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Summary document: eThekweni Greenhouse Gas Emissions Inventory 2010

1 Synopsis

A Greenhouse Gas (GHG) Emissions Inventory for the eThekweni Municipality has been compiled for the 2010 calendar year. The inventory identifies the sources of GHG emissions from both the government and community sectors within the eThekweni Municipal Area. The eThekweni Municipality has compiled the emissions Inventory to help plan climate change mitigation strategies within the Municipality.

The GHG Emissions Inventory (GHGEI) is divided into two sub-inventories, one for the broader eThekweni community and one for municipality or local government emissions. The local government “sub-inventory” includes GHG emissions from activities under the control of the eThekweni Municipality entity, whilst the community inventory includes GHG emissions from various sectors within the boundary of the eThekweni Municipal Area.

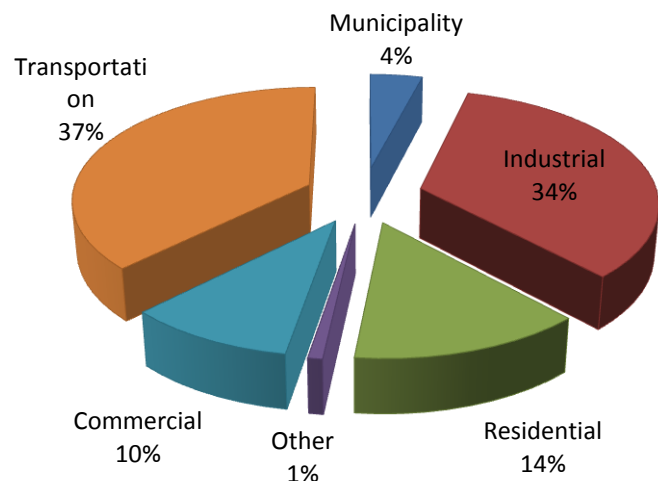


Figure 1: Carbon emissions by sector

The total greenhouse emissions recorded for entire eThekweni Municipal Area was 27 069 288 tCO₂e¹ for the 2010 year. The largest contribution to this footprint was transportation (37% of the total GHGs) followed closely by Industry emissions (24%). A graph showing the inventory by sector is shown above (Figure 1).

The 2010 GHGEI was developed as an easy to use EXCEL sheet and will allow for reporting of GHG emissions on an annual basis. The process of developing the GHGEI highlighted a number of data inadequacies, which will be systematically addressed in future GHGEIs. The 2010 inventory will be used as a baseline year for future inventories.

¹ Includes scope 1, 2 and selected scope 3 emissions (see below)

2 Background

A Greenhouse Gas (GHG) Inventory documents the amount of GHG emissions produced by a particular organisation or geographic area in a set year. Inventories generally list the different activities that produce emissions and the quantity of emissions from these activities in tonnes carbon dioxide equivalents (tCO₂e). Compiling a GHG Inventory enables a city or organisation to identify the emission sources that are contributing to their overall emissions and understanding the sources of emissions makes it possible to develop strategies to reduce these emissions.

In 2010 eThekweni Municipality, together with a number of cities across the globe, became a signatory of The Global Cities Covenant on Climate (the “Mexico City Pact”). Through this covenant, the Municipality committed to record its annual GHG emissions, climate change commitments, climate mitigation and adaptation measures, and actions. The 2010 eThekweni GHG Inventory, in addition to assisting in meeting the Municipality’s commitments to The Global Cities Covenant on Climate, will aid the Municipality in forecasting emission trends, identifying the point and mobile sources of emissions generated, and setting goals for future reductions and mitigation.

The reporting of a municipal inventory also aligns eThekweni Municipality with the intentions of the National Climate Change Response White Paper (Department of Environmental Affairs, 2011) and the broader national government policy on climate change.

As a result, the eThekweni Energy Office contracted WSP Environment & Energy South Africa to develop the eThekweni GHG Emissions Inventory 2010. The development of the GHGEI was supported by the United Nations Industrial Organisation (UNIDO) through the Durban Industry Climate Change Partnership Project.

3 Methodology Used

The following Local Government GHG Emissions Analysis Protocols, developed by ICLEI – Local Governments for Sustainability, were used to guide the development of the eThekweni GHG Inventory:

- International Local Government GHG Emissions Analysis Protocol Version 1.0²; and
- Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories Version 1.1³.

