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1. Introduction

This report is compiled to provide a comprehensive carbon footprint study of the Eskom Holdings SOC Ltd (Eskom) business for the 2020 calendar year. It aims to provide valuable insight not only into the sources and magnitude of Greenhouse Gas (GHG) emissions, but also as a basis for possible mitigation action and GHG offsetting measures.

A carbon footprint is an important tool for measuring and monitoring GHG emissions emanating from an organisation's activities. GHG emissions can result from a wide variety of activities, including electricity generation, transport, industry, agriculture, and waste processing.

For the information to be reliable and consistent, a carbon footprint needs to be based on high-quality data, which is collected and converted according to a recognised international GHG standard. Moreover, the information should be kept in a well-structured database that can provide graphical outputs useful for emissions reporting purposes.

During 2020 Eskom's Climate Change and Sustainable Development Department (CCSD) internally and independently calculated the Carbon Footprint for 2020 using the excel-based GHG calculation tool called the Enterprise Performance and Carbon Management (EPCAM) tool. The last Carbon Footprint study was conducted by EcoMetrix Africa (Pty) Ltd. in 2019. While Eskom's financial year runs from April to March, the carbon footprint is based on the calendar year. This is in part to align with the reporting period used by National GHG Emission Reporting Regulations (NGER).

A carbon footprint estimates the total GHG emissions caused by an organisation's activities. It is expressed in tonnes of carbon dioxide equivalent (tCO_2e). This provides insights into the sources and magnitude of GHG emissions and allows for better management of GHG emissions.

2. Supporting Clauses

2.1 Scope

Large organisations often have complex legal and organisational structures with varying degrees of ownership and control. This has implications for the consolidation of GHG emissions for the entity as a whole. Organisational boundaries of a carbon footprint determine the method of which GHG emissions from different business operations within the organisation are included in the carbon footprint. Eskom's organisational boundary considered for the 2020 carbon footprint study, excluding all Eskom subsidiaries, is shown in Figure 1 below.

Figure 1 – Eskom Carbon Footprint Organisational boundary (excluding Eskom subsidaries)

2.1.1 Purpose

This report will provide an updated carbon footprint, which estimates the total GHG emissions caused by Eskom activities, and the associated findings for the 2020 calendar year.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions, excluding Eskom subsidiaries.

2.1.3 Effective date

01 August 2021

2.2 Normative/Informative References

The parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] Greenhouse Gas Protocol Corporate Accounting and Reporting Standard

[2] Eskom Carbon Footprint Study, 2019

[3] The Eskom Integrated Report, 31 March 2020

2.2.2 Informative

[4] Department of Fisheries, Forestry and Environment (DFFE) National Greenhouse Gas Emissions (GHG) Reporting Regulations

[5] Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories

2.3 Definitions

- **Carbon Footprint** – a term used to describe the amount of greenhouse gas (GHG) emissions (expressed in tCO_2e) caused by a particular activity or entity and thus a way for organisations and individuals to assess their contribution to climate change.
- **Carbon reduction** – occurs as a result of reducing your gross greenhouse gas (GHG) emissions, this can be done through initiatives such as energy efficiency plans, transport efficiency programmes, fuel switch projects and process enhancement.
- **Carbon Offsetting** – is the purchase of carbon credits to offset your carbon footprint. This can be done through various carbon markets such as the mandatory market or other voluntary markets.
- **Climate Change impact** – arises due to the interaction of a climate-related hazard and the vulnerability or exposure of the natural or human system.
- **Emission** – the release of greenhouse gases (GHG's) into the atmosphere**.**
- **Emissions factors** – are the average emission rate, measured in carbon equivalent (CO_2e) per unit of activity.
- **Operational boundaries –** are governed by the concept of scopes. Scopes allow for different types of reporting methods and aim to avoid double counting by two separate companies. Scope 1 (direct emissions), Scope 2 (indirect electricity emissions) and Scope 3 (indirect emissions).
- **Organisational boundaries** – businesses vary in legal and organisational structures, organisational boundaries states the organisational make-up. There are two distinct approaches for selecting organisational boundaries, the control approach (operational control or financial control) and the equity share approach.

*(**Source**: Terra Firma Academy, Carbon Footprint Analyst Course Manual, 2019)*

2.4 Abbreviations

Abbreviation	Explanation
CCSD	Climate Change and Sustainable Development
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
DFFE	Department of Fisheries, Forestry and Environment
Dx	Distribution Division
EFs	Emission factors
GHG	Greenhouse gas
GWP	Global Warming Potential
Gx	Generation Division
IPCC	Intergovernmental Panel on Climate Change
N2O	Nitrous Oxide
NCVs	Net calorific values
NGER	National Greenhouse Gas Emission Reporting Regulations
SF_6	Hexafluoride
tCO_2e	Tonnes of Carbon Dioxide equivalent
Tx	Transmission Division

2.5 Roles and Responsibilities

The table below provides the roles and responsibilities (RACI) for the Carbon Footprint.

