



**ICRC**

independent competition and regulatory commission

# **ACT Greenhouse Gas Inventory Report for 2008-09**

**Report 7 of 2011  
September 2011**

The Independent Competition and Regulatory Commission (the Commission) was established by the *Independent Competition and Regulatory Commission Act 1997* (ICRC Act) to determine prices for regulated industries, advise government about industry matters, advise on access to infrastructure, and determine access disputes. The Commission also has responsibilities under the ICRC Act for determining competitive neutrality complaints and providing advice about other government-regulated activities. Under the *Utilities Act 2000*, the Commission has responsibility for licensing utility services and ensuring compliance with licence conditions.

Correspondence or other enquiries may be directed to the Commission at the addresses below:

Independent Competition and Regulatory Commission  
GPO Box 296  
CANBERRA ACT 2601

Level 2  
12 Moore Street  
CANBERRA CITY ACT 2601

The secretariat may be contacted at the above addresses, by telephone on (02) 6205 0799, or by fax on (02) 6207 5887. The Commission's website is at [www.icrc.act.gov.au](http://www.icrc.act.gov.au) and its email address is [icrc@act.gov.au](mailto:icrc@act.gov.au).

# Contents

<b>Contents</b>	<b>iii</b>
<b>Summary</b>	<b>v</b>
<b>1 Introduction</b>	<b>1</b>
<b>2 ACT greenhouse gas emissions</b>	<b>3</b>
2.1 Total emissions	3
2.2 Sectoral breakdown	4
2.3 Sources of emissions	5
2.4 Trend in emissions	6
2.5 Per capita emissions	11
2.6 Renewable energy consumption	11
<b>3 Methodology</b>	<b>13</b>
3.1 Stationary energy combustion	13
3.1.1 Indirect electricity and direct natural gas	13
3.1.2 Wood-fuel emissions	14
3.2 Transport emissions	15
3.3 Emissions from other activities	15
<b>Appendix A Coverage of emissions</b>	<b>17</b>
<b>Abbreviations and acronyms</b>	<b>19</b>



# Summary

The ACT Government has adopted greenhouse gas reduction targets, which are established under the *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act.)

This report provides estimates of the ACT's greenhouse gas emissions attributable to sectors within the territory for the 2009 financial year (2008-09). These estimates are based on a methodology that satisfies the legislative requirements of the Act.

The main outcomes for 2009 include:

- Total carbon dioxide equivalent (CO<sub>2</sub>-e) emissions of 4,183 kilotonnes when emission reductions from land use, land use change and forestry (LULUCF) are included.
- Total CO<sub>2</sub>-e emissions of 4,206 kilotonnes when LULUCF is excluded.
- Total CO<sub>2</sub>-e emissions (including LULUCF) are 2,268 kilotonnes greater than the 1,915 kilotonnes corresponding to the 2020 target of a 40% reduction in 1990 levels.
- Emissions attributable to electricity consumption are 63.6% of total emissions (excluding LULUCF), and are the main contributor to emissions growth since 1990.
- Per capita emissions peaked in 2006 at 12.3 tonnes, and in 2009 was 11.9 tonnes.
- Renewable energy attributable to consumption under the mandatory Renewable Energy Target and through GreenPower purchases comprised 3.39% and 3.7% of total electricity consumed in the ACT, respectively.



# 1 Introduction

The ACT Government considers that adequate and timely reporting on the territory's progress towards achieving established targets on emissions reductions and energy use is central to achieving effective legislation and community involvement.<sup>1</sup>

The *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act) establishes targets for emissions and energy use in the ACT, and requirements for reporting on these targets. Section 12 of the Act requires an independent entity to prepare a report on greenhouse gas emissions and targets and provide it to the Minister for the Environment and Sustainable Development (the Minister) within 3 months of the end of the reporting period. The Independent Competition and Regulatory Commission (the Commission) is the independent entity tasked with preparing this report for the 2009 financial year.

This is the first annual greenhouse gas inventory report for the ACT prepared by the Commission. The inventory provided in this report is a more comprehensive account of greenhouse gas emissions in the ACT than that given in *State and Territory Greenhouse Gas Inventories 2009* prepared by the Commonwealth Department of Climate Change and Energy Efficiency (DCCEE).<sup>2</sup> The DCCEE inventory for the ACT calculates emissions using a production approach which focuses on the specific facility or production process where emissions occur. It therefore only accounts for emissions occurring from sources within the ACT.

Following advice from the Commission, the Minister has determined a methodology for measuring emissions in the ACT employing a hybrid production and consumption approach to satisfy the information needs of the ACT Government, and satisfy the legislative requirements of the Act. This is the approach used for the 2009 inventory, and was also the approach adopted for the 2007 and 2008 ACT greenhouse gas inventories. A hybrid approach accounts for emissions attributable to consumption activities in addition to emissions arising from production activities within the ACT. Accounting for indirect emissions in this way allocates emissions that occur outside the ACT's geographic region to within the territory if that is where the consumption activity responsible for the emissions is located.

The methodology employed by the Commission, described in chapter 3 of this report, is as far as practicable, consistent with both national and international practices, and continues the approach taken in previous ACT greenhouse gas inventories prepared for the ACT Government. It should be noted that the time series data for some sectors presented in this report vary from that shown in the 2008 inventory. This is due to significant revisions in this data by the Australian Greenhouse Information System (AGEIS) for the 2009 reporting year, and the use of different data sources for improving the measurement of emissions from electricity consumption and fugitive emissions. The Commission will undertake further reviews of the methodology and data sources prior to the preparation of 2010 inventory to ensure the information provided remains satisfactory for its intended purpose. Consequently, the data presented in the 2009 inventory may be revised in future should better estimates of emissions become available.

The ACT's targets for emissions are expressed in terms of total emissions including reductions from land use, land use change and forestry (LULUCF). For the purpose of highlighting the contribution different activities make to the ACT's total emissions, information in terms of total

---

<sup>1</sup> *Climate Change and Greenhouse Gas Reduction Bill 2010*, p.2 0. Available at [http://www.legislation.act.gov.au/b/db\\_39279/default.asp](http://www.legislation.act.gov.au/b/db_39279/default.asp).

