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DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT

NO. 7891 **11 September 2026**

PUBLICATION OF SOUTH AFRICA'S 2024 GRID EMISSION FACTORS REPORT

I, David Maynier, Minister of Forestry, Fisheries and the Environment, hereby publish the South Africa's 2024 Grid Emission Factors Report (the Fourth GEFs Report), as set out in the Schedule hereto, for information.

This Fourth GEFs Report shows that in 2024 the grid became more carbon intensive, indicating that the carbon intensity of electricity supplied to the grid increased during the year. This change reflects greater electricity generation from emissive sources. It includes summarised information and data on electricity production and the GHG emissions associated with the electricity that was produced for the 2024 calendar year. This data was used to determine the following four grid emission factors:

GEF		Value (tCO_2e/MWh)
DOMESTIC GENERATION GRID EMISSION FACTOR	DGGEF	0.994
NATIONAL GENERATION GRID EMISSION FACTOR	NGGEF	0.960
TRANSMISSION LOSS GRID EMISSION FACTOR;	TLGEF	0.021
DISTRIBUTION LOSS GRID EMISSION FACTOR.	DLGEF	0.071

The domestic generation GEF depicts the relationship between the amount of GHGs emitted per unit of electricity that is generated within South Africa. The national generation GEF depicts the relationship of emissions and end user electricity consumption and therefore includes imported electricity along with its associated GHG emissions. The transmission losses GEF depicts the relationship between the emissions and end user electricity consumption while considering transmission losses. The distribution losses GEF depicts the relationship between the emissions and end user electricity consumption while considering distribution losses.

The 2024 GEFs Report provides information on the carbon intensity of the electricity supplied through the grid. The GEFs information is very useful for public users who intend to track their carbon footprint, including emissions associated with their electricity use. This information can equip public users to accurately track or report the change in the GHG emissions associated with mitigation measures relating to decreasing electricity usage or optimising their electricity usage. Different spheres of government can use GEFs to monitor and analyse electricity emission trends, guide climate change modelling and inform climate change mitigation policies. A copy of the South Africa's Grid GHG Emission Factor Development (the Methodological Report) can be accessed on the Departmental website at: www.dffe.gov.za, under "legislation", then "Gazetted Notices".

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1. Contents

2. Abbreviations

DFFE	Department of Forestry, Fisheries and Environment
DGGEF	Domestic generation grid emission factor
DLGEF	Distribution loss grid emission factor
GEF	Grid emission factor
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft fur Internationale Zusammenarbeit
JET IP	Just Energy Transition Investment Plan
NCCRP	National Climate Change Response Policy
NERSA	National Energy Regulator South Africa
NGERs	National Greenhouse Gas Emissions Reporting Regulations
NGGEF	National generation grid emission factor
SAGERS	South African Greenhouse Gas Reporting System
TLGEF	Transmission loss grid emission factor

3. Executive Summary

South Africa's transition toward a lower-carbon electricity sector requires reliable, transparent, and standardised data to support decision-making, reporting, and policy implementation. In this context, the development of national Grid Emission Factors (GEFs) represents a key technical instrument for quantifying greenhouse gas emissions associated with electricity generation. A GEF expresses the emissions intensity of grid-supplied electricity (typically in kg CO_2e per kWh) and provides a consistent basis for estimating indirect emissions across sectors that consume electricity. As such, GEFs are an essential parameter for national greenhouse gas inventories, corporate carbon accounting, mitigation planning, and regulatory reporting.

To institutionalise this function, Department of Forestry, Fisheries and Environment established a national methodology and reporting framework for calculating and publishing GEFs on a recurring basis. The annual publication of GEFs ensures that South Africa maintains an up-to-date emissions intensity indicator that reflects changes in the electricity generation mix, technological developments, and structural shifts in the power sector. By providing a credible and nationally consistent emissions factor, the GEF supports evidence-based climate policy, strengthens transparency in emissions reporting, and enhances the country's ability to track progress toward its climate mitigation objectives.

The first report of this nature, *South Africa's 2021 Grid Emission Factor Report*, was published in February 2024. This was followed by the *2022 Grid Emission Factor Report* in November 2024, and subsequently the *2023 Grid Emission Factor Report*, published on 25 July 2025.

This report, *South Africa's 2024 Grid Emission Factor Report*, presents the national grid emission factors derived from 2024 Calendar Year (CY) data. A Grid Emission Factor (GEF) represents the greenhouse gas (GHG) emissions associated with each unit of electricity supplied through the national grid. As South Africa advances its transition toward a low-carbon economy, the availability of an accurate and up-to-date GEF is essential to reflect the evolving emissions intensity of the national electricity system and to support transparent reporting and mitigation planning. Meeting South Africa's international climate change commitments under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement depends fundamentally on the implementation of robust carbon accounting systems.

Effective carbon accounting enables the transparent quantification, reporting, and verification of greenhouse gas (GHG) emissions across sectors, thereby supporting the tracking and achievement of South Africa's Nationally Determined Contribution (NDC). Furthermore, reliable emissions data underpins evidence-based climate policy instruments, including the Carbon Tax, sectoral mitigation measures, and long-term decarbonisation pathways. Strengthening these systems enhances environmental integrity, improves policy coherence, and ensures alignment between domestic mitigation efforts and international reporting obligations.

The Climate Change Act, 2024 mandates the establishment of a national system of data collection for the creation of a National Greenhouse Gas Inventory and the annual compilation of an inventory report that must analyse emissions trends and compare actual emissions against national trajectories and international mitigation obligations. Different spheres of government can use GEFs to monitor and analyse electricity emission trends, guide climate change modelling and inform climate change mitigation policies.

