



Nelson Mandela Bay Municipality: Greenhouse Gas Inventory 2012

By ICLEI – Local Governments for Sustainability – Africa

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1. Executive Summary

The Nelson Mandela Bay Greenhouse Gas (GHG) Inventory was conducted using data from 2012 calendar year as the baseline year. The GHG inventory is compliant to the international accounting protocols, techniques and methodologies of both International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP) version 1.0 and the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC). Data sources, assumptions and gaps are outlined within the detailed report in Section 2.

Nelson Mandela Bay Municipality is one of seven metropolitan areas in South Africa. It unites the city of Port Elizabeth and the towns of Uitenhage and Despatch, and is a major seaport and automotive manufacturing centre located on the south-eastern coast of Africa in the Eastern Cape Province of South

Africa. These economic drivers are the main contributors to the emissions for the local area and contribute to a large proportion of the emissions for the province. The population size is 1 152 115 (2011), with an annual growth rate of 1.36% over the previous 10 years, and 324 292 households (average household size 3.6). The unemployment rate of 36.6% (2011) and the Gross Value Added (GVA) per capita is R54 291. For 2012, the energy consumption per capita and emissions per capita are 26.16 gigajoules and 4.5 tonnes of carbon dioxide equivalent respectively.

Electricity is the dominant energy type used in Nelson Mandela Bay, as illustrated by the supply-side energy consumption pie charts of Figure 1. In the residential sector, some 90.7% of households are electrified according to the most recent census data from StatsSA (as illustrated in Figure 8 in the report). Liquid fuels of diesel and petrol are the second and third dominant energy types used respectively across all sectors. It should be noted that although electricity supplies 46% of the energy needs, it accounts for 75.6% of the indirect emissions per unit (scope 2) because the majority of South Africa's grid electricity is generated by coal burning power stations.

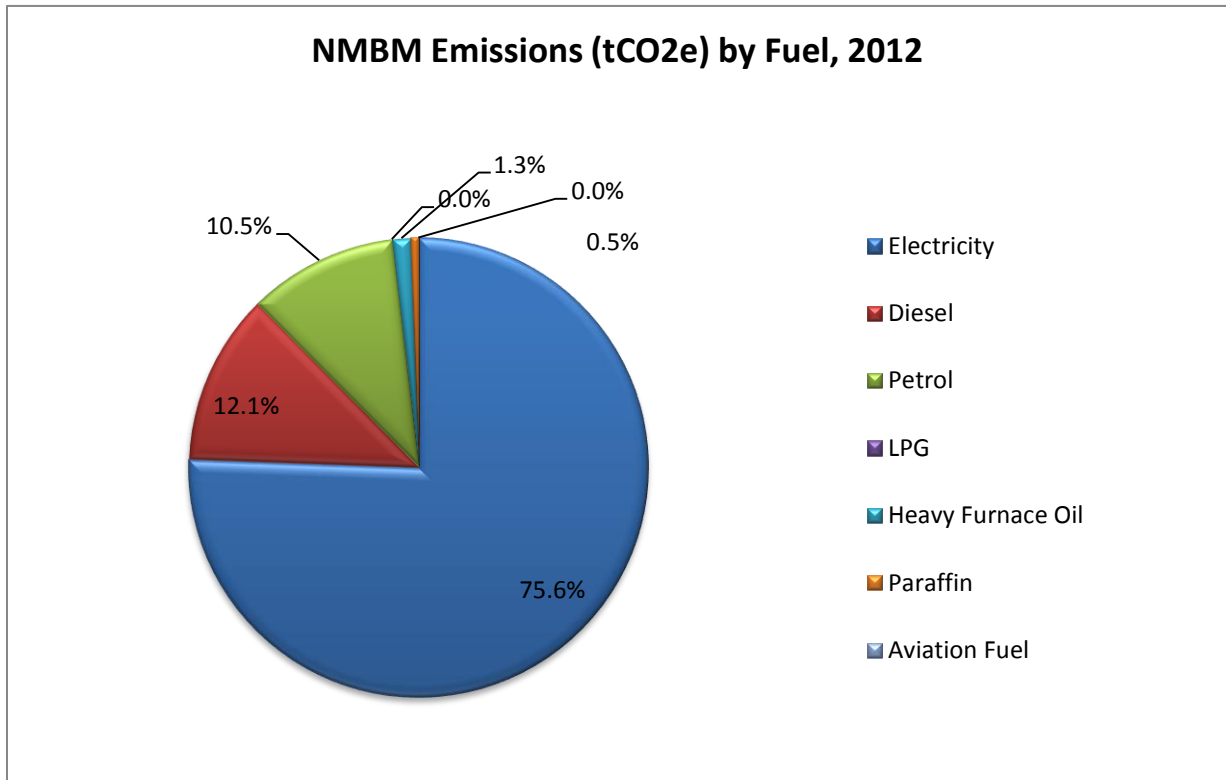
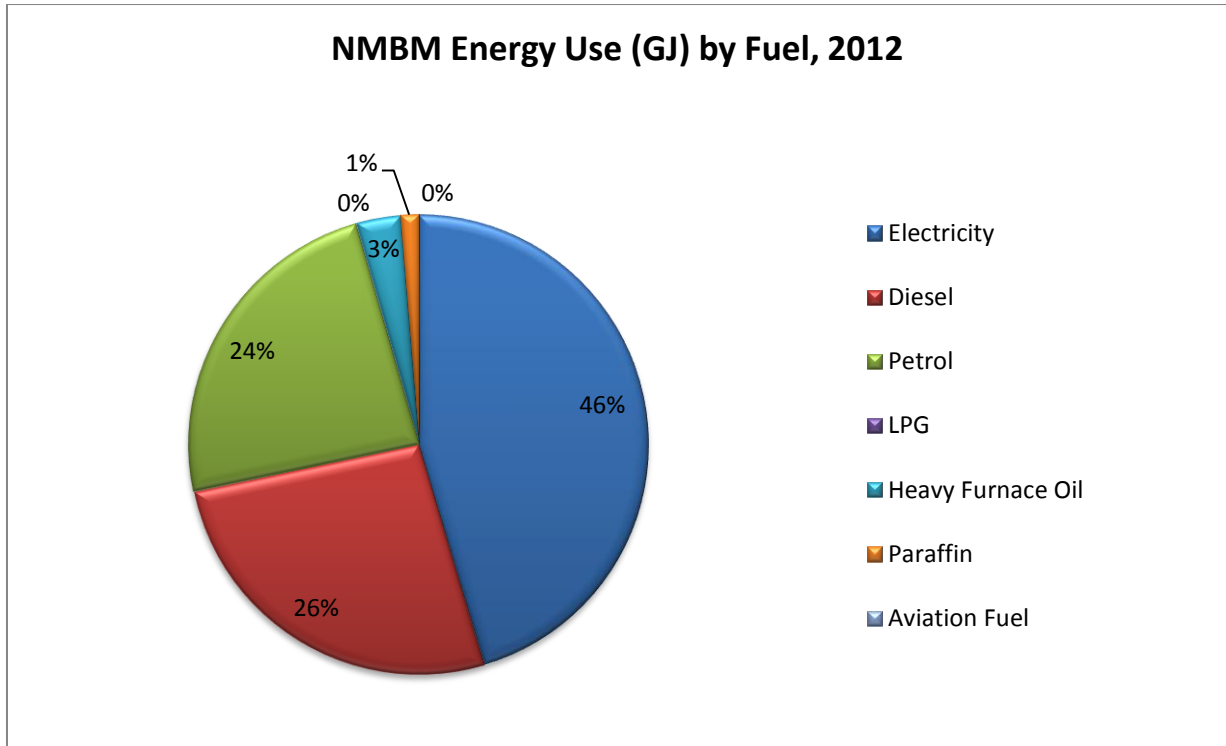


Figure 1. Nelson Mandela Bay energy consumption and energy-related emissions by fuel type, 2012

The sectors consuming the greater proportions of energy in the area are the transportation and industrial sectors. The demand-side energy consumption pie charts are seen in Figure 2 illustrating the high energy intensity and high carbon emitting sectors.

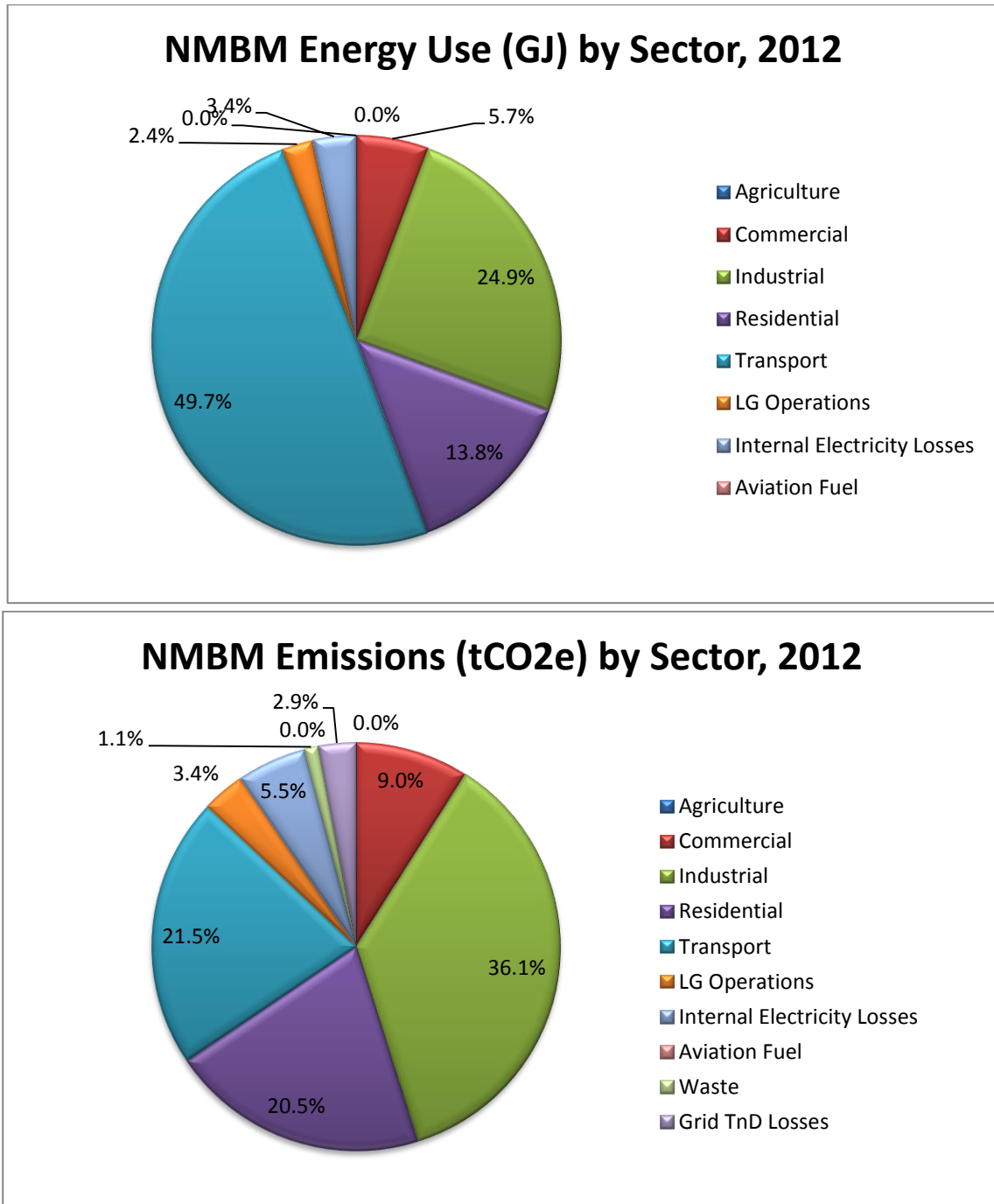


Figure 2. Energy consumption and energy related emissions by sector in NMBM, 2012.

