



# ICRC

independent competition and regulatory commission

Final Report  
**ACT Greenhouse Gas  
Inventory Report  
2009–10**  
Report 9 of 2012  
September 2012



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.

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## Summary

The Australian Capital Territory 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 2009–10. The estimates are based on a methodology that satisfies the legislative requirements of the Act.

The main outcomes for 2009–10 include:

- Total carbon dioxide equivalent (CO<sub>2</sub>-e) emissions were 4,402 kilotonnes when emissions reductions from land use, land-use change, and forestry (LULUCF) are included.
- Total CO<sub>2</sub>-e emissions were 4,434 kilotonnes when LULUCF is excluded.
- Total CO<sub>2</sub>-e emissions (including LULUCF) are 2,482 kilotonnes greater than the 1,920 kilotonnes corresponding to the 2020 target of a 40 per cent reduction from 1990 levels.
- CO<sub>2</sub>-e emissions attributable to electricity consumption are 63 per cent of total emissions (excluding LULUCF), and are the main contributor to emissions growth since 1990.
- Per capita emissions peaked in 2006 at 12.7 tonnes, and in 2010 were 12.3 tonnes.
- Renewable energy use has increased from 11.0 per cent in 2009 to 12.9 per cent in 2010.





# 1 Introduction

The *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act) establishes targets for greenhouse gas emissions and energy use in the ACT and requirements for reporting on those 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 three 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 2009–10.

This is the second 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 *Australian National Greenhouse Accounts: State and Territory Greenhouse Gas Inventories 2010* prepared by the Commonwealth Department of Climate Change and Energy Efficiency (DCCEE, 2012b). The DCCEE inventory for the ACT calculates emissions using a production approach that focuses on the geographic location of emissions sources. It therefore accounts for emissions physically occurring within the ACT, but not necessarily those related to ACT activities.

Following advice from the Commission, the Minister determined a methodology for measuring emissions in the ACT (*Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2012*). It employs a hybrid production and consumption approach satisfying the information needs of the ACT Government and the legislative requirements of the Act. A hybrid approach accounts for emissions attributable to consumption activities in addition to those arising from production activities within the ACT. The methodology accepts responsibility for emissions occurring outside the ACT's geographic region, if actions within the Territory are indirectly responsible for their creation.

The methodology adopted by the Commission is described in the appendixes to this report. It 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 2009 inventory. This difference is due to revisions in data provided by the Australian Greenhouse Emissions Information System (AGEIS) and a review of both data and the methodology by the Commission for 2009–10. The 2010 inventory uses different data sources and methods to measure indirect electricity emissions, road transport emissions, and emissions attributable to natural gas leakage. The Commission will undertake further

reviews of data sources and methodology before the preparation of the 2011 inventory to ensure the inventory's accuracy and quality. Consequently, the data presented in the 2010 inventory may be revised in future if 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 that different activities make to the Territory's total emissions, information on total 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 before 2008. The method for accounting for emissions relating to LULUCF under the Kyoto Protocol between 1990 and the 2008–12 commitment period has changed; therefore, a comparative time series is not available for the period between 1990 and 2007.

## 2 ACT greenhouse gas emissions

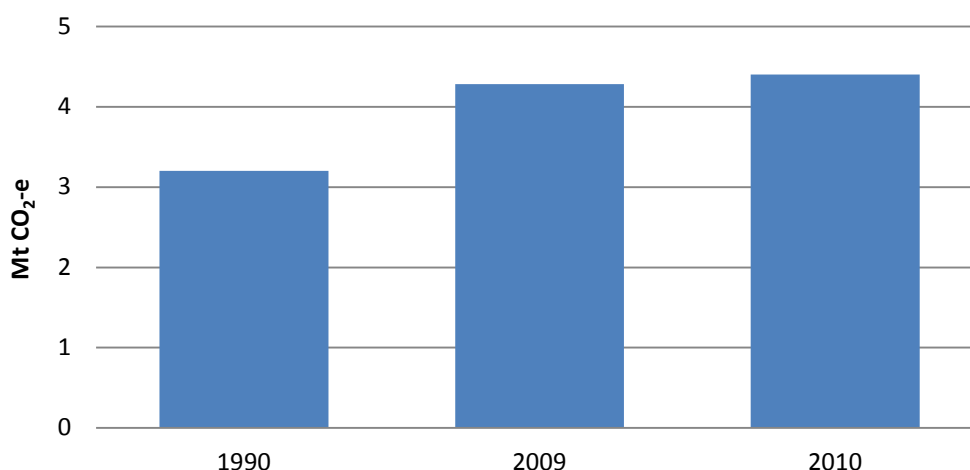
### 2.1 Total emissions

The ACT's total emissions of greenhouse gases in 2009–10 financial year were 4,402 kilotonnes (4.402 megatonnes), measured on a carbon dioxide equivalent (CO<sub>2</sub>-e) basis and including emissions reductions due to land use, land-use change, and forestry (LULUCF). When emissions reductions due to LULUCF are excluded, the total CO<sub>2</sub>-e emissions (total emissions) increase by 33 kilotonnes to 4,434 kilotonnes. These amounts represent an increase of 2.8 per cent and 3.0 per cent over 2009 total emissions when reductions from LULUCF are included and excluded, respectively.

When emissions reductions from LULUCF are accounted for, total emissions are 2,482 kilotonnes greater than the level of emissions required to meet the ACT Government's target of a 40 per cent reduction in net emissions from 1990 levels by 2020. To achieve the 2020 target, which is equivalent to total net emissions of 1,920 kilotonnes of CO<sub>2</sub>-e, the ACT needs to reduce and/or offset approximately 248 kilotonnes in each of the remaining 10 years. This projection assumes a linear reduction path and emissions reductions beginning in 2010–11.

Figure 2.1 presents total emissions including LULUCF for the 1990, 2009, and 2010 financial years.

**Figure 2.1 ACT total emissions and removals, 1990, 2009 and 2010 (including LULUCF)**



Mt = megatonnes

Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

In 2010, total emissions of CO<sub>2</sub>-e greenhouse gases were 37.5 per cent greater than the 1990 level of 3,200 kilotonnes<sup>1</sup> and 2.8 per cent greater than the 4,280 kilotonnes of greenhouse gases emitted in 2009.

## 2.2 Sectoral breakdown

Table 2.1 presents a detailed breakdown of the ACT greenhouse gas inventory for 2010 by sector.