Electricity consumers rely on the Grid Emission Factor (GEF) to quantify the greenhouse gas (GHG) emissions associated with their electricity consumption and operational activities. The availability of accurate and up-to-date GEF values enhances regulatory compliance, strengthens emissions reporting and disclosure processes, and supports informed strategic planning in response to escalating carbon pricing instruments, including carbon taxes.

Beyond domestic carbon pricing exposure, entities engaged in international trade may also be affected by climate-related trade measures, such as border carbon adjustment mechanisms introduced by jurisdictions including the European Union. Access to credible and current GEF data is therefore critical for managing transition risks, maintaining export competitiveness, and ensuring alignment with evolving international climate policy frameworks. Moreover, the GEF constitutes a key technical parameter within carbon accounting methodologies and forms an essential input to both corporate and national greenhouse gas emission inventories.

Four location-based GEFs were developed for South Africa, namely a Domestic Generation Grid Emission Factor (DGGEF), a National Generation Grid Emission Factor (NGGEF), a Transmission Losses Grid Emission Factor (TLGEF) and a Distribution Losses Grid Emission Factor (DLGEF). These GEFs were developed for South Africa based on 2024 calendar year data.

South Africa's 2024 GEFs are shown in Figure 1.

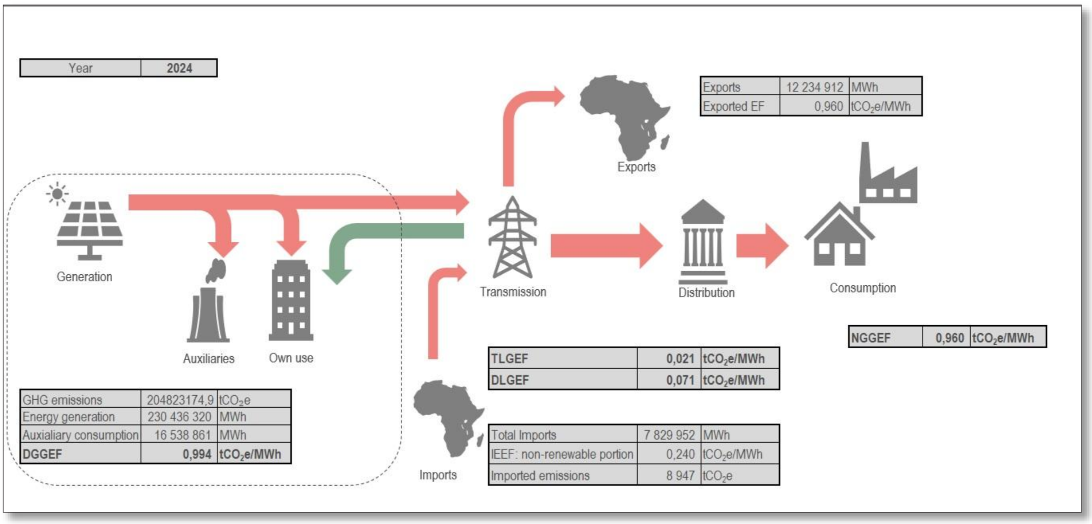

Figure 1: South Africa's Electricity Grid Information 2024

The resulting four GEFs from the above data are shown in Table 1.

Table 1: South Africa's 2024 Grid Emission Factors

GEF	Value (tCO_2e/MWh)
DGGEF	0.994
NGGEF	0.960
TLGEF	0.021
DLGEF	0.071

A high GEF (e.g., >1 kgCO2 per kWh) typically indicates that a given electricity grid is powered by carbon intensive fuel sources such as fossil fuels, while GEFs closer to zero symbolise electricity grids that are supplied by renewable energy sources. The 2024 Grid Emission Factors (GEFs) for South Africa indicate an increase in emissions intensity relative to 2023 across all reported metrics.

The Domestic Generation Grid Emission Factor (DGGEF) increased from 0.942 tCO_2e/MWh in 2023 to 0.994 tCO_2e/MWh in 2024, while the National Generation Grid Emission Factor (NGGEF) rose from 0.906 to 0.960 tCO_2e/MWh. Similarly, the Transmission Loss GEF (TLGEF) increased marginally from 0.020 to 0.021 tCO_2e/MWh, and the Distribution Loss GEF (DLGEF) increased from 0.062 to 0.071 tCO_2e/MWh.

The increase in the 2024 Grid Emission Factors reflects a higher carbon intensity of electricity generation compared to 2023, likely driven by greater reliance on coal-fired generation and reduced contributions from lower-carbon energy sources. As a result, each unit of electricity consumed in 2024 was associated with higher greenhouse gas emissions than in the previous calendar year.

4. Introduction

4.1. Background

To support transparent and consistent emissions reporting from the electricity sector, Department of Forestry, Fisheries and Environment (DFFE) developed a methodological tool to enable the periodic calculation and annual publication of South Africa's Grid Emission Factors (GEFs). A GEF quantifies the greenhouse gas (GHG) emissions associated with a unit of electricity generated (e.g., kg CO_2e per kWh) and serves as a core parameter for energy-related carbon accounting. Regularly updated GEFs strengthen the accuracy, consistency, and credibility of electricity-related emissions reported by public and private stakeholders across national and international reporting frameworks. They also provide an evidence base for policy design, regulatory implementation, and climate mitigation planning.

Recent climate governance developments , including the operationalisation of national climate legislation, strengthened reporting obligations, carbon pricing instruments, and expanding international disclosure requirements aligned with mechanisms such as those of the European Union have further increased the strategic importance of maintaining current and robust GEF datasets. Although GEFs are published annually, they are subject to an inherent data availability lag of approximately two years to allow for the consolidation and verification of national electricity and emissions statistics. For example, a GEF released in 2026 reflects calculations based on the 2024 calendar-year dataset. Consequently, South Africa's GEFs are issued on an annual cycle while maintaining methodological accuracy, completeness, and data integrity.