5.2 million tonnes of carbon dioxide equivalent (tCO₂e) emissions was emitted in year 2012 in Nelson Mandela Bay. 90.8% was emitted by the community (i.e. Residential, Industrial, Transportation, Agriculture) and 9.2% emitted directly by the operational activities of the local authority (with the inclusion of electrical losses). The emissions are associated with some 30.1 million gigajoules (GJ) of energy that was supplied to meet the city’s energy needs. See Table 1 for the final summary of carbon emissions emitted by the relevant modules (community and government) in Nelson Mandela Bay.

Table 1. Nelson Mandela Bay Greenhouse Gas emission results, 2012

2012	tCO ₂ e	
	Community	Local Government
Waste	58 770	
Electricity	3 310 258	166 849
Fuel	1 206 979	9 648
Supply Sub-total	4 576 006	176 497
Supply total	4 752 503	
Percentage	96,3	3,7
Electricity Losses		285 325
Module Totals	4 576 006	461 822
Total	5 037 828	
Percentage	90,8	9,2

	Community	Local Government
Module Totals	4 576 006	461 822
Total	5 037 828	
Percentage	90,8	9,2
Carbon Emissions per capita	4,37	
Aviation Fuel	1	
Grid TnD Losses	152 017	
	4 728 025	461 822
NMBM TOTAL EMISSIONS	5 189 847	
Carbon Emissions per capita	4,50	

The emissions intensity (carbon per capita) in the area is slightly lower than some of the other large municipalities in South Africa, including metropolitan municipalities. The value of 4.5 tCO₂e per capita for the Nelson Mandela Bay Metropolitan area is based on 2011 population figures. The carbon intensity in Nelson Mandela Bay is moderate due to the absence of heavy industrial, mining and coal power plants located within its boundary. It is therefore important to state the local context when making comparisons with other municipalities. For comparison purposes it is worth noting that the emission intensity of other (larger) port cities are eThekweni (at 8.03 tCO₂e per capita in 2011) and City of Cape Town (at 5.32 tCO₂e per capita in 2012).

The following statistics in Table 2 represent a selection of key energy indicators resulting from the analysis which can then be compared to other urban areas which have conducted similar studies.

Table 2. Nelson Mandela Bay energy indicators, 2012

Energy Indicator	Unit of Measure	Local Level (2011-2013)
Households owing private vehicles	Percentage (%)	36.0
Private vehicles per household owning private vehicles	No. of veh/household	1.58
Private vehicles per capita	No. of veh/capita	0.16
Private vehicles per household	No. of veh/household	0.56

Energy consumption per capita	GJ/capita	26.1
GHG per capita	tCO ₂ e/capita	4.5
Energy per Gross Value Added (GVA) (R' mill)	GJ /GVA	481.9
GHG per Gross Value Added (GVA) (R' mill)	tCO ₂ e/GVA	83.0

*Gross Value Added (GVA) is a geographical area's Gross Domestic Product (GDP) minus the taxes and subsidies, and is a key indicator of the economic output.

The last representation of the data is showcased in Table 3, which presents the emissions by sector per scope, as per the international standards for local governments, namely the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC), which is described in detail in Section 2 of the report.

Table 3. Greenhouse Gas emissions by sector per scope in Nelson Mandela Bay 2012

2012 Community GHG Profile Reporting Standard						
Sector	Sector Total (tCO2e)	Subsector	Subsector Total (tCO2e)	Subtotal (tCO2e)	GHG Emissions Sources	GPC No.
STATIONARY UNITS	3 854 475	Agriculture	191	49	Stationary Units Agricultural Direct Emissions (Scope1)	I
				142	Stationary Units Agriculture Energy Indirect Emissions (Scope2)	I.1.ii
		Residential Buildings	1 061 778	26 481	Stationary Units Residential Direct Emissions (Scope1)	I.1.i
				1 035 297	Stationary Units Residential Energy Indirect Emissions (Scope2)	I.1.ii
		Commercial/Institutional Facilities	918 151	1 047	Stationary Units Commercial/Institutional Facilities Direct Emissions (Scope1)	I.2.i
				917 105	Stationary Units Commercial/Institutional Facilities Energy Indirect Emissions (Scope2)	I.2.ii
		Industrial Energy Use	1 874 355	64 466	Stationary Units Industrial Energy Use Direct Emissions (Scope1)	I.4.i
				1 809 890	Stationary Units Industrial Energy Use Energy Indirect Emissions (Scope2)	I.4.ii
MOBILE UNITS	1 124 584	On-Road Transportation (Cars, LDV, HDV/Buses, others)	1 124 584	1 124 583	Mobile Units On-Road Transportation (Cars, LDV, HDV/Buses, others) Direct Emissions (Scope1)	II.1.i
				1	Mobile Units Aviation Indirect Emissions from Inter-City Domestic Flights (LTO and Cruise) (Scope3)	II.4.iii
WASTE	58 770	Solid Waste Disposal	58 770	58 770	Waste Solid Waste Future Indirect Emissions from Community Generated Waste Landfilled in the Community in the Analysis-Year (Scope1)	III.1.i
Other Indirect Emissions	152 017	Transmission & Distribution	152 017	152 017	Grid-related Transmission and Distribution Losses (Scope 3)	VI.1
5 189 846		TOTAL Community Emissions (tCO2e) by 2012 Accounting Standard (for benchmarking)				

Aggregate tCO2e by Scope	tCO2e Scope-1	1 275 395
	tCO2e Scope-2	3 762 433
	tCO2e Scope-3	152 019
Total		5 189 846

2. Methodology

Protocols

The GHG Inventory was conducted in accordance to the approved principles and standards of both local government Protocols, the *International Local Government Greenhouse Gas Emissions Analysis Protocol* (IEAP) version 1.0 and the *Global Protocol for Community-Scale Greenhouse Gas Emissions* (GPC). Both these protocols provide internationally based methodologies and guidelines to assist local governments in quantifying the greenhouse gas emissions from both their internal operations and from the whole community (residential, commercial and industrial sectors) within the geographical boundaries.

The IEAP was developed by ICLEI - Local Governments for Sustainability, informed by the Intergovernmental Panel on Climate Change (IPCC) 2006 international methodological standards in 2009. Based on the IEAP and other recognised protocols, and in collaboration with partners an international protocol is being formalised for international standard reporting for sub-national governments across the world. The GPC has been developed in collaboration with C40 Cities Climate Leadership Group, ICLEI – Local Governments for Sustainability, and the World Resources Institute (WRI) and is currently being tested by local governments across the world. By the end of 2013 the pilot test results will be incorporated into a more comprehensive GHG accounting standard for community-scale emissions, including consideration of a full range of direct and indirect GHG emissions from urban activities. This development will enable local governments to account for how the demand for goods and services as well as local innovative technologies can impact on an urban GHG footprint. The updated protocol, GPC 2.0 was released in December 2014, and the inventory compiled for Nelson Mandela Bay drew on the draft document for its compilation.

The Protocol aims to improve the consistency with which the international standard is applied and how the resulting information is publically reported.

This GHG report aims to adhere to the protocol principles through local government emission **relevancy**, **completeness** by accounting of most GHG activities within the boundary, promoting **consistency** of GHG accounting methodology, through **transparency** in a factual and coherent manner, and enhancement of the **accuracy** of the information to enable decision making with reasonable assurance.

In an effort to develop a comprehensive energy and carbon inventory, to understand the city activities, to measure the emissions, and to provide options of mitigation measures best suited for the local government's development plans, an ICLEI emissions accounting software package was used to assist with the analysis. Harmonized Emission Analysis Tool Plus (HEAT+) incorporates the latest technical findings (IPCC. 2006) and is based on the International Local Government GHG Emissions Analysis Protocol (IEAP). It also incorporates the new international reporting requirements and standards outlined in the GPC. HEAT+ is the tool used for GHG emissions accounting in the Urban-LEDS project; providing an opportunity for it to be used and tested in the South African context. Complimentary to HEAT + a number of other GHG emissions calculators were used during the carbon inventory analysis to verify and strengthen results further.

The emissions inventory comprises two parallel analyses, one for the local government operations and one for all the emissions within the community determined by the geographical boundaries of the Municipality’s jurisdiction. It must however be acknowledged that analysing community-scale emissions presents its own challenges as the natural flow of energy and materials is typically most accurate at the national level. Reducing the spatial area of an analysis, from national to sub-national level results in a lower level of accuracy in reflecting the energy flows. Therefore, analysing GHG emissions at a local community level means that a combination of national and local area information is required in order to model the emissions.

The GHG report identifies the main energy carrier and the intensive carbon emitting sectors that are situated within the municipal boundary of Nelson Mandela Bay Municipality, and aggregates the figures to determine their total contribution to carbon emissions.

Data Sources and Collation

The baseline year for this study was the calendar year of 2012 as most of the data sources were able to provide full data sets for this baseline year. A prior GHG inventory had been conducted for the 2006 year, and the results were broadly compared for consistency, however a direct comparison of the two inventories is complex given the changes in data availability, and updates to emission factors used for converting fuel consumption values to emissions equivalents.

A full GHG inventory includes emissions from energy, waste, agriculture, forestry, and land-use change. Due to limited resources and data constraints, the full quota of direct emissions from agriculture, land-use change and forestry sectors were not included as data was limited during the time of the study.

ICLEI Africa engaged through meetings and letters with a number of municipal, local, sub-national, and national stakeholders to source the relevant energy consumption data focusing on the large carbon emitters within the municipal area. Supply and demand-side data was therefore collected and analysed for this study. Supply-side refers to the classification of both primary and secondary energy types that are distributed to the demand-side for use; these include liquid and solid fuels, electricity and renewables. Demand-side energy refers to the energy end user, i.e. the residential, commercial, transport, industry, and agriculture, the sectors requiring the use of energy within and urban jurisdiction. The supply-side and demand side data sources are elaborated in the tables below.

