Built **E**nvironment **P**erformance **P**lan

Addendum **A**: Climate Resilience and Responsiveness Greenhouse Gas Emissions

2019/2020

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1 Introduction

This section of the report summarizes the City of Tshwane's accounting of Greenhouse Gas Emissions Inventory (GHGEI) from the community to corporates in Tshwane. The inventory for the city started when the city entered into a partnership with South African Cities Network, and company called Eco Metrix Africa was appointed to assist the City with the development of the Greenhouse Gas Emissions Inventory for the City's 2012 - 2013 financial years.

Developing a Greenhouse Gas (GHG) emissions inventory is the first step to implementing sustainability into municipal planning and policy-making, and is the basis from which to develop a Climate Action Plan (CAP). Measuring GHG emissions is a critical first step in developing the CAP for several reasons. First, the GHG inventory identifies and quantifies major sources of GHG emissions associated with the activities and choices currently made by residents, businesses, and public institutions. Second, the inventory provides the baseline that is used to project emissions trends and develop accurate near-term reduction targets and a long-term goal consistent with the city's objectives. The 2014/15 inventory allows the city to develop, evaluate, and implement strategies and measures to achieve its medium to long-term term GHG reduction targets goals.

2 Objective of GHGEI

The main objective of the GHGEI to is measure emissions from the city operations and help understand the magnitude of the problem of emissions and indicate key policy development as well as reporting and monitoring progress towards sustainability targets. Though the GHG Inventories are only estimates & cannot be completely measured, the exercise assists in the development of Climate Action strategies and planning for the city.

3 Methodology

The Greenhouse Gas Inventory for City of Tshwane is compiled using the Intergovernmental Panel on Climate Change (IPCC) Protocol, the United Nations body for assessing the science related to climate change. The GHGI is also compiled using the C40 tool called the City Inventory Reporting and Information System (CIRIS). The tool is a flexible Excel-based tool for managing and reporting city greenhouse gas inventory data. Based on the Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) standard, the tool facilitates transparent calculation and reporting of emissions for all sectors. The inventory is also compliant with the ICLEI Local Government GHG Emissions Analysis Protocol.

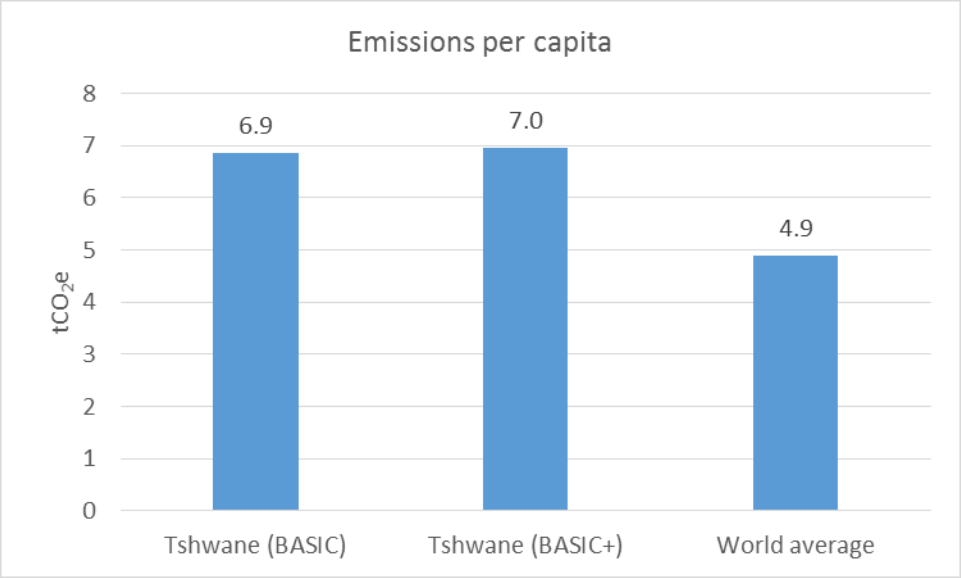
There are three main inventory sectors for Tshwane GHGEI, namely: Energy, Transport and waste with Agriculture, Forestry and Land use being excluded (AFOLU). The coverage is Scope 1 and 2 and covers CO2, CH4, N2O, Energy, Transport and Waste. Data for the inventory is sourced from respective department in the city and the liquid fuels data was taken from National Department of Energy. It should be noted that the data sources continue to be a challenge for Tshwane, hence for waste data it was challenging to confirm or quantify as it was not reflective of what is happening on the ground and thus World Bank study was utilised.