For the first Grid Emission Factor report, Department of Forestry, Fisheries and Environment (DFFE) developed the methodology for determining GEFs through technical engagements with relevant stakeholders, including Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and IBIS Consulting. As part of this initial development process, a range of methodological approaches applied in different countries and reporting frameworks were reviewed and assessed for applicability to South Africa's national context. In the end, the following four GEFs were developed:

- Domestic Generation Grid Emission Factor
- National Generation Grid Emission Factor
- Transmission Losses Grid Emission Factor
- Distribution Losses Grid Emission Factor

The definition and intended use of these GEFs is explained in section 5.7. These GEFs are location-based GEFs. Following the publication of the first report, subsequent updates for the second, third, and current fourth GEF reports have been undertaken internally by DFFE.

4.2. Purpose

The purpose of this report is to publish South Africa's 2024 Grid Emission Factors (GEFs) and to provide guidance to stakeholders on the appropriate application of these factors for greenhouse gas (GHG) reporting purposes. The report serves as a reference for all entities required to quantify and disclose emissions associated with electricity consumption, ensuring consistent and accurate use of the approved GEF values.

Four distinct GEFs have been developed, namely: the Domestic Generation Grid Emission Factor (DGGEF), the National Generation Grid Emission Factor (NGGEF), the Transmission Loss Grid Emission Factor (TLGEF), and the Distribution Loss Grid Emission Factor (DLGEF).

5. Methodology

5.1. Overview

A GEF is a value that depicts the relationship between GHG emissions and electricity usage. The generic equation used to determine a GEF is shown below;

$$GEF = GHG\ Emissions\ from\ Electricity\ Production \div Amount\ of\ Electricity\ Produced$$

Depending on the boundaries incorporated, the electricity amount used could be related to electricity generated, consumed, or transmitted also taking other factors into consideration, such as the amount of electricity imported or exported. Hence, in most cases different GEFs are developed for various scenarios.

Domestic electricity generation information (emissive and non-emissive) was sourced from the National Energy Regulator South Africa NERSA. NERSA collects electricity generation information from all licensed electricity producers in the country. Eskom provided electricity import and export data, as well as distribution and transmission loss data.

5.2. Green House Gas (GHG) Emissions

5.2.1. GHG Emissions from Domestic Production

GHGs emissions data from domestic electricity production was extracted from the South Africa's GHG Emission Reporting Programme and from individual power producers in the cases where the electricity generator falls below the 10 MW threshold set by the National GHG Emissions Reporting Regulations (NGERs).

5.2.2. GHG Emissions from Imported Electricity

Data from the approved Standardised Baseline: Grid Emission Factor for the Southern African Power Pool[1] (SAPP) was used to determine an emission factor for electricity that was imported by South Africa from regional partners.

The Imported Electricity Emission Factor (IEEF) applied in the 2021 and 2022 Grid Emission Factor (GEF) Reports was 0.168 tCO_2e/MWh. This factor was derived from electricity generated by both emissive and non-emissive sources within the Southern African Power Pool (SAPP), excluding South Africa's own electricity generation and associated greenhouse gas (GHG) emissions.

Accordingly, the IEEF of 0.168 tCO_2e/MWh was uniformly applied to all imported electricity irrespective of generation source in the 2021, and 2022 GEF Reports.

In 2024, DFFE received feedback on the 2021 GEF Report, that requested that the IEEF emission factor be revised to more accurately reflect electricity imported from hydropower plants. Hence the SAPP data was amended to remove data for electricity generated from Hidroelectrica de Cahora Bassa (HCB) and from Lesotho Electricity Company (LEC). The resulting IEEF, after excluding data from South Africa, HCB and LEC, is 0.244 tCO_2e/MWh. This updated IEEF is applied to the remainder of the electricity that is imported from various sources (both emissive and non-emissive) from the SAPP.

However, it should be noted that this improvement only yielded a difference of 0.6 % in the NGGEF. An example of this is based on the 2022 data. Table 2 below shows that the 2022 NGGEF changed from 0.931 tCO_2e/MWh to 0.925 tCO_2e/MWh by applying an updated IEEF to the remainder of the imports only.

Table 2: Impact of an improved IEEF

2022 Data	IEEF (tCO_2e/MWh)	
	Old: 0.168	Updated: 0.244

[1] Clean Development Mechanism, ASB0040-2018_PSB0044, CDM: Standardized baselines

IEEF (tCO_2e/MWh)	0.168	0.244
NGGEF (tCO_2e/MWh)	0.931	0.925
Difference in NGGEF (%)	-0.6	

Further disaggregation of this factor will render the exercise more complex as it would require a more detailed breakdown of the imported sources as well as having individual emission factors for the specific exporting company or power plant. Currently, the portion of the imported electricity, not from HCB or LEC, is 0.5% of the total imports and is hence not significant. It is recommended that this IEEF of 0.244 tCO_2e/MWh be revised when the portion of electricity not imported from HCB and LEC increases to more than 20 % of total imports.

5.3. Domestic Generation Grid Emission Factor

The domestic generation grid emission factor (DGGEF) represents the amount of GHG emissions per unit of electricity produced within South Africa. It accounts for electricity generation regardless of whether the electricity is exported or consumed domestically, but it excludes auxiliary consumption associated with generation and electricity produced for on-site use. Wheeling that is not intended for sale or grid distribution is excluded, whereas private wheeling agreements are included in the calculation. Figure 2 illustrates the measurement boundary for the DGGEF.

By definition, the DGGEF is particularly valuable for the DFFE in policy development and international reporting. It is also a useful reference for other government departments, including the Department of Energy and Electricity.