Table 4: Supply-side energy data sources

Fuel Type	Data Sources
Electricity	Eskom and Nelson Mandela Bay Municipality
Liquid Fuel	South African Petroleum Industry Association (SAPIA) via the Department of Energy. Previous studies undertaken by Sustainable Energy Africa on overlaps between municipal and magisterial districts.
Waste	Waste Management Department. Nelson Mandela Bay Municipality

Table 5: Demand-side energy data sources

Sector	Data Sources
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Agriculture	Eskom electricity distribution
Commercial	Eskom electricity distribution. Municipal electricity distribution
Industry	Eskom electricity distribution. Municipal electricity distribution. SAPIA
Mining	N/A
Residential	Eskom electricity distribution. Municipal electricity distribution. StatsSA household census statistical data
Government	Municipal electricity distribution
Local Government operations	Municipal electricity distribution
Transport	SAPIA. eNaTiS. StatsSA. Municipal vehicle management. Municipal traffic department
Waste	Waste Management Department. Nelson Mandela Bay Municipality
Other	Quantec. StatsSA. Municipal Integrated Development Plan (IDP) and related policies. Africoast (data supplied to Sustainable Energy Africa). Department of Energy: Disaggregated Energy Balance's

Data assumptions and gaps

Eskom Electricity Data

Electricity data was provided by Eskom for the municipal area for three consecutive years from 2010-2012. Data was classified in terms of electricity used, i.e. by large power users, small power users and pre-paid uses and further disaggregated into demand-side sectors (Agriculture, Commercial, Industrial, Residential). This data was used in two ways. Firstly, it was used to determine the electricity consumption (and associated indirect emissions) within the area, by consumers who are supplied directly by Eskom. Secondly the numbers are used to cross-check the total figures sold to the municipality for redistribution with the numbers recorded by the municipality as purchases from Eskom. A non-disclosure agreement was signed with Eskom to obtain the required data and permission was granted to display the data as it is presented within this report. One of the difficulties in compiling a GHG inventory for South African municipalities is that Eskom and the municipalities have different geographical boundaries, so some effort is required to determine which of Eskom's direct customers fall within the municipal boundary. A further complication is that the sector and tariff breakdowns are not the same for Eskom as they are for municipalities, making aggregation of data a challenge. For example, Eskom categorises its customers according to sector e.g. agriculture, but the municipality do not explicitly do so.

SAPIA liquid fuel data

The liquid fuel data, Fuel Sale Volumes (FVS) by magisterial district is accessible through the Department of Energy (DoE) website and is provided by South African Petroleum Industry Association (SAPIA). It should be noted that while historical figures from SAPIA are the most consistently and reliably collected data for liquid fuels, a glance at historical trends in the data for a large metro such as Nelson Mandela Bay reveals underlying gaps and inconsistencies, and an indirect recommendation of this report is that the DoE should be encouraged to undertake more thorough checks of this data. The information is also unfortunately not disaggregated according to end user or sector and therefore certain assumptions and sector allocations

were made based on consultation with the local government and in accordance to similar GHG studies undertaken in the recent past of a similar context:

- a. Aviation Gasoline was not assigned to a specific demand-side sector and only included in the concluding table as emissions from aviation falls under the category of Scope 3 emissions, and full aviation gasoline sales figures are not reported in the SAPIA data.
- b. Heavy Fuel Oil (HFO) was allocated to the industrial sector.
- c. Petrol and diesel were mainly allocated to the transport sector. Aside from a few processes using diesel generators, the main use for these fuels is in transport; regardless of the sector. More detailed data may reveal a more nuanced picture of where these fuels are used outside the transport sector (e.g. Diesel generators) but such data is not immediately accessible or available. Assumptions based on investigative work by Sustainable Energy Africa were used to determine the portion of magisterial district fuel sales that took place within the municipal boundary.
- d. According to a National Treasury Report (2003) over 70% of paraffin is consumed by households. Due to the age of this data and uncertainty as to the apportioning of the remaining paraffin, paraffin use was entirely to the residential sector.
- e. Liquid Petroleum Gas (LPG) total was obtained from the SAPIA data and was disaggregated by sector according to the proportions in each end-use sector, as per the most recent national disaggregated energy balance (2000) downloaded from the Department of Energy's website. A more accurate LPG accounting would need to be sourced through smaller outlets and data may not be readily accessible.

Coal and Biomass

Coal and Biomass (e.g. wood) consumption data was unfortunately not accessible during the time of the study as the consumption quantities are not monitored and recorded for municipal areas at a local, sub-national or national level. It is recommended for future studies that more research be undertaken to obtain this data. An exercise can be taken to identify the larger industries in the area and request annual coal and wood usage quantities to include within the next GHG inventory.

Municipal Data

Electricity

At the local level, detailed electricity data (covering redistribution from the municipality to the community) was easily accessible from the Electricity Department. However, insufficient information was available at the time of compiling the inventory to support the disaggregation of data from the designated Municipal Tariff Codes into customer categories i.e. Demand-side sectors. To enhance the accuracy and the relevance of future inventories, a table of tariff codes (along with descriptions for the various categories) should be supplied by the municipality so that consumption can be correctly allocated by sector. An example of such a table is given in Table 6 below.

Table 6: Sample table of Municipal distributed electricity by Tariff Code and the allocated end user category/sector

Description	Tariff Code	Allocated Sectors
Sport Facilities	570	LG operations
Buildings and Facilities	500	LG operations
District Council	581	Commercial/Institutional
Street lights & traffic lights	580	LG operations

Business & Small Industry	521-538	Industry
Domestic (low income)	201. 250. 251. 501	Residential
Bulk consumers /Large Industry	597-598	Industry
Domestic (mid to high income)	502-518	Residential

Waste

The total quantities of solid waste generated within the municipal area were available from the Waste Management Department from January to December 2012. Waste data received for this period was categorised into 5 composition categories: Glass, Mixed Solid Waste, Paper, Plant debris, and Yard waste. The waste quantities were not disaggregated further into allocated sectors by end user (such as commercial, residential and industrial). According to the GHG protocols, waste generation is reported as one sector within the GHG report.

eNaTiS (Electronic National Traffic Information System)

Live vehicle numbers as at June 2013 were sourced from the *eNaTiS* database which includes all vehicles that are registered within a registering authority. Within Nelson Mandela Bay there were two registering authorities: one in Port Elizabeth and one located in Uitenhage, that were accounted for within the study. However it should be noted that there may be vehicles that are registered within a particular municipal authority but are utilized and located in different areas of the country for a number of practical reasons.

It is useful to track over time the number of vehicles per population and the number of public versus private vehicles. The transport section below provides further details of the assumed transport modal split for Nelson Mandela Bay.

Table 7: Live vehicle categories and assumed classification

eNaTiS category	Assumed vehicle type
Heavy load vehicle (GVM>3500 Kg. not to draw)	Freight
Heavy load vehicle (GVM>3500Kg.equip to draw)	
Light load vehicle (GVM 3500Kg or less)	
Special Vehicle	Other
Unknown	
Light passenger mv(less than 12 persons)	Private
Motorcycle / Motor tricycle / Quadrucycle	
Heavy passenger mv (12 or more persons)	Public
Minibus	

StatsSA 2011 Census data

Municipal statistical data was obtained by the Statistics South Africa (StatsSA) from the recent National 2011 Census including demographic, household and household services information. All household and per capita figures reflect the data from the year 2011.

Gross Value Added Value (GVA) from Quantec

Gross Value Added (GVA) figures were obtained from Quantec for Nelson Mandela Bay Municipality, Mpumalanga and South Africa. The GVA measures the contribution to the economy of each individual producer, industry or sector. The GVA is equal to Gross Domestic Product (GDP) minus the taxes and subsidies. GVA also allows for regional analysis and productivity comparisons to be made. These figures were readily available and therefore were used for the per capita estimations within the study.

Carbon Inventory

Emission Factors

All the emission calculations performed in this report used emission factors (EFs) that have been published by research authoritative organizations such as Energy Research Centre of the University of Cape Town, Energy Information Administration (EIA) and Intergovernmental Panel on Climate Change (IPCC) reports. Emission factors used are region-specific, where available these are listed in the table below.

The greenhouse gases that are quantified and included within the calculations of the GHG Inventory are the emissions of carbon dioxide (CO₂), methane (CH₄) and nitrogen oxide (N₂O) from fossil fuel combustion. However due to the aggregated CO₂ equivalent factor used for electricity related emissions, individual emissions disaggregated by gas are not reported explicitly. Waste disposal and wastewater are also considered source of greenhouse gas emissions.

For liquid and solid fuel combustion, individual gases are converted to a carbon dioxide equivalent (CO₂e), which is the standard unit that accounts for the different strengths of each respective gas and its contribution to climate change; it is called the *global warming potential*. The global warming potential conversion factors are outlined by the UNFCCC for national reporting and in the IPCC's Second Assessment Report. For example:

1 unit CO₂ is equivalent to 1 CO₂e;

1 unit CH₄ is equivalent to 21 CO₂e and

1 unit N₂O is equivalent to 310 CO₂e.

Therefore it must be noted that the results of a CO₂e study will have significantly higher figures than a CO₂ analysis. The emission factors used in the calculations are outlined below in Table 8

Table 8: Greenhouse Gas emission factors for South Africa

Fuel Type	Unit	tCO ₂ e per unit			Total tCO ₂ e	Reference
		CO ₂	CH ₄	N ₂ O		
Diesel	litres	0.002687000	0.000003626	0.000021760	0.002702000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Petrol	litres	0.002264000	0.000000327	0.000000020	0.002277000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Aviation Gasoline	litres	0.002192000	0.000000313	0.000000019	0.002205000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Jet Kerosene (Jet fuel)	litres	0.002501000	0.000000350	0.000000021	0.002516000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Illuminating Paraffin	litres	0.002562000	0.000000356	0.000000021	0.002577000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Heavy Furnace Oil	litres	0.002953000	0.000000382	0.000000023	0.002968000	
Electricity	kWh				0.001030000	Eskom Annual Reports. 2011 (including 0.00004 T&D losses)
Natural Gas	litres	0.002009000	0.000000179	0.000000004	0.002014000	www.emissionfactors.com (Using 4th Assessment Report GWP)
LPG	litres	1.618000000	0.000128200	0.000002565	1.622000000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Coal (Bituminous)	kg	0.002625000	0.000000027	0.000000040	0.002458000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Anthracite	kg	0.000000100	0.000000000	0.000000000	0.002643000	www.emissionfactors.com (Using 4th Assessment Report GWP)
Marine Fuels	litres	0.002766700	0.000003000	0.000289800	0.003059500	www.emissionfactors.com (Using 4th Assessment Report GWP)

Energy conversion factors

All conversion factors relating to the study are available in the electronic database. Below are the Energy Conversion factors used to convert original units into gigajoules (GJ) and the associated source of that factor.

Table 9: Energy conversion factors

Energy Source	Conversion	Units	Source
Electricity	0.0036	GJ/kWh	Energy Information Administration, USA, 2001
Coal (bituminous)	0.031	GJ/kg	Energy Information Administration, USA, 2001
Heavy Furnace Oil	0.04	GJ/litre	Energy Information Administration, USA, 2001
Diesel	0.037	GJ/litre	Energy Information Administration, USA, 2001
Paraffin	0.036	GJ/litre	Energy Information Administration, USA, 2001
Petrol	0.034	GJ/litre	Energy Information Administration, USA, 2001
LPG	0.0268	GJ/litre	The South African Pipeline Gas Association
Jet Fuel	0.04315	GJ/litre	BP Products handbook.
Aviation Gas	0.04465	GJ/litre	BP Products handbook.
Gas (Natural)	0.0268	GJ/litre	Set to same as LPG

Emission Scopes

Emission scopes were considered in this analysis, based on the guidelines of the GPC Protocol; they are used to categorise emission sources as follows:

Scope 1 emission – All direct emission sources located within the geographical boundary of the local government

Scope 2 emission – Indirect emissions that result from as a consequence of activity within the jurisdictions

Scope 3 emission – All other indirect and embodied emissions that occur as a result of an activity within the geographical boundary

Concluding remarks

In general data required to undertake the GHG inventory was accessible by the relevant stakeholders and data sources were able to assist to provide further clarification and classification to data where needed. The municipal electricity distribution data was provided in monthly quantities for financial years (June to June) and therefore two consecutive financial years were required to process a complete calendar year for the purpose of the study. NERSA is undertaking a process whereby all local data will be collected and stored in a central data base and therefore will avoid municipal data collection of this nature. It will therefore aim to standardise the municipal electricity tariff codes, which is hoped to standardise reporting across the country. Improvements in DoE's energy data would also contribute to a more accurate inventory at the municipal level.