4 Tshwane GPC Greenhouse Gas Emissions Inventory 2014/15 - Key Findings

The emissions per capita in Tshwane metropolitan municipality boundaries are high when compared to the world average (Figure 1) and relatively high when compared to other South African metros. This

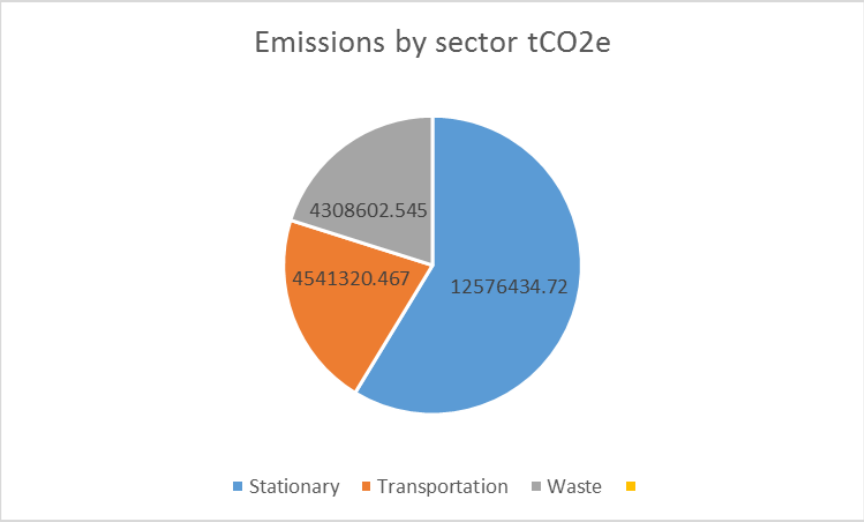
may be due to the high amount of waste emissions, as a result of servicing a very large hinterland noting that City of Tshwane is the largest municipality in South Africa and second largest in the world.

Figure 1: Emissions per capita



Total emissions for Tshwane is 21 426 357 tons and the major emission-producing sectors represented below in figure2 as the stationary energy, transport and waste sectors (Figure 1). The stationary energy sector includes emissions (largely carbon dioxide) from energy used for non-transport purposes (e.g. electricity used in buildings, LPG used in industries, etc.) as well as fugitive losses (leaks) from natural gas pipelines. The waste sector includes emissions (largely methane) from landfills and wastewater. All emissions (carbon dioxide, methane and nitrous oxide) are represented as carbon dioxide equivalent (tCO2e).

Figure 2: Emissions by sector



When comparing energy consumption and emissions production by sector, the transport sector consumes the largest proportion of energy, while the stationary energy sector produces the largest proportion of emissions (Figure 3 and Figure 4). The reason for this is that electricity consumption is captured in the stationary energy sector and electricity produces a very high amount of emissions per unit energy compared to the fuels used in the transport sector (largely diesel and petrol). South

Africa's electricity is very "dirty" (high emissions), because most of the electricity is generated using coal-fired power stations.

Figure 3: Energy consumption and emissions by sector (excluding waste)

