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eThekwini Greenhouse Gas Emissions Inventory 2011

Technical Report

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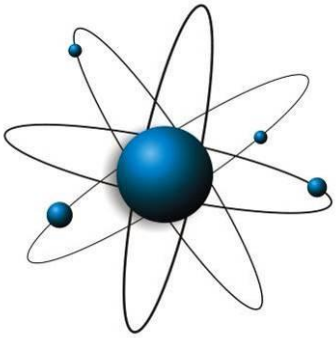

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1 INTRODUCTION

1.1 ETHEKWINI MUNICIPALITY

The eThekwini Municipal Area (EMA) stretches from Durban's coastline in the East to Cato Ridge in the West and from Umkomaas in the South to Tongaat in the North. The EMA covers an area of approximately 2 273 square kilometres of which 36% is rural and a further 29% is peri-urban. The Municipality is home to approximately 3.4 million people constituting a 7% share of the total South African population, making it the third most populated municipality in the country. The economy of the EMA is centred on the transport and logistics activities of the Port of Durban, domestic and export-oriented manufacturing and tourism[1]. The Gross Domestic Product of the eThekwini Municipality during 2011 amounted to R203.5bn with a per capita income of R47,221 (eThekwini Municipality Key Indicators 2011, Appendix A).

The EMA is governed by the eThekwini Municipality, with an Operating Budget of R26.5bn (2012/2013) and a Capital Budget of R5.3bn (2012/2013)[2]. During 2011 the Municipality increased its workforce by 23% employing 22 644 employees on a permanent and temporary basis. Basic services provided to the EMA community by the eThekwini Municipality are described in **Table 1**.

Table 1: Basic services provided by the eThekwini Municipality

Description	Details	Description	Details
Basic Services	Housing	Infrastructure	Stormwater
	Water		Roads
	Sanitation		Sidewalks
	Electricity & Lighting		Pedestrian bridges
	Solid Waste		Footpaths
	Transport		
	Safety & Security		
	Health		

1.2 ETHEKWINI GREENHOUSE GAS INVENTORY

During December 2010 the eThekwini Municipality became a signatory of the Global Cities Covenant on Climate ("Mexico City Pact"). In terms of this agreement the Municipality has committed to registering the Municipality's greenhouse gas (GHG) emissions inventory, commitments, climate mitigation and adaptation measures and actions in the Carbon Cities Climate Registry.

In addition to meeting the Municipality's Mexico City Pact commitments, reporting the Municipality's GHG emissions will aid policy makers 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 eThekwini 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.

[1] eThekwini Municipality Draft Medium Term Budget Report 2010/211 to 2012/2013
[2] http://www.durban.gov.za/media_publications/Press_Releases/Pages/201213BudgetAdopted.aspx

2 INVENTORY PARAMETERS

2.1 PROTOCOLS

The eThekwini Municipality's 2011 GHG Inventory and Inventory Report were based upon the two Local Government GHG Emissions Analysis Protocols developed by ICLEI – Local Governments for Sustainability, namely the:

- International Local Government GHG Emissions Analysis Protocol Version 1.0; and
- Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories Version 1.1.

The protocols are designed to 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 Protocol 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).

The protocols were followed closely to ensure that eThekwini's 2011 GHG Inventory can be compared with other municipalities and organisations around the world.

2.2 BOUNDARIES

2.2.1 Temporal Boundary

The 2011 eThekwini GHG Inventory comprises emissions occurring during the 2011 calendar year, as required by ICLEI.

2.2.2 Operational Boundaries

The municipal inventory separately accounts for emissions associated with the operations of the eThekwini Municipality (i.e. local government emissions) and the activities that occur within the EMA but which are not as a direct result of the Municipality's operations or assets (i.e. community emissions). These two sectors are broken down into the following analyses.

- Government Operations Analysis

The government operations analysis is defined by an organisational boundary and includes functions directly under the eThekwini Municipality's control and emissions arising from the use of all significant assets and services during 2011.

- Community Operations Analysis

The community operations analysis is defined by a geopolitical boundary and incorporates the physical area or region over which the eThekwini Municipality has jurisdictional authority. This analysis includes GHG emissions associated with activities (of the general public and industry / commerce) occurring within the eThekwini Municipality's geopolitical boundary generated during 2011.

2.3 SCOPES

The eThekwini Municipality 2011 GHG Inventory includes all important sources of GHG emissions occurring within the Municipality's geopolitical and organizational boundaries. Direct and indirect emissions are accounted for separately within each sector through the categorisation of emissions as either scope one, two or three emissions. Differentiating between emission scopes helps to avoid the possibility of double counting emissions and misrepresenting emissions when reporting.

2.3.1 Municipal Operations Emissions Scopes

Municipal operations emissions included in the inventory were categorised into the following scopes:

- **Scope 1** – Direct emission sources owned or operated by eThekwini Municipality.
- **Scope 2** – Indirect emission sources.
- **Scope 3** –Indirect and embodied emissions over which eThekwini Municipality exerts significant control or influence. Certain emissions from contracted services were included in the municipal operations emissions inventory in instances where the service provided by the contractor is commonly provided by a municipality. These contractor emissions may be either direct or indirect but are classified as scope 3 emissions within the municipal operations inventory regardless.

Table 2 details the source of emissions included within each scope of the 2011 municipal operations emissions inventory.

Table 2: Emission sources included in the 2011 municipal operations inventory

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

2.3.2 Community-scale Emissions Scopes

Community-scale emissions included within the 2011 inventory were categorised into the following scopes:

- **Scope 1** – All direct emission sources located within the geopolitical boundary of eThekwini Municipality.
- **Scope 2** – Indirect emissions that result as a consequence of activity within eThekwini Municipality's geopolitical boundary.
- **Scope 3** – Indirect and embodied emissions that occur as a result of activity within the geopolitical boundary.

Table 3 provides details of the source of emissions included within each scope of the 2011 community-scale emissions inventory.

Table 3: Emission sources included in the 2011 community inventory

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

3 INVENTORY DETAILS

3.1 MUNICIPAL EMISSIONS

This section provides a breakdown of GHG emissions calculated within the various municipal sectors. Included in the breakdown are details pertaining to data sources and calculations used to determine emissions.

3.1.1 Buildings and Other Facilities

The 'buildings and other facilities' sector includes, *inter alia*, emissions generated by administrative facilities, public venues, libraries, parks and recreational facilities operated by the eThekwini Municipality (**Table 4**). Excluded from this sector are wastewater treatment, water delivery and solid waste facilities, which are categorised separately.

Table 4: Emissions inventory and data disclosure for municipal buildings and other facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	17 225.4	41.9	42.37	17 310
■ Emissions Source: Stationary combustion of fuel by municipal buildings and other facilities – Activity Data: ICLEI recommended activity data - Known fuel use calculated from fuel purchase data – Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011, IPCC 2006, TCR 2012; Appendix B) – Data Description: Data on the quantity of fuel purchased, for stationary combustion, by the Municipality during 2011 was obtained from the Procurement Department for all departments within the Municipality – Data Source: eThekwini Procurement Department - Godfrey Appalsamy (Appendix C)					
Scope 2	Purchased Electricity				156 351
■ Emissions Source: Electricity consumption by municipal buildings and other facilities – Activity Data: ICLEI recommended data type - Known electricity use – Emissions Factor: ICLEI recommended factor type - Verified Eskom emission factor (Appendix B) – Data Description: Electricity charges supplied by the eThekwini Treasury Department and grouped according to the individual JDE code (Appendix D) Electricity supplied to departments by Eskom directly – consumption data provided by Eskom – Data Issues: Electricity charges were supplied by the Treasury department and grouped into JDE Business Units according to respective GI-codes, two additional groups were added, the JDE business units are unknown namely for, JDE 95010/Stadiums and Electricity depo accounts. Besides the account number, the electricity connection ID (Elc-Cnect-Id) were also kept for future reference. Accounts from 2010 GHG EI that do not appear in the 2011 records were tracked by the Treasury department and have been updated in purple. Many of accounts have since been terminated; this was stated in the tool. Additional accounts					

for 2011 have been added in the EI in green font.

Electricity supplied directly from Eskom to the Municipal Buildings was identified from the total Energy accounts that Eskom bills to the eThekwini Municipality. The accounts that did not belong to community services and have not been already accounted for by the electricity department (Leshan Moodliar) were considered to be directly supplied from Eskom to the municipal infrastructure. These accounts were further sub divided into water, wastewater and others for quantification purposes.

– Data Source:

Treasury Department – Wally Bentley ; Eskom - Prashunt Latchman (Appendix C)

3.1.2 Streetlights and Traffic Signals

This sector includes electricity consumption by streetlights and traffic signals owned by the Municipality (**Table 5**). It is also noted that Eskom provides street lighting infrastructure within the outer regions of the EMA. Emissions generated by Eskom owned streetlights are classified as the Municipality's scope 3 emissions.

