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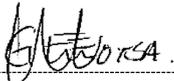
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## 1. Introduction

This report provides a comprehensive carbon footprint analysis of the Eskom Holdings SOC Ltd (Eskom) business for the 2021 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 2021, Eskom's Climate Change and Sustainable Development Department (CCSD) internally and autonomously calculated the Carbon Footprint for 2021 using the excel-based GHG calculation tool - Enterprise Performance and Carbon Management (EPCAM). The last Carbon Footprint study was conducted in 2020. 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 resulting from an organisation's activities. It is expressed in tonnes of carbon dioxide equivalent (tCO<sub>2</sub>e).

## 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. 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 2021 carbon footprint study, excluding all Eskom subsidiaries, is shown in Figure 1 below. It was recommended that a Carbon Footprint be calculated for each Division as well as the Eskom subsidiaries in the next year.

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**Figure 1 – Eskom Carbon Footprint Organisational boundary (excluding Eskom subsidiaries)**

**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 2021 calendar year.

**2.1.2 Applicability**

This document shall apply throughout Eskom Holdings Limited Divisions, excluding Eskom subsidiaries (until the subsidiaries have been included in the organisational boundary).

**2.1.3 Effective date**

01 September 2022

**2.2 Normative/Informative References**

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

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### 2.2.1 Normative

- [1] Greenhouse Gas Protocol Corporate Accounting and Reporting Standard
- [2] Eskom Carbon Footprint Study, 2019
- [3] Eskom Carbon Footprint Study, 2020
- [4] The Eskom Integrated Report, 2021

### 2.2.2 Informative

- [5] Department of Fisheries, Forestry and Environment (DFFE) National Greenhouse Gas Emissions (GHG) Reporting Regulations
- [6] Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories
- [7] Climate Change Bill, 2018 (GG 41689, Notice 580)
- [8] Carbon Tax Act, No 15 of 2019

### 2.3 Definitions

- **Carbon Footprint** – a term used to describe the amount of greenhouse gas (GHG) emissions (expressed in tCO<sub>2e</sub>) caused by a particular activity or entity and thus a way for organisations and individuals to assess their contribution to climate change.
- **Carbon reduction** – the process of directly reducing your gross greenhouse gas (GHG) emissions through efficiencies such as energy efficiency plans, transport efficiency programmes, fuel switch projects and process enhancement.
- **Carbon Offsetting** – 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 impacts** – arise 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<sub>2e</sub>) 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).

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- **Organisational boundaries** – businesses vary in legal and organisational structures; organisational boundaries state 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
AIS	Air Insulated Switchgear
CB	Circuit Breakers
CCSD	Climate Change and Sustainable Development
CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon Dioxide
CO <sub>2e</sub>	Carbon Dioxide equivalent
CT	Current Transformers
CVT	Capacitive Voltage Transformers
DCB	Disconnecting Circuit Breakers
DFFE	Department of Fisheries, Forestry and Environment
Dx	Distribution Division
EFs	Emission factors
FO	Fuel Oil
GHG	Greenhouse gas
GWP	Global Warming Potential
Gx	Generation Division
IPCC	Intergovernmental Panel on Climate Change
N <sub>2</sub> O	Nitrous Oxide
NCVs	Net calorific values
NGER	National Greenhouse Gas Emission Reporting Regulations
RT&D	Research, Testing and Development
SF <sub>6</sub>	Hexafluoride
tCO <sub>2e</sub>	Tonnes of Carbon Dioxide equivalent
Tx	Transmission Division
VT	Voltage Transformers

## 2.5 Roles and Responsibilities

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

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Table 1 – Table showing the Carbon Footprint roles and responsibilities

