATIONAL GREENHOUSE ACCOUNTS

National Inventory by Economic Sector
2008

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The Australian National Greenhouse Accounts are available on the Internet at the following address:
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May 2010

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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 *National Greenhouse Gas Inventory*, which provides estimates of emissions classified according to process-based emission categories (see Notes for details).
- In 2008 the major emission sources were primary industries and electricity, gas and water sectors.
- Australia's primary industries (agriculture, forestry and fishing and mining) accounted for 30.9% of direct emissions and the electricity, gas and water economic sector accounted for 36.6% of Australia's emissions.

Table 1: Australia's Direct Greenhouse Gas Emissions by Economic Sector 2008[a]

	Emissions (Mt CO_2-e)[b]	Share of total emissions (%)
All Sectors	**576.2**	
Primary Industries	177.9	30.9
Agriculture, Forestry and Fishing	120.1	20.9
Mining	57.8	10.0
Manufacturing	72.7	12.6
Electricity, Gas and Water	210.8	36.6
Services, Construction and Transport	60.4	10.5
Residential	54.4	9.4

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/
Notes: a) Es imated in accordance with the Kyoto Protocol accounting provisions and including Article 3.3 Land Use, Land Use Change and Forestry activities.
b) Carbon dioxide equivalent, CO_2-e.

Trends in Direct Emissions

- There have been significant differences in the trends experienced across various economic sectors.
- Direct emissions have increased since 1990 in the mining (64.5% or 22.7 Mt), electricity, gas and water (54.9% or 74.7 Mt), residential (25.1% or 10.9 Mt), services, construction and transport (25.1% or 12.1 Mt) and manufacturing (11.7% or 7.6 Mt)) sectors.
- Emissions from agriculture, forestry and fishing have declined by 45.9% (101.7 Mt CO_2-e) since 1990. The strong decline principally reflects the impacts of declining emissions from the clearing of forest cover and increased removals from afforestation/reforestation activities.

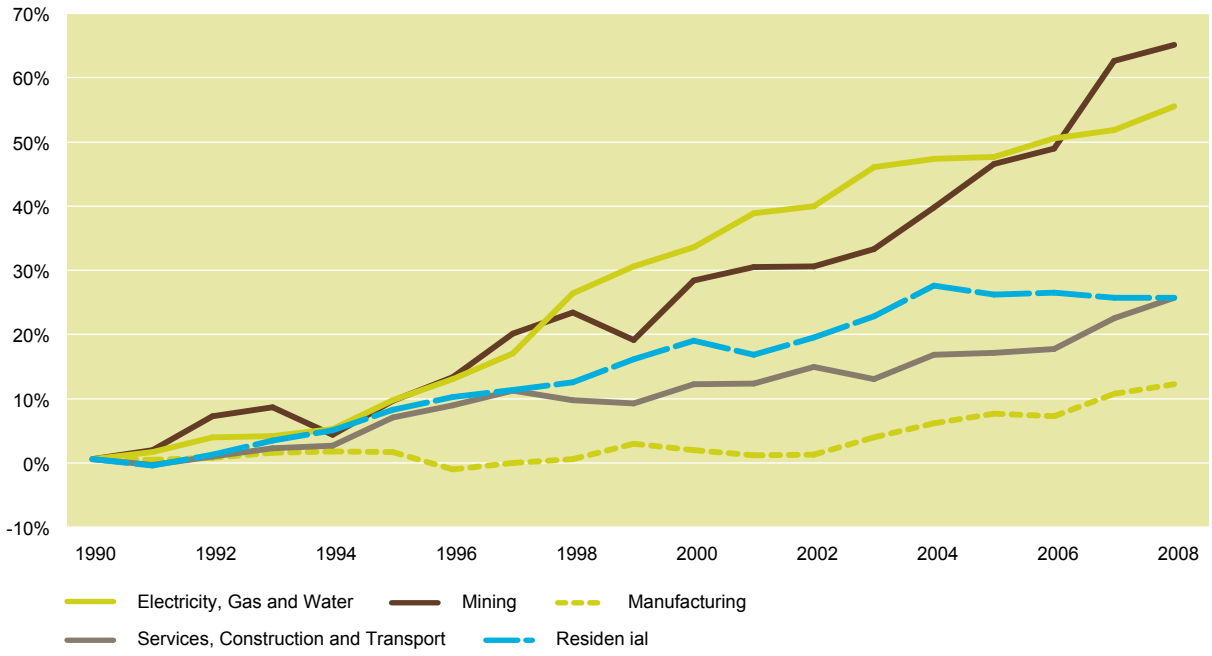
Table 2: Detailed Direct Greenhouse Gas Emissions Estimates by Economic Classification: Australia 1990, 2007 and 2008[a]