Table 1 – Table showing the Carbon Footprint roles and responsibilities

Role	Responsible	Accountable	Consult	Inform
Data collection and consolidation (e.g. coal burnt, FO burnt, SF6 used, NCV calculation etc.)	Line Divisions (Dx, Tx, Gx) External service providers	Line Divisions (Dx, Tx, Gx)	CCSD RT&D	CCSD RT&D
Sign-off and verification of data	Line Divisions (Dx, Tx, Gx)	Line Divisions (Dx, Tx, Gx) External service	CCSD	CCSD RT&D

	External service providers	providers		
Input data into data collection sheets (EPCAM)	CCSD	CCSD	Line Divisions (Dx, Tx, Gx) Consultants (EcoMetrix)	Line Divisions (Dx, Tx, Gx) RT&D
Calculation of GHG emissions using calculating tool (EPCAM)	CCSD	CCSD	Line Divisions (Dx, Tx, Gx) Consultants (EcoMetrix)	Line Divisions (Dx, Tx, Gx) RT&D
Circulation of Carbon Footprint report and Co-ordination of comments	CCSD	CCSD	Line Divisions (Dx, Tx, Gx) External service providers	Line Divisions (Dx, Tx, Gx) External service providers RT&D Finance (Integrated Reporting team)
Preparation for publication and disclosure	CCSD	CCSD	Finance (Integrated Reporting team)	Line Divisions (Dx, Tx, Gx) RT&D External service providers Finance (Integrated Reporting team)

2.6 Process for Monitoring

The data providers from the line divisions and external service providers are responsible for collecting, managing and maintaining an updated database. The Climate Change and Sustainable Development Department (CCSD) will develop a carbon footprint report annually, monitor the annual carbon footprint findings and provide recommendations, where possible.

2.7 Related/Supporting Documents

Eskom Carbon Footprint Study, 2019

3. Carbon Footprint Study

This section deals with the further clarification of the scope of the study; it sets out the approach followed in calculating Eskom's carbon footprint and presents the actual footprint results. High-level analyses of the outcomes and assumptions are provided.

3.1 GHG Report Standard

While there are various internationally recognised GHG standards, the Eskom's carbon footprint has been calculated in line with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (WRI, 2004).

3.2 Scopes of Emissions

In terms of GHG accounting and reporting, the standard identifies three different scopes of GHG emissions to differentiate between direct and indirect emissions:

- Scope 1 direct emissions (i.e. from on-site activities controlled by the organisation),
- Scope 2 indirect emissions (i.e. from purchased electricity or heat consumed by and organisation) and;
- Scope 3 indirect emissions (i.e. from activities not controlled by an organisation that occur up-and downstream in the supply chain).

Since electricity generation is Eskom's main activity, Scope 2 emissions are in principle accounted for as Scope 1 emissions in accordance with the GHG Protocol. For this reason, Scope 2 emissions are excluded from the current carbon footprint study to avoid double accounting.

3.3 Emission Factors and Global Warming Potentials

The carbon footprint study mainly relies on default emission factors (EFs) and net calorific values (NCVs) from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National GHG Inventories and global warming potentials (GWP) from the Third Assessment Report (AR3) of the IPCC. In circumstances where country-specific values were available and appropriate, for example, from the National GHG Reporting Regulations, these were applied. For coal, an Eskom-specific annual weighted yearly average NCV of 0, 01897 TJ/ T fuel was used based on actual measured NVC for 2020.

3.4 Categorisation

Table 3 shows the main source categories of GHG emissions in terms of applicability and materiality per scope.

Table 2 – Summary of GHG emission categories included in the 2020 Carbon footprint study

Scope	GHG Emission Categories
Scope 1 – Direct emissions	– Stationary Combustion (i.e. coal and other fuels consumed in power stations, and fuels consumed by back-up generators at Eskom-owned sites) – Mobile Combustion by Eskom Fleet (i.e. fuel consumption by corporate fleet, heavy trucks owned by Eskom, and Eskom aviation helicopters used for power line maintenance and inspections) – Non-Combustion Product Use (i.e. lubricant and oil use) –Waste Disposal (i.e. solid waste and wastewater treatment) – Fugitive Emissions (i.e. SF_6 from gas-insulated switchgear, current transformers and breakers)
Scope 2 – Indirect emissions	Excluded (i.e. consumption of electricity or heat purchased) as electricity generation is Eskom main activity
Scope 3 – Indirect emissions	– Air Travel (i.e. kilometres flown in the economy or business class) – Official Mileage (i.e. kilometres travelled with third-party-owned petrol or diesel cars) – Vehicle Rental (i.e. kilometres travelled with rented petrol or diesel cars) – Coal Delivery to Site (i.e. kilometres driven by third-party-owned heavy coal trucks)