These protocols provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with their government and community operations. Both protocols are based upon the Corporate GHG Protocol⁴ developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) as well as technical guidance provided by the United Nations Intergovernmental Panel on Climate Change (IPCC). Activities that cause emissions are recorded in different emission scopes:

- Scope 1 are any direct emissions produced by the organisation or area, such as combustion of fuel.
- Scope 2 activities are indirect emissions produced by electricity that is purchased by the organisation or area.
- Scope 3 emissions are those that occur from the organisation or area’s activities but the sources of the emissions are owned or controlled by another entity, such as emissions from flights where planes are not owned by the organisation/area in question.

² Available at <http://www.icleiusa.org/tools/ghg-protocol>

³ Available at <http://www.icleiusa.org/tools/ghg-protocol>

⁴ Available at <http://www.ghgprotocol.org/standards/corporate-standard>

The figure below is a summary of the different types of scopes for GHG emissions.

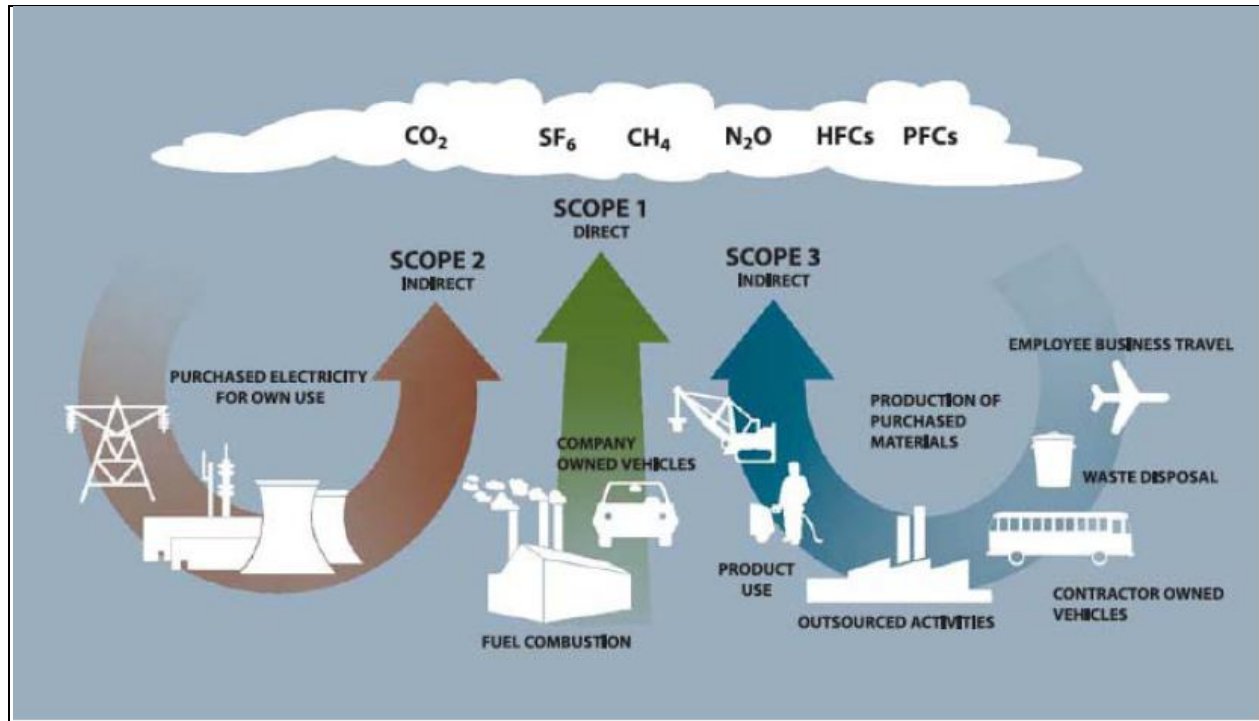


Figure 2: Total Government Emissions by Sector (Image Source: www.ghgprotocol.org)

It is important that emission scopes are differentiated as this helps to avoid the possibility of double counting emissions and misrepresenting emissions when reporting. Scope 1 and 2 emissions reporting is compulsory under the WRI’s GHG Protocol.

The eThekweni 2010 GHG Emissions Inventory comprises 2 sub-inventories, includes emissions from the government sector and a separate sub-inventory documenting emissions from the broader community. The government inventory includes GHG emissions from direct and indirect activities under the control of the eThekweni Municipality. The community inventory includes GHG emissions from industry, commercial and residential sectors as well as transport, waste and agriculture within the boundary of the eThekweni Municipal Area. The tables below show the emissions sources for government and community that are included in the Inventory.