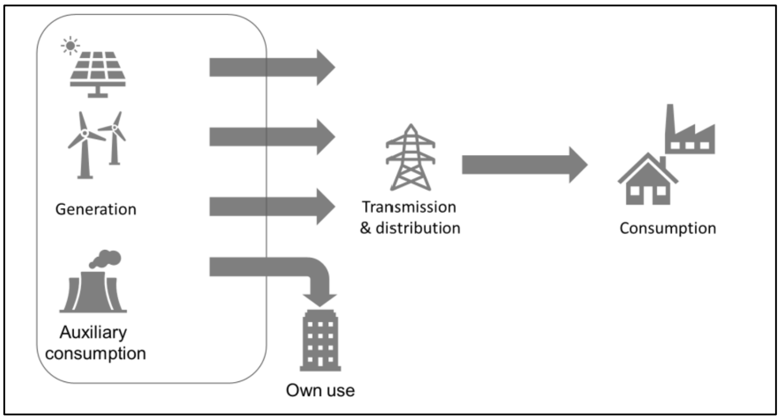

Figure 2: DGGEF Boundary

Table 3 below shows the input data that was used to determine the domestic generation GEF.

Table 3: Domestic Generation GEF Input Data[2]

	Value	Units
Domestic Electricity Generation Emissions	204 823 175	tCO_2e
Domestic Electricity Generation[3]	230 436 320	MWh
Domestic Generation Auxiliary Consumption	16 538 861	MWh
Domestic Generation Own Consumption	7 924 377	MWh

5.4. National Generation Grid Emission Factor

The national generation grid emission factor (NGGEF) depicts the relationship of emissions and end user electricity consumption. The NGGEF does not include transmission and distribution losses because these losses are typically not suited for Scope 2 emissions reporting that only includes emissions related to electricity consumption. Transmission and distribution losses are incorporated in Scope 3 emissions reporting and are further discussed in sub-sections 5.5 and 5.6.

The NGGEF includes electricity that is imported, as a generation source, and electricity that is exported, as an end consumer. The GHG emissions associated with both imported and exported electricity are included in the calculation. Figure 3 below, shows the measurement boundary for the NGGEF.

The NGGEF will be most useful to electricity consumers, especially those that need to conduct corporate reporting of GHG emissions or those that need to report on Scope 2 emissions.

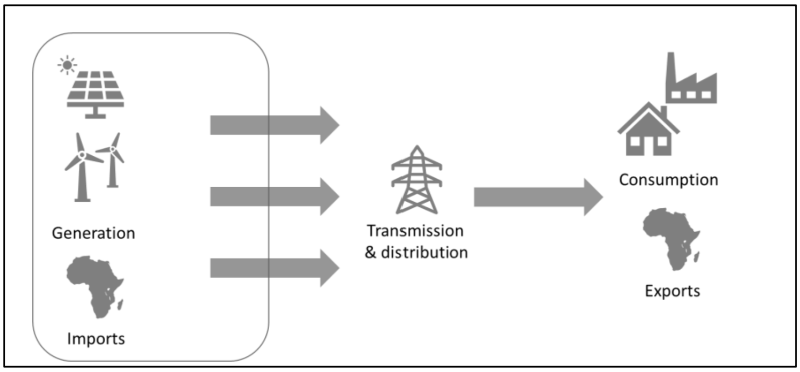

Figure 3: NGGEF Boundary

[2] Global Warming Potentials (GWPs) from the IPCC Second Assessment Report were applied in the calculation of CO_2-equivalent emissions.
[3] This values already excludes auxiliary and own consumption.

Table 4 below shows the input data that was used to determine the national generation GEF.

Table 4: National Generation GEF Input Data[4]

	Value	Units
National Electricity Generation Emissions	204 823 175	tCO_2e
Imported Electricity Emissions	4 708	tCO_2e
National Electricity Generation[5]	230 436 320	MWh
National Generation Auxiliary Consumption	16 538 861	MWh
National Generation Own Consumption	7 924 377	MWh
Imported Electricity	8 405 350	MWh

Appendix A gives an example of how the NGGEF should be used to calculate GHG emissions for reporting.

5.5. Transmission Losses Grid Emission Factor

The transmission losses grid emission factor (TLGEF) depicts the relationship between the emissions and end user electricity consumption while considering transmission losses. This is because a unit of electricity used by an end user is not related to a unit of electricity generated due to transmission (and in some cases distribution) losses.

In some cases, transmission and distribution losses are accounted for under one GEF, however, in this case the GEFs have been developed as two separate factors. This is because some facilities are fed directly by the transmission network and hence only the TLGEF would apply to them for Scope 3 reporting. Facilities that are not fed directly by the transmission network should, therefore, use both the TLGEF and the DLGEF when reporting on Scope 3 GHG emissions.

The TLGEF considers the inherent inefficiencies in the transmission process that result in energy being converted to non-useful sources (e.g., heat and noise) along the transmission network, as well as losses due to the voltage step-up and step-down transformers before and after the transmission network. Figure 4 below, shows the measurement boundary for the TLGEF and the DLGEF.

The TLGEF will be most useful to electricity consumers, especially those that need to conduct corporate reporting of GHG emissions or those that need to report on Scope 3 emissions. However, it should be

[4] Global Warming Potentials (GWPs) from the IPCC Second Assessment Report were applied in the calculation of CO_2-equivalent emissions.
[5] This values already excludes auxiliary and own consumption.

noted that this TLGEF is not suitable for use in situations involving electricity generated for own use, since the transmission losses are considered negligible due proximity to the generator.

