VOLTA RIVER AUTHORITY

2025

GREENHOUSE GAS INVENTORY REPORT

Corporate Carbon Footprint Management Programme

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VOLTA RIVER AUTHORITY

CORPORATE ENVIRONMENTAL POLICY

The Volta River Authority (herein referred to as "Authority") commits to ensuring continuous improvement of its environmental performance, minimizing potential impacts of all its operations on the environment, and addressing climate change issues arising from its operations in accordance with the principles of sustainable development in compliance with applicable national and international environmental protection regulations.

Policy Objectives

The Authority will thus prioritize sustainability, climate actions, and the protection of ecosystems and communities in all its business planning, decision-making, and operations. To achieve this, VRA commits to the following:

1) Environmental Management – Implement an Environmental Management System (EMS) to identify, assess, and mitigate environmental impacts, promote pollution prevention, resource efficiency, and ensure compliance with applicable laws and standards.
2) Climate Action – Reduce greenhouse gas emissions by promoting renewable and sustainable energy, energy efficiency, and climate-resilient practices across operations.
3) Community & Ecosystem Protection – Safeguard communities and ecosystems through proactive impact mitigation, biodiversity conservation, watershed protection, and sustainable land management.
4) Awareness & Capacity Building – Foster environmental responsibility among staff, contractors, and stakeholders through training, awareness creation, and knowledge sharing.
5) Stakeholder Engagement – Maintain transparent and collaborative engagement with communities, regulators, and stakeholders to enhance trust and shared responsibility.
6) Circular Economy & Waste Management – Adopt practices that reduce waste generation, promote recycling, safe disposal, and minimize hazardous, plastic, and electronic waste.
7) Research & Policy Support – Collaborate with partners to advance research, innovation, and policies that strengthen environmental sustainability.
8) Sustainable Resource Management – Preserve the Volta Lake and other natural resources by addressing ecological imbalances and promoting sustainable practices.

To this end, VRA shall monitor, evaluate, and periodically review this policy to ensure effectiveness, continual improvement, and alignment with industry's best practices. Any deficiencies in the policy or its implementation will be promptly identified and addressed. The Authority reaffirms its commitment to balancing energy development with environmental protection through innovation, collaboration, and accountability.

Approved: SIGNED Date: 01/07/2026

Edward E. Obeng-Kenzo

CHIEF EXECUTIVE

VOLTA RIVER AUTHORITY

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REPORT DETAILS

Title:	**2025 CORPORATE GREENHOUSE GAS INVENTORY REPORT**
Project Description:	The Volta River Authority (VRA) in 2016 initiated a "Corporate Carbon Footprint Management Programme" (CFMP) as part of its Corporate Strategic Objectives to allow for the measuring and publishing of its Greenhouse gases (GHG) assessment and strengthen its green credentials in the marketplace. The CFMP sets out the commitment of VRA to measure, monitor, manage, and communicate climate change impacts resulting from its activities – specifically greenhouse gas emissions. To give expression to this commitment, the VRA now presents its 2025 Greenhouse Gas Inventory Report. The report compares GHG emissions from 2025 to its baseline year of 2015 and includes several internal sustainability targets as well as emissions reduction initiatives achieved. As indicated, the results of our annual GHG inventory allow for the tracking of progress made against our emission targets, measuring the impact of implemented reduction initiatives, and identifying further reduction opportunities for future action.
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ABBREVIATIONS

AERs	-	Annual Environmental Reports
AHL	-	Akosombo Hotels Limited
APML	-	Akosombo Paper Mill Limited
AR2	-	Second Assessment Report
AR6	-	Sixth Assessment Report
ATP	-	Anwomaso Thermal Power Station
CAT	-	Carbon Accounting Team
CDM	-	Clean Development Mechanism
CEB	-	Communaute Electrique du Benin
CEMS	-	Continuous Emission Monitoring System
CFMP	-	Corporate Carbon Footprint Management Program
CH_4	-	Methane
CIE	-	Compagnie Ivorienne d'Electricite
CO_2	-	Carbon Dioxide
CWSP	-	Corporate Solid Waste Segregation Program
DFO	-	Distillate Fuel Oil
E&SDD	-	Environment & Sustainable Development Department
ECG	-	Electricity Company of Ghana
EPA	-	Environmental Protection Agency
ESI	-	Environment & Social Impact
GHG	-	Greenhouse Gases
GRIDCo	-	Ghana Grid Company
GWPs	-	Global Warming Potentials
HF_6	-	Sulfur Hexafluoride
HFCs	-	Hydroflorocarbon
HVAC	-	Heating Ventilation Air Condition
IPCC	-	Inter-Governmental Panel on Climate Change
KTPS	-	Kpone Thermal Power Station
LCO	-	Light Crude Oil
LNG	-	Liquified Natural Gas
MT	-	Metric Tonnes
MWH	-	Megawatts Hour
N_2O	-	Nitrous Oxide
NDA	-	Non-Disclosure Agreement
NDC	-	Nationally Determined Contributions
NED	-	Northern Electricity Department
NEDCo	-	Northern Electricity Distribution Company
NF_3	-	Nitrogen Trifluoride
PFCs	-	Perfluorocarbons

PDD	-	Project Design Document
R&M	-	Regulatory & Metering
SF_6	-	Sulphur Hexafluoride
SONABEL	-	Societe Nationale d'electricite du Burkina Faso
$tC0_2e$	-	Tonnes Carbon dioxide equivalent
T1	-	Takoradi 1 Thermal Power Station
T3	-	Takoradi 3 Thermal Power Station
TICO	-	Takoradi International Company
TT1PS	-	Tema Thermal 1 Power Station
TT2PS	-	Tema Thermal 2 Power Station
TTPC	-	Tema Thermal Power Complex
UNFCC	-	United Nations Framework Convention on Climate Change
VLTC	-	Volta Lake Transport Company Limited
VRA	-	Volta River Authority
WAPCo	-	West African Gas Pipeline Company
WAPP	-	West Africa Power Pool