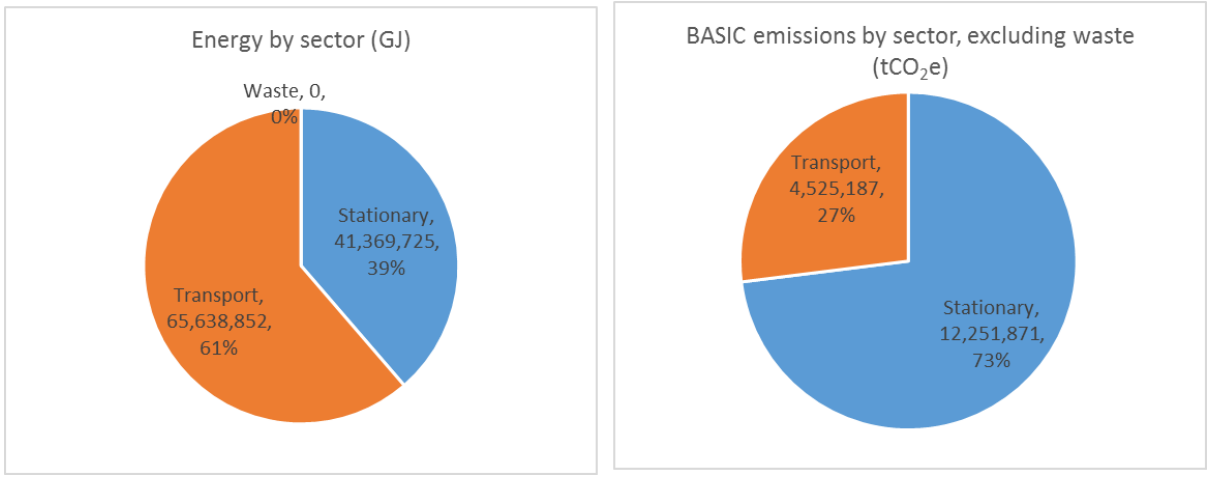


Figure 4: Energy consumption by sector

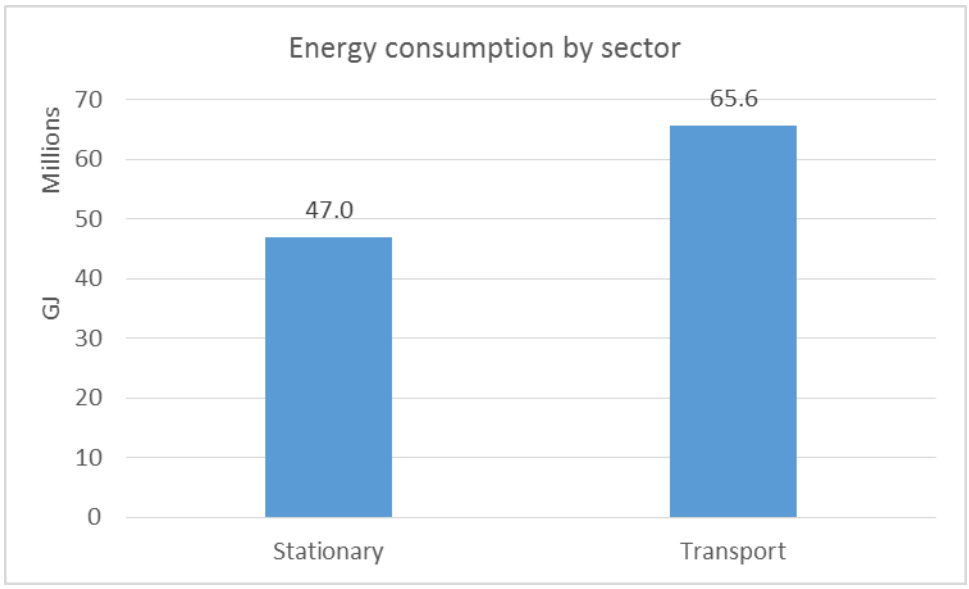
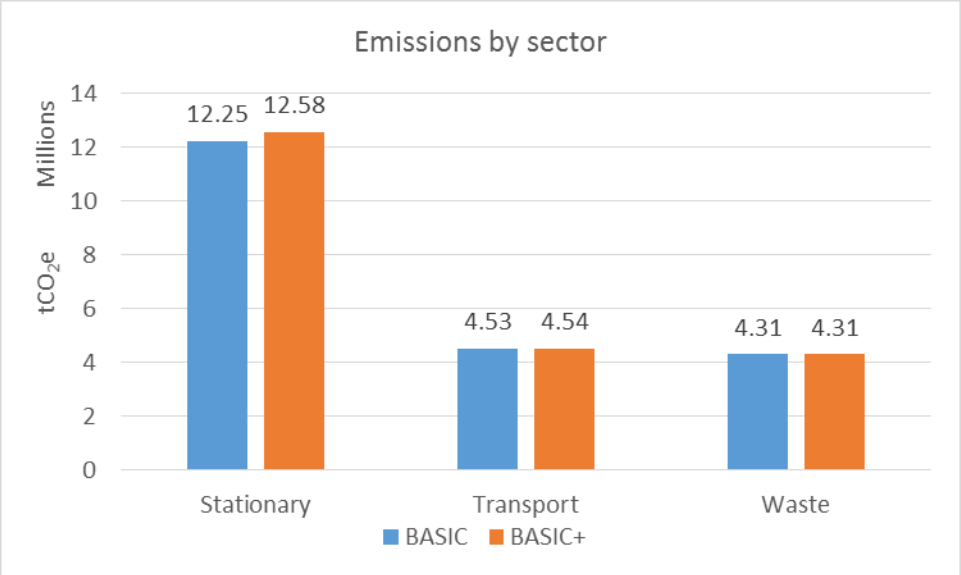


Figure 5: Emissions by sector



Looking at different types of fuels used by the transport sector considering the level of energy usage, the transport sector consumes the largest proportion of energy because the main fuels used in the transport sector are diesel and petrol, with negligible amounts of electricity (in rail), while the main fuel used in the stationary energy sector is electricity, with some use of coal (largely in the industrial sector) and negligible amounts of other fuels. This is illustrated in more detail in 6 and 7. Diesel and petrol produces proportionally fewer emissions per unit energy when compared to electricity.