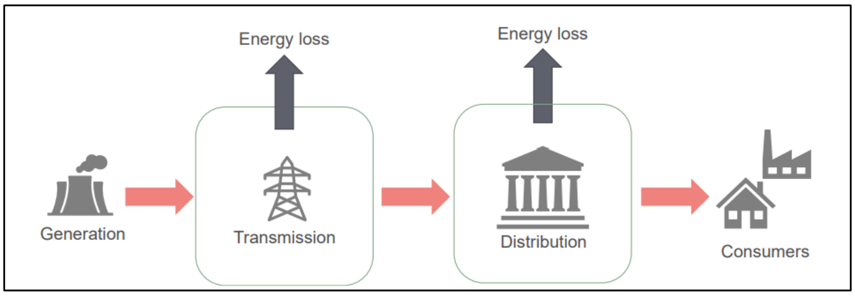

Figure 4: TLGEF and DLGEF Boundaries

Table 5 below shows the input data that was used to determine the transmission and distribution losses GEFs.

Table 5: Transmission & Distribution Losses GEFs Input Data

	Value
Transmission Losses	2.20 %
Distribution Losses (including non-technical)	10.60 %
Distribution Losses (excluding non-technical)	7,42 %

Appendix A give examples of how the TLGEF should be used to calculate GHG emissions for reporting.

5.6. Distribution Losses Grid Emission Factor

The distribution losses grid emission factor (DLGEF) depicts the relationship between the emissions and end user electricity consumption while considering distribution losses. This is because a unit of electricity used by an end user is not related to a unit of electricity generated due to distribution (and transmission) losses. The DLGEF considers technical losses and excludes non-technical losses.

The DLGEF will be most useful to electricity consumers, especially those that need to conduct corporate reporting of GHG emissions or those that need to report on Scope 3 emissions. However, it should be noted that, as with the TLGEF, the DLGEF is not suitable for use in situations involving electricity generated for own use, since the distribution losses are considered negligible due proximity to the generator.

Facilities that are not fed directly by the transmission network should use both the TLGEF and the DLGEF when reporting on Scope 3 GHG emissions.

Appendix A give examples of how the DLGEF should be used to calculate GHG emissions for reporting.

5.7. Intended Users & Uses of the Grid Emission Factors

The four different GEFs have been developed for various uses and users. Table 6 shows the intended users and uses of the four GEFs that were developed for South Africa.

Table 6: Intended Uses and Users for South Africa's Grid Emission Factors

Grid Emission Factors	Use	Intended User
Domestic generation GEF (DGGEF)	Policy development International reporting	Government
National generation GEF (NGGEF)	Corporate reporting Scope 2 emissions reporting	Consumers
Transmission losses GEF (TLGEF)	Corporate reporting Scope 3 emissions reporting	Government Consumers
Distribution losses GEF (DLGEF)	Corporate reporting Scope 3 emissions reporting	Government Consumers

6. South Africa's 2024 Grid Emission Factors

6.1. 2024 Grid Emission Factors

The diagram below presents South Africa's 2024 electricity generation and grid emission factor information (see figure 5). Total GHG emissions from electricity generation amount to 204,823,174 tCO_2e, associated with 230,436,320 MWh of energy generation. After accounting for 16,538,861 MWh of auxiliary consumption, the calculated Domestic Generation Grid Emission Factor (DGGEF) is 0.994 tCO_2e/MWh.

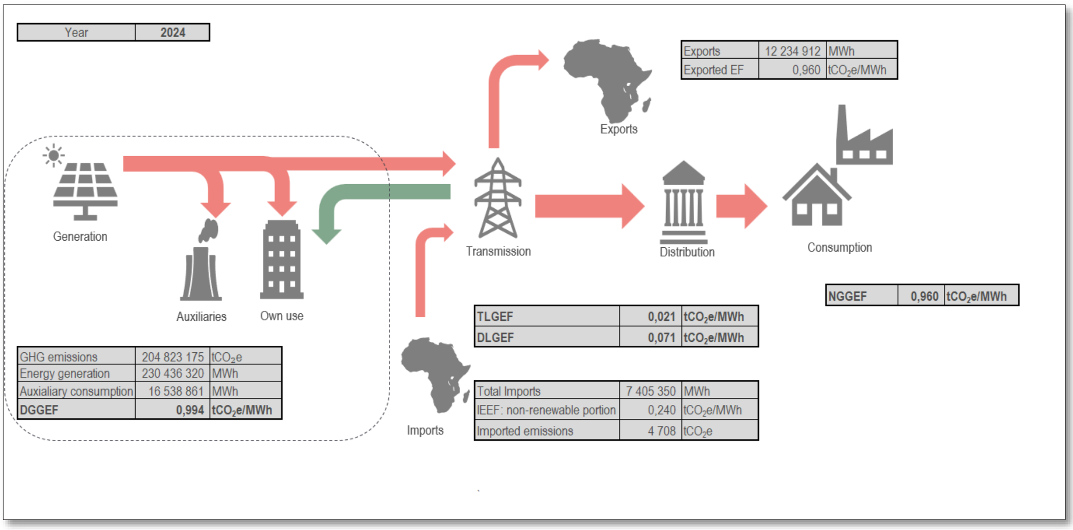

Figure 5: South Africa's Electricity Grid Information 2024

The resulting National Grid Electricity Emission Factor (NGEF) for consumption is 0.960 tCO_2e/MWh, which reflects adjustments for imports, exports, and grid losses. Overall, the data confirms that South Africa's grid remains highly carbon-intensive in 2024, with emissions dominated by domestic fossil-based generation.

Table 7 below shows the four GEFs since 2021. A GEF value above 1 tCO_2e/MWh indicates an electricity grid that is powered by carbon intensive fuels, such as non-renewables. Between 2021 and 2023, both the DGGEF and NGGEF show a clear declining trend, followed by an increase in 2024.