It must be noted that NMBM have a number of energy efficiency and renewable energy initiatives underway. However, the timing of the roll-outs are uncertain, and monitoring and verification usually take place at a project-specific level so it determination of the impact on emissions has not been carried out. With a firm baseline, more detailed monitoring of the impacts of these initiatives can take place the impact and effects it has on the total urban emissions can be expressed.

3. GHG Inventory

3.1. The Energy Picture

Nelson Mandela Bay Municipality (NMBM) falls within the Eastern Cape Province of South Africa. It is one of seven metropolitan areas in South Africa, uniting the city of Port Elizabeth and the towns of Uitenhage and Despatch. It is a major seaport and automotive manufacturing center located on the south-eastern coast of Africa in the Eastern Cape Province of South Africa. The local economy is the largest of the district and is dominated by its manufacturing and automotive industries.

Indicators based off those used in other similar reports are used similarly to highlight indicators for the Nelson Mandela Bay data in Table 10 below.

Table 10: Key energy indicators in Nelson Mandela Bay Municipality

Key sustainable energy indicator	Unit of Measure	Local Level (2012)	National Level (2000)*
Energy consumption per capita	GJ/capita	26.2	53.0
GHG per capita	tCO ₂ e/capita	4.5	7.7
Energy per Gross Value Added (GVA) (R' mill)	GJ /GVA	481.9	1095.0
GHG per Gross Value Added (GVA) (R' mill)	tCO ₂ e/GVA	83.0	159.0

*Source: Department of Energy: South African Energy Synopsis 2010: data for 2006 only/SA's 2nd National Communication, 2011, data for 2000 only

The NMBM GHG analysis is outlined in the following sections below. Data summaries are provided in tables with a selection of graphs representing energy and emission results for **Supply-side** (Electricity, Waste and Fuel), and **Demand-side** energy and emissions, followed by concluding summaries.

3.2. Supply side energy and emissions

Supply-side refers to the classification of both primary and secondary energy types that are distributed to the demand-side sectors for use; these include liquid and solid fuels, electricity and renewables.

Table 11 and Figure 3 below provide an overview of the energy types used and consumed in the NMBM area for 2012. It is clear that electricity is the dominant energy type consumed typically used for the industrial, commercial and residential sectors. Diesel and petrol liquid fuels are the second and third largest fuel type consumed in the area and would typically be associated with transport for the main economic activities in this area.

It should be noted that although electricity accounts for only 46% of energy consumed, the associated GHG emissions accounts for 75.6% of the total emissions and this is as a result of the high emissions factor allocated to electricity in the South African context, in which the majority of electricity is coal-powered.

The Supply-side energy data results are expressed in the table and graphs below.

Table 11: Nelson Mandela Bay energy consumption and energy-related emissions by fuel type. 2012

NMBM 2012 Energy, Carbon Figures (conversion factors as per IPCC)		
Energy Source	Carbon (tCO₂e)	Energy (GJ)
Electricity	3 762 433	13 681 573
Diesel	600 338	7 932 496
Petrol	524 245	7 185 633
LPG	1 771	27 704
Heavy Furnace Oil	64 466	933 920
Paraffin	25 806	382 818
Aviation Fuel	1	23
Sub-total	4 979 059	30 144 166

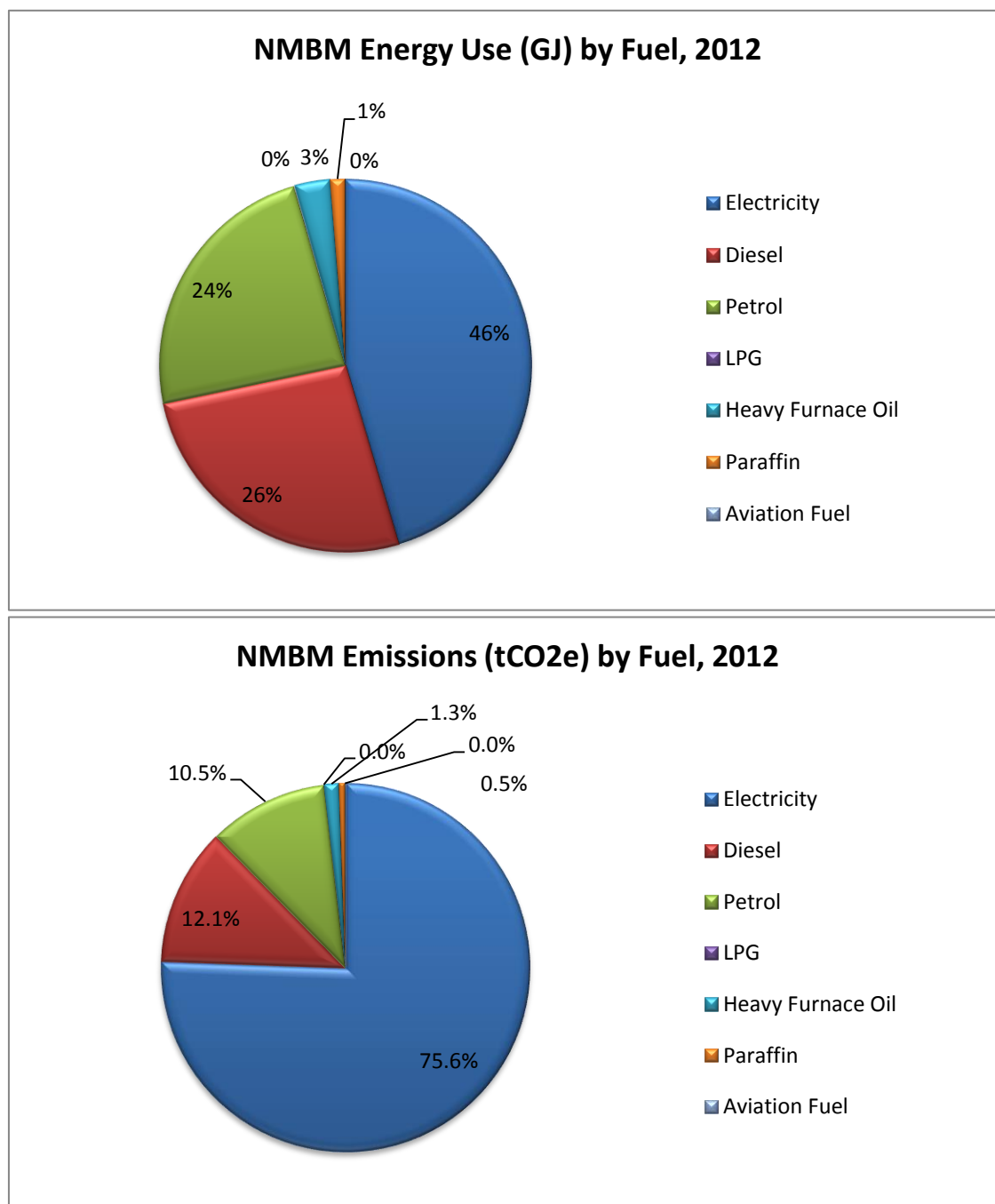


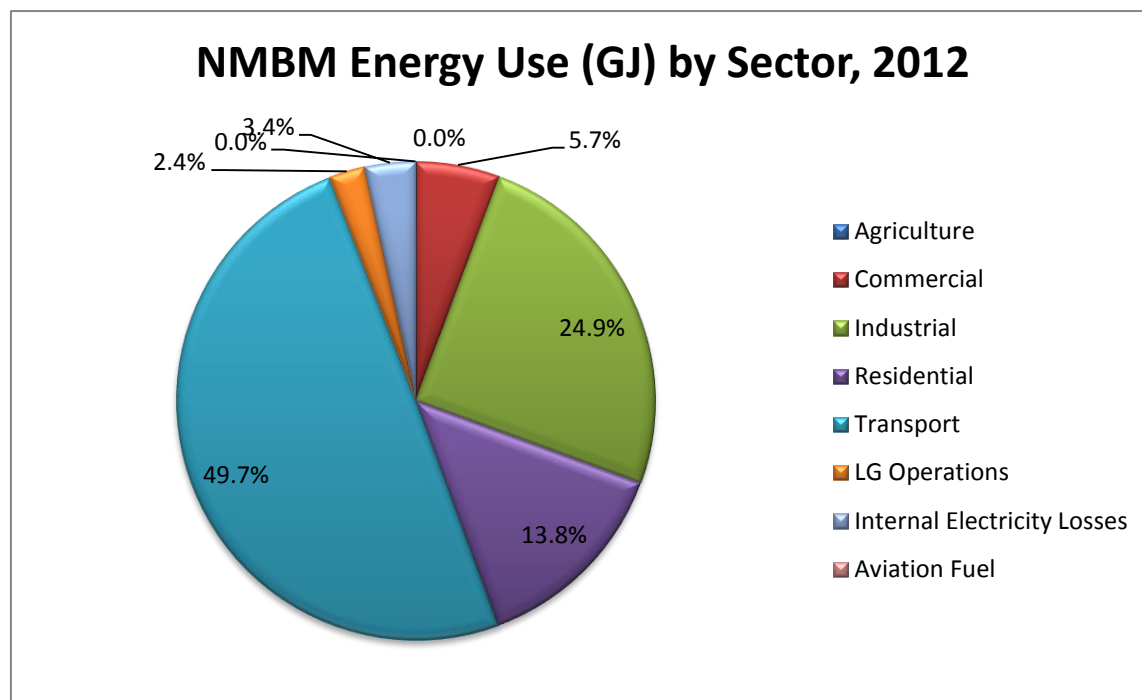
Figure 3. Energy supply and resultant emissions categorised by fuel type, 2012.

It is important for the sustainability of the environment that the communities and businesses located in the area contribute towards a low carbon future in collaborative efforts with the municipality. Joint cooperation is needed in order to address the challenges posed by high energy demand, to enable diversification of energy, increased energy efficiency and decreasing GHG emissions by increasing the use of renewables.

Through the increased number of renewable project since the introduction of the Renewable Energy Independent Power Producer Procurement (REIPPP) program in South Africa’s mix of energy; these activities will significantly contribute to the reduction of emissions in the country as a whole. Furthermore the municipality has been creating favourable conditions for the take up of Small Scale Embedded Generation, which will also contribute to the energy security and reduce the carbon footprint of the area.

3.3. Demand-Side Energy

Demand-side energy refers to the energy end-user, be they residential, commercial, industrial, or agricultural users of energy within and urban jurisdiction. For reference to the section below the concluding graphs of the demand-side sectors are represented below. From Section 3.3.1 a breakdown of the different fuel (electricity, liquid fuel and waste generation) types will illustrate the contribution per sector.