Table 5: Emissions inventory and data disclosure for streetlights and traffic signals

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Purchased Electricity				119 798

- Emissions Source: Electricity consumption by municipal owned and operated streetlights and traffic signals
  - Activity Data:

    ICLEI specified alternative activity data - Installed wattage
  - Emissions Factor:

    ICLEI recommended factor - Verified Eskom emission factor (Appendix B)
  - Data Description:

    Traffic Lights - Number of signalised intersections that the Municipality caters for, type (LED or incandescent) and the average energy drawn per intersection.

    Streetlights - Streetlight count and type (HID or LED) and actual kWh used per year.
  - Data Issues:

    Traffic Lights -An exact assessment value of electricity usage by Traffic lights is difficult to make since individual loads of traffic signals are not measured and several teams maintain the intersections, eliminating unnecessary LED modules. However, a sound calculation method with reasonable assumptions was made by the authority in providing a final consumption figure.
  - Data Source:

    Traffic Lights - Transport Authority (A.J. Cronje); Streetlights - Electricity Department (Craig Smith) (Appendix C)

Scope 3	Electricity consumed by Eskom street lighting				1 333

- Emissions Source: Electricity consumption by Eskom owned and operated streetlights
  - Activity Data:

    ICLEI recommended activity data - Known electricity use
  - Emissions Factor:

    ICLEI recommended factor - Verified Eskom emission factor (Appendix B)
  - Data Description:

    Account numbers for traffic lights that fall within the eThekwini Municipality, number of lights and wattage.

- Data Issues:

  Received data differentiates between maintenance and non-maintenance. Eskom has various options on streetlights supplies, including a normal streetlight tariff plus a maintenance contract. The latter system is usually what Municipalities opt for. Alternatively, municipalities may opt for only the streetlight tariffs without a maintenance contract, choosing to perform upkeep themselves. **This may have been the historical position with this supply and eThekwini Municipality may have taken over.**

- Data Source:

  Eskom – Prashunt Lutchman (Appendix C)

3.1.3 Water Delivery Facilities

The water delivery facilities sector includes any facilities used for the transportation, treatment and distribution of drinking water (**Table 6**).

Table 6: Emissions inventory and data disclosure for municipal water delivery facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Purchased Electricity				67 405

- Emissions Source: Electricity consumption by water pump stations and reservoirs
  - Activity Data:

    ICLEI recommended activity data - Known electricity use

  - Emissions Factor:

    ICLEI recommended factor - Verified Eskom emission factor (Appendix B)

  - Data Description:

    Electricity charges were supplied by the Treasury department and grouped into business units according to their GI-code. All Business units labelled as "Water" were accounted here

    Electricity consumption data provided by Eskom for facilities supplied directly by Eskom.

  - Data Issue:

    Data supplied from Eskom clearly does not identify municipal accounts and facilities. After the accounts have being identified as Directly Supply from Eskom to Municipal facilities from the Energy department, they have been grouped into three categories: water, wastewater and other based on their Entity name. Electricity under the water group is the one accounted for in this inventory.

  - Data Source:

    Treasury Department – Wally Bentley; Eskom – Prashunt Lutchman (Appendix C)

3.1.4 Wastewater Facilities

The wastewater sector includes all facilities used for the transportation and collection or treatment of wastewater/sewage. The eThekwini Municipality own/control and operate wastewater treatment plants (WWTP) encompassed within the inventory included KwaMashu, New Germany, Northern, Phoenix, Umdloti, Umhlanga, Tongaat Central, Gennazanno, Verulam, Kingsburgh, Umkomaas, Craigieburn, Magabeni, Amamzimtoti, Dassenhoek, Hillcrest, Hammarsdale, Cato Ridge, Fredville, Umhlatuzana and Umbilo (**Table 7**).

Table 7: Emissions inventory and data disclosure for municipal wastewater facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	-	17 264	-	17 264

- Emissions Source: Incomplete combustion of digester gas at a WWTP with anaerobic digestion of biosolids
  - Activity Data:

    Population served; ICLEI Equation 10.2
  - Data Description:

    Population served by wastewater treatment plants with anaerobic digesters. The population served was estimated by the Water & Sanitation Department based on a consumption value of 400 litres per person per day.
  - Model Issue:

    The model specified by ICLEI assumes biogas is flared; however, certain eThekwini's WWTP's do not flare. When calculating methane emissions for these facilities the model parameter 'Methane Destruction Efficiency' was assumed to be zero.
  - Data Source: Water and Sanitation Department; Mohammed Dildar & Kaverajen Pillay (Appendix C)

Scope 1	Process Emissions	-	419	11 992	12 411

- Emissions Source: Anaerobic and facultative treatment lagoons
  - Activity data:

    Population served - ICLEI Equation 10.4
  - Data Description:

    Population served by treatment lagoons adjusted for industrial discharge
- Emissions Source: WWTP with nitrification/denitrification
  - Activity Data:

    Population served - ICLEI Equation 10.7
  - Data Description:

    Population served by the WWTP with nitrification/denitrification adjusted for industrial discharge
- Emissions Source: WWTP without nitrification/denitrification
  - Activity Data:

    Population served - ICLEI Equation 10.8
  - Data Description:

    Population served by the WWTP without nitrification/denitrification adjusted for industrial discharge
- Emissions Source: Effluent discharge to receiving aquatic environment
  - Activity Data:

    Population served - ICLEI Equation 10.10
  - Data Description:

    Population served, adjusted for industrial discharge
  - Data Issues:

    The population served for Magabeni Lagoon, Glenwood facility and all effluent discharged to rivers and Estuaries couldn't be updated, hence 2010 numbers for such populations were used.

- Data Source: eThekwini Water & Sanitation; Mohammed Dildar & Kaverajen Pillay (Appendix C)

Scope 2	Purchased Electricity				67 405

- Emissions Source: Electricity Consumption
  - Activity Data:

    ICLEI recommended data type - Known electricity use
  - Emissions Factor:

    ICLEI recommended factor type - Verified Eskom emission factor (Appendix B)
  - Data Description:

    Electricity charges were supplied by the Treasury department and grouped into business units according to their GI-code. All Business units labelled as "Sanitation" were accounted here.

    Electricity consumption data provided by Eskom for facilities directly supplied by Eskom.
  - Data Issue:

    Data supplied from Eskom clearly does not identify municipal accounts and facilities. The Energy department hold the data which enables identification of municipal accounts which are directly supplied electricity from Eskom and accounts supplied directly by Eskom. The identified accounts are grouped into three categories: water, wastewater and other based on individual Entity names. Electricity under the wastewater group is the category accounted for in this inventory.
  - Data Source:

    Treasury Department – Wally Bentley; Eskom – Prashunt Lutchman (Appendix C)

3.1.5 Vehicle Fleet

The vehicle fleet sector includes all emissions generated by vehicles (on-road and off-road) owned by the eThekwini Municipality (**Table 8**). These vehicles are either managed by the City Fleet Department, Water Department, Solid Waste Department or Electricity Department.

Table 8: Emissions inventory and data disclosure for municipal vehicle fleet

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Mobile Combustion	18 393	24.04	162.68	18 589

- Emissions Source: Fuel combustion by on-road and off-road vehicles
  - Activity Data:

    ICLEI recommended activity data - Fuel purchases
  - Emissions Factor:

    ICLEI recommended factor - Default by fuel type (Defra 2011; Appendix B)
  - Data Description:

    Emissions calculated from records of internal and external refuelling held by the City Fleet Department during 2011.
  - Data Issues:

    Values for external an internal refuelling are significant smaller compared to year 2010 values. Data was reviewed and confirmed by the City Fleet department.
  - Data Source:

    City Fleet – Ranjeev Nursingh (internal refuelling); Neeren Juganath (external refuelling) (Appendix C)

3.1.6 Transit Fleet

The transit sector should include emissions from mass transit vehicles operated by the Municipality to service the community of the EMA. However, as the Municipality's transit fleet has been outsourced to a private contractor the emissions generated are classified as scope three instead of scope one emissions (**Table 9**).

Table 9: Emissions inventory and data disclosure for municipal transit fleet

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 3	Mobile Combustion	31 584	18	349	31 951

- Emissions Source: Fuel combustion by on-road transit fleet
  - Activity Data:
    ICLEI recommended activity data - Fuel purchases
  - Emissions Factor:
    ICLEI recommended factor - Default by fuel type (Defra 2011; Appendix B)
  - Data Description:
    Bulk monthly diesel consumption, by privately operated municipal busses, for calendar year 2011 obtained from private contractor.
  - Data Source: TransAfrica – John Wilkinson (Appendix C)

3.1.7 Power Generation Facilities

Although the Municipality does not own or operate any fossil fuel power generation facilities, it does own a large proportion of the electricity distribution infrastructure within the EMA. Transmission and distribution losses resulting from the transmission of electricity via the municipal owned infrastructure are therefore categorised as scope two municipal emissions (**Table 10**).