- DGGEF decreased from 1.013 tCO_2e/MWh (2021) to 0.94 tCO_2e/MWh (2023), reflecting a temporary improvement in the carbon intensity of domestic electricity generation. However, in

2024, it increased to 0.994 tCO_2e/MWh, indicating a return to more carbon-intensive generation conditions.

- NGGEF follows the same trajectory, declining from 0.985 tCO_2e/MWh (2021) to 0.91 tCO_2e/MWh (2023), then rising to 0.960 tCO_2e/MWh (2024). The NGGEF remains consistently lower than the DGGEF, reflecting the influence of imports, exports, and grid adjustments on the consumption-based emission factor.

An emission factor of 0.244 tCO_2e/MWh was used to estimate the emissions from imported electricity from sources other than HCB and LEC. This emission factor was calculated from the UNFCCC Standardised Baseline GEF for SAPP data, excluding data from South Africa, as well as from HCB and LEC which run hydro power plants.

Table 7: South Africa's Grid Emission Factors 2021-2024.

GEF (tCO_2e/MWh)	2021	2022	2023	2024
DGGEF	1.013	0.960	0.942	0.994
NGGEF	0.985	0.931	0.906	0.96
TLGEF	0.023	0.022	0.020	0.021
DLGEF	0.066	0.063	0.062	0.071

6.2. Comparison of South Africa's Grid Emission Factors

Figure 6 below shows a general downward trend in both the Domestic Generation Grid Emission Factor (DGGEF) and the National Grid Electricity Emission Factor (NGEF) from 2021 to 2023, followed by a moderate increase in 2024.

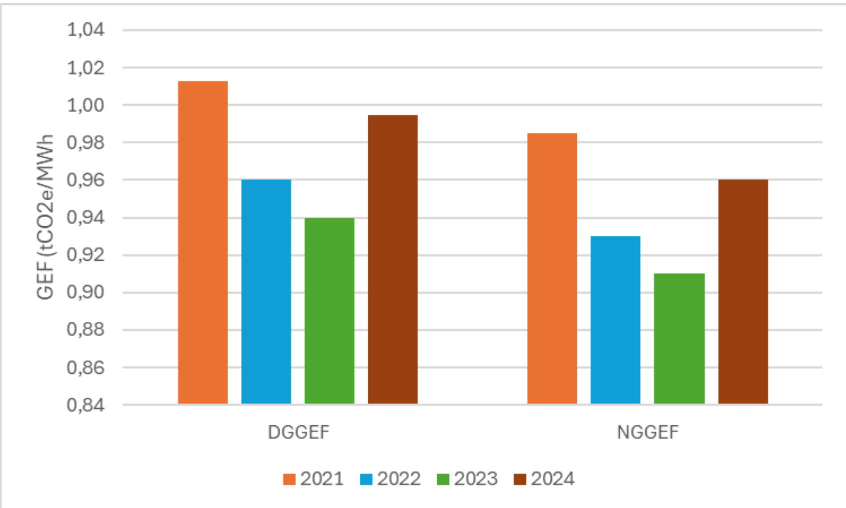

Figure 6: DGGEFs & NGGEFs for 2021 – 2024

For DGGEF, the factor declined from approximately 1.01 tCO_2e/MWh in 2021 to about 0.94 tCO_2e/MWh in 2023, indicating an improvement in generation efficiency and/or a relatively cleaner generation mix over this period. However, in 2024, the DGGEF increased again to around 0.99 tCO_2e/MWh representing an increase of approximately 5.3% compared to the 2023 value. This increase suggests a shift back toward more carbon-intensive generation, likely due to higher coal utilisation, reduced renewable output, or greater reliance on fossil-fuel-based generation during the year.

A similar pattern is observed for NGEF, which decreased from roughly 0.98 tCO_2e/MWh in 2021 to 0.91 tCO_2e/MWh in 2023, before rising to approximately 0.96 tCO_2e/MWh in 2024. The consistent gap between DGGEF and NGEF across all years reflects the impact of imports, exports, and transmission and distribution losses on the final consumption-based emission factor.