ANZSIC code	Industry Classification	Emissions (Mt CO_2-e)			Change in emissions (%)	
		1990	2007	2008	2007 to 2008	1990 to 2008
Div A	Agriculture, forestry and fishing	221.9	[b]	120.1	[b]	-45.9
Div B	Mining	35.1	56.9	57.8	1.6	64.5
11	Coal Mining	20.2	32.2	32.2	0.0	59.6
12	Oil and Gas Extraction	12.5	17.2	17.5	1.3	39.6
13-15	Mining Non-energy	2.5	7.5	8.2	9.0	232.4
Div C	Manufacturing	65.1	71.7	72.7	1.3	11.7
21	Food, beverages, tobacco	4.4	4.3	4.4	2.5	-0.2
22	Textile, clothing, footwear and leather	0.5	0.5	0.4	-3.4	-14.6
23-4	Wood, paper and printing	1.7	2.5	2.4	-3.5	43.4
25	Petroleum, coal and chemical	15.3	19.3	19.0	-1.5	23.6
26	Non-metallic mineral products	9.6	11.7	11.7	0.4	22.2
27	Metal products	33.0	33.0	34.2	3.7	3.6
28	Machinery and equipment	0.5	0.5	0.5	-0.2	1.6
29	Other manufacturing	0.0	0.0	0.0	0.0	0.2
Div D	Electricity, gas and water	136.1	205.8	210.8	2.4	54.9
Div E-H, J-Q	Commercial services and construction	21.1	18.8	19.4	3.0	-8.1
Div I	Transport and storage	27.2	40.1	41.0	2.4	50.7
	Residential	43.5	54.4	54.4	0.0	25.1
	Residential (non transport)	7.8	10.0	10.2	1.9	30.4
	Residential (transport)	35.7	44.4	44.2	-0.4	23.9

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

Notes: 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 1990 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: Percentage Change in Direct Emissions by Economic Sectors 1990-2008



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 1990 and for the commitment period (2008-2012). Therefore, it is not possible to present a consistent ime-series of emissions and removals for Division A Agriculture, Fisheries and Forestry.

Emissions Per $ GDP

The greenhouse gas emissions intensity of the Australian economy, expressed as emissions per dollar of GDP, has declined over the period 1990 to 2008 by 41.2% from 0.90 to 0.53 kg CO_2-e[1]. The emissions per unit of GDP reflects specific emissions management actions across sectors; the large decline in land use change emissions over the period; and structural changes in the economy with stronger growth in the services sector than in the more energy intensive manufacturing sector.

Emissions Per Capita

Australia has reduced its emissions per capita over the period 1990 to 2008 by 17.2% from 32.5 to 26.9 tonnes CO_2-e. The magnitude of Australia's per capita emission level reflects a number of factors in particular the dominance of the use of coal as a fuel in electricity generation – although natural gas has taken an increasing share in recent years; the historical presence of net emissions from the land use, land use change and forestry sector – which is unusual for a developed country; and the impact of international trade patterns, which result in the production in Australia of many goods with high associated emission levels – that is, resource and agricultural products that are destined for export and consumption in other countries.