EXECUTIVE SUMMARY

The Volta River Authority (VRA) in 2016 initiated a "Corporate Carbon Footprint Management Programme" (CFMP) as part of its Corporate Strategic Objectives to allow for the measuring and publishing of its Greenhouse gases (GHG) emissions and strengthen its green credentials in the marketplace. The CFMP sets out the commitment of VRA to measure, monitor, manage, and communicate climate change impacts resulting from its activities – specifically greenhouse gas emissions. Consequently, the VRA publishes this report annually to transparently disclose to its stakeholders its GHG emissions per this commitment. Furthermore, the report supports measuring, monitoring, and managing the environmental performance of VRA.

This report presents the 2025 GHG emissions inventory. It compares 2025 GHG Emissions with our designated baseline year of 2015. It also aims to identify trends and evaluate the effectiveness of emission reduction strategies - identifying further reduction opportunities for future action.

The consolidation of GHG emissions is considered from an operational control standpoint. In this regard, VRA has included in its emissions inventory all sources and sinks over which it has 100% operational control. The Stationary Combustion (for generation of energy on-site) and the Mobile Combustion (for corporate-owned and controlled transportation sources) tools as deduced from the GHG Protocol, are utilized in this report. The report also uses Global Warming Potential values and default Emission Factors sourced from the Inter-Governmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6) and the IPCC Guidelines (2006, with 2019 Refinement) for National Greenhouse Gas Inventories respectively. The use of these guidelines is to enhance the quality of the GHG emission estimates, transparency, completeness, consistency, comparability, and accuracy - in line with the National Greenhouse Gas Inventory of Ghana. The GHG inventory estimates are expressed in mass units, and carbon dioxide equivalents (CO_2e). This conversion uses the applicable global warming potential (GWP) of each gas, which reflects its relative contribution to climate change over 100 years compared to CO_2.

In this Greenhouse Gas Inventory Report, VRA has focused on quantifying and reporting Scope 1 emissions. Emissions resulting from Scope 2 are not considered because power consumed by VRA is from its own generation station and has already been considered in Scope 1. Scope 3 emissions, particularly those resulting from employee business air travel, have been estimated. The decision to restrict Scope 3 emissions to business air travels is driven by the limitations in data accuracy and availability for comprehensive Scope 3 reporting. VRA is committed to expanding its GHG inventory to include Scope 3 emissions in the future. We are actively working on improving our data collection processes and methodologies to ensure accurate and comprehensive reporting.

Results of GHG emissions from VRA's operations for the year 2025 are as summarized in the table below.

Scope	GHG Emissions (tCO_2e)	Source
Scope 1	1,946,423.53	Stationary and mobile combustions
Scope 3	323.07	Business Air Travel

In 2025, total GHG emissions rose by 5.66% (104,258.68 tCO_2e) from the 2015 baseline, driven primarily by higher generation output in 2025 (12,976.79 GWh) compared to 9,055.51 GWh in 2015. Scope 1 emissions form the bulk of 2025 emissions, contributing about 99.98% of the total GHG emissions. Scope 3 accounts for 0.02% of the total emissions as depicted in Figure 0-1.

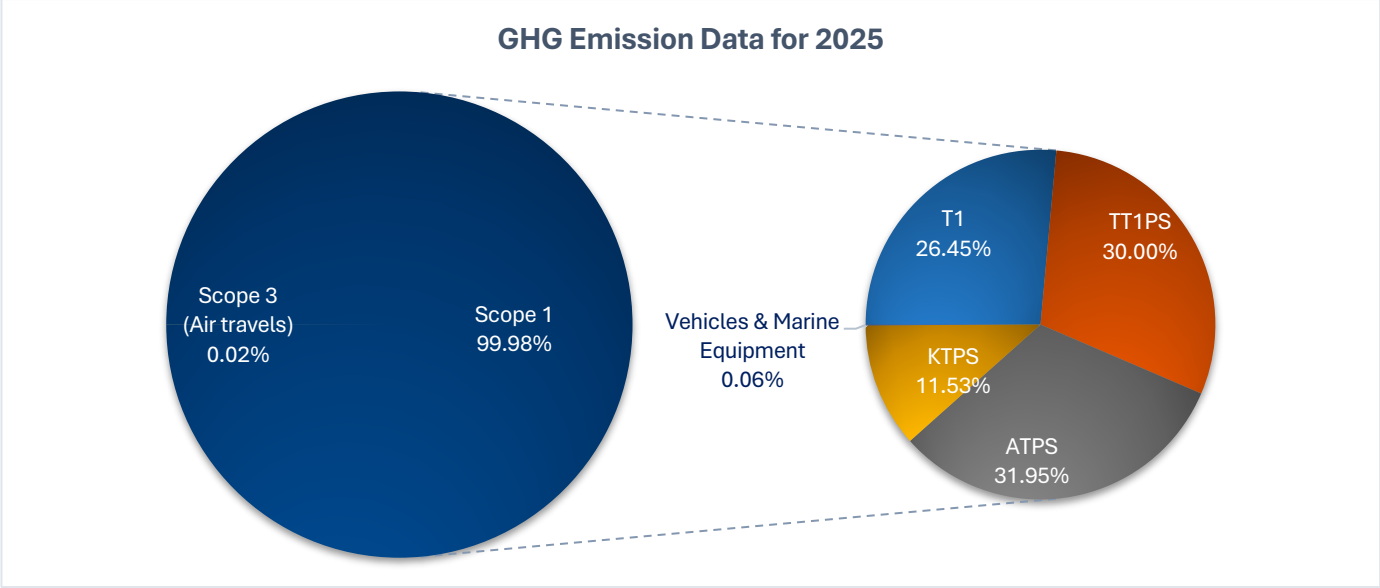

Figure 0-1: VRA's 2025 GHG Emissions (tCO_2e)