Figure 6: Energy consumption by sector and fuel

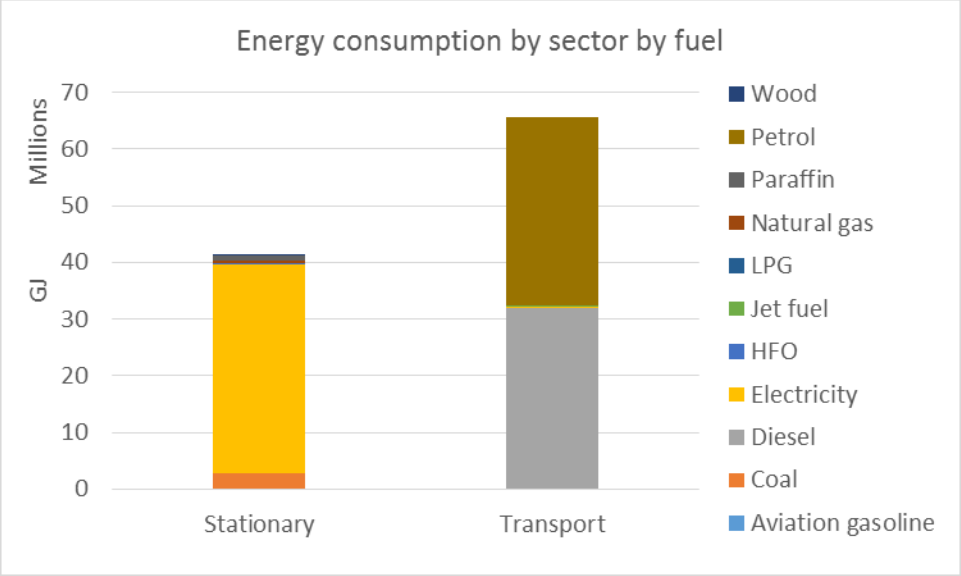
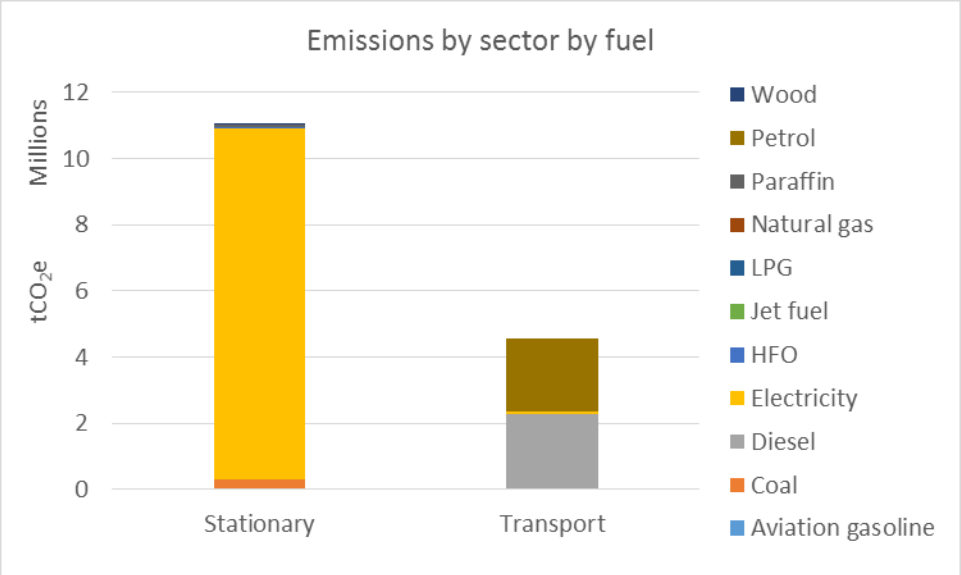
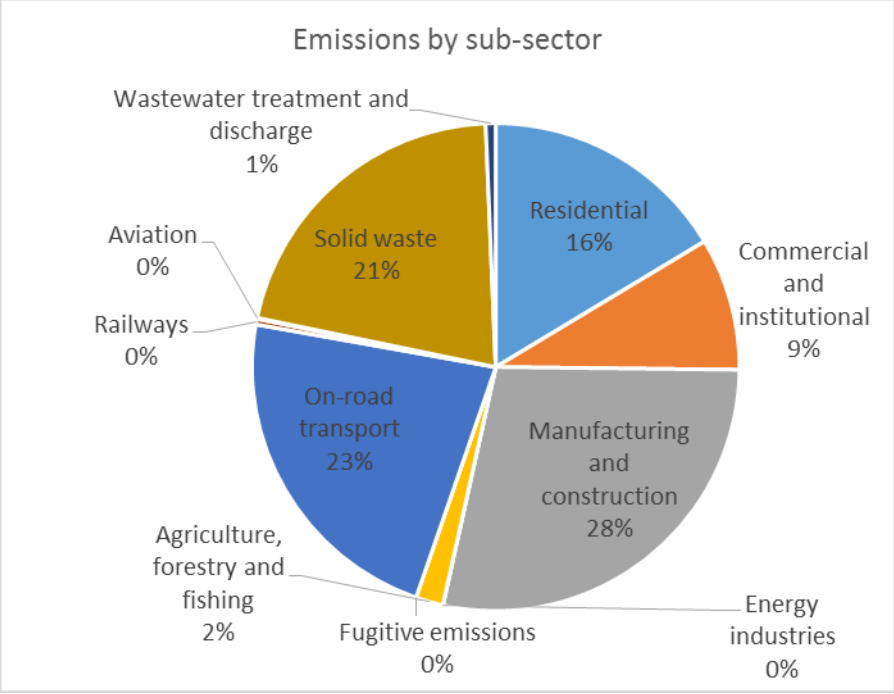