Table 1: Government Emission Sources collected according to Scope

| Scope 1 | Scope 2 | Scope 3 |
|----------------------------|--|---|
| Stationary Fuel Combustion | Electricity Consumption | Employee Air Travel |
| Mobile Fuel Combustion | Electricity Transmission & Distribution (Technical and Non-technical losses) | Transit vehicles operated by contractor |
| Wastewater Treatment | | Electricity consumption by Eskom owned streetlights |
| Solid Waste Disposal | | |

Table 2: Community Emission Sources collected according to Scope

| Scope 1 | Scope 2 | Scope 3 |
|----------------------------|-------------------------|--------------------------|
| Stationary Fuel Combustion | Electricity Consumption | Air Transport Systems |
| Mobile Fuel Combustion | | Marine Transport Systems |
| Solid Waste Disposal | | |
| Enteric Fermentation | | |
| Pre-harvest Cane Burning | | |

In order to standardise reporting, activity data (such as fuel consumption) is multiplied by an emissions factor to convert all data to tonnes carbon dioxide equivalent (tCO₂e). Emission factors are generally internationally accepted values, but are published by a range of different entities. South Africa has not published a list of emission factors for use in South Africa, with the one exception being an emission factor for electricity provided by ESKOM⁵. Therefore the United Kingdom Government Department of Environment, Food and Rural Affairs (DEFRA) emission factors have been used.

4 Results

For 2010 the total carbon emissions recorded for the entire eThekweni Municipal Area was 27,069,288 tCO₂e. This following section provides more detail on this figure but is divided into emissions from the Municipality and emissions from the broader community. The division into government and community emissions is standard practice as data for local government emissions is generally more readily available.

4.1 Local Government Emissions

Total local government emissions for the 2010 period were 1,107,214 tCO₂e. The government emissions sub-inventory included operations that are directly under the eThekweni Municipality's control and emissions arising from the use of all significant assets and services during 2010. The table below summarises the municipal emissions by GHG scope.

Table 3: Municipal Emissions by Scope

| Emissions Scope | GHG Sources | Municipal Emissions (tCO ₂ e) |
|-----------------|---|--|
| Scope 1 | Stationary Fuel Combustion, Mobile Fuel Combustion, Wastewater Treatment, Solid Waste Disposal | 188,097 (17%) |
| Scope 2 | Electricity Consumption, Electricity Transmission & Distribution (Technical and Non-technical losses) | 886,786 (80%) |
| Scope 3 | Employee Air Travel, Transit vehicles operated by contractor, Electricity consumption by Eskom owned streetlights | 32,330 (3%) |

The graph below (Figure 3) shows the distribution of emissions by sector for the government emissions for 2010. A breakdown of the sectors by emission source is provided in Table 4. The highest municipal emission source, contributing 46 % to the Municipality's total 2010 emission inventory, was electrical transmission and distribution losses (scope 2). This figure includes technical and non-technical losses from electricity purchased from Eskom. Although the emissions figure for transmission and distribution losses is relatively high compared to the other municipal associated emissions,

⁵ 1KWh = 1.03kg CO₂e

only 4.3% of the total electricity bought from Eskom was lost due to technical and non-technical causes. 4.3% for transmissions losses is significantly lower than most other municipalities in South Africa⁶.

The second highest municipal emission source was from purchased electricity and stationary fuel combustion and under the Municipal Buildings and Other Facilities sector, contributing 18% to the total Municipal emissions. The principal Municipal scope one emission was methane generated by the Municipality's four landfills, which contributed 12% of the total government emissions (part of the Municipal Solid Waste Emissions Sector). The third highest source of GHG emissions are the emissions produced by Municipal Streetlights and Traffic Signals through the consumption of electricity.