<sup>2</sup> <http://www.climatechange.gov.au/en/publications/greenhouse-acctg/state-territory-inventory-2009.aspx>.

emissions excluding LULUCF is also presented. The particular approach that is being adopted in each instance is clearly stated throughout the report. It should be noted that there is no difference between the values of total emissions including or excluding LULUCF for years prior to 2008. This is due to changes in the method for accounting for emissions relating to LULUCF under the Kyoto Protocol between 1990 and the 2008-12 commitment period, which prevent a comparative time series being available for the period 1990 to 2007.



## 2 ACT greenhouse gas emissions

### 2.1 Total emissions

The ACT's total carbon dioxide equivalent (CO<sub>2</sub>-e) emissions including emissions reductions due to land use, land use change and forestry (LULUCF) for the 2009 financial year is 4,183 kilotonnes (4.183 megatonnes). When the 23 kilotonnes of emissions reductions due to LULUCF are excluded the total emissions attributable to the ACT is 4,206 kilotonnes. These amounts represent an increase on 2008 total emissions of 1.3% when reductions from LULUCF are included, and a 1.2% increase on total emissions when the LULUCF category is excluded. Total emissions including LULUCF for 2009 represents an excess of 2,268 kilotonnes of emissions over the ACT Government's target of a 40% reduction in emissions from 1990 levels by 2020. To achieve the 2020 target, which is equivalent to total net emissions of 1,915 kilotonnes of CO<sub>2</sub>-e, the ACT needs to reduce emissions over the remaining 11 years by an average amount of 206 kilotonnes each year, or at an annual rate of 6.9% per annum.

Figure 1 ACT total emissions and removals, 1990, 2008 and 2009 (including LULUCF)

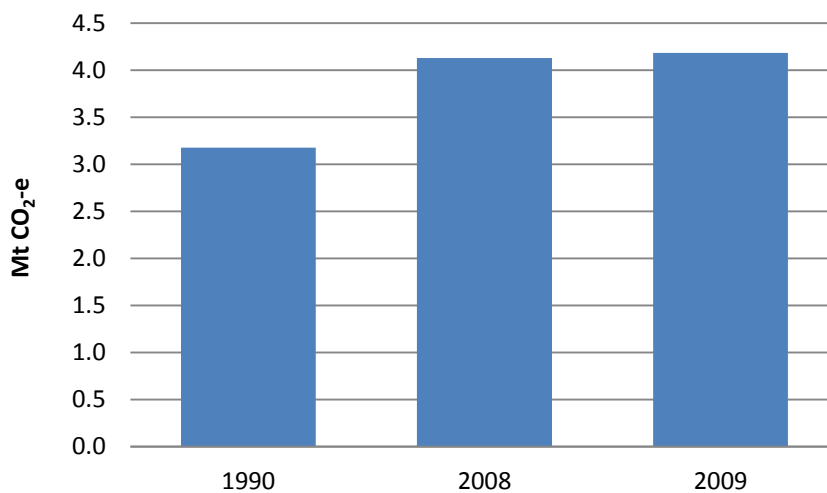


Figure 1 compares total emissions including LULUCF for 1990, 2008 and 2009. Total emissions for 2009 represent an increase of 31.7% on the 1990 level of 3175 kilotonnes of CO<sub>2</sub>-e. The corresponding increase from the 2008 level of 4129 kilotonnes is 1.3%.

## 2.2 Sectoral breakdown

Table 1 shows a detailed breakdown of sectoral emissions in the ACT for 2009.

**Table 1 Sectoral report for ACT greenhouse gas inventory, 2009**

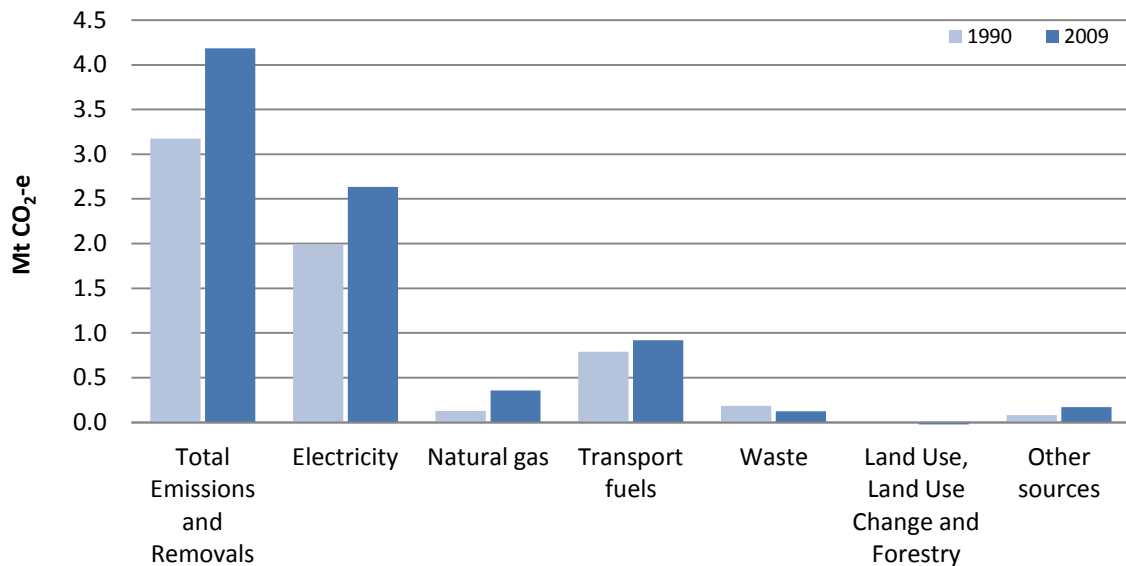
Greenhouse Gas Source and Sink Categories	Total CO <sub>2</sub> -e (gigagrams / kilotonnes)
Total ACT emissions and removals	<b>4,183.1</b>
1 Energy	3,950.2
<i>A Fuel combustion activities</i>	3,921.9
Electricity	2632.4
Natural gas	358.7
Transport fuels <sup>1,2</sup>	919.0
Fuel wood	11.7
<i>B Fugitive emissions from fuels</i>	28.3
Natural gas leakage	28.3
2 Industrial processes	107.1
Consumption of Halocarbons and SF <sub>6</sub>	101.8
Other	5.3
3 Agriculture	24.9
Enteric fermentation	20.3
Manure management	0.3
Agricultural soils	4.3
4 Land use change and forestry (LULUCF)	-23.4
Afforestation and deforestation	-23.4
5 Waste	124.2
Solid waste disposal on land	NA
Wastewater handling	NA
Total emissions including net CO <sub>2</sub> from LULUCF	<b>4,183.1</b>
Total emissions excluding net CO <sub>2</sub> from LULUCF	<b>4,206.5</b>