**Table 2.1 Sectoral report for ACT greenhouse gas inventory, 2010**

Greenhouse gas source and sink categories	Total CO <sub>2</sub> -e (kt)
<b>Total ACT emissions and removals</b>	<b>4,401.5</b>
<b>1. Energy</b>	<b>4,168.4</b>
<b>A. Fuel combustion activities</b>	<b>4,149.2</b>
Electricity	2,792.9
Natural gas	356.7
Transport fuels	987.9
Fuel wood	11.7
<b>B. Fugitive emissions from fuels</b>	<b>19.2</b>
Natural gas leakage	19.2
<b>2. Industrial processes</b>	<b>114.7</b>
Production of halocarbons and SF <sub>6</sub>	
Consumption of halocarbons and SF <sub>6</sub>	109.2
Other	5.5
<b>3. Agriculture</b>	<b>24.1</b>
Enteric fermentation	20.0
Manure management	0.2
Agricultural soils	3.9
<b>4. Land use, land-use change and forestry</b>	<b>-32.0</b>
Afforestation and reforestation <sup>1</sup>	-32.0
<b>5. Waste</b>	<b>126.3</b>
<b>Total CO<sub>2</sub>-e emissions including net CO<sub>2</sub>-e from LULUCF</b>	<b>4,401.5</b>
<b>Total CO<sub>2</sub>-e emissions excluding net CO<sub>2</sub>-e from LULUCF</b>	<b>4,433.5</b>

kt = kilotonnes

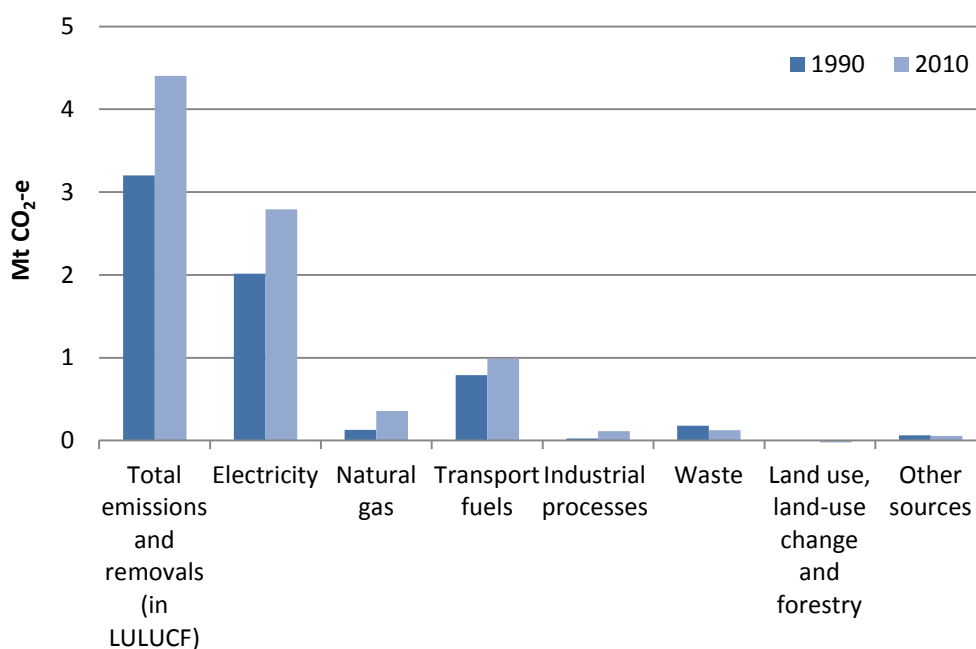
<sup>1</sup> Renamed to reflect terminology used in AGEIS published by the DCCEE (2012b)

Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

Table 2.1 shows that the consumption of electricity, natural gas, and transport fuels are the main sources of greenhouse gas emissions. Fuel combustion activities are responsible for approximately 94 per cent of total emissions excluding LULUCF. Relatively minor sources of emissions include activities relating to industrial processes and waste, which jointly account for just over 5 percentage points of the remaining 6 per cent of total emissions.

Figure 2.2 compares the level of total and sectoral emissions for 2010 with those occurring in 1990. The main sectors responsible for increased emissions over this period include electricity (38.6 per cent), natural gas (179.5 per cent), and transport fuels (25.1 per cent). Emissions from the waste sector have declined by 28.8 per cent.

**Figure 2.2 ACT emissions and removals by sector, 1990 and 2010 (including LULUCF)**



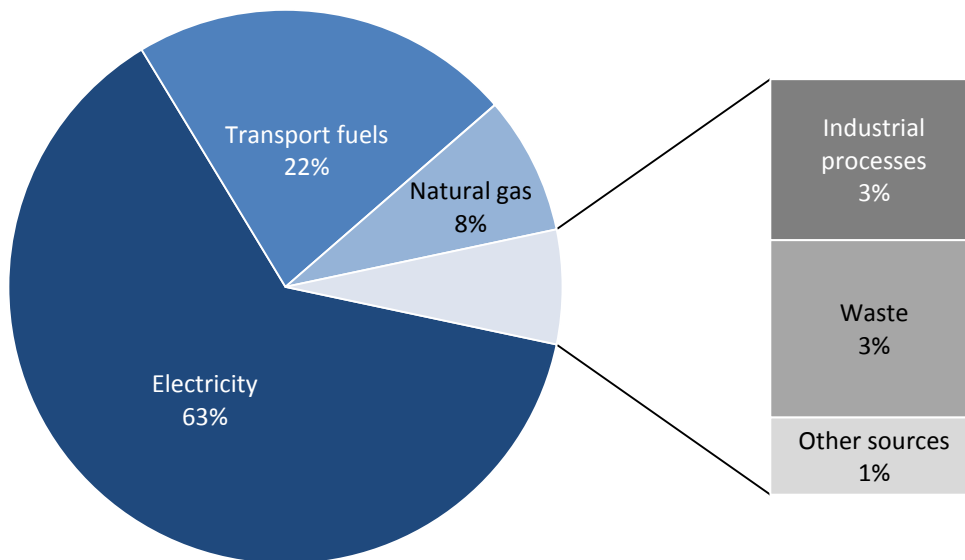
Mt = megatonne

Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT Greenhouse Gas Inventories.

### 2.3 Sources of emissions

The main sources of emissions in 2010 presented in the sectoral breakdown in table 2.1 are shown in figure 2.3 as a percentage of total emissions excluding reductions from LULUCF.

**Figure 2.3 Share of emissions by sector, 2010 (excluding LULUCF)**

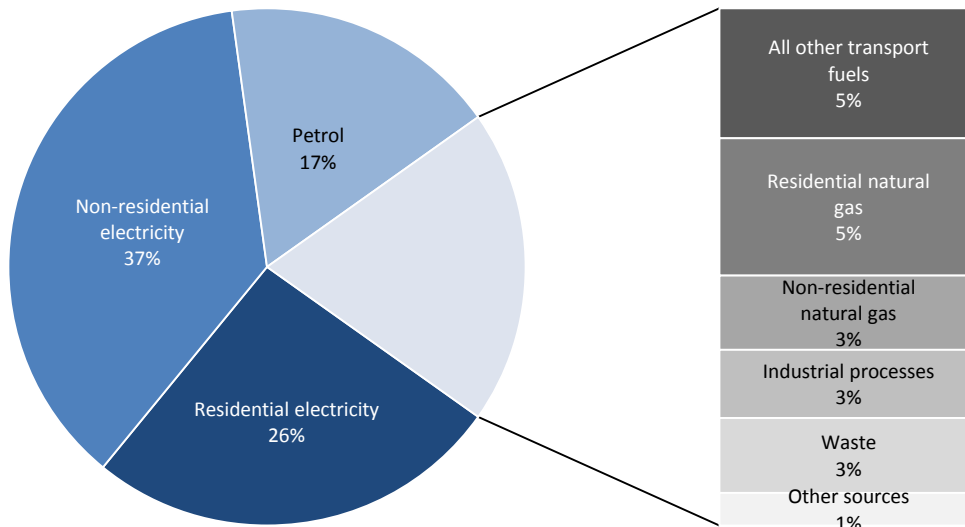


Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

Within the fuel combustion category, electricity consumption is responsible for 63 per cent of total emissions. Following electricity, the second and third largest contributions to total emissions are from transport fuels (22 percent) and natural gas (8.0 per cent), respectively. Industrial processes and waste activities each contribute approximately 3 per cent of total emissions. The ACT's profile for sectoral emissions arises from the low levels of industrial and agricultural activity, along with the absence of mining.