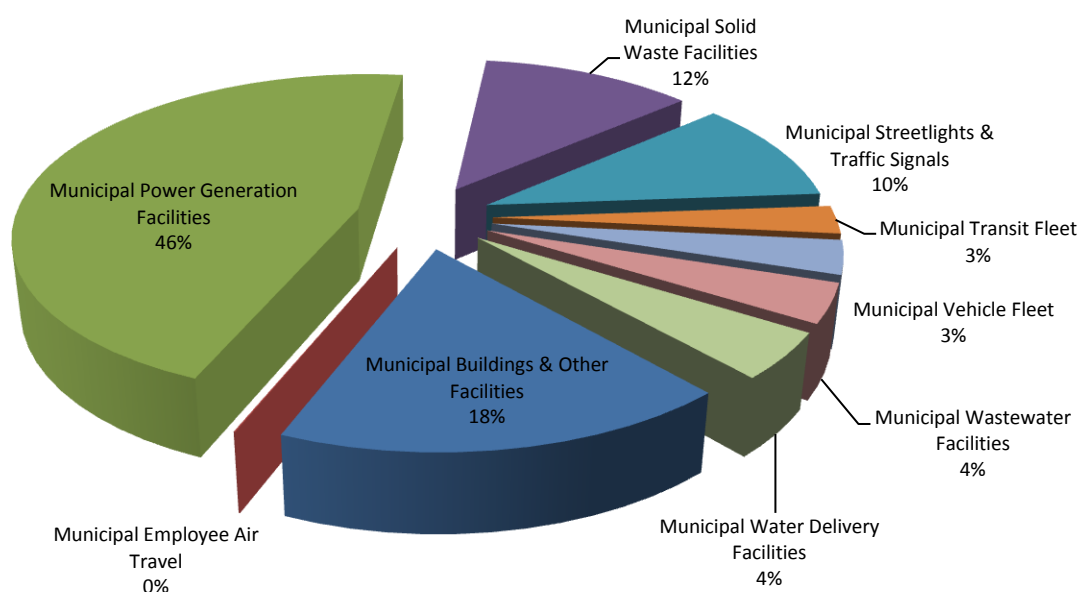


Figure 3: Total Government Emissions by Sector

Table 4: Municipal Operation Emissions by Sector and Source

| Sector | Scope | Emission Sources | Emissions (tonnes CO ₂ e) |
|--------------------------------|-------|---|--------------------------------------|
| Buildings & Other Facilities | 1 | Stationary Fuel Combustion | 100 |
| | 2 | Purchased Electricity | 196 523 |
| Streetlights & Traffic Signals | 2 | Electricity consumption by municipal owned streetlights & traffic signals | 110 956 |
| | 3 | Electricity consumption by Eskom owned streetlights | 1 076 |
| Water Delivery Facilities | 2 | Purchased electricity | 50 186 |
| Wastewater Facilities | 1 | Stationary and process emissions | 19 188 |
| | 2 | Purchased electricity | 23 443 |

⁶ National Treasury, Local Government Budgets and Expenditure Review 2011, pp 154 [here](#)

| | | | |
|-----------------------------------|---|--------------------------------|------------------|
| Vehicle Fleet | 1 | Mobile fuel combustion | 36 799 |
| Transit Fleet | 3 | Mobile fuel combustion | 30 541 |
| Power Generation Facilities | 2 | Electrical distribution losses | 505 006 |
| Solid Waste Facilities | 1 | Fugitive emissions | 132 010 |
| | 2 | Purchased electricity | 672 |
| Employee Air Travel | 3 | Mobile fuel combustion | 713 |
| Total Government Emissions | | | 1 107 214 |

4.2 Community Emissions

Total community (excluding local government) emissions equated to 25,962,074 tCO₂e. The community emissions inventory includes GHG emissions associated with activities occurring within the eThekweni Municipality's geopolitical boundary generated during 2010. The table below shows community emissions by scope.

Table 5: Community Emissions by Scope

| Emissions Scope | GHG Sources | Community Emissions (tCO ₂ e) |
|-----------------|--|--|
| Scope 1 | Stationary Fuel Combustion, Mobile Fuel Combustion, Solid Waste Disposal, Enteric Fermentation, Pre-harvest Cane Burning | 10,032,707 (39%) |
| Scope 2 | Electricity Consumption | 11,062,109 (43%) |
| Scope 3 | Air Transport Systems, Marine Transport Systems | 4,867,258 (18%) |

The sector contributing 36% to the total community GHG emissions is the industrial sector through purchased electricity and stationary fuel combustion. The second major contributor was the on-road and off-road (ground) transport sector contributing 20 % to overall community emissions. The third highest contribution to community emissions were the emissions from air and water transport systems from fuel consumption at 19%. Collectively (ground, air and water), transport sector emissions contribute the most significant proportion of the community emissions, at 39%. The residential sector is also significant, at 14% or 3,711,378 tCO₂e. Figure 4 below illustrates the total community emissions produced in eThekweni by sectors. A more in-depth breakdown of the sectors according to emission source can be found in Table 6.