<sup>1</sup> Only includes road transport emissions.

<sup>2</sup> Includes emissions from natural gas used in the ACTION bus fleet.

Figure 2 compares total and sectoral emissions for 2009 with those occurring in 1990. Focusing on the main sectors for which emissions are attributable shows that most have experienced gains in emissions over this period. Sectors responsible for increased emissions include electricity (32.3%), natural gas (181%), transport (16.3%), and other sources (89.8%). The only sector demonstrating a decrease in emissions is waste, which experienced a 32.9% decline.

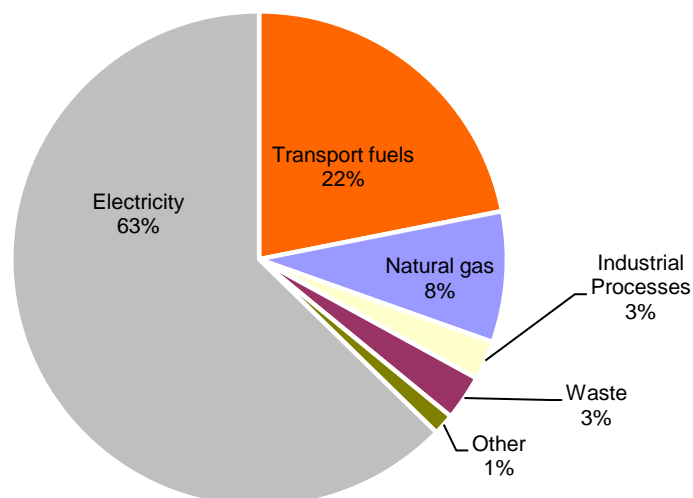
**Figure 2 ACT emissions and removals by sector, 1990 and 2009 (including LULUCF)**



## 2.3 Sources of emissions

The main sources of emissions presented in table 1 are shown in figure 3 as a percentage of total emissions attributable to the ACT in 2009 excluding reductions from LULUCF.

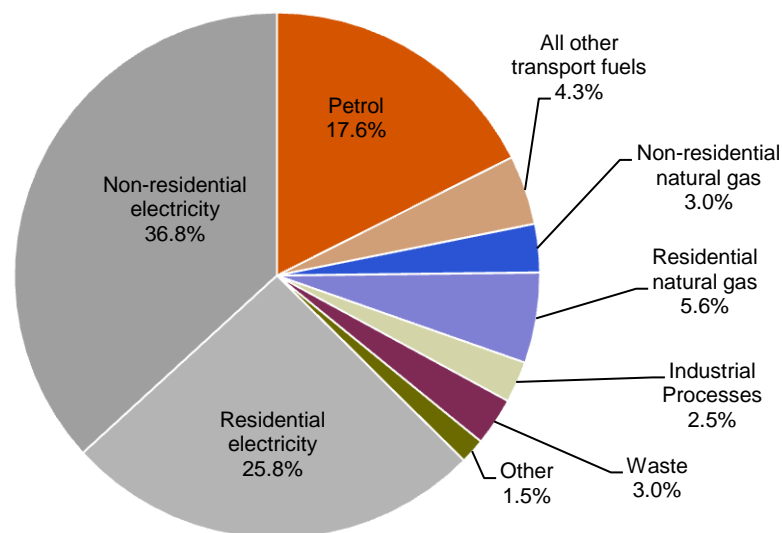
**Figure 3 Share of emissions by sector, 2009 (excluding LULUCF)**



Fuel combustion activities account for 93.2% of total emissions in 2009. Within this group of activities emissions attributable to electricity consumption is responsible for 62.6% of total emissions. Following electricity, the second and third largest contributions are from transport fuels (21.8%) and natural gas (8.5%), respectively. The ACT's profile for sectoral emissions arises from the low levels of industrial and agricultural activities undertaken in the territory, along with absence of mining when compared to other jurisdictions.

A more detailed breakdown of emissions for 2009 is presented in figure 4. The ACT's emissions profile at the sub-sector level shows non-residential electricity is the largest contributor accounting for 36.8% of total emissions, and responsible for 58.7% of total emissions attributable to electricity consumption. This is followed by residential electricity (25.8%), petrol (17.6%) and residential natural gas (5.6%). Petrol combustion accounts for 80.3% of emissions attributable to road transport fuels.<sup>3</sup>