Figure 2.4 presents a more detailed breakdown of total emissions for 2010. At the subsector level, non-residential electricity is the largest contributor, accounting for 37 per cent of total emissions. This is followed in order of contribution by residential electricity (26 per cent), petrol (17 per cent), and all other transport fuels (5 per cent).

**Figure 2.4 Share of emissions by source subsector, 2010 (excluding LULUCF)**



Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

The major subsector contributing to emissions from each fuel combustion category are non-residential electricity consumption, which is responsible for 59 per cent of emissions attributable to electricity consumption; petrol combustion, which accounts for 78 per cent of emissions attributable to road transport fuels<sup>2</sup>; and residential natural gas consumption, which accounts for 65 per cent of emissions from natural gas consumption.

## 2.4 Trend in emissions

Table 2.2 presents a detailed sectoral breakdown of emissions from 1990 to 2010.

**Table 2.2 ACT CO<sub>2</sub> equivalent emissions, 1990 to 2010, (kilotonnes)**

Greenhouse gas source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Total CO<sub>2</sub>-e emissions</b>	<b>3,200.0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>1. Energy</b>	<b>2,953.7</b>	<b>3,013.2</b>	<b>3,057.7</b>	<b>3,243.4</b>	<b>3,229.4</b>	<b>3,217.6</b>	<b>3,318.9</b>	<b>3,414.4</b>	<b>3,456.4</b>	<b>3,456.1</b>	<b>3,507.6</b>
<b>A. Fuel combustion activities</b>	<b>2,950.2</b>	<b>3,009.1</b>	<b>3,052.8</b>	<b>3,238.0</b>	<b>3,223.3</b>	<b>3,211.0</b>	<b>3,312.2</b>	<b>3,407.2</b>	<b>3,449.2</b>	<b>3,448.4</b>	<b>3,499.7</b>
Electricity	2,015.8	2,050.9	2,051.6	2,130.9	2,100.0	2,034.8	2,131.5	2,168.4	2,204.6	2,209.2	2,279.1
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>B. Fugitive emissions from fuels</b>	<b>3.5</b>	<b>4.1</b>	<b>4.8</b>	<b>5.4</b>	<b>6.1</b>	<b>6.6</b>	<b>6.7</b>	<b>7.2</b>	<b>7.2</b>	<b>7.7</b>	<b>8.0</b>
Natural gas leakage	3.5	4.1	4.8	5.4	6.1	6.6	6.7	7.2	7.2	7.7	8.0
<b>2. Industrial processes</b>	<b>24.7</b>	<b>25.2</b>	<b>24.7</b>	<b>31.7</b>	<b>21.2</b>	<b>21.7</b>	<b>12.8</b>	<b>17.6</b>	<b>22.7</b>	<b>28.9</b>	<b>36.3</b>
Production of halocarbons and SF6	18.6	18.7	17.7	24.4	13.7	12.1					
Consumption of halocarbons and SF6	3.6	4.0	4.3	4.7	5.0	7.1	10.1	14.6	19.5	25.5	32.5
Other	2.5	2.5	2.7	2.7	2.5	2.5	2.7	3.0	3.2	3.5	3.8
<b>3. Agriculture</b>	<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
<b>4. Land use, land-use change and forestry</b>											
Afforestation and reforestation <sup>1</sup>											
<b>5. Waste</b>	<b>177.6</b>	<b>181.1</b>	<b>184.6</b>	<b>188.1</b>	<b>180.9</b>	<b>184.5</b>	<b>160.9</b>	<b>157.6</b>	<b>141.2</b>	<b>144.0</b>	<b>139.3</b>
<b>Total CO<sub>2</sub>-e emissions including net CO<sub>2</sub>-e from LULUCF</b>	<b>3,200.0</b>	<b>3,263.3</b>	<b>3,309.0</b>	<b>3,504.2</b>	<b>3,470.8</b>	<b>3,461.4</b>	<b>3,529.3</b>	<b>3,624.9</b>	<b>3,654.1</b>	<b>3,661.2</b>	<b>3,718.4</b>
<b>Total CO<sub>2</sub>-e emissions excluding net CO<sub>2</sub>-e from LULUCF</b>	<b>3,200.0</b>	<b>3,263.3</b>	<b>3,309.0</b>	<b>3,504.2</b>	<b>3,470.8</b>	<b>3,461.4</b>	<b>3,529.3</b>	<b>3,624.9</b>	<b>3,654.1</b>	<b>3,661.2</b>	<b>3,718.4</b>