Figure 7: Emissions by sector and fuel (excluding waste)



When considering emissions by sub-sector as highlighted in figure 8, a larger number of carbon emissions is from manufacturing and construction sub-sector (28%) considering the intensity of electricity and energy required for production and operational purposes, followed by the on-road transport (23%), and landfilled solid waste emissions (21%) emissions from landfill gases, the residential sub-sector (16%) who uses most of the coal fired electricity and the commercial and institutional sub-sector (9%).

Figure 8: Emissions by sub-sector (including waste)



The graphs in Figure 9 below exclude waste in order to compare energy consumption and emissions production per sub-sector. (The waste sector only includes emissions directly from waste and wastewater; not the energy consumption used to transport or process waste, which is included instead in the stationary energy sector).

Most energy is consumed in on-road transport (61%), followed by the manufacturing and construction sub-sector (includes industrial activities) (21%), the residential sub-sector (11%) and the commercial and institutional sub-sector (includes offices, municipal facilities, retail, etc.) (6%), with small amounts of energy consumption taking place by rail and in the agricultural sub-sector (Figure 9). In contrast, the most emissions are produced by the manufacturing and construction sub-sector (36%), followed by on-road transport (29%), the residential sub-sector (21%) and the commercial and institutional sub-sector (11%). The sub-sectors that use very emissions-intensive fuels such as electricity (used in buildings) and coal (used in industries) produce proportionally high amounts of emissions when compared to their energy consumption.

Figure 9: Energy consumption and emissions by sub-sector (excluding waste)