**Figure 4 Share of emissions by source sub-sector, 2009 (excluding LULUCF)**



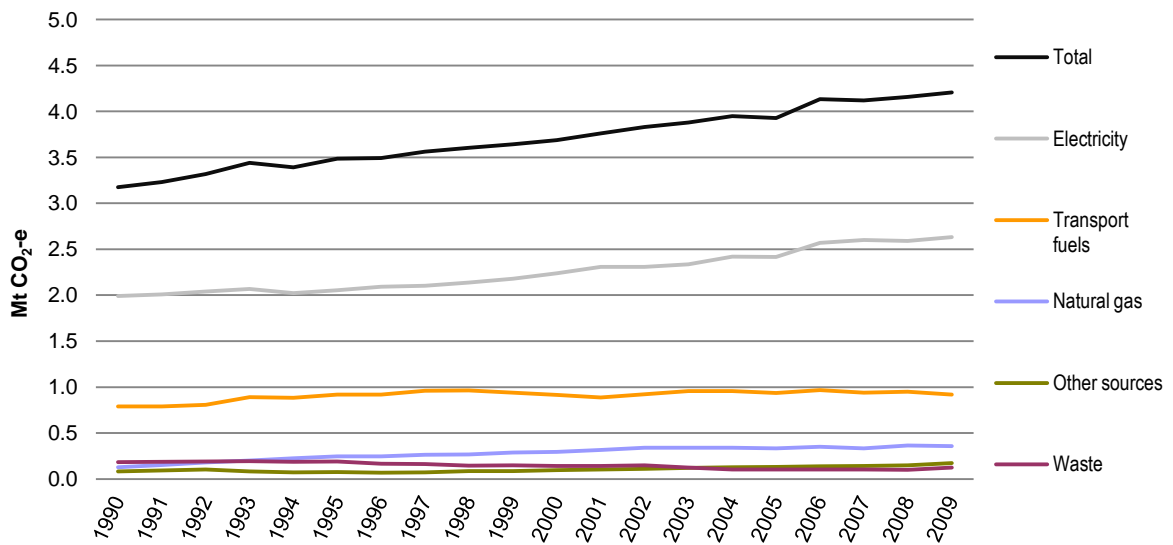
## 2.4 Trend in emissions

The ACT's total emissions has trended upward since 1990. There has been a 31.7% increase in total emissions including LULUCF from 1990 to 2009, which corresponds to emissions growing at an annual rate of 1.38%. When LULUCF is excluded the increase in total emissions over this period is 32.4%. Figure 5 shows that there has been three years in which the amount of total emissions (excluding LULUCF) declined from those of the previous year (1994, 2005 and 2007).

A comparison of the trend in total emissions from 1990 with the trend in the main sectors responsible for emissions reveals that while emissions attributable to electricity consumption is the largest share of annual total emissions, it has also made the largest contribution to the increase in the ACT's total emissions. Emissions attributable to electricity has increased at an annualised rate of 1.4% in line with the rate of increase in total emissions. Since the mid 1990s emissions from transport fuels has remained relatively stable, while emissions from natural gas has increased (along with those from 'other sources' to a lesser extent) and waste emissions has decreased.

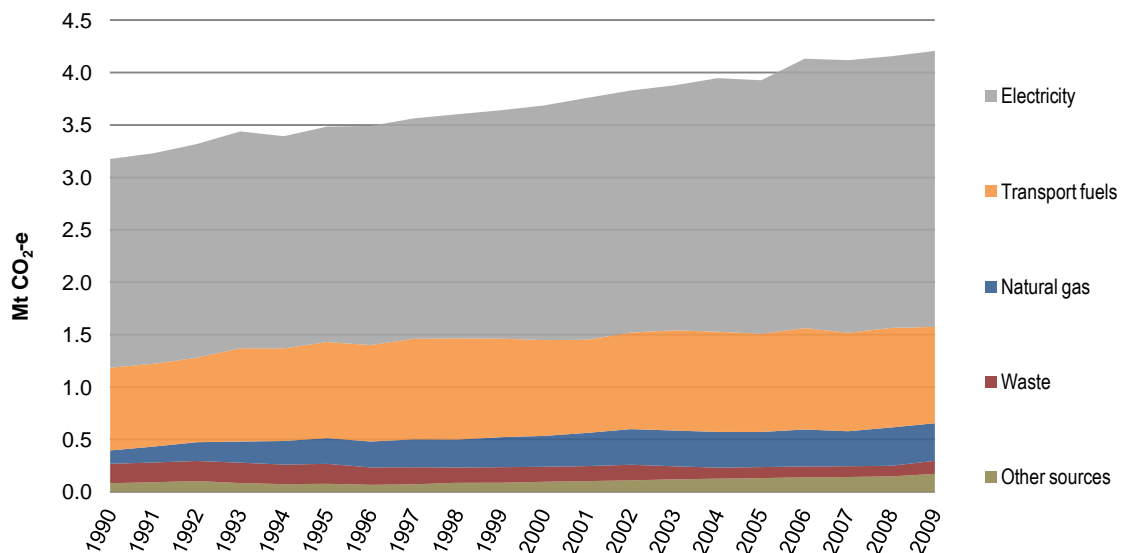
<sup>3</sup> Emissions from aviation and water transport activities occurring in the ACT are not reported.

**Figure 5 Trend in total and sectoral emissions, 1990 to 2009 (excluding LULUCF)**



An alternative presentation of the data on which figure 5 is constructed is provided in figure 6. It further highlights the significance of ‘Electricity’ as a source of emissions in the ACT by decomposing the trend in total emissions since 1990 into the contribution made by each of the main emissions sectors.

**Figure 6 Trend in composition of total emissions, 1990 to 2009 (excluding LULUCF)**



A detailed sectoral breakdown of emissions from 1990 to 2009 is presented in table 2.