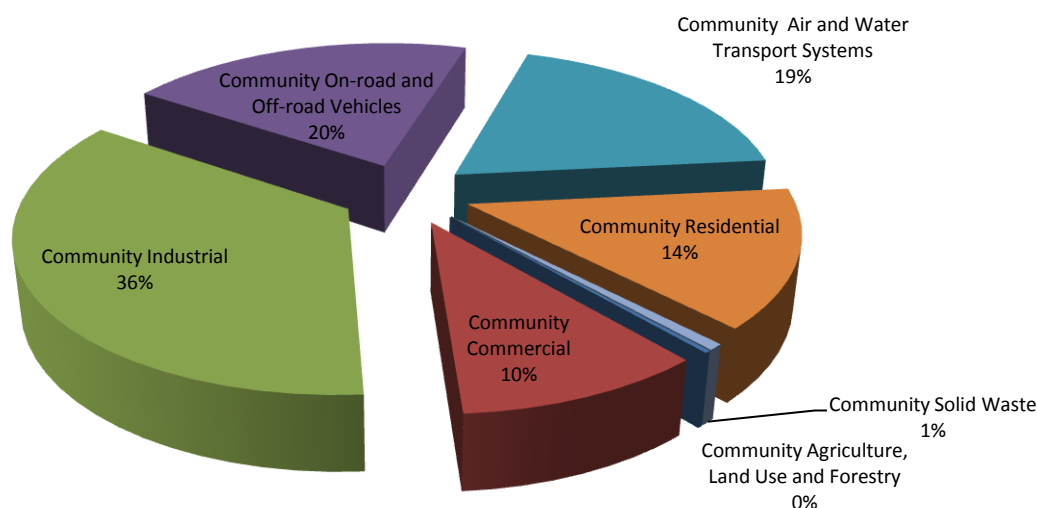


Figure 4: Total Community Emissions by Sector

Table 6: Community Operation Emissions by Sector and Source

| Sector | Scope | Emission Sources | Emissions (tonnes CO ₂ e) |
|------------------------------------|-------|--|--------------------------------------|
| Residential | 1 | Stationary fuel combustion | 146 848 |
| | 2 | Purchased electricity | 3 564 530 |
| Commercial | 2 | Purchased electricity | 2 684 324 |
| | | | |
| Industrial | 1 | Stationary fuel combustion | 4 384 966 |
| | 2 | Purchased electricity | 4 813 255 |
| On-road & Off-road Vehicles | 1 | Mobile fuel combustion | 5 267 210 |
| Air and Water Transport Systems | 3 | Mobile fuel combustion | 4 867 258 |
| Solid Waste | 1 | Fugitive emissions | 168 298 |
| Agriculture, Land Use and Forestry | 1 | Enteric fermentation and sugarcane burning | 65 384 |
| Total Community Emissions | | | 25 962 074 |

4.3 Total Emissions

For 2010 the total⁷ carbon emissions recorded for eThekweni Municipality was 27,069,288 tCO₂e. Local Government Emissions account for 4% of the total eThekweni emissions (Figure 5). Transportation (ground, air and water) and Industry contribute the highest to the total emissions (Figure 5). Emissions from electricity consumption contribute significantly to the industrial, commercial, residential and Municipal sectors and consequently to the overall emissions.

⁷ Municipal and community emissions

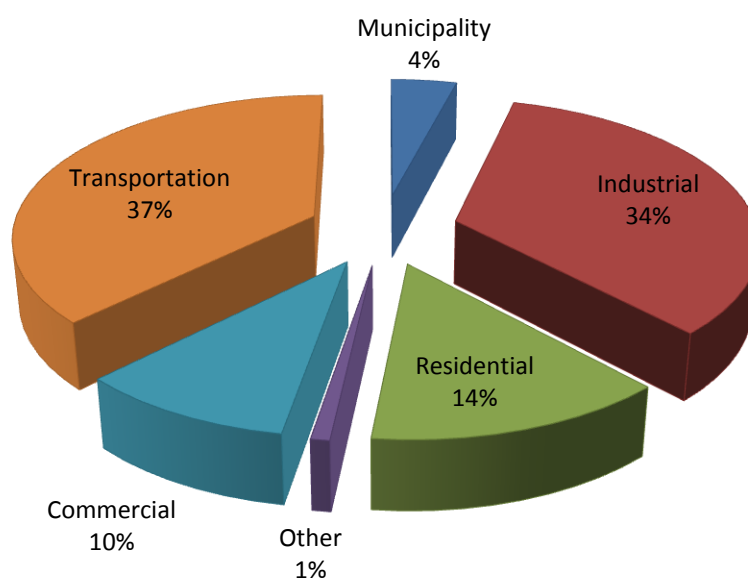


Figure 5: Carbon emissions by Sector

4.4 Intensity of Emissions

4.4.1 Government Intensity Figures

Emission intensity figures for the Municipality are recorded below in Table 7. These figures were calculated by combining all municipal scope 1 and 2 emissions and dividing them by the relevant indicator.