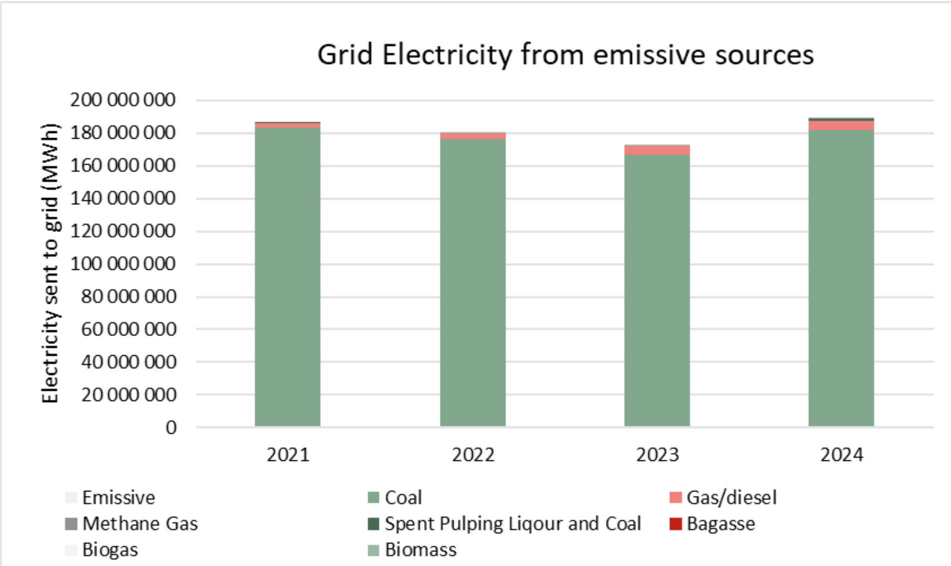

Figure 7: Grid Electricity from Emissive Sources

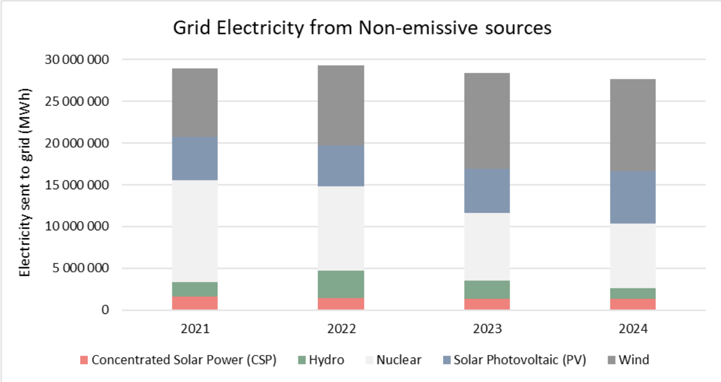

Figure 8: Grid Electricity from Non-emissive Sources

The graph on figure 9 shows the percentage share of non-emissive electricity generation in the total generation mix from 2021 to 2024. Overall, the trend indicates a slight increase between 2021 and 2023, followed by a decline in 2024.

From 2021 to 2023, the share of non-emissive generation increased from 13.4% to 14.1%, suggesting a modest improvement in the contribution of lower-carbon electricity sources such as renewables and nuclear in the electricity mix. This increase indicates a gradual shift toward cleaner generation during this period.

However, in 2024, the proportion of non-emissive generation declined to 12.8%. This decrease suggests that the electricity system relied more heavily on emissive sources, primarily fossil-fuel-based generation, relative to non-emissive sources during the year. The decline may reflect operational constraints in renewable generation, variability in resource availability, or increased use of conventional generation to maintain electricity supply.

The graph indicates that while there was progress toward a slightly cleaner generation mix up to 2023, this improvement was not sustained in 2024, resulting in a reduced share of non-emissive electricity.

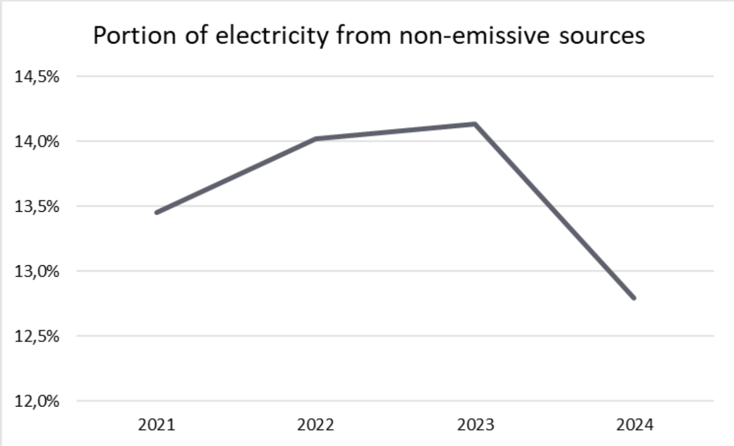

Figure 9: Portion of electricity from non-emissive sources

Overall, while 2021–2023 reflects gradual decarbonisation of the grid, the 2024 increase indicates a partial reversal, highlighting the continued structural dependence on fossil-based electricity generation.

These changes alone would not necessarily result in significantly lower GEFs, as is best illustrated in Table 8 with scenarios 1 – 3. However, together these changes do in fact result in a significantly lower GEF as shown by scenario 4.

Table 8: Scenarios for changes in GEFs

	E_{ES}* (MWh)	GHGs (tCO_2e)	E_{NES}* (MWh)	E_{NES}* Portion	GEF (tCO_2e/MWh)	GEF change	Notes
Baseline	100	100	11	10%	0.90		Baseline
Scenario 1	80	80	11	12%	0.88	-2%	Decrease in one major emissive source
Scenario 2	80	79	11	12%	0.87	-4%	Decrease in two emissive sources
Scenario 3	100	100	12	11%	0.89	-1%	Increase in portion of E_{NES}
Scenario 4	80	79	10	11%	0.83	-8%	Combination of scenarios 1 - 3

Where E_{ES} – electricity from emissive sources, E_{NES} – electricity from non-emissive sources

It is also important to note that a change in the mix of emissive sources could have a significant impact on a GEF. Particularly when significant changes to the energy mix occur. For example, if we look at coal and diesel, the IPCC default CO_2 emission factors are 96 100 $kgCO_2/TJ$ and 74 100 $kgCO_2/TJ$, respectively. Hence, significantly decreasing electricity from coal while increasing electricity from diesel would result in a less carbon intense grid because of the lower carbon content of diesel.

Figure 10 presents the trends in the Transmission Loss Grid Emission Factor (TLGEF) and the Distribution Loss Grid Emission Factor (DLGEF) for the period 2021–2024.

The TLGEF remained relatively stable across the reporting period, with only minor fluctuations. The factor decreased from approximately 0.023 tCO_2e/MWh in 2021 to 0.020 tCO_2e/MWh in 2022 and 2023, before increasing slightly to around 0.021 tCO_2e/MWh in 2024. This relatively stable trend suggests that the emissions associated with electricity losses during transmission remained broadly consistent over the period, with only marginal variation.

In contrast, the DLGEF shows more noticeable variation over the same period. The factor declined from about 0.066 tCO_2e/MWh in 2021 to 0.060 tCO_2e/MWh in both 2022 and 2023, indicating a temporary reduction in the emissions associated with electricity losses in the distribution network. However, in 2024, the DLGEF increased to approximately 0.071 tCO_2e/MWh, representing the highest value observed during the reporting period.