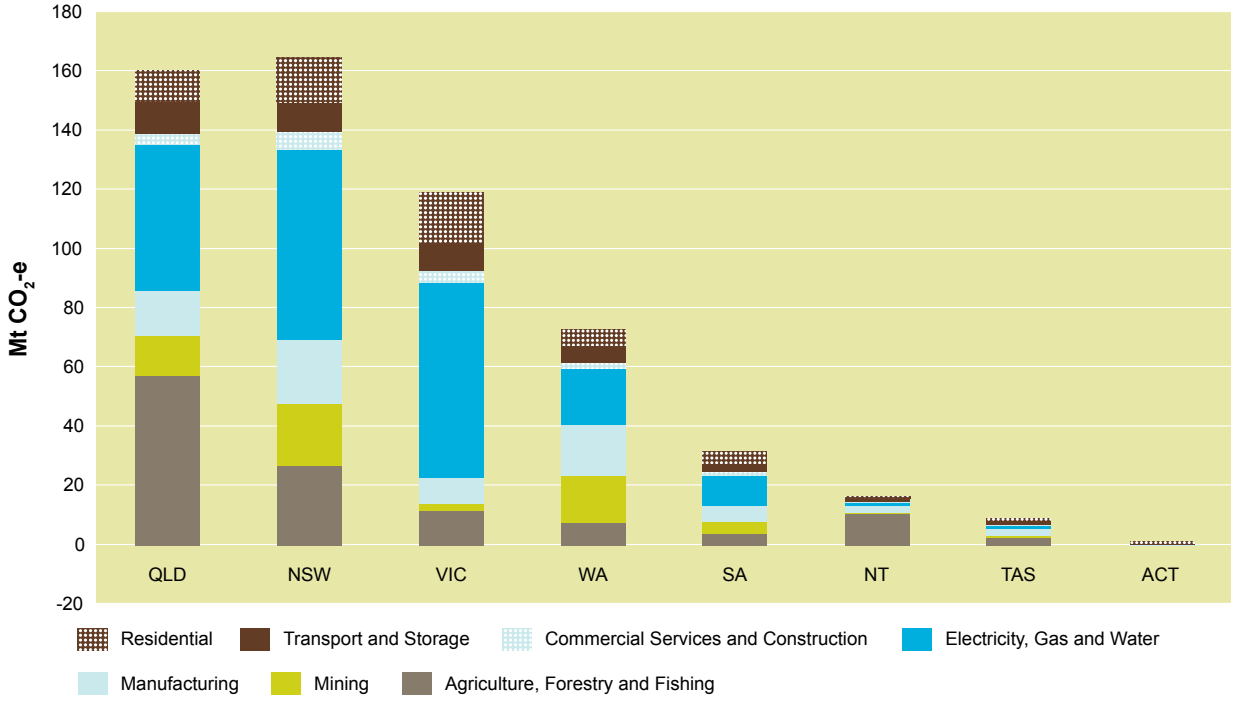
[1] 2007–08 Australian dollars

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. For example, in 2008:

- the largest quantity of net emissions from the agriculture, forestry and fishing sector was attributed to Queensland (57.0 Mt CO_2-e, see table 4).
- the largest quantity of direct emissions from the electricity, gas and water sector was attributed to Victoria (65.7 Mt CO_2-e, see table 4).
- the largest quantity of direct emissions from the manufacturing sector was attributed to New South Wales (21.4 Mt CO_2-e, see table 4).

Figure 2: Direct State and Territory Emissions by Economic Sector, 2008



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

Table 3: State and Territory Emissions by Economic Classification 1990[a][b][c]

ANZSIC code	Industry Classification	NSW[d]	VIC	QLD	WA
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**164.1**	**106.7**	**165.0**	**58.1**
Div A	Agriculture, forestry and fishing	47.7	19.8	110.5	23.8
Div B	Mining	17.3	3.8	3.3	4.7
Div C	Manufacturing	24.2	11.0	11.8	9.5
Div D	Electricity gas and water	47.0	46.2	23.3	10.9
Div E-H, J-Q	Commercial services and construction	7.8	5.3	3.7	1.8
Div I	Transport and storage	7.9	6.4	5.5	3.4
	Residential	12.3	14.3	7.0	4.0

ANZSIC code	Industry Classification	SA	TAS	NT	ACT (partial inventory)[d]
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**32.5**	**11.4**	**10.5**	**1.2**
Div A	Agriculture, forestry and fishing	7.5	5.9	6.7	0.0
Div B	Mining	4.8	0.2	0.5	0.0
Div C	Manufacturing	5.5	2.4	1.2	0.0
Div D	Electricity gas and water	7.1	0.6	0.9	0.0
Div E-H, J-Q	Commercial services and construction	1.4	0.4	0.2	0.2
Div I	Transport and storage	2.5	0.6	0.7	0.2
	Residential	3.7	1.2	0.3	0.6

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

Notes:
a) These State and Territory estimates are reported on a Kyoto Protocol accounting basis and include emissions from Article 3.3 LULUCF activities.
b) 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.
c) Uncertainty estimates at a sectoral level are reported in the national inventory. While no quantitative estimates have been produced, the Department of Climate Change assesses hat the uncertainties for emission es imates for the inventory, particularly the smaller states and territories, will be somewhat higher than for the national inventory.
d) The NSW inventory includes ACT emissions from the stationary energy sector.