**Table 2 ACT's CO<sub>2</sub> equivalent emissions (kilotonnes), 1990 to 2009**

<b>Greenhouse gas source and sink categories</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>
Total CO <sub>2</sub> -e emissions	<b>3175.6</b>	-	-	-	-	-	-	-	-	-	-
1 Energy	<b>2924.6</b>	<b>2976.3</b>	<b>3063.9</b>	<b>3175.3</b>	<b>3149.5</b>	<b>3239.7</b>	<b>3279.6</b>	<b>3350.6</b>	<b>3402.7</b>	<b>3433.6</b>	<b>3474.3</b>
A. Fuel combustion activities	<b>2924.6</b>	<b>2966.4</b>	<b>3039.6</b>	<b>3175.3</b>	<b>3146.9</b>	<b>3231.6</b>	<b>3271.9</b>	<b>3341.1</b>	<b>3382.5</b>	<b>3417.8</b>	<b>3459.1</b>
Electricity	1990.1	2008.2	2038.3	2068.2	2023.6	2055.3	2091.2	2102.3	2137.9	2178.6	2238.5
Natural gas	127.7	151.8	179.0	201.6	224.7	244.8	247.1	265.2	265.9	286.6	294.1
Transport fuels	790.0	789.9	806.2	890.0	883.7	917.0	919.6	959.8	965.4	939.6	913.8
Fuel wood	16.8	16.5	16.0	15.5	14.9	14.4	14.1	13.7	13.3	13.0	12.7
B. Fugitive emissions from fuels	<b>0.01</b>	<b>9.9</b>	<b>24.4</b>	<b>0.0</b>	<b>2.6</b>	<b>8.1</b>	<b>7.7</b>	<b>9.5</b>	<b>20.3</b>	<b>15.8</b>	<b>15.2</b>
Natural gas leakage	0.0	9.9	24.4	0.0	2.6	8.1	7.7	9.5	20.3	15.8	15.2
2 Industrial processes	<b>22.0</b>	<b>22.1</b>	<b>21.3</b>	<b>28.0</b>	<b>17.2</b>	<b>17.4</b>	<b>9.1</b>	<b>14.3</b>	<b>19.8</b>	<b>26.4</b>	<b>33.5</b>
Production of halocarbons and SF <sub>6</sub>	18.6	18.7	17.7	24.4	13.7	12.1					
Consumption of halocarbons and SF <sub>6</sub>	0.9	0.9	0.9	1.0	1.0	2.8	6.4	11.3	16.6	22.9	29.8
Other	2.5	2.5	2.7	2.7	2.5	2.5	2.7	3.0	3.2	3.5	3.8
3 Agriculture	<b>44.1</b>	<b>43.8</b>	<b>42.0</b>	<b>41.0</b>	<b>39.3</b>	<b>37.6</b>	<b>36.7</b>	<b>35.2</b>	<b>33.8</b>	<b>32.2</b>	<b>35.3</b>
Enteric fermentation	36.0	35.8	34.3	33.6	32.2	30.8	30.1	28.9	27.7	26.4	28.8
Manure management	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.3	0.3	0.3
Agricultural soils	7.6	7.6	7.2	7.0	6.7	6.3	6.2	5.9	5.7	5.5	6.1
4 Land use, land use change and forestry											
Afforestation and deforestation											
5 Waste	<b>185.0</b>	<b>188.2</b>	<b>191.2</b>	<b>194.4</b>	<b>186.8</b>	<b>190.0</b>	<b>166.1</b>	<b>162.6</b>	<b>145.8</b>	<b>148.3</b>	<b>143.3</b>
Total CO <sub>2</sub> -e emissions excluding net CO <sub>2</sub> from LULUCF	<b>3175.6</b>	<b>3230.4</b>	<b>3318.5</b>	<b>3438.7</b>	<b>3392.8</b>	<b>3484.6</b>	<b>3491.6</b>	<b>3562.7</b>	<b>3602.1</b>	<b>3640.4</b>	<b>3686.3</b>

**Table 2 (cont.) ACT's CO<sub>2</sub> equivalent emissions (kilotonnes), 1990 to 2009**

Greenhouse gas source and sink categories	2001	2002	2003	2004	2005	2006	2007	2008	2009	1990-09	2008-09
Total CO <sub>2</sub> -e emissions	-	-	-	-	-	-	-	4129.2	4183.1	31.7%	1.3%
1 Energy	3537.5	3593.2	3658.6	3737.7	3711.7	3912.8	3895.7	3930.2	3950.2	35.1%	0.5%
A. Fuel combustion activities	3523.0	3579.4	3643.1	3726.0	3700.5	3900.5	3885.1	3917.8	3921.9	34.1%	0.1%
Electricity	2307.8	2309.0	2336.5	2418.8	2417.3	2569.6	2600.1	2591.0	2632.4	32.3%	1.6%
Natural gas	317.1	340.3	340.8	340.8	334.9	352.0	333.8	365.4	358.7	181.0%	-1.8%
Transport fuels	888.0	920.3	956.1	956.0	937.3	967.3	939.5	949.8	919.0	16.3%	-3.2%
Fuel wood	10.0	9.1	9.7	10.4	11.0	11.7	11.7	11.7	11.7	-30.5%	0.0%
B. Fugitive emissions from fuels	14.5	13.8	15.4	11.7	11.1	12.2	10.6	12.4	28.3	186.8% <sup>2</sup>	129.0%
Natural gas leakage	14.5	13.8	15.4	11.7	11.1	12.2	10.6	12.4	28.3		
2 Industrial processes	42.2	49.8	60.0	70.2	76.4	83.0	91.3	98.4	107.1	387.5%	8.9%
Production of halocarbons and SF <sub>6</sub>											
Consumption of halocarbons and SF <sub>6</sub>	38.1	46.0	55.0	65.2	72.5	78.4	87.0	93.1	101.8	422.3%	9.4%
Other	4.1	3.7	5.0	5.0	3.9	4.6	4.3	5.3	5.3	114.7%	0.3%
3 Agriculture	36.5	37.1	34.7	34.1	33.2	32.1	28.5	25.7	24.9	-43.4%	-3.0%
Enteric fermentation	29.7	29.8	27.6	27.2	26.7	26.0	23.0	20.8	20.3	-43.4%	-2.2%
Manure management	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	-29.0%	-13.0%
Agricultural soils	6.4	6.8	6.5	6.5	6.0	5.7	5.1	4.6	4.3	-44.0%	-6.1%
4 Land use, land use change and forestry								-26.4	-23.4	NA	-11.3%
Afforestation and deforestation								-26.4	-23.4		
5 Waste	143.2	149.0	124.6	104.8	105.1	104.2	102.7	101.3	124.2	-32.9%	22.6%
Total CO <sub>2</sub> -e emissions including net CO <sub>2</sub> from LULUCF <sup>1</sup>								4129.2	4183.1	31.7%	1.3%
Total CO <sub>2</sub> -e emissions excluding net CO <sub>2</sub> from LULUCF	3759.3	3829.1	3877.8	3946.8	3926.4	4132.0	4118.2	4155.6	4206.5	32.5%	1.2%

<sup>1</sup> Due to changes in the method for accounting emissions relating to LULUCF under the Kyoto Protocol between 1990 and the 2008-12 commitment period, a comparative time series is not available until 2008. For this reason a figure for emissions including LULUCF is not reported from 1990 to 2007.