3.5 Data Collection

The process of collecting the necessary consumption and/or activity data per GHG emission category was initiated by contacting all relevant data providers within and outside the organisation to collect the relevant data.

Scope 1 emission data inputs were available and collected based on actual consumption data, such as fuels used. Scope 3 data inputs were based on activity data such as kilometres travelled on which basis GHG emissions were derived using default EFs in the EPCAM model.

A data quality check was performed and, in some cases, a further check with the data providers was initiated. However, in future each data provider will be required to formally verify and sign-off the data submitted.

3.6 Results and Assessment

The results of the carbon footprint study are presented in Table 3. The total GHG emissions for 2020 were 201 624 114 tCO2e, this is favourable compared to the 2019 GHG emissions of 212 601 425 tCO_2e. This indicates a decrease in Eskom's overall carbon footprint as a result of decreased electricity demand (and therefore production) attributable to the various lockdown measures implemented in response to the Covid-19 pandemic. The majority of these emissions were caused by the burning of fossil fuels at our power stations for the generation of electricity. Coal, diesel, and kerosene consumption contributed to over 99.8% of our GHG emissions.

A second significant source of GHG emissions was coal delivery to site (238 338 tCO_2e). These emissions mainly relate to the transportation of coal to power stations by third-party trucks. However, this was still less than the reported 'delivery to site' GHG emissions from 2019.

The third highest source of GHG emissions was fugitive emissions (73 904 tCO_2e). This relates to the incidental release or leak of SF_6 gas due to the failure or malfunctioning of Gas Insulated Switchgear (GIS) and circuit breakers and current transformers. Both the Transmission (Tx) and Distribution (Dx) operations were considered, hence the significant increase in SF_6 emissions as compared to 2019.

There was a considerable reduction in GHG emissions associated with all travel. The Eskom fleet emissions, official mileage and air travel emissions all reduced as a result of the Covid-19 pandemic national travel restrictions.

Table 3 – Eskom Carbon Footprint Summary by Scope and Category

Source	2019	2020
	GHG emissions (tCO_2e)	**GHG emissions (tCO_2e)**
Scope 1		
Stationary combustion	212 192 077	201 260 329
Eskom Fleet	81 797	37 810
Fugitive emissions	36 212	73 904
Waste disposal	3 468	3 820
Non-combustion product use	9	12
Scope 2		

Electricity and heat purchased	Not applicable	Not applicable
Scope 3		
Coal Delivery to site	269 963	238 338
Official mileage	12 627	6 669
Air travel	3 368	1 008
Vehicle rental	1 903	2 225
Total	**212 601 425**	**201 624 115**

[1] As electricity generation is Eskom's main activity, Scope 2 indirect emissions are in principle accounted for as Scope 1 direct emissions as per the GHG Protocol

For analysis purposes, the emission categories have been regrouped in three main types of activities irrespective of whether pertaining to a Scope 1 or Scope 3 emission:

- Stationary combustion
- Mobile combustion
- Non-combustion

Grouping the emission categories per similar type of activity enables a comparison between the different categories and can initiate discussion about potential mitigation efforts applicable for similar types of activities both inside and outside the direct control of the organisation.

3.6.1 Stationary Combustion

Stationary combustion mainly includes the burning of coal at Eskom power stations to generate baseload electricity, which is by far the largest source of GHG emissions from the organisation. To a lesser extent, it includes the consumption of diesel and kerosene used in peaking stations. Heavy fuel oil and diesel are also used for start-up and backup/auxiliary processes. The coal consumption data is internally audited by Eskom to ensure that the figures are reliable and accurate. In addition to stationary combustion for electricity generation at power stations, annual consumption of diesel by backup generators at Eskom offices are accounted for as stationary combustion as well.

Table 4 provides an overview of the GHG emissions. The power plants running on coal (the most carbon intense fuel) have the largest absolute emissions, with Komati representing the lower end of the range (as it only has one unit running and is approaching its end of life) and Matimba at the upper end of the range. The peaking stations including Acacia, Ankerlig, Gourikwa and Port Rex, have relatively low emissions as these are smaller plants, in principal only used during peaking times, and produce relatively few gigawatt hours as a result.