Table 10: Emissions inventory and data disclosure for municipal power generation and electrical distribution facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Transmission & Distribution Losses: Technical				351 885
■ Emissions Source: Technical transmission and distribution losses – Activity Data: eThekwini Electricity Department calculations – Emissions Factor: ICLEI recommended factor type - Verified Eskom emission factor (Appendix B) – Data Description: Estimated technical losses data was provided by the Electricity Department. Losses were estimated using best practice calculations dependent on distribution infrastructure (3%). Real values for street lights and traffic signals were used for 2011 calculations, as well as energy generated from landfills and CPV solar. – Data Source: eThekwini Electricity Department – Leshan Moodliar (Appendix C)					
Scope 2	Transmission & Distribution Losses: Non-Technical				338 427
■ Emissions Source: Non-technical transmission and distribution losses – Activity Data: eThekwini Electricity Department calculations – Emissions Factor: ICLEI recommended factor type - Verified Eskom emission factor (Appendix B) – Data Description: Estimated non-technical losses data was provided by the Electricity Department. Losses were calculated by subtracting total municipal energy sales/consumption (internal and external) from total electricity purchased by the municipality from Eskom (2.9%). Real values for street lights and traffic signals were used for 2011 calculations, as well as energy generated from landfills and CPV solar. – Data Source: eThekwini Electricity Department – Leshan Moodliar (Appendix C)					

3.1.8 Solid Waste Facilities

eThekwini Municipality owns four solid waste landfills, namely:

- Bisasar Road Landfill –operational, landfill gas (LFG) collection system in place;
- Mariannhill Landfill –operational, LFG collection system in place;
- La Mercy Landfill – closed, LFG collection system in place; and,
- Buffelsdraai Landfill – operational, no LFG collection system in place.

Fugitive methane emissions generated by these landfills are classified as scope one municipal emissions (**Table 11**).

Table 11: Emissions inventory and data disclosure for municipal solid waste facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Fugitive Emissions	-	370 980	-	370 980
■ Emissions Source: Landfills with comprehensive LFG collection systems					

- Activity Data:
  ICLEI recommended data type - ICLEI Equation 9.1
- Data Description:
  Annual LFG collected, fraction of methane in LFG and methane destruction efficiency of system
- Data Source:
  eThekwini Cleansing and Solid Waste Department – Marc Wright (Appendix C)

- Emissions Source: Landfills with no LFG Collection System
  - Activity Data:
    ICLEI recommended model and data type – First Order Decay Model
  - Data Description:
    Historical and inventory year waste disposal data
  - Data Source:
    eThekwini Cleansing and Solid Waste Department – John Parkin (Appendix B)

Scope 2	Purchased Electricity				1 747

- Emissions Source: Electricity consumption
  - Activity Data:
    ICLEI recommended data type - Known electricity use
  - Emissions Factor:
    ICLEI recommended factor type - Verified Eskom emission factor (Appendix B)
  - Data Description:
    Electricity charges were supplied by the Treasury department and grouped into business units according to their GI-code. All Business units labelled as "Cleansing and Solid Waste" were accounted for.
  - Data Source:
    Treasury Department – Wally Bentley(Appendix C)

3.1.9 Air Travel

Greenhouse gas emissions generated from work-related air travel, by municipal employees, are categorised as scope three municipal emissions (Table 12).

Table 12: Emissions inventory and data disclosure for municipal air travel

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 3	Business Flights	922	5	9	932

- Emissions Source: Fuel combustion by air transport systems
  - Activity Data:
    GHG Protocol recommended data type – number of flights and destination data
  - Emissions Factor:
    Defra 2011 emissions factor – emission factor based on length of flight (Appendix B)
  - Data Description:
    Number of domestic and international flights boarded by the Municipal employees during 2011 obtained from contracted travel agents.
    New routes travelled during 2011 have been included
  - Data Source:
    TWF – Musa Ndabeni (international flights); Rennies Travel – Tammy Heher (domestic flights) (Appendix C)

3.2 COMMUNITY EMISSIONS

3.2.1 Residential Sector

This emissions sector includes all emissions generated by the EMA's residential sector through electricity consumption as well as stationary fuel combustion (**Table 13**). During 2011 the EMA comprised an estimated 956 713 households with an annual per household income of R182 435 (eThekwini Municipality Key Indicators 2011).

Table 13: Emissions inventory and data disclosure for community residential sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	179 060	333	448	179 841
■ Emissions Source: Stationary combustion of fuel – Activity Data: ICLEI recommended activity data - Known fuel use – Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011, Appendix B) – Data Description: Data on the quantity of fuel purchased, for stationary combustion, within the EMA received from the Department of Energy. – Data Issue: The Department of Energy are unable to categorise data into sectors so it was assumed that 10% of total LPG and 50% total illuminating paraffin was used within the residential sector (eThekwini State of Energy Report). Data provided by the Department of Energy, was only for the full year of 2011. – Data source: National Department of Energy – Ramaano Nembahe; eThekwini State of Energy Report 2006 – Dave Mercer (Appendix C)					
Scope 2	Purchased Electricity				3 417 110
■ Emissions Source: Electricity consumption – Activity Data: ICLEI recommended data type - Known electricity use – Emissions Factor: ICLEI recommended factor type - Verified Eskom emission factor (Appendix B) – Data Description: Electricity consumption by all residences receiving electricity from the Municipality obtained from the eThekwini Electricity Department Electricity consumption by the EMA residential sector which receives electricity directly from Eskom provided by Eskom (prepaid accounts and accounts type S) – Data Source: eThekwini Electricity Department – Leshan Moodliar; Eskom – Prashunt Lutchman (Appendix C)					

3.2.2 Commercial Sector

This emissions sector includes all emissions generated by the EMA's commercial sector through electricity consumption only (**Table 14**). During 2011 annual retail trade sales within the eThekwini Municipality amounted to R54,7bn (eThekwini Municipality Key Indicators 2011).

Table 14: Emissions inventory and data disclosure for community commercial sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Purchased Electricity				3 067 300

- Emissions Source: Electricity consumption
  - Activity Data:
    ICLEI recommended data type - Known electricity use
  - Emissions Factor:
    ICLEI recommended factor type - Verified Eskom emission factor (Appendix B)
  - Data Description:
    Electricity consumption by all commercial enterprises receiving electricity from the Municipality obtained from the eThekwini Electricity Department
    Electricity consumption by the EMA commercial and Industrial sector which receives electricity directly from Eskom provided by Eskom (all accounts type L)
  - Data Source
    eThekwini Electricity Department – Leshan Moodliar; Eskom – Prashunt Lutchman (Appendix C)

3.2.3 Industrial Sector

This emissions sector includes all emissions generated by the EMA's industrial sector through electricity consumption as well as stationary fuel combustion (**Table 15**).

Table 15: Emissions inventory and data disclosure for community industrial sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	4 098 693	7 319	41 880	4 147 892

- Emissions Source: Stationary combustion of fuel
  - Activity Data:
    ICLEI recommended activity data - Known fuel use
  - Emissions Factor:
    ICLEI recommended factor - Default by fuel type (Defra 2011; Appendix B)
  - Data Description:
    Data on the quantity of fuel purchased, for stationary combustion, within the EMA received from the Department of Energy.
  - Data Issue:
    Data provided by the Department of Energy was for the calendar year 2011.. No coke, coal or refinery gas consumption data was available. Assumptions were made based on the eThekwini State of Energy report 2006.
  - Data Source:
    National Department of Energy – Ramaano Nembahe; eThekwini State of Energy Report 2006 – Dave Mercer (Appendix C)

Scope 2	Purchased Electricity				4 742 415

- Emissions Source: Electricity consumption
  - Activity Data:
    ICLEI recommended data type - Known electricity use
  - Emissions Factor:
    ICLEI recommended factor type - Verified Eskom emission factor (Appendix B)
  - Data Description:
    Electricity consumption by all industrial enterprises receiving electricity from the Municipality was obtained from the

eThekwini Electricity Department;

Electricity consumption by the EMA industrial sector which receives electricity directly from Eskom provided by Eskom was quantified together with the commercial category and already included in **Table 14** above

- Data Source

  eThekwini Electricity Department – Leshan Moodliar (Appendix C)

3.2.4 Transport

The community transport sector includes emissions generated by community owned on-road and off road vehicles as well as by the community's air and marine transport systems (**Table 16**). Air and marine transport systems are classified as scope 3 emissions.

Table 16: Emissions inventory and data disclosure for community transport sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Mobile Combustion	5 610 687	6 672	51 605	5 668 964
■ Emissions Source: On-road and off road vehicles – Activity Data: ICLEI recommended activity data - Known fuel use – Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011; Appendix B) – Data Description: Data on the amount of petrol and diesel consumed within the EMA during 2011 was provided by the Department of Energy. – Data Issue: . Data does not differentiate between type of Petrol or Diesel. Information from the DoE is per Magisterial District which may end in an overestimation for Umbumbutu and missing data from Pietermaritzburg, Ndwedwe, Camperdown, and Lower Tugela – Data Source: National Department of Energy – Ramaano Nembahe (Appendix C)					
Scope 3	Mobile Combustion – Air Travel	170 251	164	1 675	172 098
■ Emissions Source: Air transport systems fuel combustion – Activity Data: ICLEI recommended activity data - Known fuel use – Emissions Factor: ICLEI recommended factor - Default by fuel type (Appendix B) – Data Description: Data on the amount of jet fuel and aviation gasoline purchased within the EMA during 2011 was provided by the Department of Energy. Data Issue: . There are no data for International Jet Fuel provided by the DoE, 2010 values remain. – National Department of Energy – Ramaano Nembahe (Appendix C)					
Scope 3	Mobile Combustion – Water Travel	4 004 012	4 342	419 403	4 427 756
■ Emissions Source: Water transport systems fuel combustion – Activity Data: ICLEI recommended activity data - Known fuel use					

- Emissions Factor:
  ICLEI recommended factor - Default by fuel type (Appendix B)
- Data Description:
- Data Issue:
  There is not data provided by the Department of Energy for marine automotive diesel, marine diesel oil and marine fuel oil purchased within the EMA during 2011, then values from 2010 remain
- National Department of Energy – Ramaano Nembahe (Appendix C)

3.2.5 Agriculture

Emissions sources covered within the agriculture sector included enteric fermentation by livestock and pre-harvest sugarcane burning (**Table 17**). Both these emission sources are classified as community scope one emissions.