<sup>2</sup> Calculated from 1991.

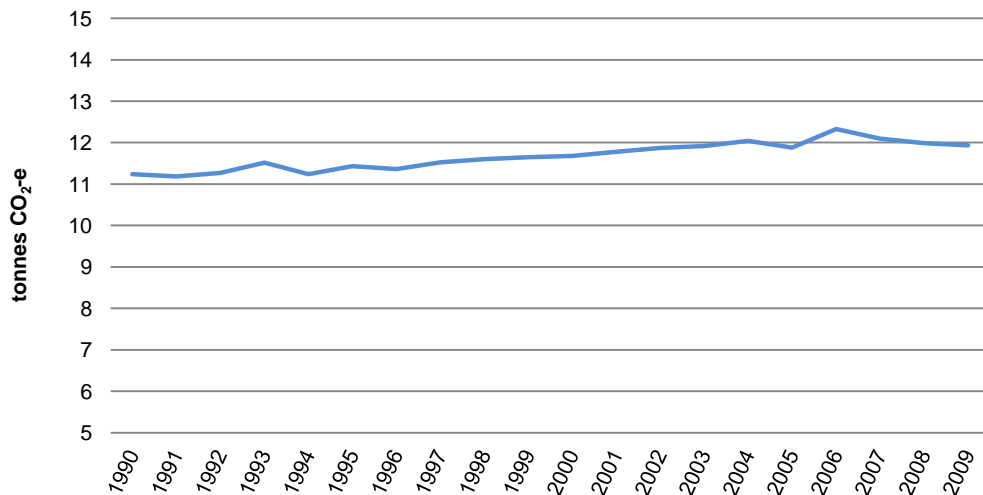




## 2.5 Per capita emissions

The Act establishes a per person greenhouse gas emissions target that requires the ACT's total emissions including LULUCF expressed on a per capita basis to peak by 30 June 2013.<sup>4</sup> Figure 7 presents the trend in per capita emissions (excluding LULUCF) in the territory since 1990.<sup>5</sup> Per capita emissions increased from 11.2 tonnes CO<sub>2</sub>-e in 1990 to peak at 12.3 tonnes in 2006. For 2009 per capita emissions was 11.9 tonnes CO<sub>2</sub>-e.

Figure 7 Trend in per capita emissions, 1990 to 2009 (excluding LULUCF)



## 2.6 Renewable energy consumption

The ACT Government has set renewable energy targets to complement the greenhouse gas reduction targets established in the Act.<sup>6</sup> The targets are for 15% of total electricity usage to be from renewable energy by 2012 increasing to 25% by 2020.

The Commonwealth's Renewable Energy Target (RET) set a Renewable Power Percentage (RPP) for liable entities of 3.14% and 3.64% for the 2008 and 2009 compliance years, respectively.<sup>7</sup> Averaging these calendar year targets implies that 3.39% of the total electricity supplied by retailers to customers in the ACT for the 2009 financial year was sourced from renewable energy to comply with the RET.

In addition to the electricity supplied from renewable sources under the RET, ACT customers also consume electricity sourced from GreenPower accredited generators.<sup>8</sup> Table 3 gives a breakdown of the amount of GreenPower consumed in the ACT since 2003 and its percentage of total electricity consumption for each year. In 2009 GreenPower consumption comprised 3.7% of total electricity consumption in the territory.

<sup>4</sup> *Climate Change and Greenhouse Gas Reduction Act 2010*, p.5.

<sup>5</sup> Population data sourced from Australian Bureau of Statistics, 3101.0 – Australian Demographic Statistics, Dec 2010, Table 4. *Estimated Resident Population, States and Territories (Number)*. Available at <http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0>.

<sup>6</sup> *Climate Change and Greenhouse Gas Reduction (Renewable Energy Targets) Determination 2011 (No 1)*.

<sup>7</sup> Renewable Power Percentages for 2001 to 2011 are available from <http://www.orer.gov.au/rpp/index.html#interim>.

<sup>8</sup> GreenPower is a voluntary government accredited program that allows electricity retailers to purchase renewable energy on behalf of customers. For details see, <http://www.greenpower.gov.au/>.

**Table 3 ACT GreenPower consumption**

<b>Consumption</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Total electricity (GWh) <sup>1</sup>	2,537	2,632	2,640	2,779	2,807	2,838	2,871
GreenPower – Residential (GWh) <sup>2</sup>	16.32	15.58	17.62	16.86	23.84	27.14	29.89
GreenPower – Non-residential (GWh) <sup>2</sup>	13.73	13.11	14.82	26.60	37.53	76.49	77.60
GreenPower % of total electricity	1.2	1.1	1.2	1.6	2.2	3.7	3.7

<sup>1</sup> As reported by ActewAGL Distribution.

<sup>2</sup> Financial year amounts imputed from *GreenPower Quarterly Reports*, available from <http://www.greenpower.gov.au/Business-Centre/Quarterly-Reports/>, and Independent Competition and Regulatory Commission *Licensed Electricity, Gas, Water and Sewerage Utilities Compliance and Performance Reports*, available from [http://www.icrc.act.gov.au/utilitieslicensing/compliance\\_and\\_performance](http://www.icrc.act.gov.au/utilitieslicensing/compliance_and_performance).

In total, based on the RET and GreenPower consumption, electricity from renewable energy sources accounted for 7.1% of consumption in 2008-09.

## 3 Methodology

The ACT GHG inventory adopts the sectoral composition recommended by the Intergovernmental Panel on Climate Change (IPCC) and used by the DCCEE in preparing both the national and state and territory inventories. Appendix A shows this composition and its constituent activities relevant for the ACT. The approach to measuring emissions for each source and sink is as follows.