**Table 2.2 (cont.) ACT CO<sub>2</sub> equivalent emissions, 1990 to 2010 (kilotonnes)**

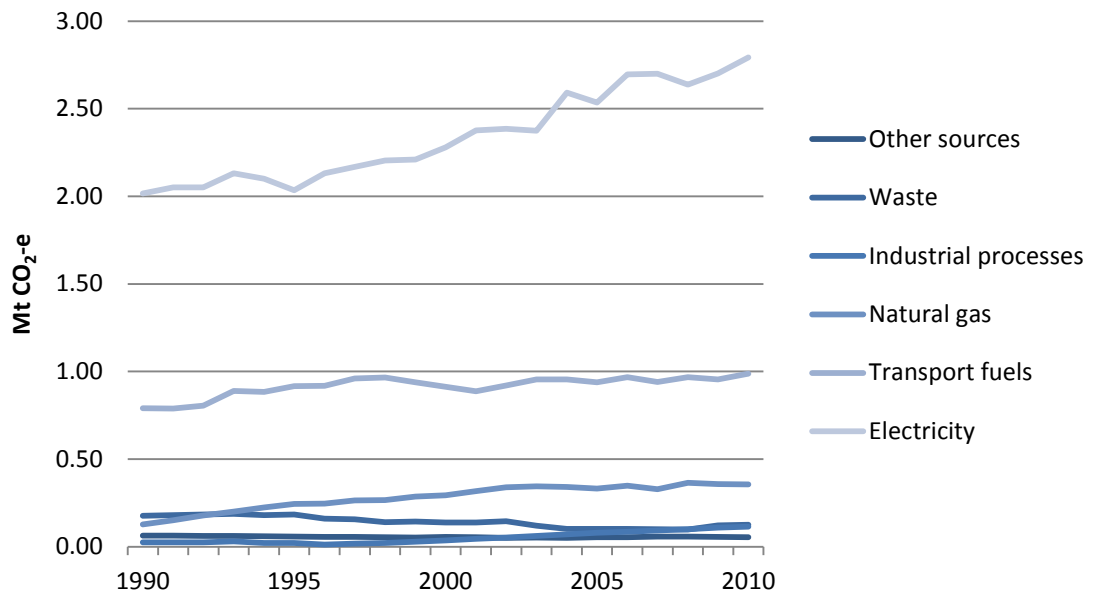
Greenhouse gas source and sink categories	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	1990-2010	2009-2010
<b>Total CO<sub>2</sub>-e emissions</b>	-	-	-	-	-	-	-	-	4,280.3	4,401.5	37.5%	2.8%
<b>1. Energy</b>	<b>3,600.1</b>	<b>3,660.8</b>	<b>3,695.0</b>	<b>3,905.2</b>	<b>3,828.3</b>	<b>4,036.2</b>	<b>3,998.6</b>	<b>4,004.5</b>	<b>4,047.4</b>	<b>4,168.4</b>	<b>41.1%</b>	<b>3.0%</b>
<b>A. Fuel combustion activities</b>	<b>3,591.5</b>	<b>3,655.6</b>	<b>3,685.7</b>	<b>3,898.3</b>	<b>3,818.1</b>	<b>4,025.5</b>	<b>3,980.2</b>	<b>3,982.7</b>	<b>4,027.9</b>	<b>4,149.2</b>	<b>40.6%</b>	<b>3.0%</b>
Electricity	2,376.4	2,385.4	2,374.2	2,591.1	2,535.1	2,696.7	2,699.2	2,637.4	2,702.2	2,792.9	38.6%	3.4%
Natural gas	317.1	340.2	345.6	340.8	333.2	348.7	329.2	365.4	358.5	356.7	179.5%	-0.5%
Transport fuels	888.0	920.9	956.1	956.0	938.9	968.4	940.1	968.2	955.6	987.9	25.1%	3.4%
Fuel wood	10.0	9.1	9.7	10.4	11.0	11.7	11.7	11.7	11.7	11.7	-30.5%	0.0%
<b>B. Fugitive emissions from fuels</b>	<b>8.6</b>	<b>5.2</b>	<b>9.3</b>	<b>7.0</b>	<b>10.2</b>	<b>10.7</b>	<b>18.3</b>	<b>21.8</b>	<b>19.5</b>	<b>19.2</b>	<b>457.6%</b>	<b>-1.5%</b>
Natural gas leakage	8.6	5.2	9.3	7.0	10.2	10.7	18.3	21.8	19.5	19.2	457.6%	-1.5%
<b>2. Industrial processes</b>	<b>45.0</b>	<b>52.6</b>	<b>62.9</b>	<b>71.4</b>	<b>80.2</b>	<b>85.6</b>	<b>93.1</b>	<b>100.2</b>	<b>108.7</b>	<b>114.7</b>	<b>364.5%</b>	<b>5.5%</b>
Production of halocarbons and SF6												
Consumption of halocarbons and SF6	40.9	48.9	57.8	66.5	76.3	81.0	88.8	94.9	103.4	109.2	2896.5%	5.7%
Other	4.1	3.7	5.0	5.0	3.9	4.6	4.3	5.3	5.3	5.5	119.8%	2.3%
<b>3. Agriculture</b>	<b>36.5</b>	<b>37.1</b>	<b>34.6</b>	<b>34.1</b>	<b>33.2</b>	<b>32.1</b>	<b>28.5</b>	<b>25.7</b>	<b>24.9</b>	<b>24.1</b>	<b>-45.4%</b>	<b>-3.5%</b>
Enteric fermentation	29.7	29.8	27.6	27.2	26.7	26.0	23.0	20.8	20.3	20.0	-44.5%	-1.8%
Manure management	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.2	-56.3%	-38.4%
Agricultural soils	6.4	6.8	6.5	6.5	6.0	5.7	5.1	4.6	4.3	3.9	-49.0%	-9.0%
<b>4. Land use, land-use change and forestry</b>								<b>-26.2</b>	<b>-23.2</b>	<b>-32.0</b>		<b>37.7%</b>
Afforestation and reforestation <sup>1</sup>								-26.2	-23.2	-32.0		37.7%
<b>5. Waste</b>	<b>139.4</b>	<b>145.5</b>	<b>121.3</b>	<b>101.7</b>	<b>102.3</b>	<b>101.7</b>	<b>100.6</b>	<b>99.4</b>	<b>122.4</b>	<b>126.3</b>	<b>-28.8%</b>	<b>3.2%</b>
<b>Total CO<sub>2</sub>-e emissions including net CO<sub>2</sub>-e from LULUCF</b>	<b>3,821.0</b>	<b>3,896.0</b>	<b>3,913.8</b>	<b>4,112.5</b>	<b>4,043.9</b>	<b>4,255.6</b>	<b>4,220.8</b>	<b>4,203.6</b>	<b>4,280.3</b>	<b>4,401.5</b>	<b>37.5%</b>	<b>2.8%</b>
<b>Total CO<sub>2</sub>-e emissions excluding net CO<sub>2</sub>-e from LULUCF</b>	<b>3,821.0</b>	<b>3,896.0</b>	<b>3,913.8</b>	<b>4,112.5</b>	<b>4,043.9</b>	<b>4,255.6</b>	<b>4,220.8</b>	<b>4,229.8</b>	<b>4,303.5</b>	<b>4,433.5</b>	<b>38.5%</b>	<b>3.0%</b>

<sup>1</sup> Renamed to reflect terminology used in AGEIS published by the DCCEE (2012b).

Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

In 2010 the ACT's total greenhouse gas emissions continued the upward trend that began in 1990. Total emissions including LULUCF have increased by 37.5 per cent over that period, which corresponds to a 38.5 per cent increase in total emissions excluding LULUCF. The trend in total emissions and those of the main emitting sectors from 1990 to 2010 are shown in figure 2.5.

**Figure 2.5 Trend in sectoral emissions, 1990 to 2010 (excluding LULUCF)**

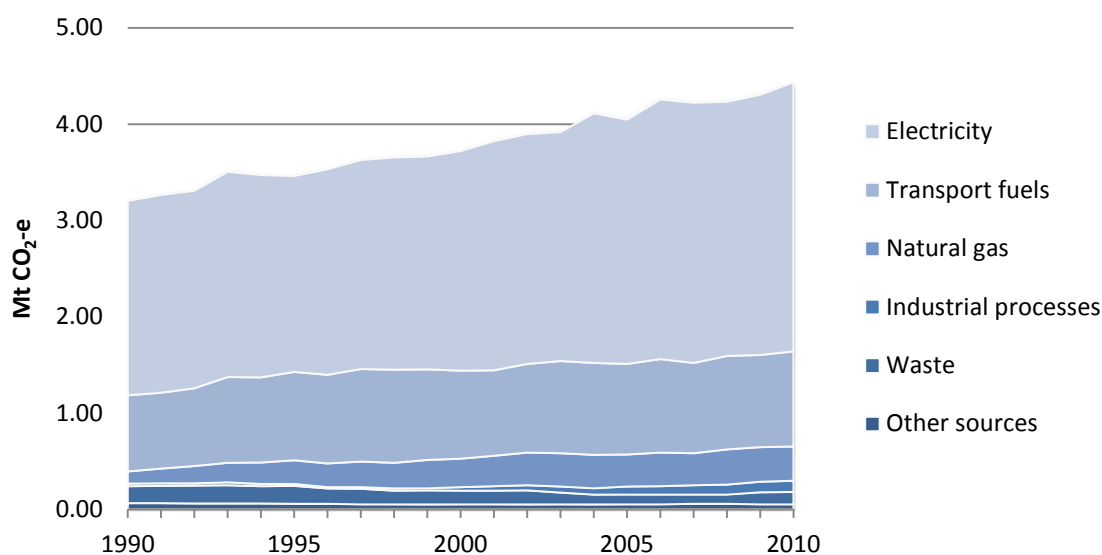


Mt = megatonnes

Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

Figure 2.6 shows the cumulative contribution of each of the main sectors to total emissions, and highlights that since 1990 there have only been three years in which total emissions (excluding LULUCF) declined from those of the previous year (1994, 2005, and 2007).