Table 4: State and Territory Emissions by Economic Classification 2008[a][b][c]

ANZSIC code	Industry Classification	NSW[d]	VIC	QLD	WA
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**164.7**	**119.1**	**160.3**	**72.8**
Div A	Agriculture, forestry and fishing	26.6	11.8	57.0	7.6
Div B	Mining	21.2	2.3	13.8	15.5
Div C	Manufacturing	21.4	8.7	14.9	17.6
Div D	Electricity gas and water	64.4	65.7	49.4	18.7
Div E-H, J-Q	Commercial services and construction	5.9	4.4	3.9	2.1
Div I	Transport and storage	10.0	8.9	11.0	5.9
	Residential	15.2	17.3	10.3	5.2

ANZSIC code	Industry Classification	SA	TAS	NT	ACT (partial inventory)[d]
		Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
	Total Net Emissions	**31.7**	**9.1**	**16.3**	**1.2**
Div A	Agriculture, forestry and fishing	3.9	2.8	10.4	0.0
Div B	Mining	4.0	0.3	0.8	0.0
Div C	Manufacturing	5.4	2.7	2.0	0.0
Div D	Electricity gas and water	10.2	0.8	1.3	0.0
Div E-H, J-Q	Commercial services and construction	1.2	0.4	0.2	0.1
Div I	Transport and storage	3.0	0.8	1.2	0.3
	Residential	4.0	1.2	0.4	0.7

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

Notes: a) These State and Territory estimates are reported on a Kyoto Protocol accounting basis and include emissions from Article 3.3 LULUCF activi ies.

b) 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.

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

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

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 and Energy Reporting (Measurement) Determination 2008 (NGER 2008),* 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*[2]*).*
- 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 1990, 2008[(a)(b)(c)(d)]

	Emissions (Mt CO_2-e)[(b)]		Change in emissions (%)
	1990	2008	1990 - 2008
All Electricity Generation	**129.5**	**204.3**	**57.8%**
Primary Industries	9.2	15.1	63.5%
Agriculture, Forestry and Fishing	1.6	1.5	-1.2%
Mining	7.7	13.5	76.7%
Manufacturing	42.2	63.6	50.6%
Services, Construction and Transport	24.6	46.0	87.1%
Residential	33.8	48.7	43.8%