### 3.1 Stationary energy combustion

Emissions caused by the consumption of energy from stationary sources in the ACT include electricity, natural gas and firewood.

#### 3.1.1 Indirect electricity and direct natural gas

Data for the annual consumption of electricity and natural gas in the territory is sourced from utilities as part of annual reporting requirements.<sup>9</sup> In the case of electricity, an allowance is made for transmission and distribution losses since these contribute to the total amount of electrical energy that must be generated in order to satisfy demand in the ACT. The total amount of GreenPower purchased annually within the ACT is subtracted from the sum of electricity consumed and network losses because GreenPower is excluded from the National Greenhouse Accounts (NGA) calculation of the scope 2 emissions factor.<sup>10</sup> The amount of GreenPower purchased is obtained from quarterly reports available from the GreenPower website.<sup>11</sup> The *National Greenhouse Accounts (NGA) Factors* provides the factor for the “consumption of purchased electricity from the grid” for New South Wales and the ACT.

Electricity generated under the ACT’s electricity feed-in scheme<sup>12</sup> is accounted for through the distribution loss factor.<sup>13</sup> The following equation calculates emissions attributable to electricity consumption in the ACT:

$$EIE = \frac{((DL \times TL) \times QE - GP) \times EFE}{1000}$$

Where:

*EIE* is emissions from electricity consumption expressed in tonnes of CO<sub>2</sub>-e

*DL* is the distribution loss factor for ActewAGL Distribution for the relevant financial year

*TL* is the transmission loss factor for electricity supplied to the ACT for the relevant financial year

*QE* is the consumption of purchased electricity expressed in kW hours

<sup>9</sup> Much of this information is provided to the Commission for its preparation of the annual *Licensed Electricity, Gas, Water and Sewerage Utilities Compliance and Performance Report*, and for calculating the electricity distribution loss factor for the Australian Energy Regulator (AER).

<sup>10</sup> The scope 2 emissions factor is a state-wide average calculated by DCCEE that reflects the emissions intensity of the mix of technologies used to generate the electricity consumed in each state and territory. For 2009 the ACT’s scope 2 emissions factor is the same as that applying to New South Wales.

<sup>11</sup> <http://www.greenpower.gov.au/our-audits-and-reports.aspx>.

<sup>12</sup> The scheme is established through the *Electricity Feed-in (Renewable Energy Premium) Act 2008*.

<sup>13</sup> The greater the amount of energy supplied by the feed-in scheme the smaller will be the distribution loss factor at any given level of electricity consumption.

*GP* is the consumption of purchased GreenPower expressed in kW hours

*EFE* is the emissions factor for scope 2 electricity consumption for NSW/ACT in kilograms of CO<sub>2</sub>-e emissions per kilowatt hour.

The emissions factor for natural gas consumed in the ACT, expressed as tonnes of CO<sub>2</sub>-e per gigajoule (tonnes CO<sub>2</sub>-e/GJ), is obtained from *Emission factors for the consumption of natural gas: Natural gas distributed in a pipeline* in the annual *National Greenhouse Accounts (NGA) Factors*. Annual emissions are calculated using the following equation:

$$ENG = \frac{QNG \times \sum_j EFNG_j}{1000}$$

Where:

*ENG* is emissions from natural gas consumption expressed in tonnes of CO<sub>2</sub>-e

*QNG* is the consumption of purchased natural gas less consumption by ACTION Buses expressed in gigajoules

*EFNG<sub>j</sub>* is the emissions factor for natural gas combustion for greenhouse gas type *j* = CO<sub>2</sub>, CH<sub>4</sub> (methane) and N<sub>2</sub>O (nitrous oxide) in kilograms of CO<sub>2</sub>-e per gigajoule.

### 3.1.2 Wood-fuel emissions

Fuel wood activity data for the ACT is somewhat out of date.<sup>14</sup> Although it would have been possible to commission an update of information on ACT fuel wood activity and emission factors, given that firewood represented less than 0.3 % of the ACT's emissions in 2006–07, it is doubtful that there is sufficient improvement in the accuracy of the ACT greenhouse gas inventory to be gained from commissioning such a study. For the purpose of the 2009 inventory wood fuel activity is assumed to be the same as in 2008. Annual emissions are calculated as follows:

$$EWF = \sum_i \frac{QWF \times ECWF \times UWF_i \times \sum_j EFWF_{ij}}{1000}$$

Where:

*EWF* is emissions from wood fuel consumption expressed in tonnes of CO<sub>2</sub>-e

*QWF* is the consumption of dry wood expressed in tonnes

*ECWF* is the energy content factor for dry wood expressed in gigajoules per tonne

*UWF<sub>i</sub>* is the share of wood fuel consumption used in activity type *i* = heating and stoves

*EFWF<sub>ij</sub>* is the emissions factor for activity type *i* for greenhouse gas type *j* = CH<sub>4</sub> and N<sub>2</sub>O in kilograms of CO<sub>2</sub>-e per gigajoule.

---

<sup>14</sup> Anderson, G., *ACT greenhouse gas inventory 2006/07*, Report prepared for the [then] ACT Department of the Environment, Climate Change, Energy and Water, Pitt & Sherry, Canberra (2009).

### 3.2 Transport emissions

Previous ACT GHG inventories only include road transport fuels in their estimation of transport emissions and this is the approach adopted for the 2009 inventory. Road transport emissions could be measured based on data for fuel sales within the ACT or the vehicle distance travelled by ACT residents. Neither approach offers a perfect measure of emissions in the ACT. For example, fuel sales data will include purchases, and therefore emissions, by residents outside the ACT. Alternatively, distance travelled data includes emissions occurring outside the territory. The Minister has determined that the inventory should continue to base road transport emissions on fuel sales using ACT fuel sales data collected by the ACT Government. Such an approach provides estimates of emissions that are consistent with previous inventories.