Koeberg is the only nuclear-fuelled power plant in the Eskom portfolio, which uses some fossil fuels (diesel) for auxiliary and backup processes with GHG emissions associated with it. The Kusile and Medupi power stations GHG emissions are expected to rise in the coming years as the plants are being completed and all units come online.

Table 4 – Overview of Stationary Combustion

Total GHG emissions	201 260 329	tCO_2e
Total GWh generated	194 238	GWh
Overall GHG intensity	1.04	tCO_2e/MWh

3.6.2 Mobile Combustion

Scope 1 Mobile Combustion emissions entail Eskom fleet including Eskom-owned vehicles (e.g. passenger cars and heavy-duty trucks using petrol/ diesel) and Eskom-owned helicopters used for power line inspections and live line maintenance work.

Scope 3 Mobile Combustion emissions include coal delivery to site (kilometres driven by third-party-owned heavy trucks for transporting coal to Eskom power stations), official mileage (business travel by staff in their own vehicles), air travel (kilometres flown by Eskom employees), and vehicle rental (kilometres driven by Eskom employees in rented vehicles). Figure 3 provides an overview of their respective contributions in tCO_2e. It shows that transportation of coal to Eskom power stations contributed the most in the Mobile Combustion category, over 83%, and air travel contributed the least.

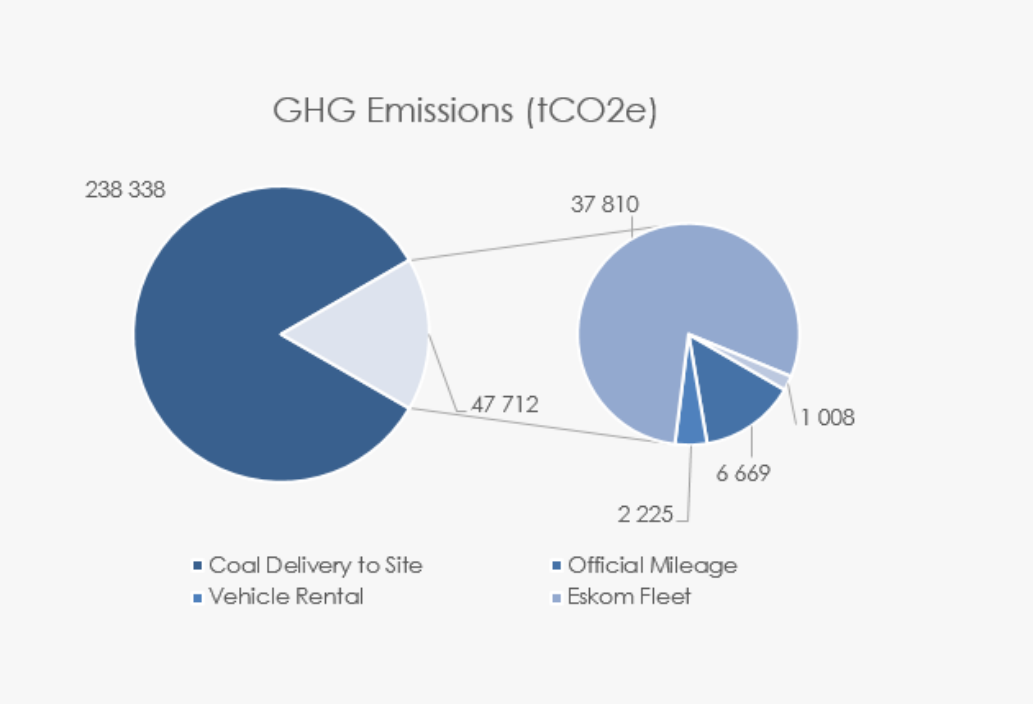

Figure 2 – Mobile Combustion GHG Emissions in 2020

3.6.3 Non-Combustion GHG Emissions

Non-combustion emissions arise in the form of fugitive emissions including the release of SF_6 from gas-insulated switchgear, methane emissions from solid waste disposal and wastewater treatment as well as non-combustion product use pertaining to the unintended oxidation of lubricants used in engines. Included in the footprint are only the emissions from activities under the control of Eskom and therefore these emissions qualify as Scope 1 emissions.

The absolute emissions in tCO_2e within Non-Combustion activities are provided in Figure 4. It shows that fugitive emissions related to the use of SF_6 in switchgear are by far the largest contributor with a share of over 95%, with the remaining sources accounting for less than 5%. This relates to the incidental release or leak of SF_6 gas due to the failure or malfunctioning of Gas Insulated Switchgear (GIS) and circuit breakers. Previously only Transmission SF_6 data was considered, for this year (2020) both Transmission (TX) and Distribution (DX) SF_6 data were considered.