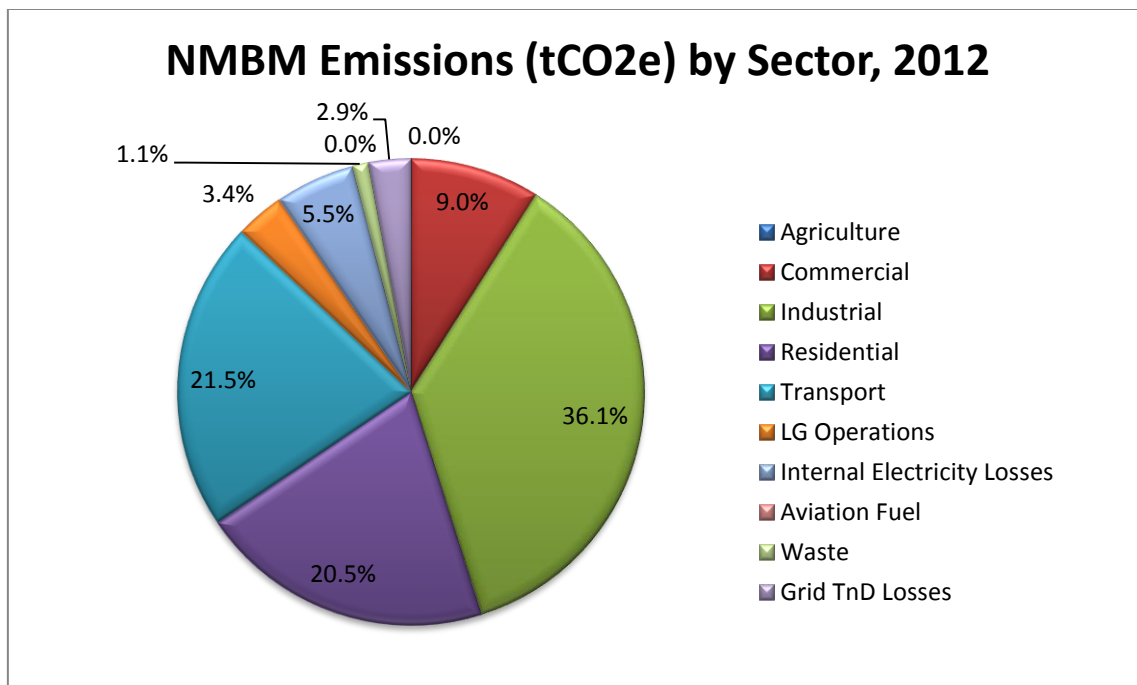


Figure 4: Energy consumption and energy related emissions by sector in NMBM, 2012.

3.3.1. Electricity

Electricity is supplied by South African electricity public utility, Eskom. Eskom supplies electricity directly to end users within the municipal boundary, and also supplies bulk quantities to municipalities across South Africa for municipalities to supply electricity through the municipal electricity grid to end users within the boundary.

Electricity consumption data was obtained from Eskom, who provides electricity to a small number of individual customers and also bulk monthly quantities to the local authority for redistribution to the rest of the community. The local authority provided the detailed data recorded based on the local authority redistribution tariff codes. Given the great importance of electricity in GHG emissions, especially taking South Africa’s energy mix into account, it was a key data requirement in the compilation of the inventory.

Eskom Distribution and Sectoral Analysis

During 2012, Eskom distributed a total of 3800 GWh to the Nelson Mandela Bay area. The Industrial sector is the main consumer constituting 48.1% of the electricity, followed by the residential sector at 27.5%, and commercial sector at 12.4%. Agriculture, Local Government Operations and Losses make up the remaining 12%. Figure 5 provides a breakdown of Eskom’s direct customer supply by sector.

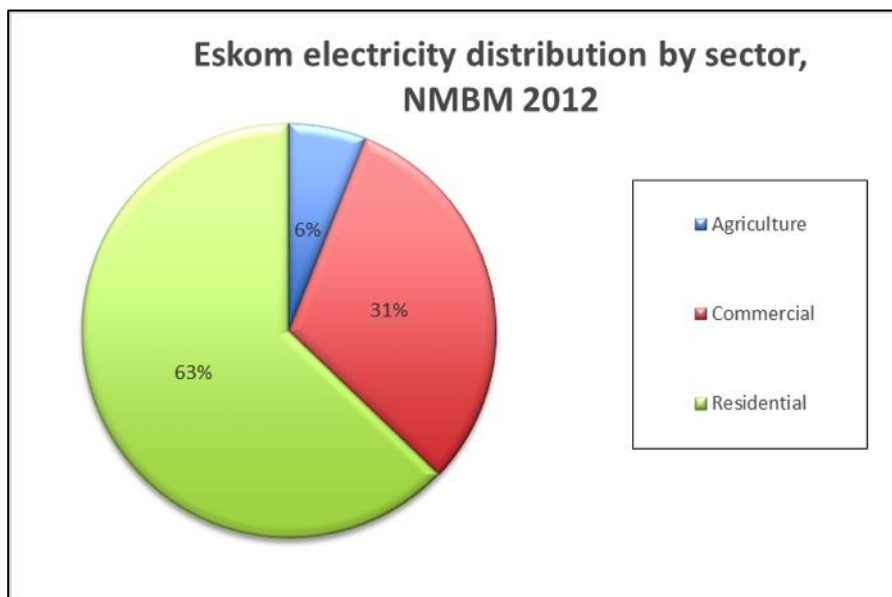


Figure 5. Eskom’s electricity supply to sectoral customers in NMBM, 2012 (Source: Eskom).

Nelson Mandela Bay Municipal Distribution

Nelson Mandela Bay receives bulk electricity from Eskom, which it then re-distributes to end users within the community. For the year 2012 NMBM received a total of 3.80 GWh from Eskom, of which it captured a recording of a total of 3.51 GWh that was redistributed to the community. An annual total of 0.29 GWh could not be accounted for and was classified as electrical losses, constituting 7.6% of the bulk electricity total received by Eskom. The percentage losses are in line with other municipalities in South Africa in reference to the publication: State of Energy in South African Cities 2011 by Sustainable Energy Africa. These electricity losses can be concluded as technical (transmission and distribution through the electrical infrastructure) and non-technical (non-metered electricity use and theft) losses.

Due to either a lack of metering or information captured by local government operations it is uncertain whether the data in the previous section provides a true reflection of the internal municipal consumption of electricity. It is believed that a certain portion of these losses is also due to the municipality’s operational consumption. However more detailed information could not be obtained from the municipal electricity department at the time of writing. Furthermore, assumptions had to be made with regards to the accounting for the municipal own energy consumption, and resultant emissions. A more comprehensive inventory would endeavour to obtain more detail on the electricity consumption within the municipal operations, which would be a valuable resource to the municipality with regard to monitoring and reporting its efforts towards becoming more energy efficient.

Based on the available figures, Table 12 outlines the electricity consumption by sector. It was assumed that the difference between electricity purchased from Eskom, and the electricity sold to end-users accounts for technical losses in the municipalities network, as well as own-consumption that is not explicitly accounted for (where data was not available for electricity consumed for municipal operations).

Table 12. Summary of Nelson Mandela Bay distribution of electricity to end-users, 2012).

Description	Allocated Sector	2012 (kWh)	Percentage
Water and Sewerage (estimate from 2013/14)	LG operations	105 875 267	2.8%
Street Lights	LG operations	57 531 930	1.5%
Metro Buildings (estimate from 2013/14)	LG operations	5 127 233	0.1%
Electrical Losses		288 207 443	7.6%
Small Business	Commercial	29 117 187	0.8%
Medium Business	Commercial	439 773 030	11.6%
Large Business	Industrial	1 698 026 257	44.7%
EBSTEAM	Industrial	130 145 083	3.4%
Residential (Conventional Meter)	Residential	245 921 775	6.5%
Residential (Prepaid)	Residential	740 882 192	19.5%
Residential (Free Basic)	Residential	57 461 250	1.5%
Total		3 798 068 647	100%

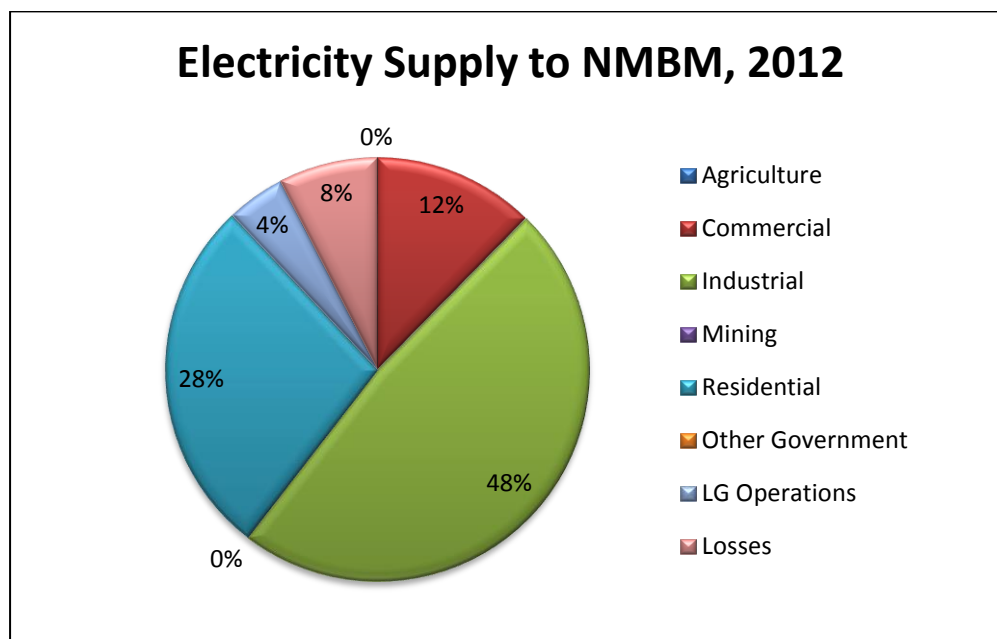


Figure 6. Sectoral representation of Nelson Mandela Bay distribution of electricity, 2012.

Sectoral analysis of total electricity consumption in Nelson Mandela Bay

The summary provided in Table 12 and Figure 5 provides the total electricity consumption in the Nelson Mandela Bay area distributed by the local authority, represented by the Demand-side sectors. Figure 6 shows the sectoral demand including electricity supplied by Eskom to its on customers.

It is clearly seen that the industrial sector dominates as the main electricity consumer in the area with residential sector consumption at 28%, and Commercial at 12%. It is by these sectors where electricity saving measures can be implemented to curb and reduce the electricity and associated emissions. With that in mind, it is not in the municipality's control to enforce low carbon measures within these sectors, however partnerships can be established and strengthened to promote renewable and energy efficient solutions. It should be noted that the EBSTEAM electricity consumption switched boilers mid-way through 2012, and these industrial processes now make use of other fuels to power their boilers. The quantities of these fuels (coal, and biomass) were not known at the time of writing.