Role	Responsible	Accountable	Consult	Inform
<b>Data collection and consolidation (e.g., coal burnt, FO burnt, SF6 used, Jet A1 Fuel consumption, NCV calculation etc.)</b>	Line Divisions (Dx, Tx, Gx) RT&D	Line Divisions (Dx, Tx, Gx) RT&D	CCSD	CCSD
<b>Submission of consolidated Data</b>	Data providers (internal and external)	Data Providers (internal and external)	CCSD	CCSD
<b>Sign-off and verification of data</b>	Line Divisions (Dx, Tx, Gx)  Data providers (internal and external)	Line Divisions (Dx, Tx, Gx)  Data providers (internal and external)	CCSD	CCSD RT&D
<b>Input data into data collection sheets (EPCAM)</b>	CCSD	CCSD	Line Divisions (Dx, Tx, Gx) Data providers (internal and external)	Line Divisions (Dx, Tx, Gx) RT&D
<b>Calculation of GHG emissions using calculating tool (EPCAM)</b>	CCSD	CCSD	Line Divisions (Dx, Tx, Gx) Data providers (internal and external)	Line Divisions (Dx, Tx, Gx) RT&D
<b>Circulation of</b>	CCSD	CCSD	Line Divisions	Line Divisions

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<b>Carbon Footprint report and Co-ordination of comments</b>			(Dx, Tx, Gx) Data providers (internal and external)	(Dx, Tx, Gx) Data providers (internal and external) RT&D Finance (Integrated Reporting team)
<b>Preparation for publication and disclosure</b>	CCSD	CCSD	Finance (Integrated Reporting team)	Line Divisions (Dx, Tx, Gx) RT&D External service providers Finance (Integrated Reporting team)
<b>Disclosure in IR</b>	Finance (Integrated Reporting team)	Finance (Integrated Reporting team)	CCSD	CCSD Data providers (internal and external)

**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 of their carbon emissions. 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

Eskom Carbon Footprint Study, 2020

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### 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 (from on-site activities controlled by the organisation),
- Scope 2 indirect emissions (from purchased electricity or heat consumed by and organisation) and;
- Scope 3 indirect emissions (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 report to avoid double accounting. Electricity purchased from Independent Power Producers (IPPs) has not been accounted for and will be included under scope 2 in the 2022 Carbon Footprint.

#### 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, 01901 TJ/ T fuel was used based on actual measured NVC for 2021.

#### 3.4 Categorisation

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

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

Scope	GHG Emission Categories
Scope 1 – Direct emissions	<ul style="list-style-type: none"> <li>– Stationary Combustion (coal and other fuels consumed in power stations, and fuels consumed by back-up generators at Eskom-owned sites)</li> <li>– Mobile Combustion by Eskom Fleet (fuel consumption by corporate fleet, heavy trucks owned by Eskom, and Eskom aviation helicopters used for power line maintenance and inspections)</li> <li>– Non-Combustion Product Use (lubricant and oil use)</li> <li>– Waste Disposal (solid waste and wastewater treatment)</li> <li>– Fugitive Emissions (SF<sub>6</sub> from               <ul style="list-style-type: none"> <li>○ Gas-insulated switchgear,</li> <li>○ Instrument transformers i.e., current transformers (CT) voltage transformers (VT), Capacitive voltage transformers (CVT) and</li> <li>○ Air Insulated Switchgear (AIS) - circuit-breakers (CB) and disconnecting circuit breakers (DCB)</li> </ul> </li> </ul>
Scope 2 – Indirect emissions	Excluded (consumption of electricity or heat purchased) as electricity generation is Eskom main activity
Scope 3 – Indirect emissions	<ul style="list-style-type: none"> <li>– Air Travel (kilometres flown in the economy or business class)</li> <li>– Official Mileage (kilometres travelled with third party owned petrol or diesel cars)</li> <li>– Vehicle Rental (kilometres travelled with rented petrol or diesel cars)</li> <li>– Coal Delivery to Site (kilometres driven by third party-owned heavy coal trucks)</li> </ul>

### 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.

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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 conducted. 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 2021 were 207 625 568 tCO<sub>2</sub>e, this is higher than the 2020 emissions of 201 624 115 tCO<sub>2</sub>e. This indicates an increase in Eskom's overall carbon footprint attributable to the increased demand in electricity due to relaxation of various lockdown measures implemented in response to the Covid-19 pandemic. Most of these emissions were caused by the burning of fossil fuels at power stations for the generation of electricity. Coal, diesel, and kerosene consumption contributed over 99.8% of our GHG emissions.