ATPS was the largest contributor, recording emissions of 621,939.45 tCO_2e, representing 31.95% of Scope 1. TT1PS followed with 583,994.92 tCO_2e (30.00%), while T1 contributed 514,956.01 tCO_2e (26.45%). KTPS recorded the lowest emissions among the stationary combustion sources at 224,406.91 tCO_2e (11.53%). The observed ranking reflects differences in generation output, fuel consumption, plant dispatch, operating hours, and overall operational efficiency across the facilities during the year. Data on 2025 GHG emissions by source category is presented in the table below.

Operational Emissions Category	Emissions Source Category	GHG Emission Source	2025	% of Scope	% of Grand Total
Scope 1	**Stationary Combustion**	T1	514,956.01	26.45%	26.44%
		TT1PS	583,994.92	30.00%	29.99%
		ATPS	621,939.45	31.95%	31.95%
		KTPS	224,406.91	11.53%	11.53%
	Mobile Combustion	Vehicles & Marine Equipment	1,126.24	0.06%	0.06%
	Scope 1 - Total		**1,946,423.53**	**100.00%**	**99.98%**
Scope 3	**Business Travels**	Air travels	323.07		
	Scope 3 - Total		**323.07**	**100.00%**	**0.02%**
Grand Total			**1,946,746.60**	—	**100.00%**

GHG Emissions expressed as a unit of production (per megawatt-hour of electricity generated) and compared with previous years and the baseline year (2015) to assess the efficiency and environmental impact of VRA's operations is as shown in Figure 0-2 below.

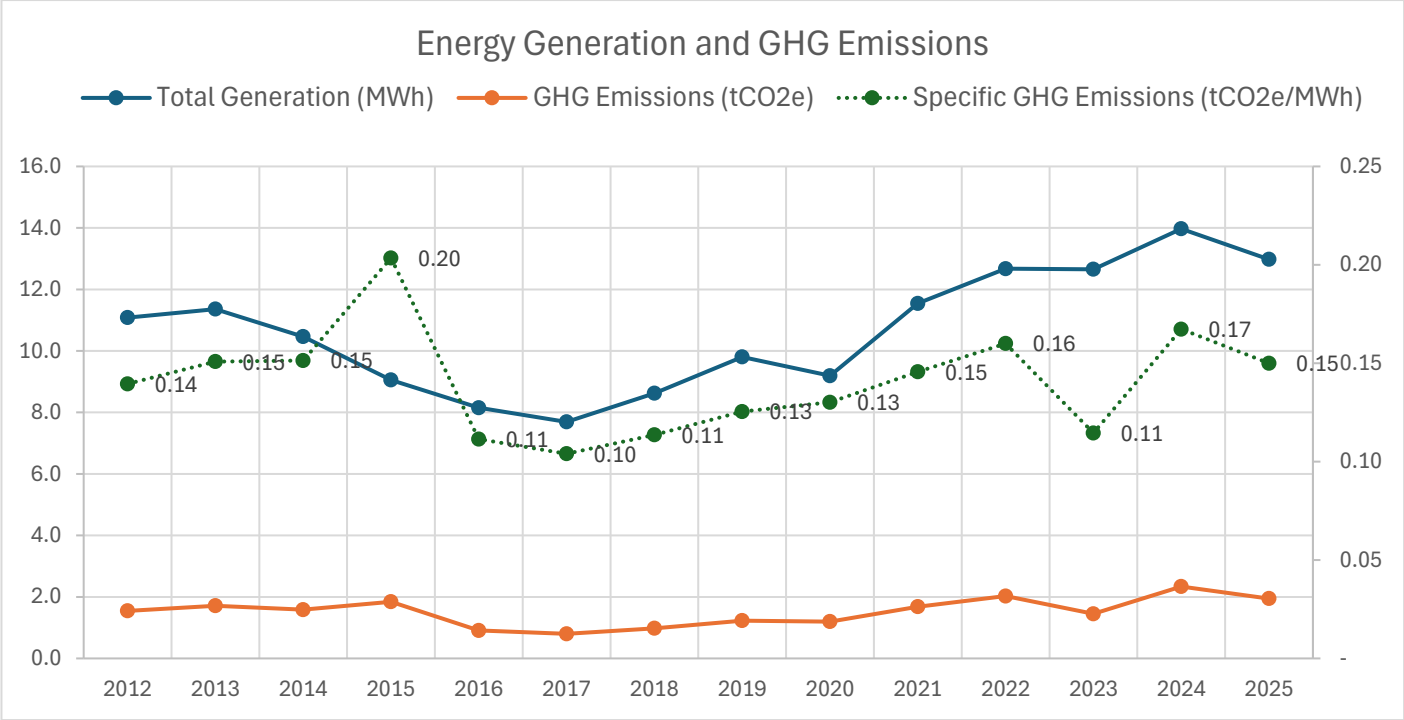

Figure 0-2: Trend analysis of Specific GHG Emission for 2012-2025

Although total GHG emissions in 2025 were significantly higher than in 2015, the emission intensity declined from 0.20 tCO_2e/MWh in 2015 to 0.15 tCO_2e/MWh in 2025. This reduction in intensity is largely due to the increased use of natural gas instead of crude oil or diesel fuel oil for power generation.