Table 17: Emissions inventory and data disclosure for community agricultural sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Enteric Fermentation		791		791

- Emissions Source: Enteric fermentation by livestock
  - Activity Data:
    IPCC 2006 recommended data – livestock type and numbers
  - Emissions Factor:
    IPCC 2006 emissions factor - Default by animal type (Appendix B)
  - Data Description:
    Livestock survey results for 2011 obtained from the Department of Agriculture, Forestry and Fisheries
  - Data Source:
    National Department of Agriculture, Forestry and Fisheries – Selebogo Leshoro (Appendix C)

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
Scope 1	Residue Burning		46 670	17 861	64 532

- Emissions Source: Infield pre-harvest sugarcane burning
  - Activity Data:
    IPCC 2006 Equation 2.27 Estimation of GHG Emissions from Fire
  - Emissions Factor:
    IPCC 2006 factors
  - Data Description:
    Area under sugarcane calculated from D'MOSS database provided by Municipality's Environmental Management Department
  - Data Source:
    Environmental Management Department – Cameron McLean (Appendix C)

3.2.6 Solid Waste

The community solid waste sector includes emissions generated by privately owned landfills situated within the Municipality's geopolitical boundary (**Table 18**).

Table 18: Emissions inventory and data disclosure for community solid waste sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Fugitive Emissions		180 461		180 461

- Emissions Source: Fugitive emissions generated by two privately owned landfills

- Activity Data:

  ICLEI recommended model and data type – First Order Decay Model

- Data Description:

  Historical and inventory year waste disposal data provided by private facilities; for previous years where disposal data was not available, data published in the Integrated Waste Management Plan for eThekwini Municipality and in the 2005/06 eThekwini Municipality GHG inventory was used to estimated emissions for the various landfills.

- Data Issue:

  Values updated for 2011; however previous years disposal data couldn't be obtained.

  Shongweni is a H:h site receiving industrial sludge, the composition could not be obtained nor GHG emissions be estimated.

- Data Source:

  Enviroserv – Clive Kidd; Wasteman – Neville Chetty (Appendix C)

4 EMISSIONS ANALYSIS

Within both the Municipal Operations Analysis and the Community Operations Analysis the principal contributor to GHG emissions are scope 2 indirect emissions from electricity consumption, although community scope 1 emissions are almost as large as the community scope 2 (**Table 19**).

Table 19: GHG emissions inventory results

EMISSIONS SCOPE	MUNICIPAL EMISSIONS (tCO2e)	COMMUNITY EMISSIONS (tCO2e)
Scope 1	450555 (29%)	10 271 299 (39%)
Scope 2	1 066 649 (69%)	11 226 826 (43%)
Selected Scope 3	34 216 (2%)	4 599 854 (18%)

The high carbon intensity of Eskom electricity (emissions factor of 1.03 kg CO_2e / kWh) significantly impacts on the emissions generated by electricity consumption within the EMA. The generation of electricity from fugitive methane emissions as part of the Landfill to Gas Projects implemented at Bisasar Road Landfill and Mariannhill Landfill and the CPV solar project resulted in 44 616 239 kWh of renewable energy being fed into the electrical grid during 2011. The displacement of Eskom electricity with electricity generated from landfill gas resulted in the estimated avoidance of 45 954 tonnes of CO_2e for 2011.

4.1 MUNICIPAL EMISSIONS

The principal municipal emission source, contributing 45% to the Municipality's total 2011 GHG emission inventory, was electrical transmission and distribution losses (scope 2). Of the total electrical losses, technical losses contributed approximately 235% and non-technical losses contributed 229% to total municipal emissions (**Figure 1: Municipal Sector Emissions Figure 1**,**Table 20**).

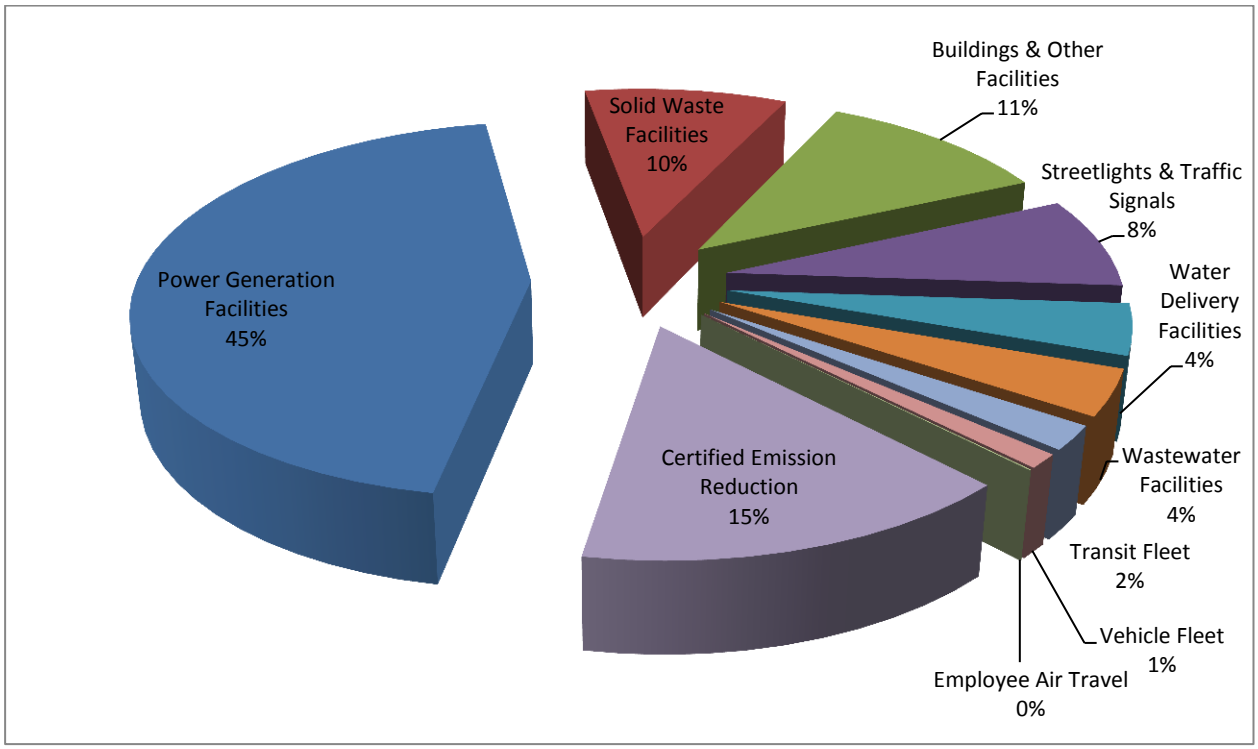

Figure 1: Municipal Sector Emissions

Table 20: Municipal sector emissions

Municipal Sector	Emissions Scope	Emissions (tCO2e)	%
Buildings & Other Facilities	Scope 1	17 310	11.2
	Scope 2	156 351	
Employee Air Travel	Scope 3	932	0.1
Power Generation Facilities	Scope 2	690 311	44.5
Solid Waste Facilities	Scope 1	150 483	24.9
	Scope 1	234 507	
	Scope 2	17 47	
Streetlights & Traffic Signals	Scope 2	119 798	7.8
	Scope 3	1 333	
Transit Fleet	Scope 3	31 951	2.1
Vehicle Fleet	Scope 1	18 581	1.2
Wastewater Facilities	Scope 1	29 675	3.9.
	Scope 2	31 037	
Water Delivery Facilities	Scope 2	67 405	4.3

4.1.1 Municipal GHG Emissions Intensity Figures

Emissions intensity figures calculated for the Municipality are provided in **Table 21**. These figures were calculated by combining all municipal scope 1 and 2 emissions and dividing them by the relevant indicator.