Table 13. Total Electricity consumed in Nelson Mandela Bay - sectoral representation, 2012

Sector	2012 (kWh)
Agriculture	143 123
Commercial	469 626 520
Industrial	1 828 171 340
Residential	1 045 754 082
LG Operations	168 534 430
Losses	288 207 443
TOTAL	3 800 436 938

Monthly analysis of electricity consumption

The monthly electricity consumption for Nelson Mandela Bay is represented in Figure 7, indicating the monthly consumption is on average 298 MWh per month with a demand fairly flat throughout the year, declining somewhat towards the year-end, most likely as a result of many large industries shutting down over the holiday season. As temperature fluctuations are not as extreme as many other parts of the country, the common winter peak arising from electricity used for heating in the residential sector is absent.

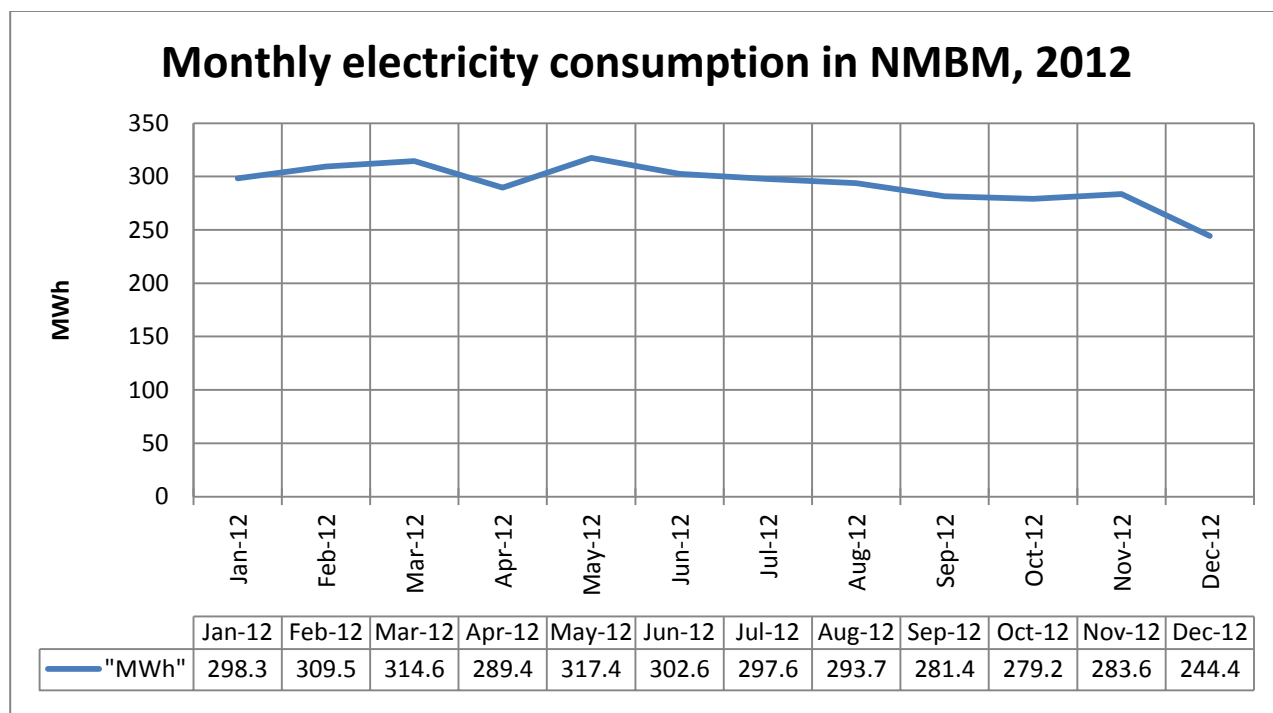


Figure 7. Monthly electricity consumption for Nelson Mandela Bay area for 2012.

Residential Sector: fuel types

The graph below represents data from the 2011 Household Survey (Census) which illustrates the household fuel mix in meeting the main household energy needs, notably lighting, cooking and space heating.

The 2011 Census data revealed that there are 324292 households in NMBM. Lighting can be used as a proxy for electrification, since electrified households use electricity for lighting first and foremost. The proportion of houses using electricity for lighting can therefore conclude that the majority of households in the municipal area are electrified at 90.65% (Figure 8) compared with the national estimation of 82% households electrified in South Africa.

For comparative purposes the list of Provinces are listed below (Figure 9) demonstrating the percentage of households that use electricity for lighting. This graph reiterates that Nelson Mandela Bay’s electrification of houses is much higher when compared to national figures, and even the provincial figures which are the lowest in the country, reflecting the high rates of non-electrification outside of the metro.

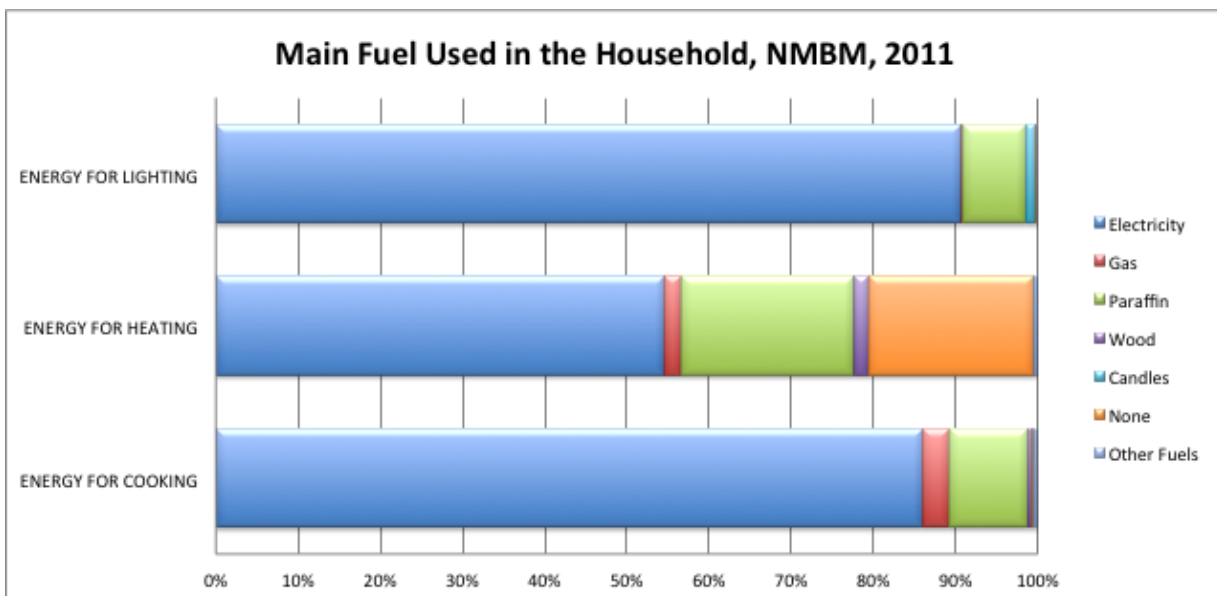


Figure 8. Fuels used for lighting, heating and cooking in NMBM, 2011. (Source: StatsSA)

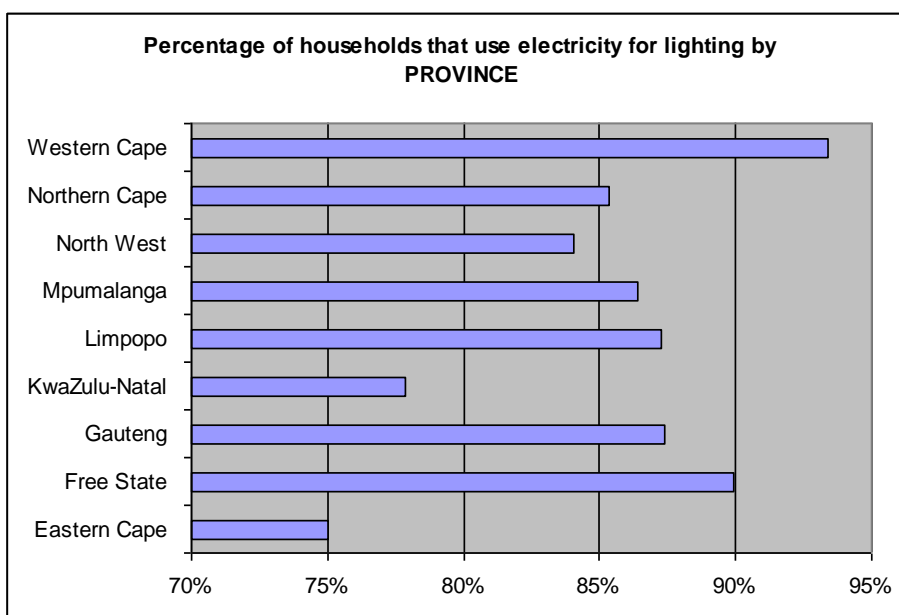


Figure 9. Comparative study by province of the households that have access to electricity for lighting purposes (Source: StatsSA)

Roughly 10% of households still use paraffin for cooking, due to the high cost of electricity, and therefore the associated health and fire risks associated with paraffin stoves remains.

Residential Sector: electricity consumption

The monthly electricity data explanations that were obtained from NMBM provided insufficient information to undertake a detailed analysis determining the proportion of households in the residential sector that can

be categorized in terms of household income, which could then further support conclusions in relation to estimated consumption patterns and revenue received by these domestic customers respectively.

3.3.2. Liquid Fuel Consumption

Liquid fuel consumed within the Nelson Mandela Bay magisterial district, data obtained by SAPIA, is represented in the below table accompanied by the assumed sectoral categories outlined in the methodological section of the report. Diesel and petrol are the two liquid fuels that are largely used in the area. The consumption thereof is assumed to be by the transportation sector. As per the State of Energy Reports compiled by Sustainable Energy Africa for other South African cities, assumptions needed to be made about the proportional allocation to municipal district. For Nelson Mandela Bay, figures of 80% and 20% of magisterial district were applied to the SAPIA data for Port Elizabeth and Uitenhage respectively.

Table 14. Fuel Volume Sales by SAPIA. DoE and assumed sector consumers. 2012

Liquid Fuel types	2012 (litres)	Assumed Sector
Diesel	214 391 774	Transport
Petrol	211 342 135	Transport
Heavy Furnace Oil	23 348 000	Industry
Paraffin	10 633 827	Residential
Aviation Gasoline	515	Aviation
LPG	1 112 617	Agriculture/Commercial/Residential
TOTAL	460 828 871	

From the diesel and petrol totals above the municipality consumes the below quantities for the municipal vehicle fleet which can therefore be subtracted from the bulk magisterial district totals for these liquid fuels.

Table 15. Nelson Mandela Bay Municipal liquid fuel consumption for 2012.