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

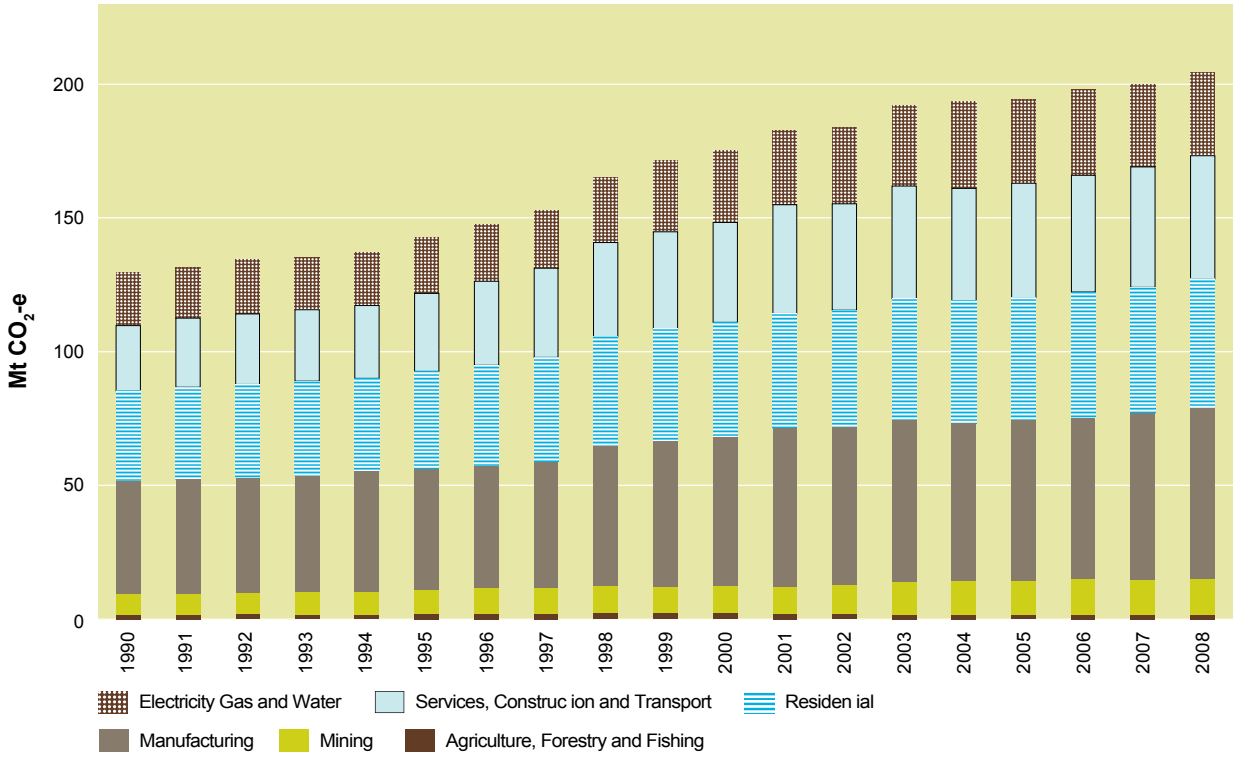
Notes: a) Es imated in accordance with the Kyoto Protocol accounting provisions.
b) Scope 2 emissions account for greenhouse gas emissions from the generation of purchased electricity. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (NGER 2008).
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 he table above. Electricity generation emissions attributed to the electricity, gas and water sector were 19.6 Mt CO_2-e in 1990 and 31.0 Mt CO_2-e in 2008.
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).

[2] WRI/WBCSD (2004) *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*, World Business Council for Sustainable Development and World Resources Institute (Revised edition), 2004.

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 57.8% since 1990 (see table 5). The largest drivers of increased indirect emissions from the generation of purchased electricity are the manufacturing, residential and the services, construction and transport sectors which have recorded increases of 21.3 Mt CO_2-e, 14.8 Mt CO_2-e and 21.4 Mt CO_2-e respectively.

Figure 3: Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity Trends by Economic Sector: 1990 – 2008



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 (NGER 2008). 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 NGER 2008 definition of scope 2 emissions.

Table 6: Indirect Emissions from the Generation of Purchased Electricity (Scope 2 Emissions), Australia, 1990, 2007, 2008[(a)(b)(c)]

ANZSIC code	Industry Classification	Emissions (Mt CO_2-e)[(b)]		
		1990	2007	2008
Div A	Agriculture, forestry and fishing	1.6	1.6	1.5
Div B	Mining	7.7	13.1	13.5
Div C	Manufacturing	42.2	62.2	63.6
Div E-H, J-Q	Commercial services and construction	23.0	42.7	43.5
Div I	Transport and storage	1.6	2.3	2.4
	Residential	33.8	47.3	48.7

Source: Australian Greenhouse Emissions Information System: http://ageis.climatechange.gov.au/
Notes: a) Estimated in accordance with he Kyoto Protocol accounting provisions.
b) 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 (NGER 2008).
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) hey 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 1990, 30.9 Mt CO_2-e in 2007 and 31.0 Mt CO_2-e in 2008.

Table 7: 1990 State and Territory Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) [a)(b)(c)(d)]

ANZSIC code	Industry Classification	NSW	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	
	Residential	2.3	0.1	0.2

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

Notes: a) Es imated 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 (NGER 2008).

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 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, 0.0 Mt CO_2-e in TAS and 0.1 Mt CO_2-e in NT.