To offset GHG emissions. VRA has initiated a variety of conservation programs, involving renewable energy projects (Wind/Solar), Retooling Single Cycle Plants to Combine Cycle, Reforestation programs, Solid Waste Management Programs, Utilization of Fuel-Efficient Stoves, Paper Usage Reduction, Reduction in Travel/Transportation, and all these will result in significant reductions in GHG emissions. A summary of these conservation programs is provided in the report.

The following actions are to be pursued to improve future data capture and reporting as well as reduce GHG emissions:

1. Continue with the implementation of resource use efficiencies programs under the Corporate Sustainability Plan, targeting a reduction in paper and vehicular fuel usage, the adoption of video conferencing for meetings, and the digitization of our Internal business processes and operations.
2. Continue staff awareness and training to effectively embrace carbon-caring values throughout the operation of VRA.

3. Continue with the “Eco-Friendly Department” awards.
4. Initiate strategies to collate data on Hydrofluorocarbon emissions from specifically office Air Condition systems by 2026. Responsible staff will be trained on data collection methods and input into the spreadsheets.
5. Undertake area and ground survey to assess carbon sequestration of the VRA Reforestation program to offset VRA’s carbon emissions within its carbon accounting program by 2027.
6. Explore GHG savings from a reduced rate of deforestation or forest degradation within the catchment area of the Volta Lake as a result of VRA’s social interventions.
7. Build the capacity of KFL to publish their own GHG Report by 2027.
8. Inclusion of electric vehicles in the Authority’s fleet of vehicles to reduce GHG emissions.

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1 INTRODUCTION

1.1 BACKGROUND

Global warming and climate change have emerged as critical challenges of our time, with far-reaching implications for environmental sustainability, economic development, and social well-being. The United Nations Sustainable Development Goal (SDG) 13 – Climate Action calls for urgent measures to combat climate change and its impacts, emphasizing the need for organizations to take proactive steps in reducing greenhouse gas (GHG) emissions. As a key player in Ghana's energy sector, the Volta River Authority (VRA) recognizes its responsibility to contribute to global climate action by measuring, managing, and mitigating its carbon footprint.

In 2016, VRA launched the Corporate Carbon Footprint Management Programme (CFMP) as part of its broader commitment to environmental sustainability. This initiative aligns with VRA's corporate strategic objectives and reflects its dedication to strengthening its green credentials in the marketplace. The CFMP enables VRA to systematically measure, monitor, and report its GHG emissions, ensuring transparency and accountability in its environmental performance. This 2025 GHG Inventory Report serves to quantify VRA's Scope 1 and Scope 3 emissions in accordance with the IPCC Guidelines (2006, with 2019 Refinement), and validates its emissions trajectory through comparative year-on-year analysis. The report also highlights VRA's progress in reducing emissions, outlining future strategies for further reductions. By publishing this report, VRA reaffirms its commitment to environmental stewardship and its role in supporting Ghana's national and international climate commitments.

1.2 PURPOSE OF THIS REPORT

The primary purpose of this report is to provide a transparent, credible, and comprehensive account of VRA's GHG emissions for the year 2025. The report aims to:

1. Measure and report VRA's Scope 1 (direct) and Scope 3 (indirect) emissions, using internationally recognized methodologies and standards.
2. Compare current emissions levels with the baseline year of 2015, to assess progress toward emission reduction targets.
3. Analyze trends in emissions over time, highlighting key drivers and areas for improvement.
4. Assess the effectiveness of implemented emission reduction initiatives and identify opportunities for further action.
5. Communicate VRA's environmental performance to stakeholders, including regulators, investors, and the public, in a clear and accessible manner.
6. Support Ghana's Nationally Determined Contributions (NDCs) under the Paris Agreement.

1.3 REPORTING PERIOD COVERED

This inventory covers the period from 1 January 2025 to 31 December 2025. The base year for comparison remains 2015.

1.4 Sustainability & Climate Change Context

The VRA operates at the nexus of energy generation, environmental stewardship, and national development. As Ghana's premier power utility, VRA recognizes that its mandate to generate reliable electricity must be pursued within a framework that safeguards ecological integrity and aligns with global climate imperatives. Over the past decade, VRA has deepened its commitment to sustainability, embedding climate-conscious practices across its operations. VRA's strategic shift toward cleaner energy sources, (i.e. hydro, solar, and the exclusive use of natural gas in thermal generation when available) demonstrates its commitment to minimizing GHG emissions. This conscious decarbonization trajectory aligns with Ghana's Nationally Determined Contributions (NDCs), obligations under the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC), and the goals of the Paris Agreement, underscoring VRA's proactive role in supporting national and global climate objectives. Through its CFMP, VRA integrates climate accountability into operational performance and long-term planning. From 2016, VRA has incrementally reduced its carbon intensity by:

- Transitioning all thermal generation units to natural gas as primary fuel, achieving lower CO_2 and CH_4 emissions per megawatt-hour.
- Integrating grid-scale photovoltaic projects.
- Enhancing dispatch protocols that prioritize hydro and solar assets during peak emission periods.

Complementing these operational shifts are strategic interventions in environmental resilience and community engagement, including:

- **Deforestation mitigation and carbon sink restoration** through riparian reforestation in the Volta Basin catchment.
- Deployment of **climate-smart cookstove technologies** in vulnerable communities, which directly reduce black carbon and particulate emissions.
- **Circular waste initiatives** such as pilot solid waste segregation programs in plant catchment areas.