Liquid Fuel types	2012 (litres)
LG Diesel	1 995 770
LG Petrol	1 636 390
TOTAL	3 632 160

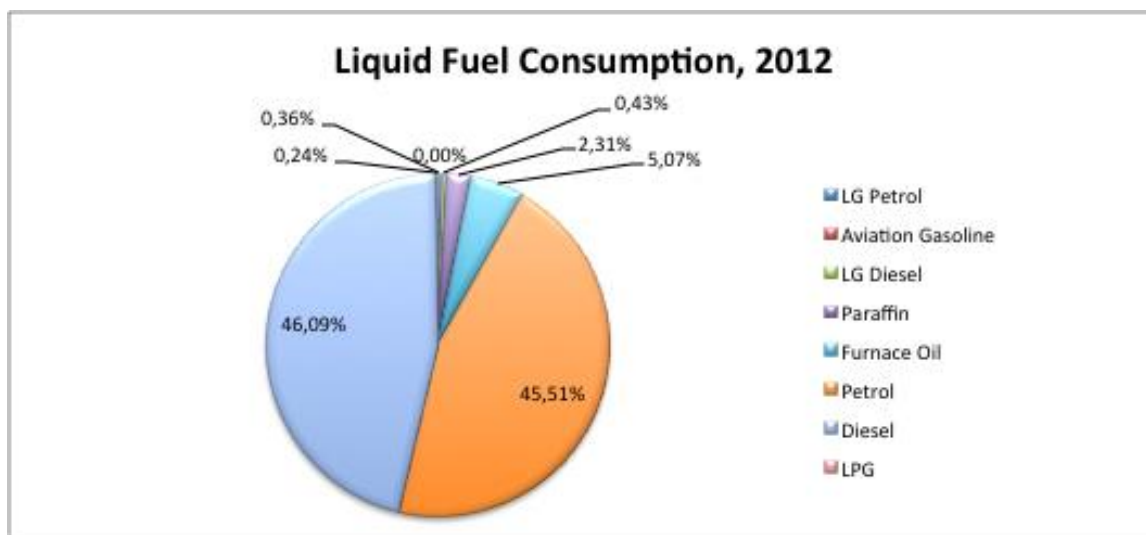


Figure 10. Nelson Mandela Bay fuel consumption by fuel type, 2012

Transportation Sector

Transportation is seen as the main liquid fuel consumer in this municipal area and is consistent with other municipal areas as well as at the national level. Transportation is not solely a local government mandate and therefore it is encouraged that NMBM seek partnership with neighbouring municipal authorities, especially to prioritize sustainable transportation in the fast growing economy area. It is also encouraged that the municipal areas incorporate vehicle population management and integrated public transportation systems into all future planning policies to ensure fuel emissions can be monitored, measured and managed in a verifiable manner to ensure increased reduction in emissions in this sector.

Table 16. Total live vehicles in Nelson Mandela Bay as of June 2013

eNaTiS category	Sub-totals	Assumed vehicle type	Totals
Heavy load veh (GVM>3500 Kg. not to draw)	5971	Freight	77746
Heavy load veh (GVM>3500Kg.equip to draw)	5795		
Light load veh (GVM 3500Kg or less)	65980		
Special Vehicle	4681	Other	5434
Unknown	753		
Light passenger mv (less than 12 persons)	170588	Private	183329
Motorcycle / Motor tricycle / Quadrucycle	12741		
Heavy passenger mv (12 or more persons)	881	Public	6505
Minibus	5624		
Total	273014		273014

The total numbers of vehicles within the Nelson Mandela Bay area are presented in the above table.

Transport sector: Summary remarks

From the 2011 population figures the following transportation indicators are derived regarding the transportation sector in Nelson Mandela Bay as per the table below. It is important to keep in mind that transportation accounts for some 50% of total energy consumption in the municipality. A key determinant of the long-term sustainability of a city is embedded in its spatial form. To reduce the overall energy consumption of NMBM and reduce its carbon emissions, planning should pay special attention to:

1. The avoidance of urban sprawl that would lead to disproportionate increases in energy required for transportation as well as increased congestion, and higher levels of local pollution.
2. Models of effective densification in city planning that reduce the need for mobility by motor vehicles.
3. Effective public transport systems, and non-motorised transport options (such as cycle lanes and improved pedestrianisation) also contribute to reduced energy intensity and reduced carbon emissions.

Table 17. Transport indicators for Nelson Mandela Bay

Key Transport Statistics	Unit of Measure	Local Level (2011-2013)
Households owing private vehicles	Percentage (%)	36.0
Private vehicles per household owning private vehicles	No. of veh/household	1.58
Private vehicles per capita	No. of veh/capita	0.16
Private vehicles per household	No. of veh/household	0.56

3.3.3. Waste Generation

Waste generation by category

The municipality's waste department for the period January to December 2013 provided waste quantities in Table 19 below. Waste data was categorised as per the table and reported as an individual sector. Mixed/Municipal Solid Waste accounts for 52% of the landfilled waste in Nelson Mandela Bay. The opportunity for recycling is an option that should be explored in the municipality to decrease the amount of disposed MSW, create job opportunities and enhance general environmental good behaviour.

Table 18. Total waste measured and reported by Nelson Mandela Bay Municipality.

Waste: Composition type	2012 (tonnes)
Plant debris	67 976
Yard Waste	151 717

Glass	2367
Municipal Solid Waste	242 446
Paper - Mixed General	3574
Total	467 780

It is important that waste quantities are monitored and evaluated annually (bi-annually) in future in order to manage waste minimization by the respective composition categories and assumed sectors.

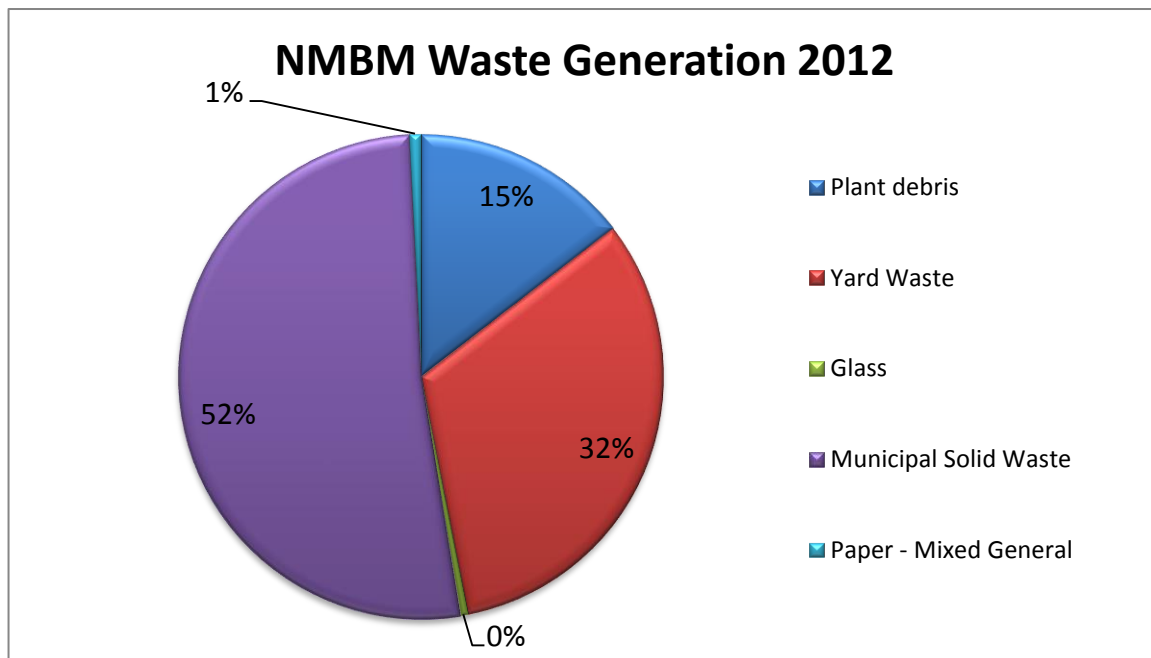


Figure 11. Waste measured and reported in Nelson Mandela Bay by category, 2012.

3.4. Demand side energy and emissions conclusions

Demand-side energy refers to the energy consumed by the energy end user, i.e. sectors such as residential, commercial, industrial users of energy within an urban jurisdiction. The table and pie charts below illustrate the energy use and carbon emissions across sectors within this municipal boundary. It is evident again that the industrial sector dominates the energy sector accounting for the larger proportion of energy consumed (20.1%) and carbon emitted (36.8%) in the area, attributed energy-intensive intensive manufacturing activities.

Transportation as a sector is also seen as a high consumer of energy with 82 971 vehicles registered within the municipal area, 40% of which are heavy and light load vehicles classified as freight vehicles can directly attribute to these results. Transportation contributes to 44% of the energy used and 9% of the emissions emitted in Nelson Mandela Bay.

Table 19. Sectoral Analysis of Energy and Emissions, 2012

Sector	Energy (GJ)	Emissions (tCO₂e)
Agriculture	1 280	191
Commercial	1 707 030	465 977
Industrial	7 515 337	1 874 355
Residential	4 158 097	1 061 778
Transport	14 988 648	1 114 935
LG Operations	736 205	176 497
Internal Electricity Losses	1 037 547	285 325
Aviation Fuel	23	1
Waste	-	58 770
Grid TnD Losses	-	152 017
TOTAL	30 144 166	5 189 846

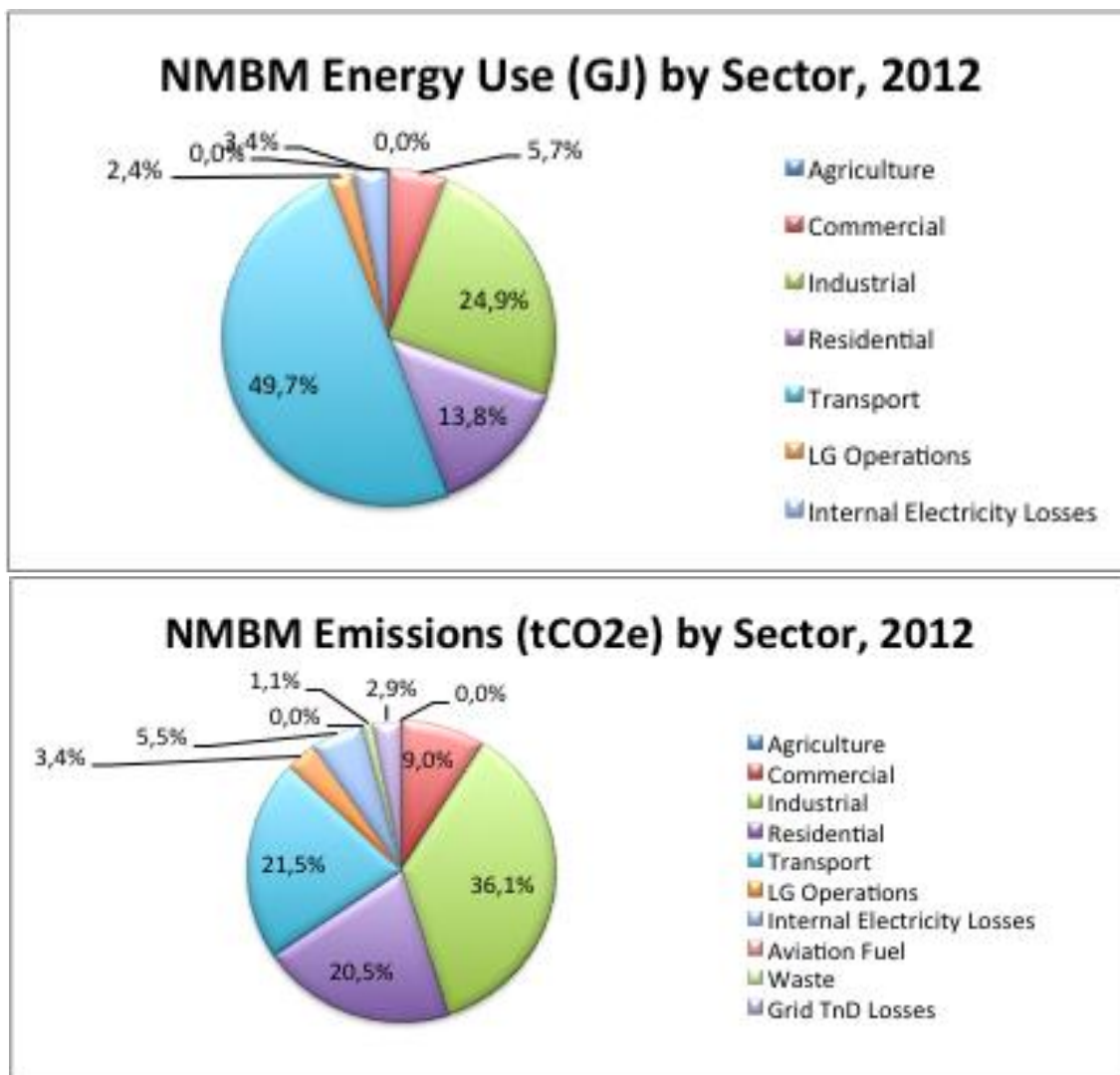


Figure 12. Energy consumption and energy related emissions by sector in NMBM, 2012.