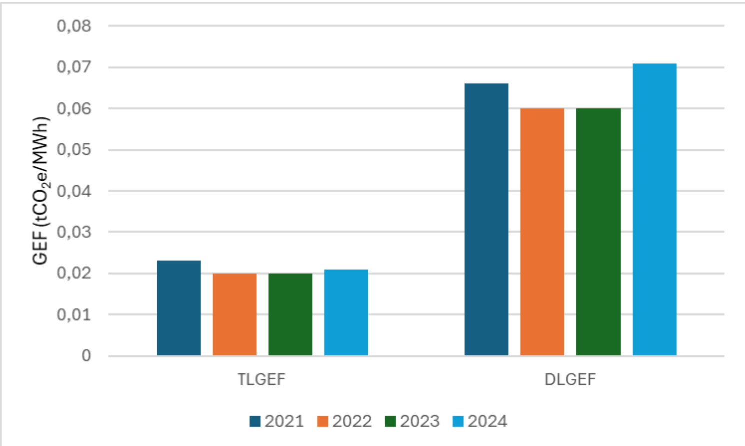

Figure 10: TLGEFs & DLGEFs for 2021 - 2024

The increase in the Distribution Loss Grid Emission Factor in 2024 is consistent with the higher share of emissive electricity generation and the decline in the proportion of non-emissive electricity sources during the year. As electricity losses in the distribution network are calculated based on the emissions intensity of electricity supplied to the grid, a more carbon-intensive generation mix results in higher emissions associated with distribution losses.

7. Appendix A – Example Calculations

Below are examples showing how the NGGEF, TLGEF and DLGEF should be used. The GEFs in Figure 11 below will be used. These GEFs should be used as location-based GEFs.

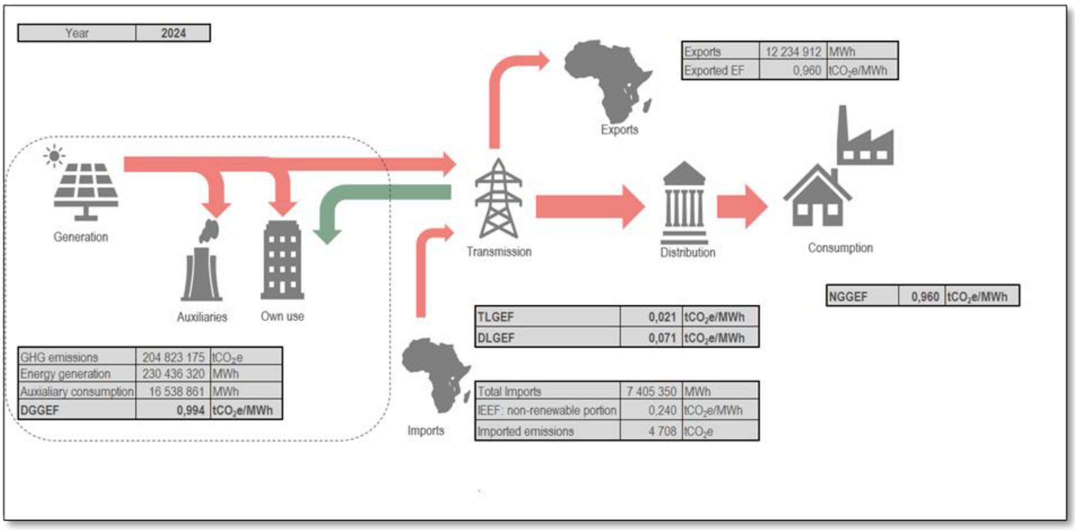

Figure 11: Example of GEFs

7.1. A.1. Calculations using the NGGEF

The NGGEF is used, for instance, for Scope 2 emissions reporting. If a consumer purchased 500 MWh during the year from the grid, the Scope 2 GHG emissions would be as follows;

Scope 2 GHG emissions = electricity purchased * NGGEF

$$= 500\ MWh * 0.960 \frac{tCO_2e}{MWh}$$

$$= \mathbf{480} \boldsymbol{tCO_2e}$$

7.2. A.2. Calculations using the TLGEF

The TLGEF is used by consumers on the transmission network, for instance, for Scope 3 emissions reporting. If a consumer purchased 500 MWh during the year, the Scope 3 GHG emissions would be as follows;

Scope 3 GHG emissions for the transmission network = electricity purchased * TLGEF

$$= 500\ MWh * 0.021 \frac{tCO_2e}{MWh}$$

$$= \mathbf{10.5}\ \boldsymbol{tCO_2e}$$

7.3. A:3. Calculation using the TLGEF and the DLGEF

For consumers on the distribution network, both the TLGEF and the DLGEF are applicable, for instance for Scope 3 reporting. If a consumer purchased 500 MWh during the year, the Scope 3 GHG emissions would be as follows;

Scope 3 GHG emissions for the distribution network = electricity purchased * (TLGEF + DLGEF)

$$= 500\ MWh * (0.021 + 0.071)\frac{tCO_2e}{MWh}$$

$$= \mathbf{46}\ \boldsymbol{tCO_2e}$$

8. Appendix B – List of published GEF Reports

Report	Publish Date	Report Link
2021 GEF Report	2024	https://www.dffe.gov.za/research-documents
2022 GEF Report	2024	https://www.dffe.gov.za/sites/default/files/legislations/nemaqa_gridemissionsreport2022.24_g51495gon5498.pdf
2023 GEF Report	2025	https://www.dffe.gov.za/sites/default/files/legislations/publication_SAgridemissionfactorsreport_g53079gon6454.pdf