**Figure 2.6 Trend in composition of total emissions, 1990 to 2010 (excluding LULUCF)**



Mt = megatonnes

Source: ABS, 2011, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

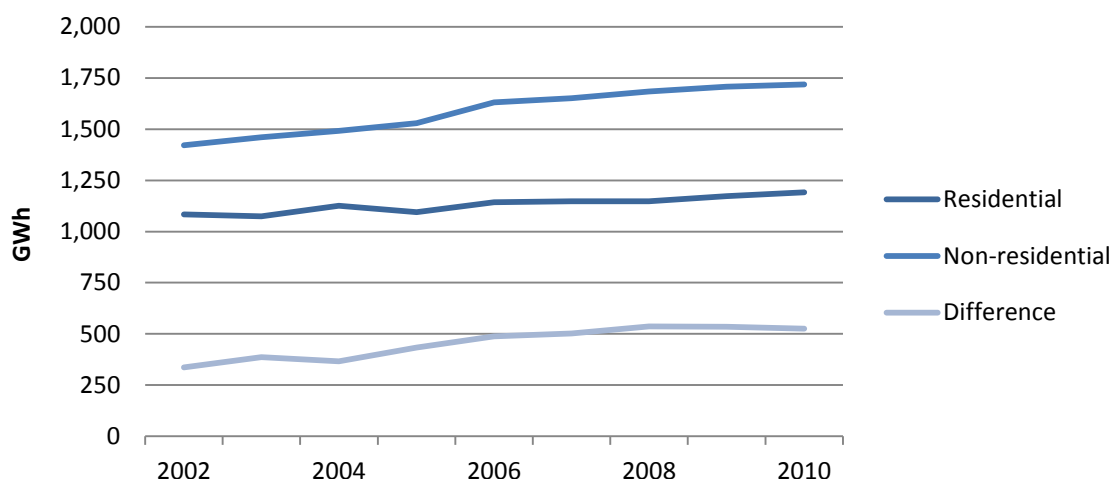
Electricity consumption is responsible for the largest share of annual total emissions, and has also made the greatest contribution to the increase in the ACT's total emissions since 1990. It has increased at an annualised growth rate of 1.6 per cent in line with the growth rate in total emissions. Emissions from the consumption of natural gas have experienced the largest rate of growth of all fuel combustion activities, increasing at an annualised rate of 5.3 per cent. The growth rate in transport fuel emissions has grown at an annual rate of 1.1 per cent.

Other sources of emissions experiencing significant rates of growth from 1990 to 2010 are natural gas leakage (9.0 per cent per annum) and the consumption of halocarbons and SF<sub>6</sub> in industrial processes (18.5 per cent per annum). Waste is the only activity emitting more than 100 kilotonnes per annum that experienced a negative growth rate in emissions (-1.7 per cent per annum).

Comparing emissions for each of the major categories excluding LULUCF in 2009 with those in 2010 shows that energy increased by 3.0 per cent, industrial processes increased by 5.5 per cent, agriculture decreased by 3.5 per cent, and waste increased by 3.2 per cent. The main sectors contributing to total emissions are all within the energy category. Between 2009 and 2010, emissions from electricity consumption increased by 3.4 per cent, natural gas decreased by 0.5 per cent, and transport fuels increased by 3.4 per cent.

Figures 2.7 and 2.8 show the trend in electricity consumption and natural gas consumption, respectively, for both residential and non-residential consumers. The residential sector represents a greater share of gas consumption, but a smaller share of electricity consumption. Non-residential electricity consumption has been growing as a share of total electricity consumption, while the ratio of residential to non-residential consumption has remained fairly constant for gas.

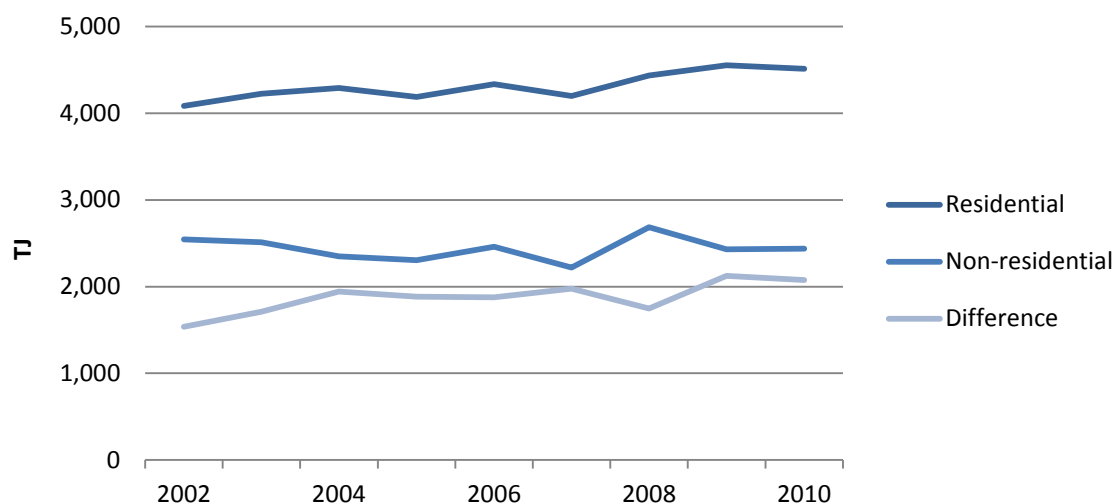
**Figure 2.7 Trend in electricity consumption, 2002 to 2010**



GWh = gigawatt hours

Source: ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution; and previous ACT greenhouse gas inventories.

**Figure 2.8 Trend in natural gas consumption, 2002 to 2010**

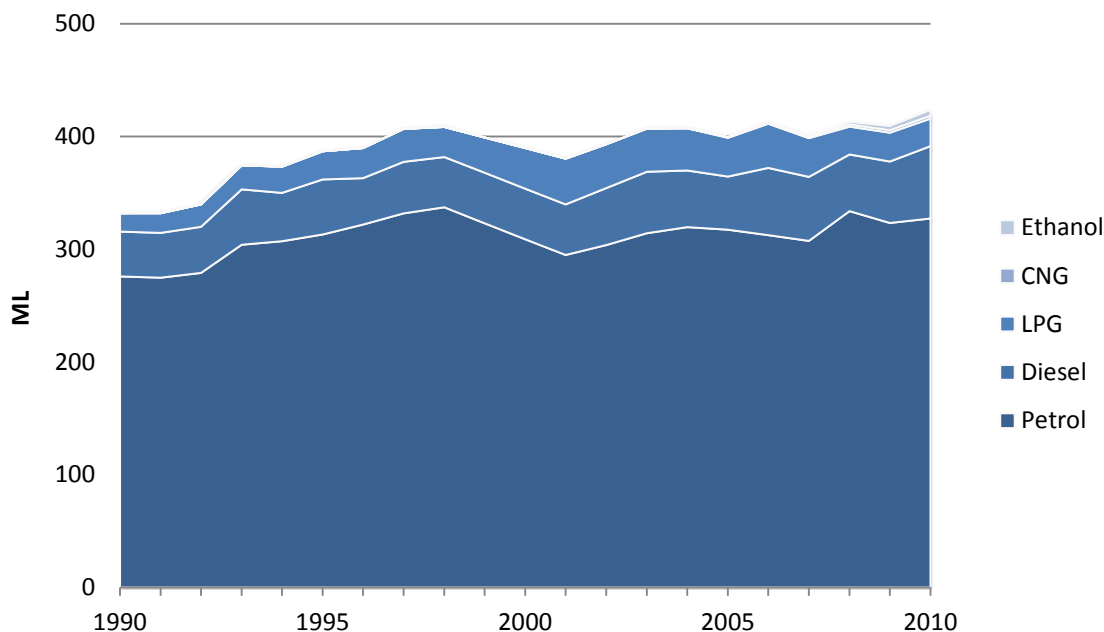


TJ = terajoules

Source: ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; and previous ACT greenhouse gas inventories.