1.5 Alignment with Reporting Standard

VRA's GHG inventory is developed in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard. This standard, a globally recognized framework developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), provides guidance on the preparation of a corporate-level GHG emissions inventory. It ensures consistency, transparency, and comparability across reporting entities. The inventory also aligns with the ISO 14064 and incorporates default emission factors from the IPCC 2006 Guidelines for National GHG Inventories, while applying Global Warming Potentials (GWPs) from the IPCC Sixth Assessment Report (AR6).

1.6 Responsibility for Reporting

The Carbon Accounting Team (CAT), chaired by the Director of the Environment & Sustainable Development Department (E&SDD), leads the preparation of this report. The team consists of members with internal and external expertise in environmental management, energy systems, and GHG accounting.

2 REPORTING BOUNDARIES

2.1 ORGANIZATIONAL PROFILE

The Volta River Authority (VRA) is a state-owned power utility established in 1961 under the Volta River Development Act (Act 46) with the primary mandate to generate, transmit, and distribute electricity in Ghana. However, following the promulgation of a major amendment to the VRA Act in the context of the Ghana Government Power Sector Reforms in 2005, VRA's mandate has been largely restricted to the generation of electricity. VRA supplies electricity to local industries, mining companies, distribution companies, and export markets in neighboring countries, including Togo, Benin, and Burkina Faso. The corporate organizational structure of VRA is provided in Appendix 1. Additional company information can be located at www.vra.com.

2.2 PORTFOLIO

2.2.1 Power Business Activities

Over the years, VRA has diversified its energy portfolio to include hydro, thermal, and renewable energy sources, with a total installed capacity of 2,239.213MW as of December 2025 (see Table 2-1).

Table 2-1: Details of VRA's Operational Power Plants

#	Commissioning Year	Power Plant	Plant Type	Installed Capacity MW)	Location
1	1965	Akosombo Generation Station	Hydro	1020	Akosombo
2	1982	Kpong Generation Station	Hydro	160	Akuse
3	1997	Takoradi 1 Thermal Power Station	Thermal	330	Aboadze
4	2007	Mines Reserve Power Plant[1]	Thermal	80	Tema
5	2009	Tema Thermal 1 Power Plant	Thermal	110	Tema
6	2010	Tema Thermal 2 Power Plant	Thermal	80	Tema
7	2013	Takoradi 3 Thermal Power Plant	Thermal	132	Aboadze
8	2013	Navrongo Solar Plant	Solar	2.5	Navrongo
9	2016	Kpone Thermal Power Station	Thermal	220	Kpone
10	2020	Head Office Rooftop	Solar	0.148	Accra
11	2021	Lawra Solar Plant	Solar	6.5	Lawra
12	2021	ESD Rooftop	Solar	0.065	Akuse
13	2021	Kaleo Solar Plant I	Solar	13	Kaleo
14	2023	Kaleo Solar Plant II	Solar	15	Kaleo
15	2024	Anwomaso Thermal Power Station	Thermal	150[2]	Anwomaso
Total				**2,239.213**	

[1] *Mines Reserve Power Plant was decommissioned in 2016*

[2] *150MW presently available; additional 100MW relocated to Anwomaso*

2.2.2 Subsidiary Companies

Various departments and outfits are responsible for the variety of activities performed by the company. In fulfillment of its responsibility to provide facilities for its staff as well as assistance for the socio-economic development of the Volta Basin, the VRA has the following subsidiaries:

2.2.2.1 Akosombo Hotels Limited

The Akosombo Hotels Limited, incorporated in 1991, runs a three-star hotel (Volta Hotel) restaurant, modern conferences / seminar facilities and pleasure activities, including cruises boat on the Volta Lake.

2.2.2.2 Volta Lake Transport Company

The Volta Lake Transport Company, incorporated in 1970, operates river transportation for passengers, cement products, bulk haulage of petroleum products, and other cross-lake ferry services along the Volta Lake. The company's current operational stations are Yeji, Dambai, Kete Krachi, Adawso and Akosombo. The company carries an average of 647,000 passengers and 57,000 cars per year, on all its ferries.

2.2.2.3 Kpong Farms Limited.

Kpong Farms Limited (KFL) was incorporated in May 1982 by the VRA as a wholly-owned agricultural commercial venture to carry out mechanized commercial farming, agro-processing, and provision of machinery services. KFL was established to harness the water resources of the Volta Lake at Kpong for the use of viable agricultural ventures and for the Farm to serve as a demonstration project in a modern agricultural system. Over the years, KFL has evolved into a commercial venture with a huge potential for expansion with the private sector.

2.2.2.4 VRA Property Holding Company (PROPCo)

PROPCo was incorporated on December 5, 2012. It is a fully owned subsidiary of the Volta River Authority. Its principal activities amongst others, is to own, hold and manage the commercial real estate assets of the Volta River Authority.

2.2.2.5 VRA Health Services Limited

VRA Health Services was established in 1964 as a Medical Service Unit in Akosombo. It was later transformed into the Health and Safety Department and subsequently, the Health Services Department. In February 2014, it was incorporated as a limited liability company, a wholly owned subsidiary of the VRA, established under the Volta River Development Act, 1961 (Act 46). VRA Health Services was established to safeguard the health and safety of VRA employees, their families and dependents, the inhabitants of the Akosombo Township and the riparian areas along the Volta Lake. Their services are opened also to the public and other Towns.

2.2.2.6 VRA Schools Limited

The Akosombo International School was stablished in 1962 and over the years has expanded its facilities, adding the Akuse and Aboadze International School. In February 2014 it was incorporated under the Companies Act 1963 (Act 179) as "VRA International Schools Limited", a subsidiary solely owned by the VRA. The schools exist to provide best quality and affordable education to its clients as well as pre-tertiary education within the Ghana Education Service (GES) and International Curriculum like the Cambridge International Examination (UK) certificates.