Table 21: Municipal GHG intensity figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
R 58.50	tCO_2e / million Rand of operating budget	1 551 420	tCO2e (Municipal Scope 1 & 2)	R 26 520.00[3]	Million Rand Operating Budget (2012/ 2013)
R 92.72	tCO_2e / million Rand of Capital budget	1 551 420	tCO2e (Municipal Scope 1 & 2)	R 5 300.00[4]	Million Rand Capital Budget (2012/ 2013)
77.88	tCO_2e / Permanent employee	1 551 420	tCO2e (Municipal Scope 1 & 2)	19 920[5]	Permanent Employees

4.2 COMMUNITY EMISSIONS

4.2.1 Community Emissions Analysis

[3] http://www.durban.gov.za/media_publications/Press_Releases/Pages/201213BudgetAdopted.aspx
[4] http://www.durban.gov.za/media_publications/Press_Releases/Pages/201213BudgetAdopted.aspx
[5] EThekwini Municipality, Human Resources

The principal community sector emission source within the EMA during 2011 was the industrial sector, contributing 32% to total community emissions (**Figure 2**, **Table 22**). The second major contributor was the on-road and off-road (ground) transport sector contributing 20% to overall community emissions.

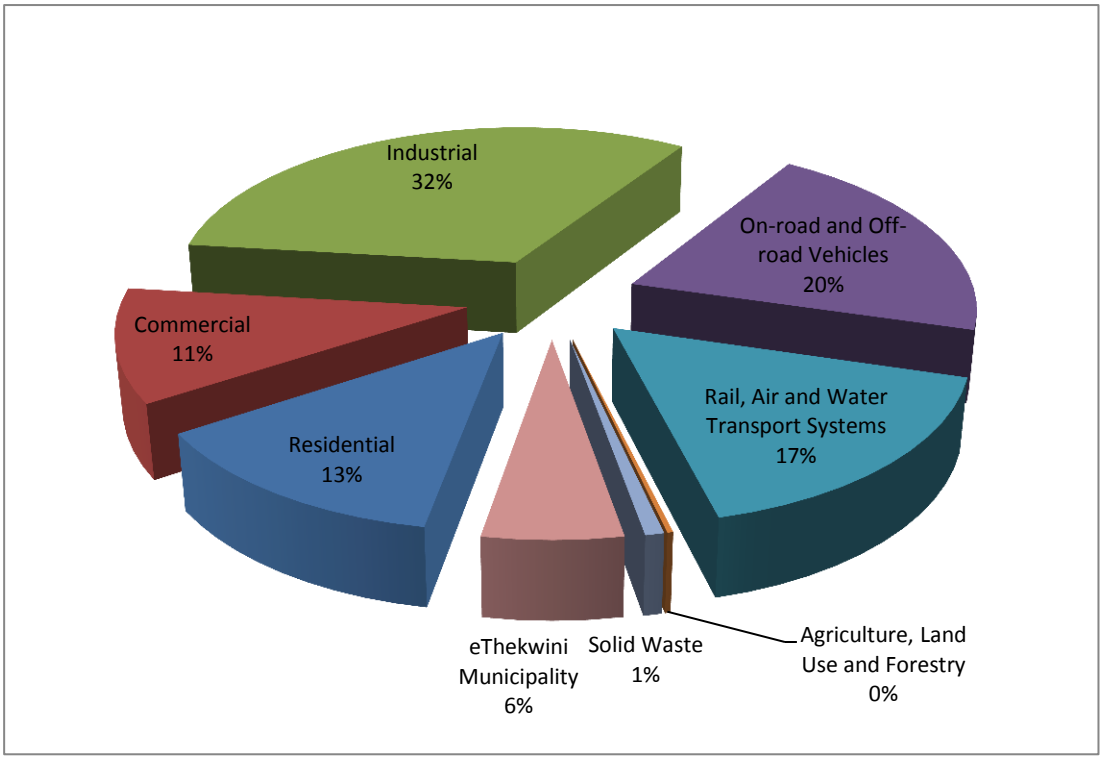

Figure 2: Community Sector Emissions

Table 22: Community sector emissions

Community Sector	Emissions Scope	Emissions (tCO_2e)	%
Industrial	Scope 1	4 147 892	34.07
	Scope 2	4 742 415	
On-road and off-road Vehicles	Scope 1	5 668 964	21.72
Air and Water Transport Systems	Scope 3	4 599 854	17.63
Residential	Scope 1	179 841	13.78
	Scope 2	3 417 110	
Commercial	Scope 2	3 067 300	11.75
Agriculture, Land Use and Forestry	Scope 1	65 322	0.25
Solid Waste	Scope 1	209 280	0.80

4.2.2 Community Emissions Intensity Figures

Emissions intensity figures calculated for the EMA for 2011 are provided in **Table 23**. These emissions were calculated by combining relevant sector scope one and two emissions and dividing them by the relevant indicators.

Table 23: Community GHG intensity figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit

3.76	tCO2e / household	3 596 951	tCO2e (Residential Scope 1 & 2)	956 071[6]	Number of households within the EMA
R 56.07	tCO_2e / million Rand of Capital budget	3 067 300	tCO2e (Commercial Scope 1 & 2)	R 54 700.00[7]	2010 Annual retail trade sales

4.2.3 Total Emissions Intensity Figures

Total emission intensity figures (for the municipality and the community) are recorded below in the table below. 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 24: Total Emissions Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
6.67	tCO2e / Capita	23 015 329	tCO2e (Scope 1 & 2)	3 442 361[8]	Population within the EMA
8.03	tCO2e / Capita	27 649 400	tCO2e (Scope 1, 2 & 3)	3 442 361	Population within the EMA

5 COMPARISON AGAINTS BASELINE

The 2010 eThekwini GHG Inventory works as the baseline inventory; the comparison of results for the years 2010 and 2011 are shown below in Table 25. Total emissions for 2011 were estimated in 27 649 400 tCO2e, 26 097 979 (94. 4%) from the Community sector, while 1 551 402 tCO2e (5.6%) are produced from the Municipal sector.

[6] EThekwini Municipality, Integrated Developed Plan 2012/2013
[7] http://www.durban.gov.za/media_publications/edge/Documents/Edge%20Fast%20Facts%20Issue%204%202012.pdf
[8] STATSSA: Census 2011: Municipal Fact sheet

Table 25: Comparison of Emissions 2011 against baseline (2010)

Scope	Type	Sub-Type	2010 (tCO2e)	2011 (tCO2e)	Difference (tCO2e)	Difference %
Municipal Scope 1	Fuel Consumption	Stationary Fuel Combustion	99.85	17 309.79	17 209.94	17236%
		Vehicle Fleet	36 798.73	18 580.76	-18 217.97	-50%
	Solid Waste	Solid Waste (CH4)	129 007.97	150 483.06	21 475.09	17%
	Wastewater Treatment	Wastewater (CH4)	19 188.41	29 675.24	10 486.83	55%
	CERs	Certified Emission Reduction	-	234 506.50		
Municipal Scope 2	Electricity Consumption	Buildings	196 522.65	156 350.86	-40 171.79	-20%
		Streetlights & Traffic Signals	110 956.33	119 798.04	8 841.71	8%
		Water Delivery Facilities	50 186.08	67 404.77	17 218.69	34%
		Transmission and Distribution Losses	505 006.31	690 311.41	185 305.09	37%
		Solid Waste Facilities	672.13	1 747.04	1 074.91	160%
		Wastewater Facilities	23 442.83	31 037.08	7 594.25	32%
Municipal Scope 3	Transport Systems	Streetlights	1 076.11	1 332.70	256.59	24%
		Transit Fleet	30 540.96	31 951.42	1 410.46	5%
		Flights	713.28	931.72	218.44	31%
Subtotal Municipal			1 104 211.65	1 551 420.37	447 208.72	41%
Scope	**Type**	**Sub-Type**	**2010 (tCO2e)**	**2011 (tCO2e)**		
Community Scope 1	Fuel Consumption	Stationary Fuel Combustion	4 531 814.62	4 327 733.46	-204 081.16	-5%
		Mobile Fuel Combustion	5 267 209.94	5 668 963.52	401 753.58	8%
	Solid Waste	Solid Waste	168 298.00	209 280.00	40 982.00	24%
	Agric & Landuse	Agric & Landuse	65 383.96	65 322.36	-61.59	0%
Community Scope 2	Electricity Consumption	Residential	3 564 529.89	3 417 110.09	-147 419.80	-4%
		Commercial	2 684 323.64	3 067 300.36	382 976.73	14%
		Industrial	4 813 255.49	4 742 415.06	-70 840.44	-1%
Community Scope 3	Transport Systems	Air Transport Systems	439 501.62	172 097.92	-267 403.70	-61%
		Water Transport Systems	4 427 756.39	4 427 756.39	-	0%
Subtotal Community			25 962 073.54	26 097 979.15	135 905.61	1%
Total			**27 066 285.19**	**27 649 399.52**	**583 114.33**	**2%**

Total emissions show a small variation of only 2% from year 2010 to 2011, which is equivalent to an additional 583 114 tCO2e emitted. The municipal sector presents an increase of 44% (447 209 tCO2e), while the community sector changed by 1% (135 905.6 tCO2e).

5.1 MUNICIPAL EMISSIONS:

Attention is brought to a significant increase on Stationary Fuel Combustion Emissions from Municipalities, this mainly caused because of the Heavy Fuel Oil; in 2010 it was 285 000L (this value was incorrectly entered as 28 500L when publishing the results) and by 2011 it was 505 000L. Additional changes for 2011 include the addition of Acetylene used for welding.