A second significant source of GHG emissions was coal delivery to site (252 743 tCO<sub>2</sub>e). These emissions mainly relate to the transportation of coal to power stations by third-party trucks. This was more than the reported 'delivery to site' GHG emissions from 2020. The third highest source of GHG emissions was from the Eskom fleet (78 138 tCO<sub>2</sub>e). This relates to the fuel consumed by corporate fleet and heavy trucks owned by Eskom, as well as Eskom helicopters used for power line maintenance and inspections. There was an increase in Eskom travel due to the lifting of the Covid-19 national travel restrictions. There was, however, a decrease in SF<sub>6</sub> emissions from Transmission and Distribution operations, as compared to 2020 because of the repair and replacement of faulty breakers during maintenance and an improved understanding of the reporting requirements.

**Table 3 – Eskom Carbon Footprint Summary by Scope and Category**

Source	2021	2020	2019
		GHG emissions (tCO <sub>2</sub> e)	GHG emissions (tCO <sub>2</sub> e)
	<b>Scope 1</b>		
<b>Stationary combustion</b>	207 230 321	201 260 329	212 192 077
<b>Eskom Fleet</b>	78 138	37 810	81 797
<b>Fugitive emissions</b>	52 841	73 904	36 212

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<b>Waste disposal</b>	3 366	3 820	3 468
<b>Non-combustion product use</b>	3	12	9
	<b>Scope 2</b>		
<b>Electricity and heat purchased</b>	Not applicable	Not applicable	Not applicable
	<b>Scope 3</b>		
<b>Coal Delivery to site</b>	252 743	238 338	269 963
<b>Official mileage</b>	6 003	6 669	12 627
<b>Air travel</b>	937	1 008	3 368
<b>Vehicle rental</b>	1 216	2 225	1 903
<b><u>Total</u></b>	<b><u>207 625 568</u></b>	<b><u>201 624 115</u></b>	<b><u>212 601 425</u></b>

<sup>1</sup> 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

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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 principle 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**

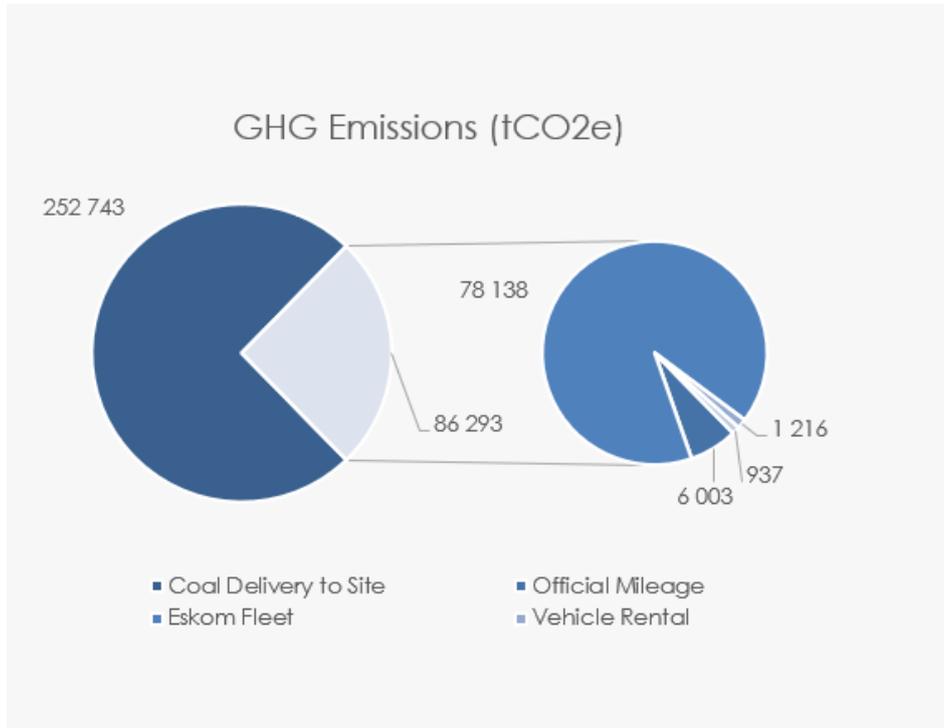
<b>Total GHG emissions</b>	207 230 321	tCO <sub>2e</sub>
<b>Total GWh generated</b>	195 824	GWh