Table 7: Municipal Intensity Figures

| Intensity Figure | Metric Numerator | Metric Denominator |
|--|--|-------------------------------------|
| 45.9 tCO ₂ e / million Rand of operating budget | Scope 1 & 2 (1 074 883 tCO ₂ e) | Operating Budget (2011/12) R23,4 bn |
| 228.7 tCO ₂ e / million Rand of capital budget | Scope 1 & 2 (1 074 883 tCO ₂ e) | Capital Budget (2011/12) R4,7 bn |
| 66.42 tCO ₂ e / Permanent employee | Scope 1 & 2 (1 074 883 tCO ₂ e) | Permanent Employees 16 182 |

4.4.2 Community Intensity Figures

Community intensity figures are recorded below. These emissions were calculated by combining relevant sector scope emissions and dividing them by the relevant indicators.

Table 8: Community Emissions Figures

| Intensity Figure | Metric Numerator | Metric Denominator |
|--|---|---|
| 4.11 tCO ₂ e / household | Residential Sector Scope 1 & 2 (3 711 378 tCO ₂ e) | Number of households within the EMA 903 562 |
| 56.16 tCO ₂ e / million Rand retail sales | Commercial Sector Scope 2 (2 684 324 tCO ₂ e) | 2010 Annual retail trade sales R47,8 bn |

4.4.3 Total Emissions Intensity Figures

Total emission intensity figures (for the municipality and the community) are recorded below in Table 8. These emissions were calculated by combining relevant sector scope emissions and dividing them by the relevant indicators. A per capita figure has been calculated using total scope 1 and 2 emissions, and separately using emissions from all three scopes to account for different methodologies of calculating this figure.

Table 9: Total Emissions Intensity Figures

| Intensity Figure | Metric Numerator | Metric Denominator |
|----------------------------------|--|---|
| 6.34 tCO ₂ e / capita | Scope 1 & 2 (22 169 699 tCO ₂ e) | Population within the EMA, 3 499 254 ⁸ |
| 7.74 tCO ₂ e / capita | Scope 1, 2 & 3 (27 069 288 tCO ₂ e) | Population within the EMA, 3 499 254 ⁹ |

4.5 Quality of Data Used for the 2010 eThekweni Municipality GHG Inventory

In developing the GHGEI, a number of significant data inadequacies were identified. Where complete data was not provided, it was extrapolated from smaller data sets and in some cases previous inventory data was used. More information on data availability is provided in the detailed GHG Report for 2010. The eThekweni Municipality, nevertheless takes note of these data gaps, and intends to implement reporting systems to better collate GHG emission information.

5 Analysis of the GHG Inventory

5.1 Understanding the Scale

As outlined above, the total GHG emissions for the city in 2010 was 27,069,288 tCO₂e. However, this figure is difficult to comprehend as a stand-alone number. In order to better understand the total GHG emissions figure, the example of the carbon offset at the Buffelsdraai Landfill Site Community Reforestation Project has been used.

The Buffelsdraai Landfill Site Community Reforestation Project¹⁰ has been established within the buffer area of the eThekweni Municipality's Buffelsdraai Regional Landfill Site, north of Durban. The reforestation project has a number of objectives including the creation of a natural carbon sink. The Buffelsdraai project was initiated in November 2008, and by 30 June 2011, approximately 185 hectares of the 757 hectare municipal-owned buffer area around the landfill had been replanted from sugar cane and fallow farmland to forest habitat at an average tree density of 1000 trees / hectare. The restoration of forest at this site could result in approximately 89.4 tonnes of carbon being offset per hectare over a twenty year period.¹¹

Using the carbon sequestration estimates from the Buffelsdraai project, the eThekweni Municipality would require 3,028 square kilometres of land for reforestation to offset the total 2010 GHG emissions figure of 27,069,288 tCO₂e. Considering that the entire eThekweni Municipal Area (EMA) is 2,297 square kilometres, almost one and a half times the size of the EMA could be required for reforestation in order to offset the emissions produced by the city for one year.

⁸ Stats SA Mid-Year 2010 Figure

⁹ Stats SA Mid-Year 2010 Figure

¹⁰ <http://www.durban.gov.za/durban/services/development-planning-and-management/epcpd/projects/buffelsdraai-community-reforestation-project>

¹¹ It should be noted that the carbon offset of reforestation projects varies considerably depending on factors such as the vegetative cover of land prior to the project, the species of trees used, density of planting and climate of the area.

Another way to visualise the total GHG emission is by the volume of coal required to produce it. Converting the entire 27,069,288 tCO₂e to a physical coal equivalent would require approximately 13.4 Million tonnes of coal¹². If this volume of coal was placed over the entire Moses Mabhida stadium soccer field¹³, a column of coal 1.9KM high would be required, every year.