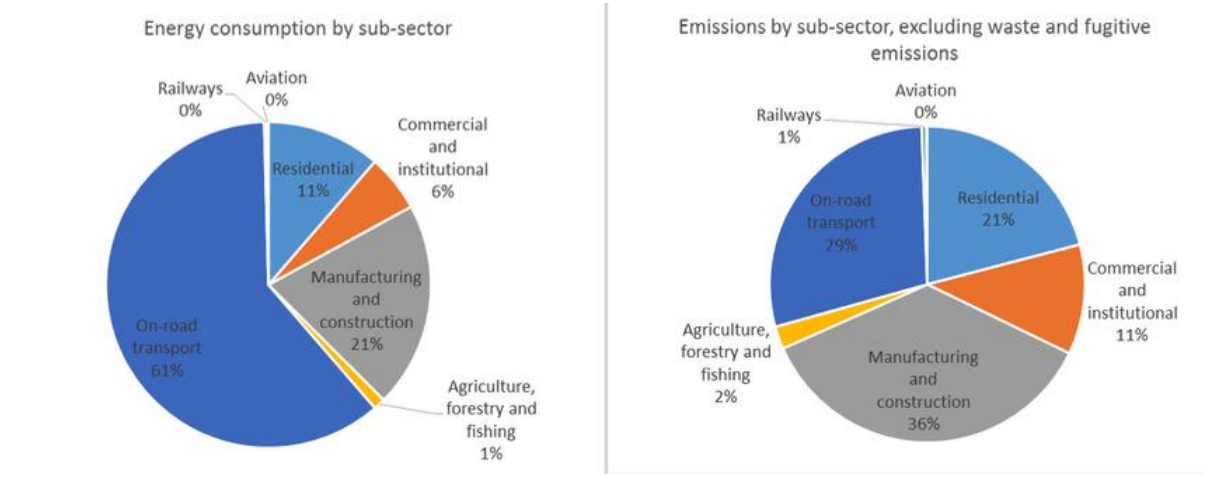
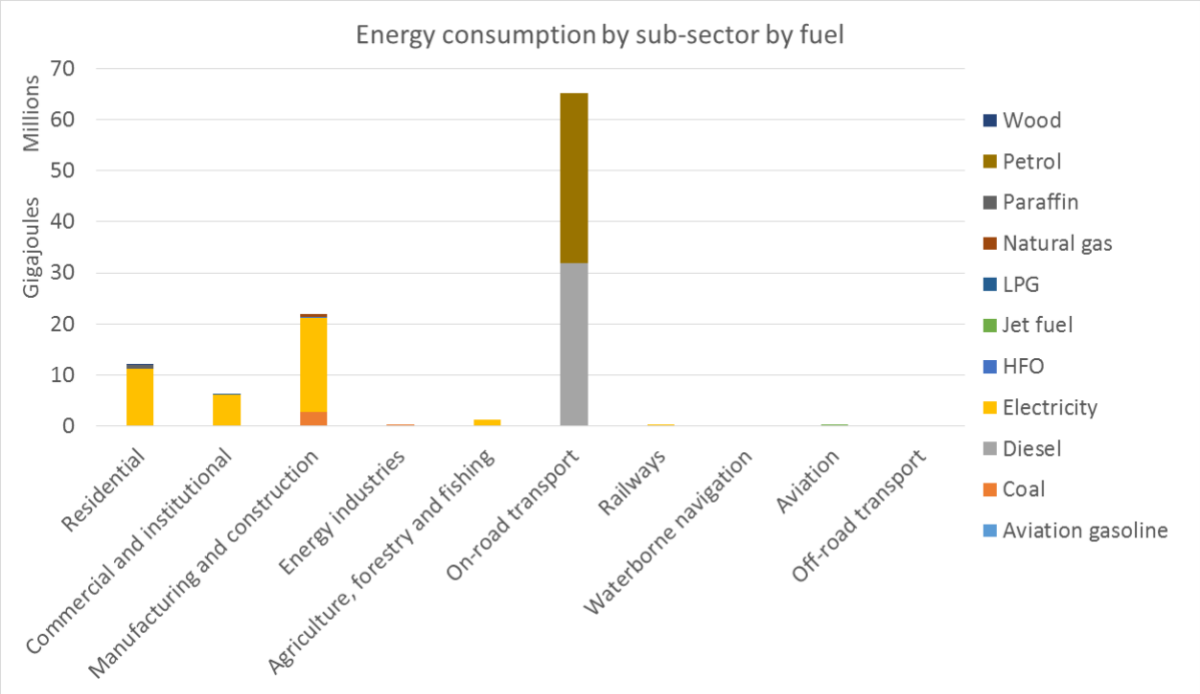