Figure 2.9 illustrates the trend in the consumption of transport fuels and each category's relative share. Petrol, diesel, and liquefied petroleum gas are the three most consumed fuels. Compressed natural gas and ethanol are newer forms of transportation fuel; their use continues to be low in the ACT.

**Figure 2.9 Trend in transport fuel consumption, 1990 to 2010**



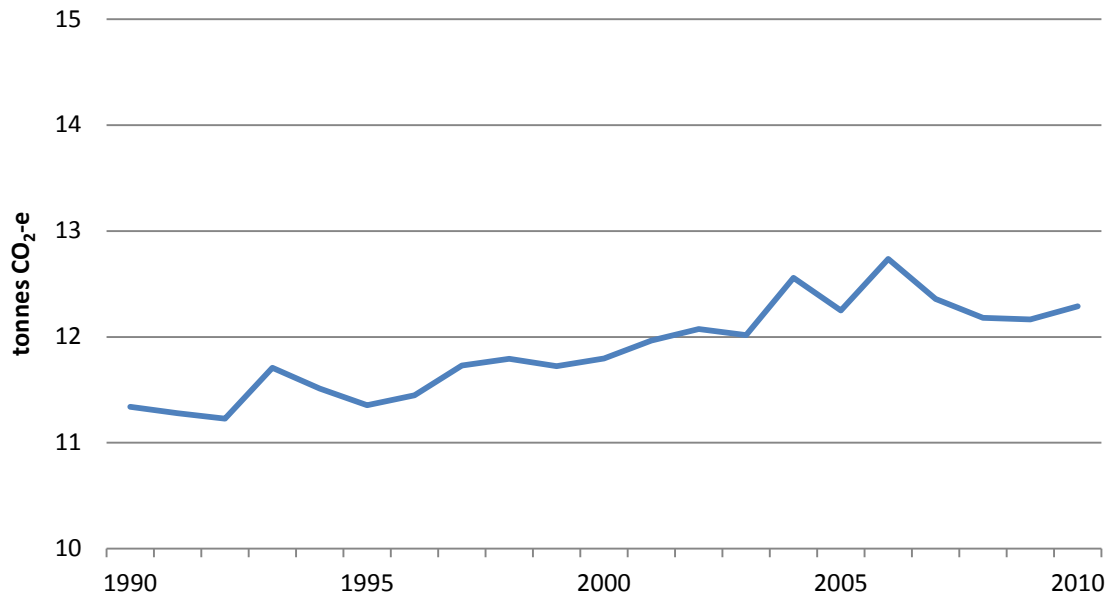
ML = megalitres

Source: ESDD, 2011; unpublished data from ACTION; and previous ACT greenhouse gas inventories.

## 2.5 Per capita emissions

The Act establishes a greenhouse gas emissions target that requires per capita total emissions including LULUCF to peak by 30 June 2013 (p. 5). Figure 2.10 shows the trend in per capita emissions in the ACT from 1990 to 2010. Emissions increased from 11.3 tonnes CO<sub>2</sub>-e in 1990 to a high of 12.7 tonnes in 2006. In 2010, per capita emissions were 12.3 tonnes, which is 0.1 tonnes greater than the 12.2 tonnes emitted in 2009.

**Figure 2.10** Trend in per capita emissions, 1990 to 2010 (excluding LULUCF)



Source: ABS, 2011, 2012a, 2012b; DCCEE, 2012a, 2012b; ESDD, 2011; GreenPower, 2012; ICRC, 2004a, 2004b, 2005, 2007, 2008, 2009a, 2009b, 2011a, 2011b, 2012b; unpublished data from ActewAGL Distribution, ACTION, ESAA; and previous ACT greenhouse gas inventories.

### 3 Renewable energy consumption

The ACT Government has set renewable energy targets to complement the greenhouse gas reduction targets established in the Act (*Climate Change and Greenhouse Gas Reduction (Renewable Energy Targets) Determination 2011 (No 1)*). The targets are for 15 per cent of total electricity use in the Territory to be from renewable energy by 2012, increasing to 25 per cent by 2020.

The calculation of renewable energy use in the ACT each financial year consists of four components:

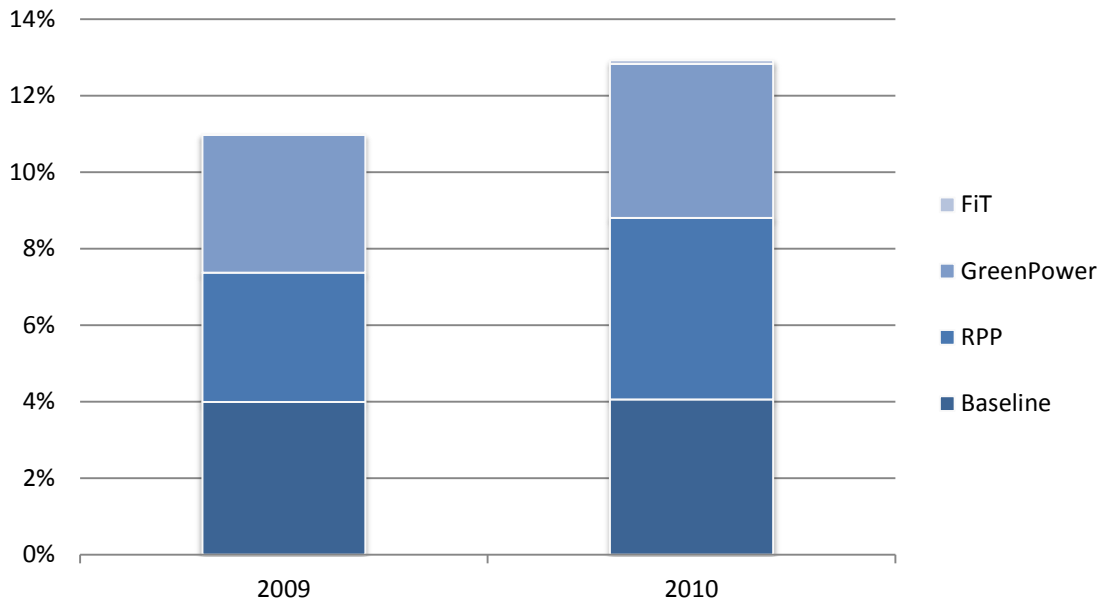
- the ACT's share of the pre-1997 baseline level of electricity generated from renewable energy plants in New South Wales – that is, renewable energy from generation plants ineligible for the creation of renewable energy certificates under the Australian Government's renewable energy target. This share is calculated based on the Territory's electricity consumption as a percentage of total consumption in the NSW region in the National Electricity Market<sup>1</sup>
- the amount of renewable energy purchased by ACT electricity retailers to comply with the Australian Government's renewable energy target as specified by the annual renewable power percentage and the ACT's consumption profile for each half of the financial year
- the amount of GreenPower purchased by consumers within the ACT
- the amount of renewable energy generated under the ACT Government's Feed-in Tariff Scheme.