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

Table 8: 2008 State and Territory Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) [a)(b)(c)(d)]

ANZSIC code	Industry Classification	NSW	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	0.4	0.4	0.3	0.2
Div B	Mining	3.6	1.4	4.8	2.6
Div C	Manufacturing	22.0	23.1	10.9	3.2
Div E-H, J-Q	Commercial services and construction	13.6	13.2	9.3	4.0
Div I	Transport and storage	1.0	0.5	0.7	0.1
	Residential	18.7	12.3	9.6	3.9

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	
Div B	Mining	0.4	0.3	0.4
Div C	Manufacturing	2.4	2.0	0.0
Div E-H, J-Q	Commercial services and construction	2.3	0.5	0.5
Div I	Transport and storage	0.1		
	Residential	3.2	0.7	0.2

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

Notes: a) Estimated in accordance with he 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 (NGER 2008).

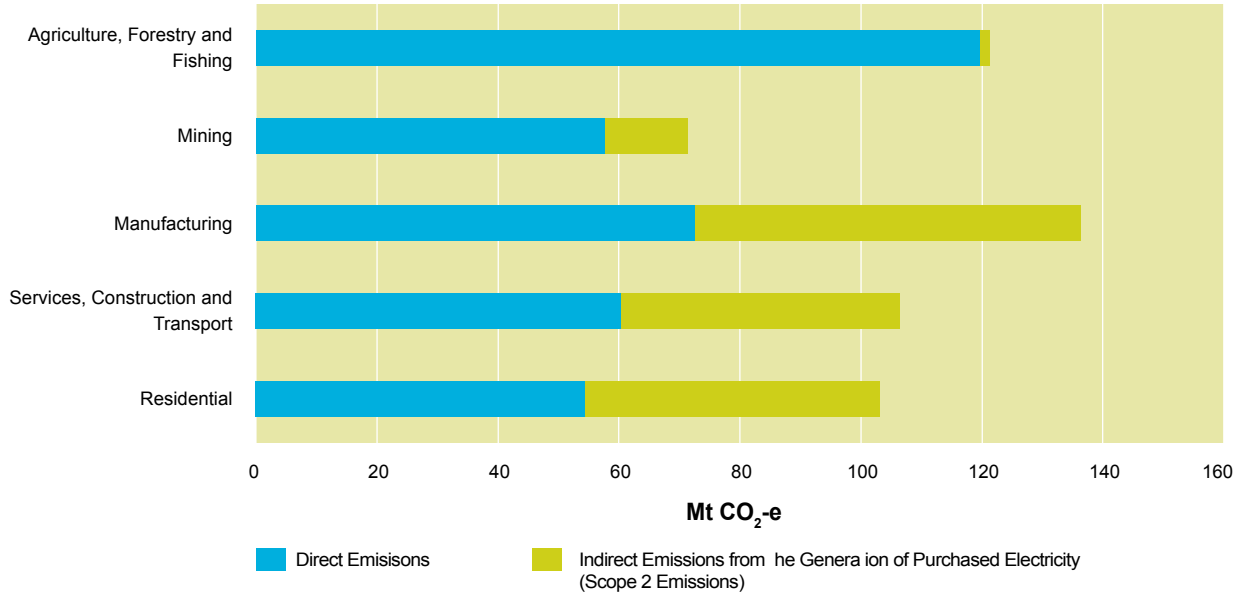
c) The estimate of scope two emissions from electricity generation consumed within the electricity, gas and water sector includes own use of electricity by generators and is not necessarily purchased electricity. As these emissions do not necessarily meet the definition outlined at (b) hey have been 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, 8.7 Mt CO_2-e in VIC, 8.1 Mt CO_2-e in QLD, 3.8 Mt CO_2-e in WA, 1.4 Mt CO_2-e in SA, 0.2 Mt CO_2-e in TAS and 0.2 Mt CO_2-e in NT.