Emissions factors for each liquid fuel type are obtained from “Fuel combustion emission factors – liquid fuels and certain petroleum based products for stationary energy purposes” in the *National Greenhouse Accounts (NGA) Factors*. The following equation is used to calculate annual transport emissions:

$$ERT = \sum_i \frac{QRT_i \times ECRT_i \times \sum_j EFRT_{ij}}{1000}$$

Where:

*ERT* is emissions from road transport vehicles expressed in tonnes of CO<sub>2</sub>-e

*QRT<sub>i</sub>* is the quantity of transport fuel type *i* = petrol, diesel, and LPG sold measured in kilolitres and CNG consumed by ACTION Buses expressed in cubic metres

*ECRT<sub>i</sub>* is the energy content factor for transport fuel type *i* expressed in gigajoules per kilolitre or gigajoules per cubic metre

*EFRT<sub>ij</sub>* is the emissions factor for transport fuel type *i* for greenhouse gas type *j* = CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in kilograms of CO<sub>2</sub>-e emissions per gigajoule.

### 3.3 Emissions from other activities

Emissions for the remaining activities in the ACT listed in Appendix A are all adequately covered by the scope 1 measures in the National Greenhouse Accounts provided by the Australian Greenhouse Emissions Information System (AGEIS) and, therefore, data for the ACT GHG inventory is drawn from this source.<sup>15</sup> These activities are:

- fugitive emissions from natural gas distribution
- industrial processes
- agriculture
  - enteric fermentation
  - soils
- land use change and forestry
  - afforestation and deforestation
- waste.<sup>16</sup>

<sup>15</sup> Data for the ACT as measured by DCCEE is available at <http://ageis.climatechange.gov.au/SGGI.aspx>.

<sup>16</sup> Waste emissions in previous years were decomposed into ‘solid waste disposal on land’ and ‘wastewater handling’ in AGEIS. This breakdown is no longer provided by AGEIS for the 2009 inventory due to confidentiality reasons.



## Appendix A Coverage of emissions

Emissions source	NGA emissions activity <sup>1</sup>	ACT GHG emissions covered and data source
Energy	Stationary energy fuel combustion emissions – solid fuels	Wood fuel (biomass) – <i>ACT specific calculation</i>
	Stationary energy fuel combustion emissions – gaseous fuels	Consumption of purchased natural gas – <i>ACT specific calculation</i>
	Stationary energy fuel combustion emissions – liquid fuels	Fuel combustion, other sectors, residential, lawn mowers - <i>AGEIS<sup>17</sup></i>
	Transport fuel emissions	Petrol, diesel and LPG sales, and CNG consumed by buses – <i>ACT specific calculation</i>
	Indirect emissions from consumption of purchased electricity	Consumption of purchased electricity less GreenPower purchased adjusted for network losses – <i>ACT specific calculation</i>
	Fugitive emissions from fuels	Natural gas, Distribution – <i>ACT specific calculation</i>
Industrial processes including use of synthetic gases	Cement clinker production	NA
	Lime production	NA
	Use of carbonates for the production of a product other than cement clinker, lime or soda ash	NA
	Soda ash use and production	NA
	Ammonia production	NA
	Nitric acid production	NA
	Adipic acid production	NA
	Carbide production	NA
	Chemical or mineral production, other than carbide production, using a carbon reductant	NA
	Iron and steel or other metal production using an integrated metalworks	NA
	Ferroalloy metals	NA
	Aluminium — emissions from consumption of baked carbon anodes in aluminium production	NA
	Aluminium — emissions from production of baked carbon anodes in aluminium production	NA
	Aluminium (perfluorinated carbon compound emissions) – tetrafluoromethane and hexafluoroethane	NA
Other metals	NA	

<sup>17</sup> Not included in the 2009 inventory pending a review on improving measurement.

	Industrial processes — emissions of hydrofluorocarbons and sulphur hexafluoride gases	Consumption of halocarbons and SF <sub>6</sub> – AGEIS <sup>2</sup> /State and Territory GHG Inventory
Waste emissions	Methane released from landfills (other than from flaring of methane)	(Only aggregate waste emissions is available - AGEIS)
	Biological treatment of solid waste at the landfill — composting and anaerobic digestion	NA
	Wastewater handling (domestic and commercial)	NA
	Wastewater handling (industrial) — wastewater treatment	NA
	Wastewater handling (industrial) — flaring of methane in sludge biogas	NA
	Waste incineration — carbon dioxide emissions	NA
Agriculture	State and national-level estimates of greenhouse gas emissions from agriculture are prepared using the methodology set out in the <i>National Inventory Report 2007</i> (p.47)	Enteric fermentation, agricultural soils, manure management - AGEIS
Land-use change and forestry (vegetation sinks)	The National Carbon Accounting System is used to estimate emissions for land-based activities	AGEIS

<sup>1</sup> The NGA emissions activities are those presented in the *National Greenhouse Accounts (NGA) Factors, June 2009*.

<sup>2</sup> A sub-sector breakdown is shown in the State and Territory GHG Inventory for the ACT but there is no data for sub-sectors for the ACT in AGEIS, only total emissions for the main sector.



## Abbreviations and acronyms

ACT	Australian Capital Territory
AER	Australian Energy Regulator
AGEIS	Australian Greenhouse Emissions Information System
the Act	<i>Climate Change and Greenhouse Gas Reduction Act 2010</i>
CH <sub>4</sub>	Methane
CNG	Compressed natural gas
CO <sub>2</sub> -e	Carbon dioxide equivalent
Commission	Independent Competition and Regulatory Commission (ACT)
DCCEE	Department of Climate Change and Energy Efficiency
GHG	Greenhouse gas
ICRC	Independent Competition and Regulatory Commission
ICRC Act	<i>Independent Competition and Regulatory Commission Act 1997 (ACT)</i>
IPCC	Intergovernmental Panel on Climate Change
LPG	Liquid petroleum gas
LULUCF	Land use, land use change and forestry
Mt CO <sub>2</sub> -e	Million tonnes of carbon dioxide equivalent
N <sub>2</sub> O	Nitrous oxide
NGA	National Greenhouse Accounts
RET	Renewable Energy Target
RPP	Renewable Power Percentage
Utilities Act	<i>Utilities Act 2000</i>