The reduction by 50% from the Fuel consumption by the Vehicle fleet is to be noted. It was confirmed with the City Fleet department that not significant reduction of the vehicle fleet or operations has taken place. Data for the full calendar year of 2011 was provided whilst for 2010 it was only for July to December and then doubled, it may be thought data for 2010 perhaps didn't comprehend the full 12 months period.

The increase by 152% on Solid Waste emissions was mainly due to a reduction in the flare efficiency for Bisasar Road Landfills from 90% to about 35% and Mariannhill from 97% to 62%. The 2010 flare efficiency numbers were obtained from the CDM-CER Claims, these values were confirmed directly by the Solid Waste department for 2011. There are no longer emissions quantified for La Mercy because the landfill has since closed. The CO_2 emissions from Buffelsdraai Landfill from the First Order Decay model have been added to the CH_4 emissions previously calculated.

An increase of 55% in wastewater treatment since 2010 may be attributed to the increase in population served. The emissions from incomplete combustion of digester gas had a population figure of 459 695 people for 2010 which rose to 948 975 for 2011. Likewise population for quantification of emissions from WWTP with nitrification/denitrifacion increased from 544 019 people in 2010 to 1 123 524 in 2011. Population discharging effluent into rivers and estuaries couldn't be updated for 2011, hence the 1 193 952 population value from 2010 was applied.

Electricity consumption from municipal buildings seems to have reduced by 20% from 2010 to 2011; however it is to be taken into account that the method used for quantification in the current inventory differs from the ones used during the 2010 baseline. The 2010 values were constructed from a building mapping exercise whilst the 2011 values correspond to electricity charges provided by the Treasury department. Additional electricity accounts found for the year 2011 were included in the calculations and terminated accounts from 2010 were removed.

Energy used for the distribution of water or water delivery facilities has also shown increase in the energy allocated, and therefore reflects in an increase in the total emissions. Water accounts for electricity directly supplied by the eThekwini Municipality which correspond to the JDE Business unit: Water, and the energy supplied by Eskom directly to water delivery facilities. These two sources of energy from the Municipality and directly supplied by Eskom account for the energy distribution values for water delivery facilities used in this report.

Transmission and distribution losses appear to have been the biggest emitter in the Municipal category at 45% of the emissions produced by the municipal operations. However, these only constitute 2.5% of the total GHG emissions for the eThekwini Municipality. Technical losses from distribution are estimated to be around 3% of the total energy delivered. The difference between energy purchased and produced by the Municipality and energy sold or distributed (traffic lights) results in non-technical losses of 5.9%. Technically losses were accounted for, adding up to 3%, therefore only 2.9% of the unaccounted energy can be attributed to non-technical losses.

Electricity consumption from the waste sector has increased by 160% from 672 tCO2e in 2010 to 1747 tCO2e in 2011. The baseline number was obtained from the building mapping exercise while the 2011 values correspond to electricity charges provided by the Treasury department with a JDE business, Cleansing and Solid Waste. The same

applies to the Wastewater sector for which 2011 values are the addition of the JDE business: Sanitation, and the Water and Sanitation energy accounts provided directly by Eskom.

There are no major differences in the Diesel consumption for both years from the municipal buses operated by an external contractor, resulting in only 5% increase in the Transit fleet emissions from the Municipality. Emissions from flights have augmented by 31% mainly due to the introduction of more long-haul flights. All new routes, domestic, short-haul and long-haul, have been included and updated correspondently in the calculation tool.

5.2 COMMUNITY EMISSIONS:

All Stationary fuel combustion emissions decreased by 5% when compared to the 2010 emission values. Stationary fuel combustion values are equivalent to 17% of the emissions from the community sector in the eThekwini Municipality. Fuel Volume Sales (FVS) are recorded and published annually by the Department of Energy. Considerations include Illuminating Paraffin and LPG used by the residential sector, and Heavy fuel oil, LPG, Illuminating paraffin and Paraffin wax used in the Industrial sector.

Assumptions from the 2010 Baseline were that 90% of LPG reported is used in Industrial activities and the remaining 10% is used for residential activities. In the case of Paraffin 50% is assumed to be consumed by the industry and 50% in the households. Such assumptions were kept for the 2011 GHG Inventory.

Data from the DoE corresponds to Fuel Sales Volume, but does not include coal, coke or refinery gas; such values were estimated from the State of Energy Report (2006) and the 2005/2006 eThekwini GHG Inventory EI, they remain the same for 2011 as for 2010 because it was not possible to obtain upadated values.

An increase of 8% in the Mobil fuel combustion is a reflection of the Petrol and Diesel sales increase in the eThekwini Municipality.

Emissions from the Solid Waste private sites in Shongweni and Bulbul landfill have been updated with information supplied directly from the companies managing the sites. Inputs for Shongweni landfill for the years 2007, 2008, 2009, 2010 and 2011 were updated in the current version of the inventory. Shongweni landfill is classified as a H:h site receiving industrial sludge, whose composition or carbon content is unknown and therefore it was not possible to estimate GHG emissions for it using the FOD model.

Bulbul landfill received approximately 58 255 tons of residues during 2011, significantly less than the previous estimate of 169 376 tons/year since opening in 1995. Efforts for contacting the managing company and update previous years inputs were unsuccessful, so it is thought the FOD model may be overestimating current GHG emissions based on high inputs from previous years.

For both landfill sites, CO_2 and CH_4 have been accounted as CO2eq, different to the baseline calculations where only CH_4 was taken into account.

There is a minimum reduction in the Agriculture and Land Use emissions of 0.1% which was attributed to slightly smaller livestock populations accounted for during 2011.

Residential, commercial and industrial electricity are the biggest contributors to community emissions (43%), it is calculated from the energy sales from the Municipality and the direct sales done by Eskom to the community. The first is informed by the Electricity Department and the latest by Eskom.

Residential electivity supplied by the Municipality have reduced from 3 419 848 105 kWh in 2010 to 3 258 616 119 kWh in 2011, while the amount directly supplied by Eskom passed from 58 880 587 kWh in 2010 to 71 592 116 kWh in 2011. Eskom direct energy split from 2010 between residential, commercial and industrial couldn't be reproduced

for the current inventory and it was decided to account as residential (all prepaid users and users type S), as commercial and industrial (all users type L). It may explain the increase in residential electricity supplied directly by Eskom if some of the accounts included here were taken as commercial in the baseline emissions inventory.

Commercial electricity supplied by the Municipality changed from 2 581 691 733 kWh in 2010 to 2 733 282 441 kWh in 2011 (increased by ±5%). Directly energy supplied by Eskom went from 36 511 875 kWh in 2010 to 256 012 219 kWh in 2011 (increased by ±14%), such increase is due to the grouping of commercial and industrial energy rather than increase in energy consumption by the community sector.

Electricity supplied by the municipality used by the Industrial sector remained relatively stable with a 2010 value of 4 622 423 068 kWh to 4 621 808 861 kWh in 2012. Directly supplied by Eskom electricity was 72 272 726 kWh in 2010 and for 2011 was added into the commercial sector as stated above.

Regarding transport systems, there is not changed in Water Transport Systems because the 2011 Fuel Volume Sales from the DoE didn't included information for Marine Automotive Diesel, Marine Diesel Oil and Marine Fuel Oil so the assumption that similar volumes were used during 2011.

Emissions from Air Transport Systems are done based on amount of Jet fuel (local), Aviation Gasoline and International Jet fuel, the latest values was not provided in the FSV data from the DoE and so numbers from 2010 were kept.

6 CONCLUSIONS AND RECOMENDATIONS

Total emissions for the 2011 are estimated to be around 27 649 400 tCO2e, which translates to 523 341 tCO2e (2%) more than the 2010 baseline. The community sector accounts for 94.4% of all the emissions, the largest emitter being electricity consumption with 40.7% of the total emissions from the municipality, followed by fuel consumption (stationary and mobile) which accounts for 36.2% of the total emissions. The municipality sector produces 5.6% of the total emissions, the largest contributor being electricity consumption with 3.9% of the total emissions (2.5% from transmission and distribution losses).

The comparison amongst the two years is not enough for the municipality to make a statement regarding its performance in terms of reduction of GHG emissions. As the 2011 results show, there is a slight increase of the emissions which may be due to an improved methodology for the collection of applicable information. Efforts from the municipality to reduce its' emissions may be reflected in the analysis in future years when the results reflect new renewable energy facilities and other policies in place for the mitigation of the GHG emissions. In order to further improve the reliability, completeness and accuracy of the inventory in future years the Municipality should work on identifying means to collect accurate data pertaining to the use of coal, coke and refinery gas within the municipal area.

Fuel used for domestic energy generation typically comprises of coal, wood, paraffin and LPG, with animal dung and other waste materials used to a smaller extent. Electricity is used where available, but factors such as cultural traditions also play a role in the continuing use of other fuels. Combustion remains the prevalent energy source for space heating and winter cooking in many rural areas, high density low income, and informal settlements particularly in the absence of electrification and where income profiles cannot meet the capital outlay required for electrical goods. Although many households are electrified, informal households use predominantly a contribution of this fuel mix (coal, wood, paraffin and LPG with animal dung and other waste materials used to a smaller extent) primarily due its availability and affordability, although factors such as cultural traditions also play a role in the continuing use of other fuels. Income profiles, population density and growth also play a significant part, amongst a variety of additional factors.