5.2 Comparisons

5.2.1 National

The eThekweni Municipality's GHG Inventory has revealed a high carbon emission per capita figure of 7.74 tCO₂e (including Scope 3 emissions). The per capita national figure for South Africa for the year 2000 was 9.97 tCO₂e (DEAT, 2009¹⁴). The eThekweni Municipality is therefore below the national average for GHG emissions. However, this comparison is relatively weak, given that the national GHG data is for 2000. With the completion of the 2011 census data and the revised national GHG inventory, a more accurate comparison can be made.

Table 10: South Africa's Total GHG Emissions and Per Capita Figure for the year 2000

| | Population | Year of Inventory | Total Emissions (tCO ₂ e) | Total Per Capita Emissions |
|--------------|--------------------------|-------------------|--------------------------------------|----------------------------|
| South Africa | 43 686 000 ¹⁵ | 2000 | 435,461,620 ¹⁶ | 9.97 |
| Durban | 3 499 254 ¹⁷ | 2010 | 27,069,288 | 7.74 |

5.2.2 Other cities

The table below provides an indication of how eThekweni compares to cities that are also reporting through The Global Cities Covenant on Climate and displays their total emissions in tonnes of carbon equivalent and per capita. All data was copied from Carbons Registry (www.carbons.org) which stipulates the methodology that should be used to calculate emissions. The eThekweni Municipality per capita figure is higher than Nagpur (India) and Mexico City (Mexico) which are both developing cities, but is much lower than the city of Calgary in Canada. However, these figures should be used with caution as scope 3 emissions are excluded for reporting under Carbons. Emissions also vary according to the activities in each city. For instance cities with a smaller industrial base are expected to have much lower per capita emissions. In the table below eThekweni's emissions are lower than previously recorded in this summary because the Carbons methodology specifically excludes Scope 3 emissions.

¹² Using a conversion of 833 kg/m³ of broken bituminous coal.

¹³ 0.714 ha

¹⁴ This figure was calculated using total emission figures and population figures from the following report: DEAT. (2009). *Greenhouse Gas Inventory South Africa, 1990 to 2000*, National Inventory Report, Compilation under the United Nations Framework Convention on Climate Change, <http://www.pmg.org.za/files/docs/090812greenhouseinventory.pdf>

¹⁵ DEAT (2009). *Greenhouse Gas Inventory South Africa, 1990 to 2000*, National Inventory Report, Compilation under the United Nations Framework Convention on Climate Change, <http://www.pmg.org.za/files/docs/090812greenhouseinventory.pdf>

¹⁶ Emissions figure includes land use, land-use change and forestry emissions and sinks. DEAT (2009). *Greenhouse Gas Inventory South Africa, 1990 to 2000*, National Inventory Report, Compilation under the United Nations Framework Convention on Climate Change, <http://www.pmg.org.za/files/docs/090812greenhouseinventory.pdf>

¹⁷ Stats SA Mid-Year 2010 Figure

Table 11: Comparison of Community and Government emissions and per capita emissions for four cities who have registered as part of The Global Cities Covenant on Climate

| City | Year of Inventory | Total Community Emissions (tCO ₂ e) | Total Government Emissions (tCO ₂ e) | Total Emissions (tCO ₂ e) | Total Per Capita Emissions |
|--|-------------------|--|---|--------------------------------------|----------------------------|
| eThekweni Municipality, South Africa (Population 3,499,254) | 2010 | 21,094,816 | 1,074,883 | 22,169,699 | 6,34 |
| Nagpur, India (Population 2,447,000) | 2007 | 1,534,552 | 121,185 | 1,655,737 | 0.68 |
| Mexico City, Mexico (Population 8,720,916) | 2010 | 28,058,873 | 2,434,420 | 30,493,293 | 3.5 |
| Calgary, Canada (Population 1,100,000) | 2009 | 16,508,131 | 286,712 | 16,794,843 | 15.27 |

5.2.3 Previous eThekweni Municipality GHG Inventories

Prior to the 2010 Inventory, three GHG emissions inventories have been compiled for the eThekweni Municipality. The table below shows a comparison of the emissions calculated for government and community sectors for each year that an inventory was compiled using the ICLEI methodology. Over the 8 year period the data collection process has improved considerably. As a result more types of emissions are being included in the inventories. Nevertheless, it is evident that the general trend in GHG emissions in the city has an upward trend.