In 2010 renewable energy use in the ACT was 12.9 per cent of total electricity consumption. This compares to 11.0 per cent in 2009. Figure 3.1 illustrates the component shares for both years.

The baseline component increased slightly from 4.0 per cent of total renewable energy consumption in 2009 to 4.1 per cent in 2010. The increase occurred because the amount of electricity generated in 2009 was less than the full amount of baseline generation.

The renewable power percentage for 2009 and 2010 adjusted for the variation in electricity consumption in each half of the financial year is 3.4 and 4.7 per cent, respectively. GreenPower sales were 104 GWh in 2009 and 117 GWh in 2010, which represents 3.6 per cent and 4.0 per cent of renewable energy consumption. The contribution from the ACT Feed-in Tariff component was small: 0.01 per cent in 2009 and 0.10 per cent in 2010.

**Figure 3.1 Percentage of renewable energy use, 2009 and 2010**



Source: AER, 2010; BREE, 2012; CER, 2012; GreenPower, 2012; ICRC, 2012a; IES, 2002; Snowy Hydro, nd; and unpublished data from ActewAGL Distribution.



# Appendix 1: Advice to Minister

## Note of advice on the Method for Measuring Greenhouse Gas Emissions in the ACT

The *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act) sets targets to reduce greenhouse gas (GHG) emissions and increase renewable energy use and generation in the ACT. The Act also provides for monitoring and reporting on progress made in achieving GHG emissions reductions, informs the government's development of policies and progress to address climate change and encourages private entities to address climate change actively. Pursuant to section 12 of the Act, the Independent Competition and Regulatory Commission (the Commission) as an independent entity prepares an annual report that includes an estimate of measured emissions (the annual emissions amount). As the annual emissions amount is subject to the publication of data from national sources, the annual report on the ACT GHG emissions is released two years after the relevant period each year (for example, the 2010 ACT GHG inventory will be published in 2012). The report must be provided to the Minister within three months after the end of the reporting period—that is, by 30 September each year.

The Commission advised the Minister on a methodology for the measurement of GHG emissions in the ACT in July 2011.<sup>1</sup> In that advice it was foreshadowed that the methodology would be continually reviewed to ensure that the method for calculating emissions passed the test of reasonable accuracy given future improvements to data as well as changing economic and policy environments.<sup>2</sup> The Commission undertook to provide the Minister with timely advice on the changes that it identified as refinements to the methodology. The Commission has reviewed the methodology in preparation for producing the 2009–10 GHG inventory and identified several refinements that would improve the measurement of GHG emissions in the ACT.

The proposed methodology is largely consistent with that adopted in the original advice provided to the Minister. Recommended changes to the methodology

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<sup>1</sup> ICRC (2011c) *Method for Measuring Greenhouse Gas Emissions in the ACT*, Report 6

<sup>2</sup> *Ibid*, p.iii.

involve refinements to the measurement of indirect electricity emissions, road transport emissions and emissions attributable to natural gas leakage.

#### *Indirect electricity*

The current methodology accounts for the additional energy that needs to be generated over and above that actually consumed to cover losses of electricity through the transmission and distribution network. A distribution loss factor and a transmission loss factor are the variables used to determine network losses in the calculation of emissions from electricity consumption. In reviewing the calculation the Commission has found that the transmission loss factor relevant to the ACT, which is provided by the Australian Energy Market Operator (AEMO), is not appropriate for the purpose of measuring emissions from electricity consumption. The AEMO transmission loss factor is a marginal loss factor which is a measure of transmission losses in providing an extra unit of energy at the transmission node connecting the ACT relative to the losses incurred by providing an extra unit of energy at the Regional Reference node in Western Sydney. Its purpose is to adjust prices for energy supplied at the ACT transmission node to allow for any differences in the transmission losses associated with supplying energy at the ACT node and the Regional Reference Node. To address this issue it is recommended that emissions attributable to network losses are calculated using NSW and ACT electricity generation and consumption data published in *Electricity Gas Australia* by the Energy Supply Association of Australia (ESAA). The recommended methodology provides a better approximation for network losses in the ACT.

#### *Road transport*

The current methodology for measuring road transport emissions does not differentiate between the emissions intensity of motor vehicles manufactured in different years. It therefore does not account for improvements in the emissions intensity of motor vehicles over time. The *National Greenhouse Accounts Factors* provides emissions factors for methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) for vehicles manufactured before and after the end of 2004. It is recommended that the measurement of road transport emissions be refined to capture improvements in the emissions intensity of motor vehicles by using pre-2005 and post-2004 emissions factors in the calculation of road transport emissions for the ACT.

### *Natural gas leakage*

The current methodology reports fugitive emissions from natural gas leakage using data provided by Australian Greenhouse Emissions Information System. A measure of emissions attributable to natural gas leakage that is more specific to the ACT may be obtained using data on unaccounted gas acquired through the utility compliance and performance reporting function of the Commission. It is recommended a separate calculation for natural gas leakage, based on reported ‘unaccounted for gas’ for the distribution network within the ACT, is included in the methodology.

In recommending these refinements to the methodology, the Commission is satisfied that the methodology is, as far as practicable, consistent with the best national and international practices in relation to measuring greenhouse gas emissions.

# Appendix 2: Determination

Australian Capital Territory

## Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2012

### Disallowable Instrument DI2012

made under the

***Climate Change and Greenhouse Gas Reductions Act 2010* (the Act) s 11  
(Measuring greenhouse gas emissions – determination)**

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#### **1 Name of instrument**

This instrument is the *Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2012*.

#### **2 Commencement**

This instrument commences on the day after it is notified.

#### **3 Revocation**

I revoke the *Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2011*, DI2011-257.

#### **4 Determination of method for measuring greenhouse gas emissions**

I determine the method for measuring the amount of greenhouse gas emissions in the ACT for the year (the *annual emissions amount*) as set out in the schedule attached to this instrument.

Simon Corbell MLA

Minister for the Environment and Sustainable Development

2012

## **Schedule to the Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2012**

### **1. Objects of the determination**

This determination sets out the method for the measurement of greenhouse gas emissions arising from sources, or attributable to activities, located within the geographic boundary of the Australian Capital Territory (ACT).

### **2. Application of the determination**

The method determined in this instrument must be used to measure the amount of greenhouse gas emissions in the ACT for the year (the annual emissions amount) in the annual report prepared by an independent entity as required under section 12 of the Act.

### **3. Greenhouse gas emissions covered**

The emissions covered by this determination are:

- Scope 1 emissions from:
  - fuel combustion
  - fugitive emissions from fuels
  - industrial processes
  - agriculture
  - land use, land-use change, and forestry
  - waste.
- Scope 2 emissions from electricity consumption in the ACT, adjusted for scope 3 electricity transmission and distribution losses.

The annual data on these emissions will be obtained from the National Greenhouse Accounts except for the following:

- electricity consumption
- natural gas consumption
- wood fuel combustion
- road transport
- natural gas leakage.

## 4. Definitions

In this Determination:

**carbon dioxide equivalence** or **CO<sub>2</sub>-e**, means the amount of greenhouse gas multiplied by its specific global warming potential.

**dry wood** means wood that:

- a) has a moisture content of 20% or less if the moisture content is calculated on a wet basis; and
- b) is combusted to produce heat.