The Transmission reporting of SF_6 gas handling has seen an improvement compared to previous years. Historically, only top-ups and the introduction of new SF_6 gas during major failure incidents were reported. However, the Grids have improved by also reporting information on the SF_6 gas that is used for outdoor circuit-breakers and current transformers.

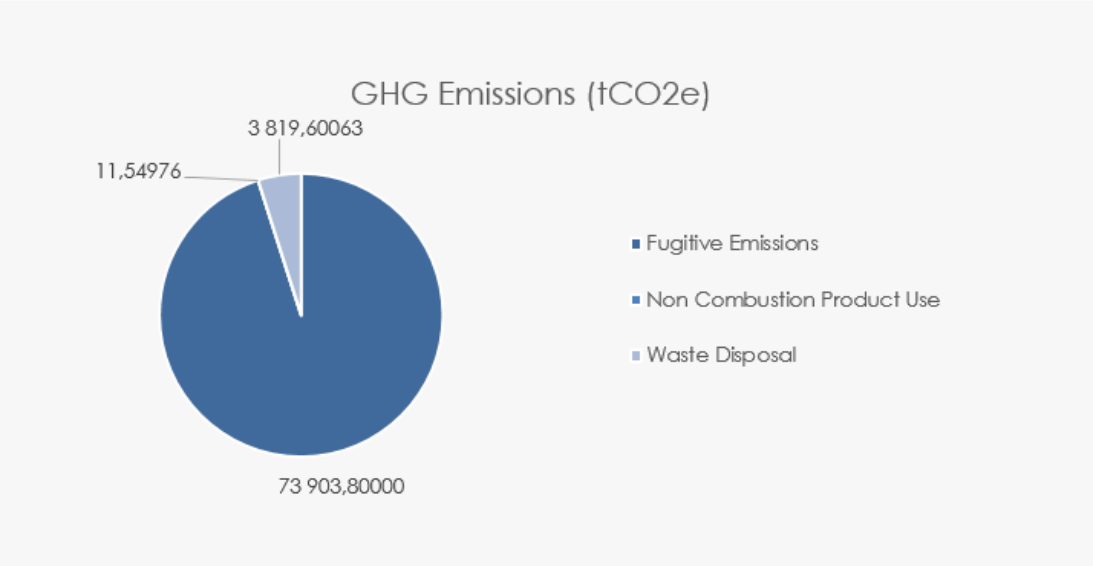

Figure 3 – Non-Combustion GHG Emissions in 2020

3.6.4 Distribution by GHG Emission Scope

Lastly, to align with the GHG Protocol, the results of the Eskom carbon footprint are presented in table 4 as per the main scope of emissions.

Table 5 – Eskom Carbon Footprint Scopes and Emissions

Scopes	GHG (tCO2e)	%
Scope 1	201 375 873	99,82%
Scope 2	N/A	N/A
Scope 3	248 241	0,18%

This study makes considerable progress in terms of data collection from additional GHG emitting activities compared to the previous carbon footprint study, e.g. the inclusion of Distribution (Dx) SF_6 data, and Eskom fleet vehicle separation into petrol and diesel categories.

3.6.5 Areas of improvement

Areas for future improvement include the inclusion of data from rail transportation from mines. It is recommended that Eskom account for all purchased electricity under Scope 2. Lastly, it is recommended that the data be verified by a third party to enhance credibility of the data.

This Carbon Footprint is currently calculated for Eskom, as per organisational boundary. However, once the Divisions have been separated, a Carbon Footprint will need to be calculated for each Group (Tx, Gx, Dx and Corporate) as well as the Eskom subsidiaries.

4. Acceptance

This document has been seen and accepted by:

Name	Designation
Fiona Havenga	Senior Manager, Climate Change and Sustainable Development Department & Environmental Department (Acting)
Gina Downes	Corporate Specialist, Climate Change and Sustainable Development Department
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Phindile Dlamini	Chief Environmental Officer (Tx)

5. Revisions

Date	Rev.	Compiler	Remarks
August 2021	0	Noella Molefe	2020 Carbon Footprint report for the Eskom business

6. Development Team

The following people were involved in the development of this document:

- Noella Molefe, Senior Advisor, Climate Change and Sustainable Development, Risk and Sustainability Division
- Michelle Magazi, Graduate in training, Climate Change and Sustainable Development, Risk and Sustainability Division

7. Acknowledgements

EcoMetrix Africa (Pty) Ltd