2.2.2.7 Northern Electricity Distribution Company

The Northern Electricity Distribution Company (NEDCo), incorporated in 1997 and operational in 2012, is the sole distributor of electricity in the northern part of Ghana, as well as parts of Ashanti, Western and Volta Regions. NEDCo also manages VRA's electricity supply to some border towns in Burkina Faso, Cote D'Ivoire and Togo.

3 DESCRIPTION OF EMISSION SOURCES

3.1 ORGANIZATIONAL BOUNDARY

The organizational boundary defines the entities and operations included in VRA's GHG inventory. Consistent with the GHG Protocol Corporate Standard, VRA has adopted the 'operational control approach' to consolidate its GHG emissions. Under this approach, VRA accounts for emissions from facilities and operations over which it has full operational control, meaning it has the authority to introduce and implement operational policies.

Organizational boundaries represent the distinction of GHG emissions that will be included or not included in an inventory. These boundaries define the businesses and operations that constitute the company for the purposes of accounting and reporting greenhouse gas emissions. The GHG Protocol Corporate Standard recommends two approaches for consolidating GHG data as follows:

- **Equity share**: Accounts for an organization's GHG emissions based on its percentage ownership.
- **Operational Control**: Accounts for an organization's GHG emissions based on its financial or operational control.

VRA defines its organizational boundary using the operational control approach. Consistent with this approach, VRA accounts for GHG emissions from its locations for which it has direct control over operations, and where it can influence decisions that impact GHG emissions. The inventory includes power generation facilities as listed in Table 3-1, company-owned vehicles, and marine fleet. Facilities in which VRA holds equity interest but lacks operational control, such as TICO (340MW), are excluded from the inventory.

Table 3-1: Power Plants under VRA's Operational Control

#	Commissioning Year	Power Plant	Plant Type	Installed Capacity (MW)	Location
1	1965	Akosombo Generation Station	Hydro	1020	Akosombo
2	1982	Kpong Generation Station	Hydro	160	Akuse
3	1997	Takoradi 1 Thermal Power Station	Thermal	330	Aboadze
4	2009	Tema Thermal 1 Power Plant	Thermal	110	Tema
5	2010	Tema Thermal 2 Power Plant	Thermal	80	Tema
6	2013	Navrongo Solar Plant	Solar	2.5	Navrongo
7	2016	Kpone Thermal Power Station	Thermal	220	Kpone
8	2020	Lawra Solar Plant	Solar	6.5	Lawra
9	2021	Kaleo Solar Plant (I)	Solar	13	Kaleo
10	2024	Kaleo Solar Plant (II)	Solar	15	Kaleo
11	2024	Anwomaso Thermal Power Station	Thermal	150[3]	Anwomaso

[3] 150MW presently available; additional 100MW relocated to Anwomaso

3.2 Operational Boundaries

An operational boundary defines the scope of direct and indirect emissions for operations that fall within a company's established organizational boundary. Establishing operational boundaries helps to verify that all applicable GHG emission sources are appropriately accounted for, and that "double counting" is avoided. Accordingly, the operational boundary of VRA's carbon footprint encompasses:

3.2.1 Scope 1 - Direct Sources

A facility's direct GHG emission sources (Scope 1) are considered as those direct emissions resulting from sources that are within the 'fence line' of the facility (i.e., are under the operational control of the operator of the facility). Direct emissions may include emissions from stationary combustion, mobile combustion, process emissions, and fugitive sources resulting from the combustion of fossil fuels. Our direct emissions are included in the following categories:

3.2.1.1 Stationary Combustion

Direct combustion of fossil fuels from thermal power plants, located in Aboadze, Tema, and Kpone. Significant emissions of these plants are from the direct combustion of fossil fuels that it uses, which are distillate fuel oil (DFO), light crude oil (LCO), and Natural Gas.

3.2.1.2 Mobile Combustion

This involves the combustion of fuels, mostly diesel, and petrol, in VRA owned/controlled mobile sources, such as trucks, buses, cars and motorbikes. It also includes marine fleets being operated on the Volta Lake System for various activities.

3.2.1.3 Fugitive Emissions

This includes emissions from the following:

a) Refrigeration and air conditioning equipment at the various offices.

b) Mobile air conditioning sources from vehicles and marine fleets.

c) Emissions from fixed and portable fire suppression equipment at VRA power plant facilities.

d) Direct emissions from purchased industrial gases for use by VRA workshops and laboratories.

3.2.2 Scope 2 - Indirect Sources

Scope 2, also referred to as Energy Indirect GHG emissions are emissions that are a consequence of the activities of the reporting company but occur at sources owned or controlled by another company. VRA's indirect sources of emissions include:

- Purchased grid electricity at office buildings outside its power generating enclaves, which are the Electro Volta House (Head office), Heritage Towers, and Ridge Towers, all in Accra. This includes emissions from imported energy.
- The natural gas distribution lines associated with thermal power generation facilities at Aboadze, Tema, and Kpone.

3.2.3 Scope 3 – Other Indirect Sources:

Scope 3 or Other Indirect GHG emissions are defined as emissions that are a consequence of the operations of an organization but are not directly owned or controlled by the organization. VRA's Scope 3 sources of emissions include:

- Employee Commuting including business air travel both internal and external.
- VRA-owned Akosombo waste landfill site
- Power purchased to meet electricity demand from utility companies in neighbouring countries as shown in Table 3-2, totaled 0.08% during the period.