### 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<sub>2e</sub>. It shows that transportation of coal to Eskom power stations contributed the most in the Mobile Combustion category, over 74.55%. Eskom fleet contributed 23.05%, Official mileage contributed 1.77%, vehicle rental contributed 0.36% and air travel contributed the least, 0.28%.

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**Figure 2 – Mobile Combustion GHG Emissions in 2021**

### 3.6.3 Non-Combustion GHG Emissions

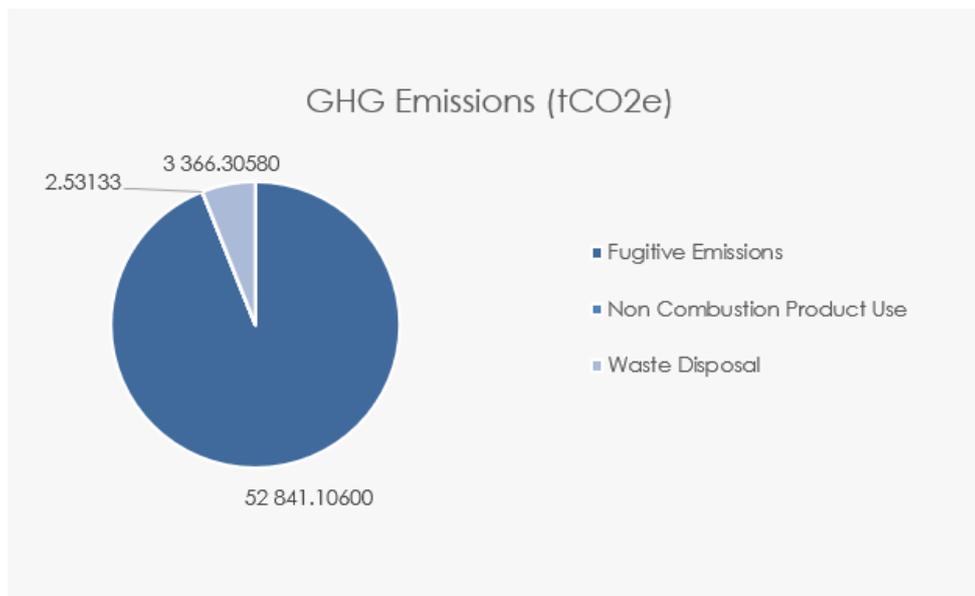
Non-combustion emissions arise in the form of fugitive emissions including the release of SF<sub>6</sub> from gas-insulated switchgear, instrument transformers (CT, VT, CVT), air insulated switchgear (CB and DCB), methane emissions from solid waste disposal and wastewater treatment as well as non-combustion 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<sub>2</sub>e within non-combustion activities are provided in Figure 4. It shows that fugitive emissions related to the use of SF<sub>6</sub> in switchgear are by far the largest contributor with a share of over 94%, with the remaining sources accounting for less than 6%. This relates to the incidental release or leak of SF<sub>6</sub> gas due to the failure or malfunctioning of Gas Insulated Switchgear (GIS) and circuit breakers. Both Transmission (Tx) and Distribution (Dx) SF<sub>6</sub> data were considered.