**emission factors** refer to the kilograms of carbon dioxide equivalent emitted per unit of activity.

**energy content factor**, for a fuel, means gigajoules of energy per unit of the fuel measured as a gross calorific value.

**fugitive emissions** means the release of emissions that occur during the extraction, processing and delivery of fossil fuels.

**global warming potential** refers to an index (on a 100 year time horizon) representing the combined effect of the differing times greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation.

**greenhouse gas emissions** has the meaning given by the *Climate Change and Greenhouse Gas Reduction Act 2010*.

**scope 1 emissions** refer to the emission of greenhouse gases directly resulting from an activity, or series of activities (including ancillary activities).

**scope 2 emissions** refer to the emission of greenhouse gases that occurs outside the ACT as a consequence of using grid-supplied electricity, heating and/or cooling within the ACT.

**scope 3 emissions** refer to the emissions of greenhouse gases not included as a scope 1 or scope 2 emissions that occur outside the ACT as a result of activities within the jurisdiction due to use of goods and services. Scope 3 emissions include electricity transmission and distribution losses.

## 5. Method

The method for calculating the emissions for which annual data will not be obtained from the National Greenhouse Accounts will be made using the following equations:

### Equation 1: Stationary energy combustion emissions – electricity consumption

$$EIE = \frac{\left(\frac{QE}{1-NL} - GP\right) \times EFE}{1000}$$

Where:

*EIE* is emissions from electricity consumption expressed in tonnes of CO<sub>2</sub>-e  
*NL* is the network loss (that is, transmission and distribution losses) expressed as a ratio of combined NSW and ACT electricity generation and consumption  
*QE* is the consumption of purchased electricity expressed in kilowatt hours  
*GP* is purchases of GreenPower expressed in kilowatt 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.

### Equation 2: Stationary energy combustion emissions – natural gas

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

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> and N<sub>2</sub>O in kilograms of CO<sub>2</sub>-e per gigajoule

**Equation 3: Stationary energy combustion emissions – wood fuel**

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

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

**Equation 4: Transport fuel emissions – road transport**

$$ERT = \sum_i \sum_k \frac{QRT_{ik} \times ECRT_i \times \sum_j EFRT_{ijk}}{1000}$$

Where:

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

*QRT<sub>ik</sub>* is the quantity of transport fuel type *i* = auto gasoline, ethanol, diesel, and liquefied petroleum gas (LPG) sold measured in kilolitres and CNG consumed by ACTION Buses expressed in cubic metres, consumed by vehicle year of manufacture *k* = pre-2005 or post-2004

*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>ijk</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, consumed by vehicle year of manufacture *k* = pre-2005 and post-2004



**Equation 5: Fugitive emissions – natural gas leakage**

$$ENGL = S \times \%UAG \times L \times \sum_j C_j$$

Where:

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

*S* is the total gas utility sales from the pipeline system expressed in terajoules

*%UAG* is the percentage of unaccounted for gas in the Territory's pipeline system, relative to the amount issued annually by gas utilities

*L* is the portion of unaccounted for gas allocated as leakage, which is equal to 0.55<sup>1</sup>

*C<sub>j</sub>* is the natural gas composition factor for greenhouse gas type *j* = CO<sub>2</sub> and CH<sub>4</sub> supplied from the Territory's pipeline system expressed in tonnes of CO<sub>2</sub>-e per terajoule<sup>2</sup>

<sup>1</sup> Variable is consistent with 'Method 1 – natural gas distribution' defined in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Cwth)*.

<sup>2</sup> ACT and NSW share the same coefficient.

## 6. Annual report about greenhouse gas emissions and targets

The annual report prepared by an independent entity as required under section 12 of the Act must include the information as calculated in the following table:

Greenhouse gas source and sink categories		Total (CO <sub>2</sub> -e) Gg (kilo tonnes)
Total ACT emissions and removals		1+2+3+4+5
1 Energy		A+B
<i>A Fuel combustion activities</i>		a+b+c+d
	Electricity	a <sup>1</sup>
	Natural gas	b <sup>2</sup>
	Transport fuels	c <sup>3</sup>
	Wood fuel	d <sup>4</sup>
<i>B Fugitive emissions from fuels</i>		e
	Natural gas leakage	e <sup>5</sup>
2 Industrial processes		f+g
	Consumption of Halocarbons and SF <sub>6</sub>	f <sup>6</sup>
	Other	g <sup>6</sup>
3 Agriculture		h+i+j
	Enteric fermentation	h <sup>6</sup>
	Manure management	i <sup>6</sup>
	Agricultural soils	j <sup>6</sup>
4 Land use, land-use change, and forestry		k
	Afforestation and deforestation	k <sup>6</sup>
5 Waste		l+m
	Solid waste disposal on land	l <sup>6</sup>
	Wastewater handling	m <sup>6</sup>
Total emissions including net CO <sub>2</sub> from LULUCF		1+2+3+4+5
Total emissions excluding net CO <sub>2</sub> from LULUCF		1+2+3+5

<sup>1</sup> EIE given by equation 1

<sup>2</sup> ENG given by equation 2

<sup>3</sup> ERT given by equation 4

<sup>4</sup> EWF given by equation 3

<sup>5</sup> ENGL given by equation 5

<sup>6</sup> Data from the Australian Greenhouse Emissions Information System (DCCEE 2012c)

## Abbreviations and acronyms

ABS	Australian Bureau of Statistics
Act	<i>Climate Change and Greenhouse Gas Reduction Act 2010 (ACT)</i>
AER	Australian Energy Regulator
AGEIS	Australian Greenhouse Emissions Information System
BREE	Bureau of Resources and Energy Economics
CER	Clean Energy Regulator
CH <sub>4</sub>	methane
CNG	compressed natural gas
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> -e	carbon dioxide equivalent
Commission	Independent Competition and Regulatory Commission (ACT)
DCCEE	Department of Climate Change and Energy Efficiency
ESAA	Energy Supply Association of Australia
ESDD	Environment and Sustainable Development Directorate (ACT)
GWh	gigawatt hours
ICRC	Independent Competition and Regulatory Commission (ACT)
ICRC Act	<i>Independent Competition and Regulatory Commission Act 1997 (ACT)</i>
IES	Intelligent Energy Systems
kt	kilotonnes
LPG	liquefied petroleum gas
LULUCF	land use, land-use change, and forestry
Minister	Minister for the Environment and Sustainable Development (ACT)

ML	megalitres
Mt	megatonnes
N <sub>2</sub> O	nitrous oxide
REC	Renewable Energy Certificate
SF <sub>6</sub>	sulphur hexafluoride
TJ	Terajoules
total emissions	total CO <sub>2</sub> -e emissions
Utilities Act	<i>Utilities Act 2000 (ACT)</i>

# Endnotes

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## Chapter 2

<sup>1</sup> 1990 emissions are revised up from the 3,175.6 kilotonnes reported in the 2009 inventory.

<sup>2</sup> Emissions from aviation and water transport activities occurring in the ACT are not reported.

## Chapter 3

<sup>1</sup> The NSW pre-1997 renewable energy baseline of 3,280 GWh is taken from estimates provided to the Office of the Renewable Energy Regulator (IES, 2002: 53–59).

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ABS, see Australian Bureau of Statistics.

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ESDD, see Environment and Sustainable Development Directorate.

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ICRC, see Independent Competition and Regulatory Commission.

IES, see Intelligent Energy Systems.

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