Table 3-2: VRA Generation & Import Data for 2025

Year	Total Generation (GWh)	Total Import (GWh)	Percentage Import
2025	12,976.79	10.65	0.08%

In pursuit of continual improvement, the VRA reviews its footprint boundary annually and regularly seeks opportunities to expand its scope of reporting, especially for Scope 3 emissions.

3.3 EXCLUSIONS

The following sources of GHG emission have been excluded in this inventory.

1. Fugitive emissions such as Hydrofluorocarbon (HFCs) from air condition systems and refrigeration in offices have been excluded from this inventory because of difficulties obtaining consistent data. We assume that the impact of these is likely to be non-material, although further efforts will be made in subsequent reporting years to include them in the inventory.
2. Emissions associated with employee transport in their own vehicle to work have also been excluded. The exclusion of this source is because such data are not available and therefore difficult to incorporate.
3. Concerning purchased electricity, all VRA offices and facilities except those in Accra, utilize electricity from the company's power plants. In Accra, it is not clear where exactly it comes from as the electricity supply is not segregated in the country. It is however assumed that the electricity supply will be from power generating facilities in Tema as these are the nearest power plants, of which VRA's generating plants form about 30% of the power from Tema. Aside from the Electro Volta House which VRA shares with only ECG, the Heritage Towers and Ridge Towers are shared with various other companies. Thus, purchased electricity at these facilities is considered insignificant to the total GHG emissions and is excluded from the accounting.
4. Fugitive emissions from the natural gas distribution lines associated with thermal power generation in Aboadze, Tema and Kpone facilities have not been considered at this stage of the VRA's GHG calculation and reporting as data is difficult to obtain.
5. Emission sources under Scope 3 are not mandatory under WRI reporting protocols. Therefore, at this stage of reporting, VRA is also not considering optional sources under Scope 3. The decision to exclude Scope 3 emissions from the inventory is based on our current strategic emphasis on Scope 1 emissions reductions,

limitations in data accuracy and availability for comprehensive Scope 3 reporting and resource constraints and prioritization.

6. Emissions from subsidiary companies have also been excluded from this inventory. It is planned that emissions from these subsidiaries will be reported separately.
7. In line with the opted inventory boundary, the underlisted thermal power plants in which VRA owns an interest but has no operational control are also excluded:
    - 345MW Takoradi International Company (TICO) owned as a joint venture with TAQA, from Abu Dhabi in the United Arab Emirates.

3.4 Scope of GHG Savings

3.4.1 Renewable Energy

In line with national actions in the renewable energy sector, VRA in February 2010 adopted a Renewable Energy Policy to develop and operate RE plants in an efficient, cost-effective, and environmentally sustainable manner. The REDP sets a 5 to 10-year Renewable generation capacity target, taking cognizance of the local and export demand and the system constraints, and is being rolled out in two (2) phases.

The Navrongo Solar Plant (NSPS) was commissioned in 2013 with an installed capacity of 2.5MW and has since been in operation, with CO_2 equivalent emissions assessed accordingly. In 2020, VRA commissioned the 6.5MW Lawra Solar Plant (LSP). The Kaleo Solar Plant (KSP) was developed in two phases — Phase I (13MW) commenced operation in November 2021, and Phase II (15MW) commenced operation in April 2024. In July 2018, the Ministry of Energy formally handed over five (5) mini solar power off-grid systems to VRA for operation and maintenance, with a combined installed capacity of 228.5 kWp:

1. 54 kWp – Kudorkope
2. 54 kWp – Aglakope
3. 50 kWp – Perdiatorkope
4. 40.5 kWp – Atigagorme
5. 30 kWp – Wayokope

In April 2025, three (3) additional mini solar power off-grid systems were handed over to VRA, bringing the total number of off-grid systems under VRA's operations and maintenance to eight (8). The capacities of the new systems are as follows:

6. 110 kWp – Aflive
7. 72 kWp – Aloekpem
8. 72 kWp – Azizakpe

The combined installed capacity of all eight off-grid systems stands at 482.5 kWp. The solar power infrastructure facility represents an investment in clean, renewable energy infrastructure, which given the challenges created by climate change, represents a positive social benefit for society, as it would indirectly reduce/eliminate a considerable percentage of air pollutants emissions due to consistent use of thermal power generation to support the existing hydropower plants.

3.4.2 Waste Management Practices

VRA in 2017 adopted an "**Office Waste Segregation Policy**" aimed at reducing the total volume of office waste generated at its Offices and disposed of at landfills. The policy also seeks to address the control, management, and disposal of electrical and electronic waste in accordance with the then-applicable waste-management legislation, and it continues to align with the consolidated requirements of the *Environmental Protection Act, 2025 (Act 1124)*. Under this policy, VRA commenced an "Office Wastepaper Exchange Programme" in August 2017 with Akosombo Paper Mill Limited (APML), whereby 80 pieces of unwrapped toilet rolls were exchanged for 1 ton of office wastepaper supplied to APML. However, operational challenges at APML led to the closure of the factory in 2022. Subsequently, VRA executed a 'Memorandum of Understanding' with Shinefeel Ghana Company Limited, located at Asutuare for the recycling of its office wastepaper. Office Wastepaper exchanged are weighed at the factory premises and signed by both parties on an ***Office Paper Waste Log sheet***, which is then used as a source document for reporting purposes.