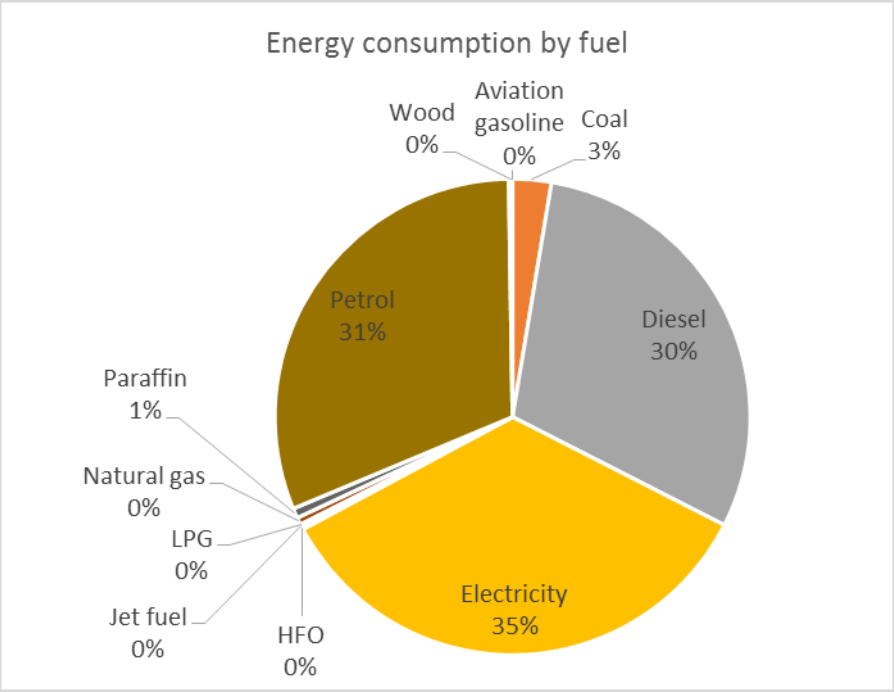
Figure 10 below indicates that most energy is consumed in the transport sub-sector, largely in the form of diesel and petrol. This is followed by the manufacturing and construction sub-sector, largely reliant on electricity and coal. The majority of the remaining energy is consumed in the form of electricity in the residential, and commercial and institutional sub-sectors.

Figure 10: Energy consumption by sub-sector and fuel



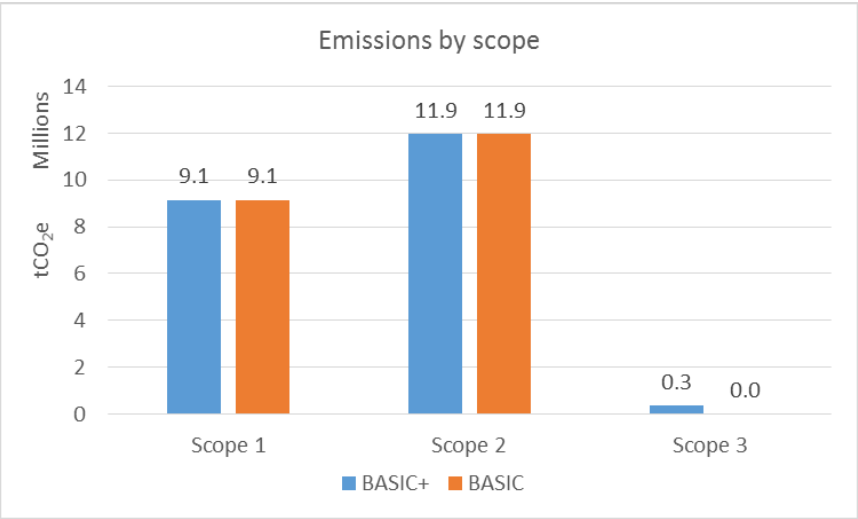
Energy consumption is dominated by three energy sources: petrol and diesel (largely consumed by on-road transport), and electricity (which is mainly generated through the use of coal-fired power stations, with roughly 10% coming from nuclear and large hydro, and a small amount from renewable energy sources) (Figure 11). Coal makes up most of the remainder, with negligible amounts of energy consumption of other fuels (LPG, paraffin, etc.) Therefore most energy needs are supplied through the use of fossil fuels.