Local Government operations accounts for a very small proportion of the overall energy used and carbon emitted within the municipal area, however it is evident that the greater proportion of energy consumed is by the municipal utility services and street lights (Figure 13). Local governments have a large role to play in terms of leading by example to implement energy efficient and renewable energy measures and to advocate to the demand-side sectors to undertake similar measures for emission reduction.

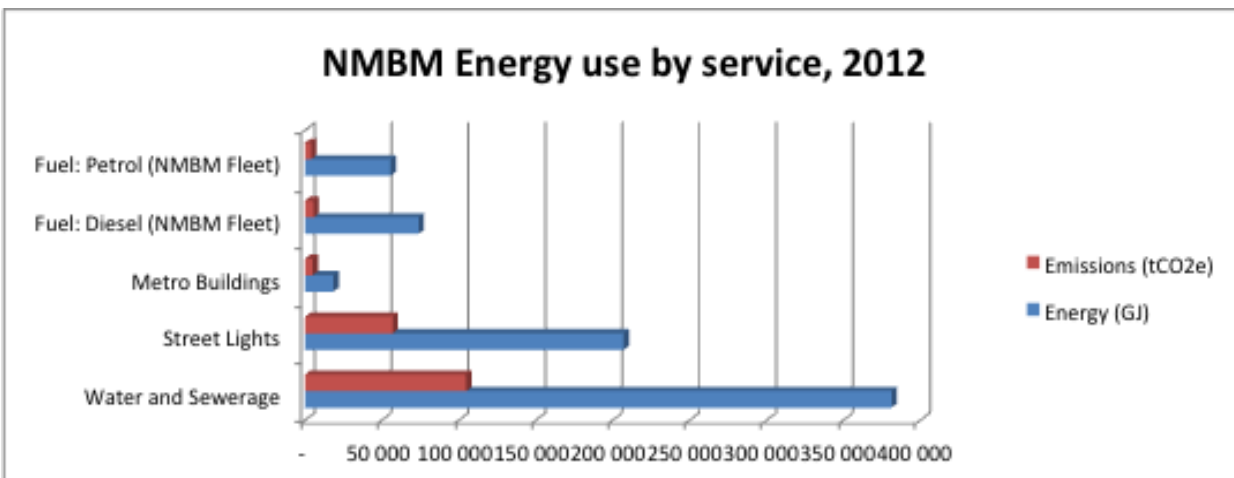


Figure 13. Energy used and carbon emitted by the NMBM operations, 2012

Electricity is the dominant energy type used in Nelson Mandela Bay, which is consistent with other municipalities in South Africa. The sectors consuming the greater proportion of energy in the area are the industrial and transportation sectors. Just less than 5.2 million tonnes of carbon equivalent emissions were accounted for in year 2012. 90.8% emitted by the community and 9.2% emitted by the local authority (with the inclusion of electrical losses). Per capita, this accounts for 4.5 tCO₂e per capita for the Nelson Mandela Bay area based on 2011 population figures.

It must be noted that aviation fuel consumed was not included within any of the previous sections and only included in this summary table in this section. The emissions from aircrafts and the boundaries of these emissions is largely contested and therefore only included within the summary table as the last inventory. There is also a quantity of emissions that indirectly result from consumption of electricity within the municipal boundary, but represent losses in the national grid. These emissions are treated alongside Aviation Fuel as part of Scope 3. The inclusion of the aviation fuel and grid transmission losses within the results increases the per capita of carbon emissions by 0.2 tCO₂e, which is insignificant when considering the results as a whole.

Table 20. NMBM Energy and Emissions: Government versus Community

2012	tCO ₂ e	
	Community	Local Government
Waste	58 770	
Electricity	3 310 258	166 849
Fuel	1 206 979	9 648
Supply Sub-total	4 576 006	176 497
Supply total	4 752 503	
Percentage	96,3	3,7
Electricity Losses		285 325
Module Totals	4 576 006	461 822
Total	5 037 828	
Percentage	90,8	9,2

	Community	Local Government
Module Totals	4 576 006	461 822
Total	5 037 828	
Percentage	90,8	9,2
Carbon Emissions per capita	4,37	
Aviation Fuel	1	
Grid TnD Losses	152 017	
	4 728 025	461 822
NMBM TOTAL EMISSIONS	5 189 847	
Carbon Emissions per capita	4,50	

Table 21 shows the emissions by sector per emission scope as per the international standards for local governments.

Emission scopes are based on the guidelines of the GPC Protocol; they are used to categorize emission sources as follows:

Scope 1 emission – All direct emission sources located within the geographical boundary of the local government

Scope 2 emission – Indirect emissions that result from as a consequence of activity within the jurisdictions

Scope 3 emission – All other indirect and embodied emissions that occur as a result of an activity within the geographical boundary

Table 21. Greenhouse Gas emissions by sector per scope in Nelson Mandela Bay 2012

2012 Community GHG Profile Reporting Standard						
Sector	Sector Total (tCO2e)	Subsector	Subsector Total (tCO2e)	Subtotal (tCO2e)	GHG Emissions Sources	GPC No.
STATIONARY UNITS	3 854 475	Agriculture	191	49	Stationary Units Agricultural Direct Emissions (Scope1)	I
				142	Stationary Units Agriculture Energy Indirect Emissions (Scope2)	I.1.ii
		Residential Buildings	1 061 778	26 481	Stationary Units Residential Direct Emissions (Scope1)	I.1.i
				1 035 297	Stationary Units Residential Energy Indirect Emissions (Scope2)	I.1.ii
		Commercial/Institutional Facilities	918 151	1 047	Stationary Units Commercial/Institutional Facilities Direct Emissions (Scope1)	I.2.i
				917 105	Stationary Units Commercial/Institutional Facilities Energy Indirect Emissions (Scope2)	I.2.ii
		Industrial Energy Use	1 874 355	64 466	Stationary Units Industrial Energy Use Direct Emissions (Scope1)	I.4.i
				1 809 890	Stationary Units Industrial Energy Use Energy Indirect Emissions (Scope2)	I.4.ii
MOBILE UNITS	1 124 584	On-Road Transportation (Cars, LDV, HDV/Buses, others)	1 124 584	1 124 583	Mobile Units On-Road Transportation (Cars, LDV, HDV/Buses, others) Direct Emissions (Scope1)	II.1.i
				1	Mobile Units Aviation Indirect Emissions from Inter-City Domestic Flights (LTO and Cruise) (Scope3)	II.4.iii
WASTE	58 770	Solid Waste Disposal	58 770	58 770	Waste Solid Waste Future Indirect Emissions from Community Generated Waste Landfilled in the Community in the Analysis-Year (Scope1)	III.1.i
Other Indirect Emissions	152 017	Transmission & Distribution	152 017	152 017	Grid-related Transmission and Distribution Losses (Scope 3)	VI.1
5 189 846		TOTAL Community Emissions (tCO2e) by 2012 Accounting Standard (for benchmarking)				

Aggregate tCO2e by Scope	tCO2e Scope-1	1 275 395
	tCO2e Scope-2	3 762 433
	tCO2e Scope-3	152 019
Total	5 189 846	

3.5. Recommendations

The following recommendations are listed below in response to the GHG analysis within this report under the respective headings. These should be considered when developing and outlining objectives and actions towards Urban Low Emission Development through the Urban-LEDS project and beyond.

3.5.1. Energy data collection and analysis:

- Assign responsibility to a competent municipal staff member to undertake this specific data management task and score performance under key performance areas (KPA).
- Repeat data collection and analysis on an annual basis.
- Store data readily available on a central data base system.
- Installation of an internal energy management system.
- Disseminate and publically display GHG findings within the municipality to respective sectors and to external stakeholders (newspaper, website, and posters).
- Annually report energy data and climate action to the HEAT+ and carbonn Climate Registry (cCR).
- Lobby the Department of Energy to ensure consistency of the SAPIA data, as liquid fuels represent a large contribution to the energy consumption within the municipality, and the inventory depends on being able to source reliable and consistent data.

3.5.2. Continuation of measuring, monitoring and reporting:

- Put systems in place to measure electricity consumed by individual local government operations (buildings, water and sanitation facilities, street and traffic lighting).
- Continuously report on individual consumption patterns and report to respective municipal platforms.
- Report and record to a central data base any projects relating to energy savings that will have an impact on electricity consumption from local government operations – publically disseminate information to the public.

3.5.3. Measures and solutions:

- Local Government operations
 - Measure and report all municipal electricity consumption by local government operations (services and facilities).
 - Monitor fuel consumption by the municipal vehicle fleet; put measures in place to limit fuel consumption.
 - Measure and report on recycling initiatives by municipal staff and buildings, include these records within waste management database and report to respective platforms on performance.
 - Introduce non-motorised transportation mechanisms for municipal staff.
 - Reduce car-based travelling allowance for staff members to encourage less fuel consumption.
 - Subsidise public transportation for respective staff members.
- Waste Management

- Initiate residential waste separation and recycling initiatives and incentives to the residential, commercial and residential sector.
- Develop bi-annual reports of waste generation quantities and report to respective internal and external platforms.
- Electricity use
 - Undertake energy savings campaigns amongst municipal staff, public and schools
 - Promote Earth Hour (normally annually in March) to 'switch off' lights and electrical appliances, and continue to participate in the Earth Hour City Challenge.
 - Annually report on electricity consumption per sector and encourage energy savings by large electricity consumers in the area (create a competitive spirit between organisations of similar nature.
 - Acknowledge and reward private sectors for energy savings.
 - Continue the pioneering work to encourage small-scale embedded generation using renewable energy, and fostering more opportunities for wheeling agreements for the purchase and sale of renewable energy within the NMBM grid with green power companies (for example the case of Amatola Green Power).
- Transportation
 - Focus on spatial planning that facilitates effective densification, and avoidance of urban sprawl.
 - Revise transportation policy to encourage non-motorised transportation
 - Encourage non-motorised transportation amongst citizens
 - Promote public transport where available.
 - Promote bicycle use.
 - Encourage car-pooling.
 - Undertake public awareness campaigns for energy efficient transportation mechanisms

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