d) 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

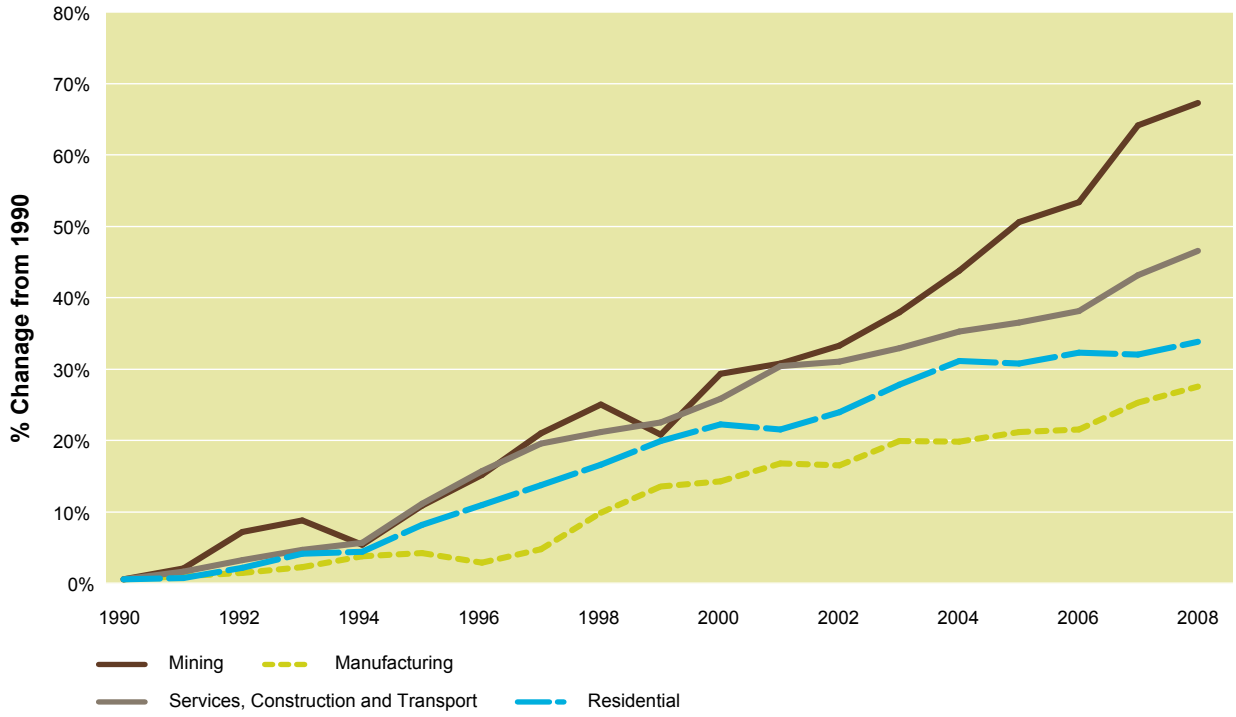
In this view of emissions allocation, the direct and scope 2 emissions have been combined to provide a broader understanding of the emissions resulting across the economy from activity within each economic sector. The direct emissions associated with electricity generation have been removed to avoid 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 4: Australia's Combined Direct and Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) by Major Economic Sector, 2008



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 (NGER 2008). 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 NGER 2008 definition of scope 2 emissions.

Figure 5: Percentage Change in Combined Direct and Indirect Greenhouse Gas Emissions from the Generation of Purchased Electricity (Scope 2 Emissions) by Major Economic Sectors, 1990–2008



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

Notes: 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 es imates.

b) Estimates of the emissions and removals from the Article 3.3 LULUCF activities are only available for 1990 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.

Appendix 1 – Notes

Australian National Greenhouse Accounts

The Australian National Greenhouse Accounts comprise the:

- *National Greenhouse Gas Inventory;*
- *National Inventory by Economic Sector;*
- *State and Territory Greenhouse Gas Inventories; and*
- *National Inventory Report.*

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 IPCC Energy sector (fuel combustion from Division A industries); the IPCC Agriculture sector (processes such as enteric fermentation); and the 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 electricity consuming sector.

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 and the incineration of municipal and clinical 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 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 have been used to convert each of the major greenhouse gases to carbon dioxide equivalents (CO_2-e). As greenhouse gases vary in their radiative activity and in their atmospheric residence time, converting emissions into CO2-e allows the integrated effect of emissions of the various gases to be compared. The GWPs used in this Report were the 100-year global warming potentials (GWPs) contained in the 1995 IPCC Second Assessment Report (IPCC 1996), as agreed for use under the Kyoto Protocol.