It is suggested the usage of Census 2011 data which identify income levels, electrification rates and number of houses using *x* type of fuel to supply cooking, heating or lightning needs. Such information together with a ground level survey may be useful to estimate the amount of fuel consumed by the households, know the burning techniques and estimate GHG emissions from it. A further assessment in the process, distribution and final usage of

refinery gas must be undertaken by the municipality in order to better estimate the consumption from this fuel and therefore the estimation of emissions.

The current inventory presents a gap regarding the estimation of GHG emissions from the industrial sector, which according to the IPCC accounted for 19% of the global GHG emissions in 2007 and was found to be the second largest source of emissions in South Africa's GHG 2000 inventory after the energy sector.

Two primary sources of information will be required to identify significant emitters and subsequently quantify emissions:

1. Listed activities in terms of air quality legislation (i.e. those with Atmospheric Emissions Licenses and those with APPA registration certificates still to converted)

2. Scheduled trades (i.e. those issued with scheduled trade permits in terms of the eThekwini municipal by-laws P.N. 134/1979 SECTION D.6, SCHEDULE A)

NEMAQA recognises the importance of GHG emissions and included monitoring and reporting on GHG emissions as a part of the license conditions in Section 43.1 (l), The APPA to NEMAQA AEL conversion process may be exploited to source information required for GHG emissions inventory. It is also noted that there may be numerous smaller facilities which may not be accounted for in the groups above including restaurants and pizza ovens etc., unless a ground survey takes place or there is an already database for boilers and other appliances.

Quantification of emissions of significant sources should be based on activity rates and fuel supply information where available. The assistance of the eTM health division and the municipal Air Quality officer will be imperative in accounting for such emission quantifications. Relevant industry bodies may also be consulted. It will be necessary to undertake quantifications based on activity rates, and fuel supply data (gas, HFO, coal, coke, paraffin etc) as well as accounting for emissions from flaring where applicable.

Solid waste emissions from community may be improved if records of the previous year's input into the landfills can be updated to reflect real disposals; also if for non-general landfill composition of the waste or carbon content may be known. Additional efforts should be made to ensure appropriate quality assurance and control of data provided from municipal stakeholders and departments.

7 REFERENCES

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8 APPENDIX A: ETHEKWINI MUNICIPALITY KEY INDICATORS 2011

EThekwini Municipality: Key Indicators: 2011[9]	
Indicators	2011
Gross Value Added (GVA)	R182,2 bn (Constant 2005 Prices)
Gross Domestic Product (GDP)	R203,5 bn (Constant 2005 Prices)
Gini Coefficient	0.61
Per Capita Income	R47,221
GVA Average Annual Growth (2000-2010)	3.06%
Population	3,495,604
Geographic Area	2, 293km^2
Population Growth (2000-2010)	0.80%
Population Density	1,538.2 persons/ km^2
Number of people living with < $2 per day	68,652
Number of households	956,713
Urbanization Rate	92.0%
Percentage of people in poverty	31.3%
Annual Per household income	R182.435
Human Development Index	0.61
Annual Disposable income	R104.389
Municipal Staff Employed	Permanent: 16 182 Temporary: 3 371
Unemployment Rate	30.2%
Annual Expenditure	R160,087,603 bn R164.7???
Annual Retail Trade sales	R54.7 bn
Council Operating Budget: 2011/12	R23,4 bn
Council Capital Budget: 2011/12	R4,7 bn
Total Exports:	R44.3 bn
Total Imports:	R71.2 bn

[9] Source: Global Insight/Economic Development Unit/Procurement & Infrastructure: Development Engineering

9 APPENDIX B: EMISSION & CONVERSION FACTORS

Emission & Conversion Factors

Emission Factors

Fuel Combustion Factors						
Stationary Fuel						
		CO_2	CH_4	N_2O	Total kg CO_2e	**Reference**
		kg CO_2 per unit				
HFO	tonnes	3212.5	2.8	13	3228.3	2011, Defra GHG Conversion Factors
Bitumen	TJ	80700	210	186	81096	2006 IPCC Guidelines
Natural Gas	cubic meters	2.0154	0.003	0.0012	2.0196	2011, Defra GHG Conversion Factors
LPG	litres	1.4884	0.001	0.0023	1.4917	
Coal (Industrial)	tonnes	2339	1.4	42.7	2383.1	
Coke	tonnes	2955.4	30.4	70.7	3056.5	
Illuminating Paraffin (Burning O	litres	2.5299	0.0054	0.0069	2.5422	
Acetylene	litres	0.003719			0.003719	2012, The Climate Registry
Paraffin Wax	TJ	73300	210	186	73696	2006 IPCC Guidelines
Refinery Gas	GJ	54.2	0.02	0.03	54.25	NGA 2010
Road Transport Fuel						
		CO_2	CH_4	N_2O	Total kg CO_2e	**Reference**
		kg CO_2e per unit				
Petrol	litres	2.30	0.0046	0.02	2.322	2011, Defra GHG Conversion Factors
Diesel	litres	2.64	0.0015	0.03	2.672	
Aviation Fuel						
		CO_2	CH_4	N_2O	Total kg CO_2e	**Reference**
		kg CO_2 per unit				
Int. Jet Fuel (Aviation Turbine F	litres	2.52	0.0012	0.02	2.548	2011, Defra GHG Conversion Factors
Jet Fuel Local	litres	2.52	0.0012	0.02	2.548	
Aviation Gasoline	litres	2.21	0.0227	0.02	2.259	
Marine Fuel						
		CO_2	CH_4	N_2O	Total kg CO_2e	**Reference**
		kg CO_2 per unit				
Marine Fuels	litres	2.7667	0.003	0.2898	3.0595	2011, Defra GHG Conversion Factors

Indirect Energy Source Factors						
Electricity						
		CO_2	CH_4	N_2O	Total kg CO_2e	**Reference**
		kg CO_2e per unit				
Eskom	KWh	n/a	n/a	n/a	1.03	Eskom Annual Report, 2011 (T&D losses not included)

Agriculture & Land use Factors						
Livestock						
		CO_2	CH_4	N_2O	Total kg CO_2e	**Reference**
		kg CO_2e per head per year				
Goats	head	n/a	105	n/a	105	2006 IPCC Guidelines
Cattle	head	n/a	651	n/a	651	
Sheep	head	n/a	105	n/a	105	

Aviation Factors						
Conversion Factors						
		CO_2	CH_4	N_2O	Total kg CO_2e	Reference
		kg CO_2e per passenger km				
Domestic Flights	Average	0.16313	0.0001	0.00161	0.16484	2011, Defra GHG Conversion Factors
Short-haul International	Average	0.09589	0.00001	0.00094	0.09684	
Long-haul International	Average	0.11037	0.00001	0.00109	0.11147	
Distances						

Global Warming Potential Factors

GWP's			
GHG Global Warming Factors			
Emissions	**Chemical Formula**	**Conversion Factor**	**Reference**
Carbon dioxide	CO2	1	2011, Defra GHG Conversion Factors
Methane	CH4	21	
Nitrous oxide	N2O	310	

Conversion Factors

Conversion Factors			
Common			
1 barrel	159	litres	2011, Defra GHG Conversion Factors
1 gigagram	1000	tonnes	
1 cubic meter	1000	litres	
HFO			
1 cubic meter	977.5	kilograms	
Bitumen			
1 tonne	6.06	barrels	2006 International Energy Annual (IEA)
1 gigagram (Gg)	40.2	TJ	2006 IPCC Guidelines
Paraffin Wax			
1 tonne	7.87	barrels	2006 International Energy Annual (IEA)
1 gigagram (Gg)	40.2	TJ	2006 IPCC Guidelines
Lubricants			
1 cubic meter	950	kilograms	2011, Defra GHG Conversion Factors

10 APPENDIX C: CONTACT DETAILS

Fuel Consumption Raw Data

Municipal

Stationary Combustion				
Department:	**Procurement**			
Contact:	**Godfrey Appalsamy**	Tel:	**(031) 311 7518**	appalsamyg@durban.gov.za
Date Received:	**27/09/2012**	**Notes**: Limited information provided. Acetylene has been added to the list of fuels, Argoshield has been omitted due to the small quantity, not clarity in EF to be used and it also requires CO2 composition percentage to reduce from the emissions.		
Data1				
Mobile Combustion				
Internal Refueling				
Department:	**City Fleet**			
Contact:	**Ranjeev Nursingh**	Tel:	**(031) 311 5304**	NursinghR@durban.gov.za
Date Received:	**21/08/2012**	Notes: Data for Internal and External refueling was sent in the same file. Data was grouped in the categories described in this tool		
Data2				
External Refueling				
Department:	**City Fleet**			
Contact:	**Neeren Juganath**	Tel:	**082 378 0875**	juganathn@durban.gov.za
Date Received:	**21/08/2012**	Notes: Data for Internal and External refueling was sent in the same file. Data was grouped in the categories described in this tool		
Data3				
Transit Fleet				
Company:	**Transnat**			
Contact:	**Jhon Wilkinson**	Tel:	**(031) 309 3250**	john@ethekwinibus.co.za
Date Received:	**21/08/2012**	**Notes:** This contact info and data was included for the 2011 version		
Data4				
Bussiness Flights				
International Flights				
Company:	**TWF**			
Contact:	**Musa Ndabeni**	Tel:	(031) 811 9153	musan@twf.co.za
Date Received:	**18/09/2012**	**Notes**: Confirmed with Danny Govender (govenderdanny@durban.gov.za) what companies what travel agencies were contracted to arrange the domestic and international flights for the EMA during the year 2011		
Data20				
Local Flights				
Company:	**Rennies Travel**			
Contact:	**Tammy Heher**	Tel:	**(031) 251 5340**	Tammy.Heher@renniestravel.com
Date Received:	**11/09/2012**	**Notes:** Payment must be done by the Municipality for the extraction of results if the contract with the Municipality is not longer valid		
Data19				