Table 12: Comparison of emissions across previous eThekweni Municipality GHG inventories

| Year | Government Emissions | Community Emissions | Total Emissions |
|---------------------|----------------------|---------------------|-----------------|
| Yr 2002 | 1,047,000 | 18,890,000 | 19,937,000 |
| Yr 2003/2004 | 1,247,000 | 18,890,000 | 20,137,000 |
| Yr 2005/2006 | 1,118,061 | 21,413,906 | 22,531,967 |
| Yr 2010 | 1,107,214 | 25,962,074 | 27,069,288 |

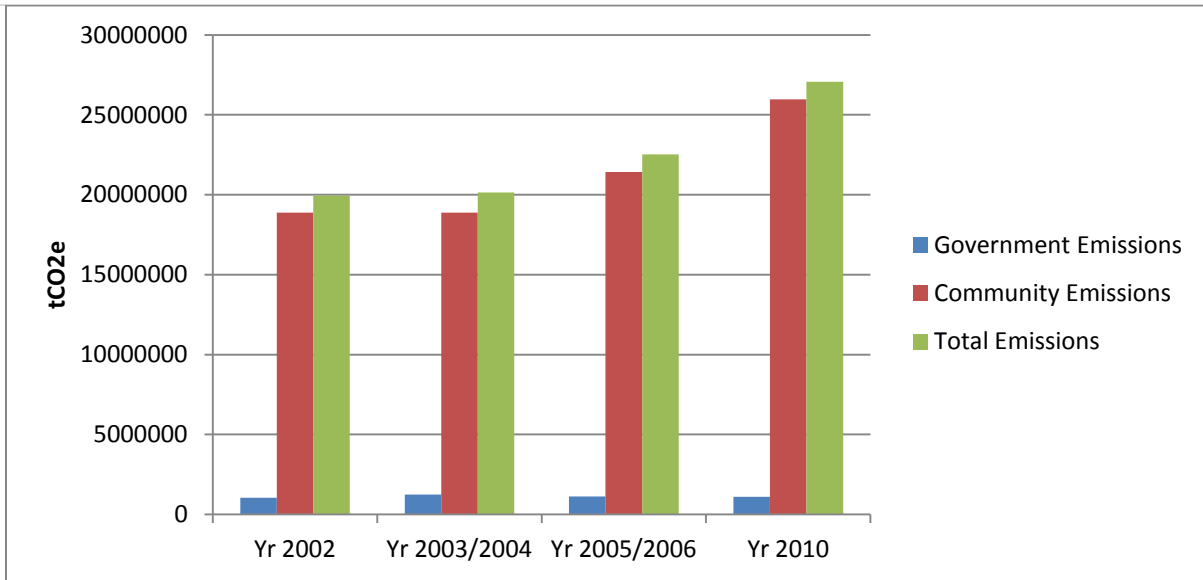


Figure 6: Carbon emissions by Sector

There has been significant progress by the eThekweni Municipality in collecting data for quantifying municipal and community emissions. Table 13 shows the data improvements since the last inventory conducted for the 2005/2006 year.

Table 13: Data improvements in the 2010 inventory compared to the 2005/2006 inventory

| Municipal Emission Sources | 2005 / 2006 Inventory Data | 2010 Inventory Data |
|----------------------------|--|--|
| Stationary Fuel Combustion | Not included | Included |
| Mobile Fuel Combustion | Internal refuelling by City Fleet | Internal refuelling by City Fleet, Electricity Department and Solid Waste Department External Refuelling (BP) by all departments Fuel consumption by council busses |
| Business Flights | Not included | Comprehensive flight data obtained from Travel Agents |
| Electricity Consumption | Excludes bulk electricity purchases and consumption by facilities with an account number only (no E-number). Electricity consumption by municipality owned streetlights | Includes bulk electricity purchases and facilities with no E-numbers Electricity consumption by municipality and Eskom owned streetlights Electricity consumption by traffic lights |
| Wastewater Treatment | Emissions from anaerobic digestion quantified | Emissions from anaerobic digestion, wastewater treatment lagoons, WWTP with nitrification/denitrification, WWTP without nitrification/denitrification and emissions generated during effluent discharge to rivers and estuaries quantified |
| Community Emission Sources | 2005 / 2006 Inventory | 2010 Inventory |
| Stationary Fuel Combustion | Excluded marine transport systems fuel consumption | Included combustion of marine fuel |
| Electricity Consumption | Electricity consumption provided by eThekweni Electricity Department | Electricity consumption provided by the eThekweni Electricity Department and Eskom |
| Agricultural Emissions | Not included | Emissions from enteric fermentation and pre-harvest cane burning |

6 Conclusion and Way Forward

The compilation of the eThekweni 2010 GHG Inventory is an important step in documenting the eThekweni Municipality's government and community emissions that are contributing to climate change. This document can now be used as a basis to develop strategies to reduce carbon emissions in eThekweni Municipality. In order to have up to date emissions information available, the eThekweni Municipality, will compile annual GHG emissions inventories going forward. The 2010 inventory will be used as a baseline year for future inventories.