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

National Greenhouse Gas Inventory

State and Territory Greenhouse Gas Inventories 2008

National Inventory Report 2008

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 results – Australian Greenhouse Emissions Information System (AGEIS) – available at **http://ageis.climatechange.gov.au/**

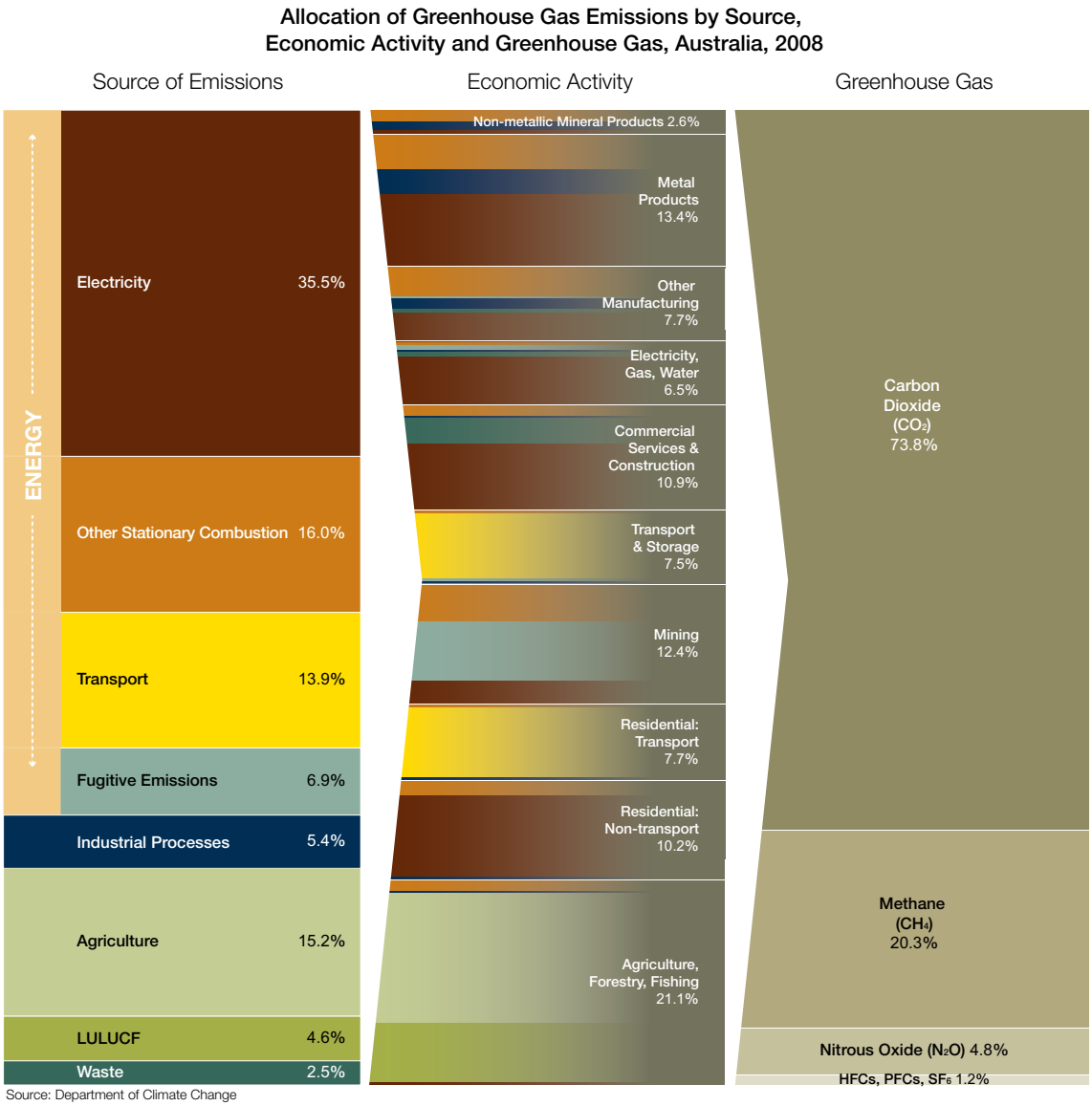
Appendix 2 – Allocation of Greenhouse Gas Emissions by Source, Economic Activity and Gas

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 *National Greenhouse Gas Inventory 2008*.
- 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 (grey), and electricity production (maroon)).

Figure 6: Allocation of Greenhouse Gas Emissions by Source, Economic Activity and Greenhouse Gas, Australia, 2008



Source: Department of Climate Change

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