Community

Stationary & Mobile Combustion				
Source:	**Department of Energy**	Position:	**Energy Officer, Directorate of Energy Information Management, Process Design and Publications**	
Contact:	**Ramaano Nembahe**	Tel:	**(012) 444 4038**	ramaano.nembahe@energy.gov.za
Date Received:	**24/08/2011**	**Notes**: Data for 2011 calendar year. Units are litres. Based on 2006 Energy Report: LPG - 90% industrial; 10% resedential. Paraffin - 50% industrial; 50% resedential. No data received for marine automotive diesel, marine diesel, oil and marine fuel oil and internation jet fuel received then 2010 data was maintained		
Data6 annual	Data6 quarterly			

Electricity Consumption Raw Data

Government

Municipal Electricity Consumption

Municipal Electricity Consumption

Department:	**Treasure Department**			
Contact:	**Wally Bentley**	Tel:	**(031) 3221878**	Wally.Bentley@durban.gov.za
Date Received:	**10/01/2013**	**Note 1**: Links to original data. Check files for processing of it. **Note 2**: The bulk accounts (161) have been migrated to a new billing system, info has been obtained from the RMS billing system **Note3**: A lot of the accounts have been terminated since the last review, it was indicated on the spreadsheet **Note4**: Treasure department have not acces to ESKOM codes that are included within the "Municipal" group **Note5**: Categories have been grouped according to JDE Bussiness unit **Note6**: Two additional groups have been created: Stadium (JDE 95010) and Electricty depo		

Data18-a | Data18-b | Data18-c | Data18-d | Data18-e | Data18-f | Data18- calc

Losses

Department:	**Electricity Department**			
Contact:	**Leshan Moodliar**	Tel:	**(031) 311 9286**	MoodliarL@elec.durban.gov.za
Date Received:	**03/10/2012**	**Notes: Real v**alues from street and traffic signals used, also information from energy generated from landfills as CPV solar. Technocal losses factor = 3%		

Data17

Streetligths & Traffic Signals

Streetlights - Supplied directly by Eskom

Company:	**Eskom**			
Contact:	**Prashunt Lutchman**	Tel:	**(083) 2840330**	LutchmP@eskom.co.za
Date Received:	**29/10/2012**	**Notes:** Received data differentiate between, maintenance and not maintenance. Eskom has various options on streetlights supplies. This includes the normal streetlight tariff plus a maintenance contract. This is usually what most Municipalities opt for. However, sometimes they opt for only the streetlight tariffs and perform their own maintenance. This may have been the historical position with this supply and eTM may have taken over		

Data14

Streetlights

Department:	**Electricity Department**			
Contact:	**Craig Smith**	Tel:	**(031) 311 9538**	SmithC@elec.durban.gov.za
Date Received:	**05/09/2012**	**Notes: none**		

Data15

Traffic Lights

Department:	**Transport Authority**			
Contact:	**A.J. Cronje**	Tel:	**(031) 311 7674**	Abrie.Cronje@durban.gov.za
Date Received:	**06/09/2012**	**Notes:** An accurate measurement of the Traffic lights is almost impossible to make since they do not measure the loads of each traffic signal and they have several teams maintaining the intersections and eliminating unnecessary LED modules. However an educated guess considered relative accurate was made.		

Data16

Community

eThekwini Electricity Department Sales to Community

Purchases and Sales

Department:	**Electricity Department**			
Contact:	**Leshan Moddliar**	Tel:	**(031) 311 9286**	MoodliarL@elec.durban.gov.za
Date Received:	**03/10/2012**	**Notes:** Data includes internal municipality electricity use. Values correspond more to a factor applied throught the year for each category (residential, commertial and industrial) rather than real monthly data for each category.		

Data17

Eskom sales to the Community

Source:	**Eskom**			
Contact:	**Prashunt Lutchman**	Tel:	**(083) 2840330**	LutchmP@eskom.co.za
Date Received:	**23/01/2013**	**Notes**: Eskom file includes all sales in the eThekwini Municipality. Sales to the municipality and direct sales to municipality buildings, were identified by the deparment of energy. Direct residential sales correspond to Prepid customer and customers type S. Commercial and Industrial direct saler correspond to the ones identified as Type L. Direct sales to the municipality buildings were added into the municipal accounts as provided directly by Eskom.		

Data 14-a | Data 14-b | Data 14 - calculations

Solid Waste Disposal Raw Data

Municipal

Landfills with LGF system			
Department:	**Solid Waste**		
Contact:	**Marc Wright**	Tel: **(031) 263 1371**	marcwr@dmws.durban.gov.za
Date Received:	**27/08/2012**	**Notes**: La Mercy Land fill is closed	
Data8			

Landfills with NOT LGF system (Buffelsdraai Landfill)			
Department:	**Solid Waste**		
Contact:	**Marc Wright**	Tel: **(031) 263 1371**	JohnPa@dmws.durban.gov.za
Date Received:	**21/08/2012**	**Notes:** none	
Data9			

Community

Landfill A: Enviroserv - Shongweni			
Company: **Enviroserv**			
Contact: **Clive Kidd**		Tel: **(082) 7796318**	CLIVEK@enviroserv.co.za
Date Received:	**10/10/2012**	**Notes**: Contact was made with Mr. Kidd but information was supplied by David Cornish (dcornish@gessa.co.za) from ENER-G Systems (PTY) LTD as consutant company for Enviroserv **Note2:** Shongweni a H:h site, it recives Industrial sludge whose composition for GHG estimations is unkown. **Note3:** Previous inputs to the landfill from 2007 were also available and have been used to update values from previous years	
Data10			

Landfill B: Wasteman - BulBul Landfill			
Company: **Wasteman**			
Contact: **Neville Chetty**		Tel: **(031) 460 4621**	technical@wasteman.co.za
Date Received:	**04/10/2012**	**Notes:** Waste deposits for previous years does not seem very accurated, attemps were made to obtain such values directly from Wasteman without success	
Data11			

Wastewater Raw Data

Municipal

Treatment Statistics			
Department:	**Water and Sanitation**		
Contact:	**Mohammed Dildar**	Tel: **(031) 311 8671**	DildarMo@dmws.durban.gov.za
Date Received:	**05/11/2012**	**Notes**: The population that Magabeni and Glenwood works serve is not known, neither the population that each river serves. The final person that provided the data was Mr. Keane Dharmalingam	
Data7			

Agriculture and Land Raw Data

Community			
Livestock			
Department:	**National Department of Agricuture, Forestry and Fisheries**		
Contact:	**Selebogo Leshoro**	Tel: **(012) 319 8037**	SelebogoL@nda.agric.za
Date Received:	**20/08/2012**	**Notes:** None	Data12
Standing Cropland			
Department:	**National Department of Agricuture, Forestry and Fisheries**		
Contact:	**Cameron McLean**	Tel:	Cameron.McLean@durban.gov.za
Date Received:	**26/09/2012**	**Notes:** None	Data13

11 APPENDIX D: JDE BUSSINESS UNITS

CATEGORIES FOR GROUPING OF MUNICIPAL ENERGY ACCOUNTS
Airport services
Area based management
Assessment rates
Audit
Business support
City enterprises
City fleet
City hall admin & city secretary
City manager's office
Cleansing & solid waste
Communications
Community participation & acti
Corporate GIS
Corporate policy
Development planning & management
Disaster management
Durban energy office
Durban transport
Economic development & facility
Electricity
Electricity depo
Emergency control centre-admin
Emergency services
Engineering
EThekwini transport authority
Expenditure
Finance & major projects
Formal housing
Gas to electricity
General - JSB
Health
Housing
Human resources
Income
Information technology
Ink
Internal control & business sy
Investigations
Legal services
Management services & org stru
Markets
Metropolitan police
Miscellaneous
Occupational health & safety
Office of dcm:health & social
Office of dcm:safety & security
Office of international & government

Office of the d c m:corp & hum
Office of the d c m:governance
Office of the d c m:procuremen
Office of the d c m:sust.devel
Office of the d c m:Treasury
Ombudsperson & head:investigat
Parks, recreation & culture
Performance management
Real estates
Regional centres
Retail market
Sanitation
Sdb
Security management
Skills development
Strategic projects
Stadium
Supply chain management
Trading results
Transport
Vat claims - SARS
Water