Figure 11: Energy consumption by fuel



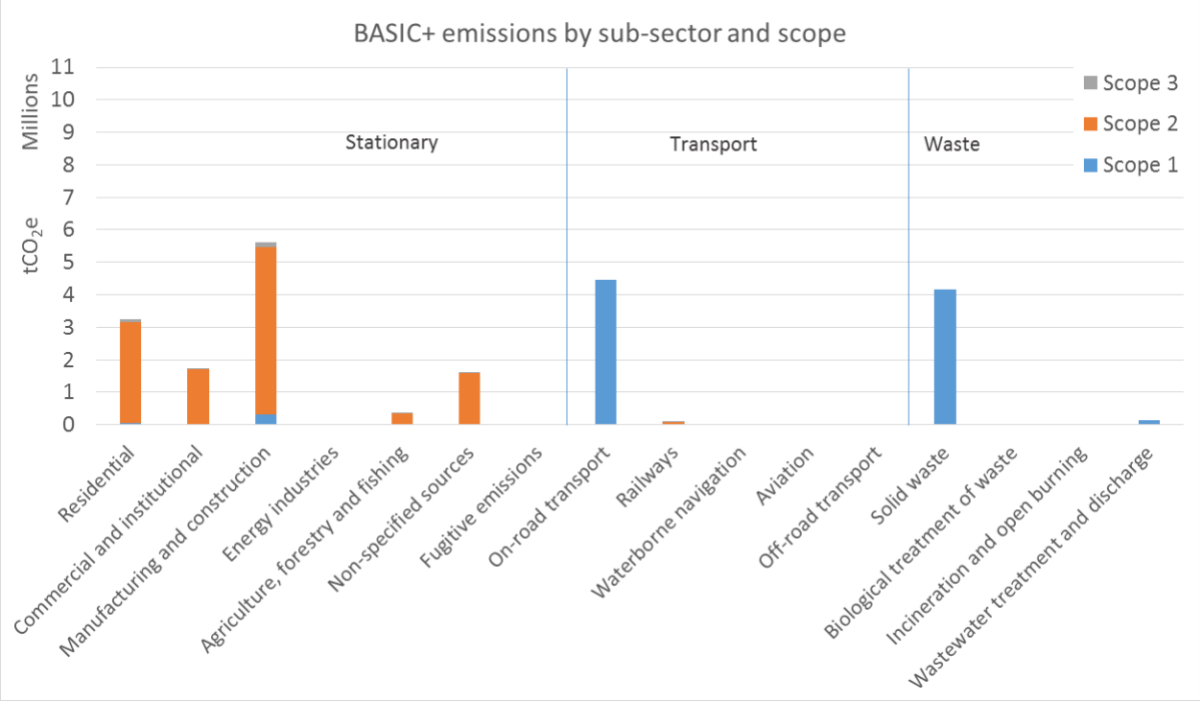
Emissions are classified into 3 scopes: scope 1 includes emissions produced inside the metropolitan boundary, scope 2 includes all emissions from electricity consumption and scope 3 includes emissions outside the metropolitan as a result of activities inside the boundary (includes electricity transmissions and distribution losses). Most emissions produced fall within scope 1, with the majority of the remainder falling under scope 2 (Figure 12).

Figure 12: Emissions by scope



Most scope 2 (electricity consumption) emissions occur in the stationary energy sector. Waste and on-road transport emissions fall largely within scope 1 (emissions within the metropolitan boundary). If waste from the municipal residents was ever landfilled outside the metropolitan boundary, these emissions would move to scope 3. Transport emissions are currently all captured under scope 1 (inside metropolitan boundary), but this is largely due to the difficulty in disaggregating the proportion of fuel burnt inside vs. outside the boundaries when vehicles make cross-boundary trips – the current assumption is that all fuel sold within the metropolitan boundary is used within the boundary.

Figure 13: Emissions by sub-sector and scope



5 Conclusions

Electricity from coal fired power stations is the greatest contributor to the city's carbon emissions (58%) with all the energy utilised in buildings, residential, commercial and industries. Followed by electricity emissions is the transport sector which contributes 22% of emissions largely the source being from the usage of diesel and petrol. Waste management sector contributes 20% greenhouse gases mainly from landfill sites.

Investments and infrastructure planning for a more sustainable development is required to reduce the current level of emissions in the city. Currently the emissions per capita in Tshwane are higher (as stated above) when compared to the global average and this needs to change. Alternatives on electricity usage, transportation and waste management for the city needs to be considered starting with the city's own infrastructure development and maintenance necessary to reduce emissions. The city own a number of building were alternative energy sources like solar power can be introduced, while in the transportation sector the city can invest in low carbon mobility and seek to retrofit the current asset fleet to be more energy efficient. Sustainable waste management practices and programmes can be introduced to divert waste from landfill.

The city needs to have ambitious pathways to address increased emissions hence there is work currently underway to consult service delivery departments on mainstreaming sustainability and work on identification and setting sustainability targets which will address emission reductions and ultimately tackling climate change effects and vulnerabilities the city faces. This work is currently undertaken through the climate action planning process.

As we are currently working on stakeholder engagement, integrated target identification and setting, the element of prioritising finance is considerably important as there cannot be achievement of emissions reduction activities (programmes and projects) without the necessary funding. Sustainable infrastructure development and rehabilitation needs prioritisation in reducing the tons of emissions indicated in the GHGEI.