There was a reduction in SF<sub>6</sub> from 2020, from 73 904 tCO<sub>2</sub>e to 52 841 tCO<sub>2</sub>e, as a result of the faulty breakers being repaired or replaced during maintenance. There has also been an improved understanding of the reporting requirements (e.g., reporting of only emissions related topping-up and not all other SF<sub>6</sub> gas usage; upon returning to service filling with new SF<sub>6</sub> gas or when new delivered empty vessels are filled up the first time).

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The Transmission reporting of SF<sub>6</sub> gas handling has seen an improvement compared to previous years. Historically, only top-ups and the introduction of new SF<sub>6</sub> gas during major failure incidents were reported. However, the grids have improved by also reporting information on the SF<sub>6</sub> gas that is used for outdoor circuit-breakers and current transformers.



**Figure 3 – Non-Combustion GHG Emissions in 2021**

### 3.6.4 Distribution by GHG Emission Scope

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 (tCO <sub>2</sub> e)	%
Scope 1	207 364 669	99,87%
Scope 2	N/A	N/A
Scope 3	260 899	0,13%

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This study makes considerable progress in terms of data collection, however, not all the data for the backup generators and wastewater was received from the business.

### 3.6.5 Areas of improvement

The Climate Change and Sustainable Development (CCSD department) is in the process of updating the existing carbon footprint calculating tool, as per last year's report recommendations, to calculate a separate carbon footprint for each of the Line Divisions (Generation, Transmission, Distribution), to include data sources from rail transportation of coal (scope 3) and purchased electricity (scope 2) and to verify the data.

EcoMetrix have proposed that we migrate from the EPCAM excel-based version to an EPCAM Cloud Solution as this solution has several benefits over the excel based version. The solution has been designed with flexibility in mind, which the current excel tool has limitations. The solution is much more versatile in that additional sustainability parameters, users, sites, and organisational layers can be easily added. Data can be captured manually, semi-automatically and or fully automatically via a data exchange interface. The system allows for various data providers to capture data remotely and take responsibility for the completeness and accuracy as the system allows to easily identify data gaps and outliers. Multiple users can access and work on the cloud solution simultaneously. The cloud solution is hosted online on a secure server with the necessary security certificates. Access can be controlled by two factor authentication. Moreover, specific user access can be limited to certain parts of the organisation and certain authorisation levels.

Areas for future improvement include the inclusion of additional back-up generator data and wastewater data. It was also particularly difficult to get the data from data providers, as there have been changes in the business. The data providers had either moved to different areas of the business or were no longer responsible for capturing the data required.

## 4. Conclusion

The total GHG emissions for 2021 were 207 625 568 tCO<sub>2</sub>e, with 99.8% of these emissions coming from our power stations. Other significant sources of emissions came from the transportation of coal to the Eskom sites by third-party trucks as well as Eskom fleet, including Eskom-owned vehicles and helicopters.

Once the carbon footprint calculating tool (EPCAM) is updated, Eskom will calculate the carbon footprint for each of the line divisions and subsidiaries. This will illustrate how each division and subsidiary contributes to Eskom's overall carbon footprint. This will allow them to effectively manage and improve their operations and activities to reduce emissions.

To ensure completeness, additional data sources and outstanding data will be included in the next carbon footprint study. To ensure data integrity, the data that is uploaded on the EPCAM tool will be verified by a third-party.

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## 5. Acceptance

This document has been seen and accepted by:

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Fulufhelo Makananise	CoE manager (Acting): ERT

## 6. Revisions

Date	Rev.	Compiler	Remarks
August 2021	1	Noella Molefe	2020 Carbon Footprint report for the Eskom business
September 2022	2	Noella Molefe	2021 Carbon Footprint report for the Eskom business

## 7. Development Team

The following people developed 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

## 8. Acknowledgements

EcoMetrix Africa (Pty) Ltd for developing the carbon footprint calculating tool.

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