4 EMISSIONS INVENTORY AND METHODOLOGY

4.1 EMISSION FACTORS

The emission factor refers to the rate at which a pollutant is released into the atmosphere (or captured) because of some processing activity or unit throughput. Emission factors convert activity data (e.g., amount of fuel used, kilometres driven, and kilowatt-hours of purchased electricity) into a value indicating carbon dioxide equivalent (CO_2 Equiv.) emissions generated by that activity. Default values are used by the GHG Protocol to assist businesses that are unable to develop accurate customized values. These default values are representative averages based on the most extensive data sets available and are largely identical to those used by the IPCC, the premier authority on greenhouse gas accounting practices at the global level.

The GHG Protocol recommends, however, that businesses should use customized values whenever possible, as industrial processes or the composition of fuels used by businesses may differ with time and by region. This report uses default emission factors from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, as refined in 2019.

4.2 GLOBAL WARMING POTENTIAL & CARBON DIOXIDE EQUIVALENT

ISO 14064 recognizes that not all GHGs have the same properties. Due to the varying ability of greenhouse gases to trap heat in the atmosphere, some are more harmful to the climate than others. Each greenhouse gas has a 'global warming potential' (GWP), which refers to its heat-trapping potential relative to that of CO_2. GWPs compare the climate impact of different greenhouse gases with that of CO_2, and they are used to calculate emissions in terms of CO_2 equivalents. Therefore, to provide a comparable final figure, all emissions are reported as a relative figure to CO_2, i.e., as CO_2e values as required by the GHG Protocol. As scientific understanding advances, the GWP values of GHGs can change. The IPCC's Sixth Assessment Report, 2021 (AR6) values are the most recent has been adopted for the VRA reporting.

4.3 QUANTIFICATION METHOD

Quantifying GHG emissions include the data collection process and the application of documented emission factors. The quantification is based on two calculation-based methodologies, depending on the type of emission source:

- Emission sources in which there is a chemical transformation process (combustion, fixed or mobile) and indirect emissions from electricity consumption:

  Emissions of CO_2 (tCO_2e) = Activity data x Emission factor

- Emission sources where there is no chemical transformation process (fugitive emissions), or in case the results in GHG are different from CO_2 are converted to tonnes of CO_2e using the Global Warming Potential (GWP) values provided by the IPCC:

  Emissions of CO_2 (tCO_2e) = Activity data x Global warming potential

The combustion of fuels produces emissions of the following greenhouse gases: Carbon Dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O). Carbon Dioxide accounts for most greenhouse gas emissions from most stationary combustion units. When weighted by their Global Warming Potentials (GWPs), CO_2 typically represents over 99% of the GHG emissions from the stationary combustion of fossil fuels. The GHG Protocol provides tools that present step-by-step

guidance and electronic worksheets to help users calculate GHG emissions from specific sources or industries. These tools are based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, as refined in 2019, which updated and supplemented the 2006 Guidelines where gaps or out-of-date science had been identified.

Furthermore, they are designed to be user-friendly for non-technical company staff and to increase the accuracy of emissions data at a company level. Based on engagement with the Ghana Environmental Protection Authority, VRA utilized the following GHG quantification tools:

a) World Resources Institute (2024) Stationary Combustion Tool Version 4.2
b) World Resource Institute (2024). GHG Protocol tool for Mobile Combustion. Version 2.7.
c) Tool for GHG Accounting for Energy Projects, developed by KfW Development Bank
d) Waste Reduction Model (WARM), Version 16 (December 2023)

4.4 Scope 1 Emissions

4.4.1 Stationary Combustions Emissions

As indicated the Corporate Accounting and Reporting Standard quantification methodology, "*World Resources Institute (2024) Stationary Combustion Tool Version 4.2*", was utilized in estimating the amount of CO_2, CH_4 and N_2O emissions from fuel consumed by VRA's thermal power plants. One needs to supply information on the type and amount of fuel combusted as well as the industry sector. Emissions are then automatically calculated using default emissions factors, chosen to reflect this information. Data on fuel usage, as indicated in Tables 4-1, was utilized in quantifying GHG emissions from the stationary combustion plants.

Table 4-1: Fuel Consumed in Thermal Power Plants for Power Generation in 2025

Year	Natural Gas (mmBTU)				Diesel Fuel Oil (litres)
	T1	TT1PS	KTPS	ATPS	KTPS
2025	8,691,335.77	9,856,562.22	3,780,659.07	10,496,983.20	137,606.98

4.4.2 Mobile Combustion Emissions

According to the GHG Protocol - Mobile Guide (03/21/05) v1.3, for all mobile sources, one may apply either a fuel-based or distance-based methodology to calculate CO_2 emissions. In the fuel-based approach, fuel consumption is multiplied by the CO_2 emission factor for each fuel type. This emission factor is developed based on the fuel's heat content, the fraction of carbon in the fuel that is oxidized (generally approximately 99% but assumed to be 100% in this tool), and the carbon content coefficient. Since this approach uses previously aggregated fuel consumption data, it is considered "fuel-based." Fuel based approach can be used also when vehicle activity data and fuel economy factors are available that enable the calculation of fuel consumption. In the distance-based method, emissions can be calculated by using distance-based emission factors to calculate emissions. The Mobile Combustion GHG Emissions Calculation Tool Version 2.7 calculates the CO_2, CH_4 and N_2O emissions from:

- Vehicles that are owned/controlled by the reporting entity, including freight lorries.
- Public transport by road, rail, air, and water.

- Mobile machinery, such as agricultural and construction equipment.

Activity data could be in terms of vehicle kilometers (or miles) travelled, freight ton-kilometers (or miles), passenger-kilometers (or miles), etc. Because the data on fuel are generally more reliable, the fuel-based method is the preferred approach for this tool. The distance-based method should only be used as a last resort as it can introduce considerably higher levels of uncertainty in the CO_2 estimates. In view of this, the "fuel-based" approach has been used in calculating the emissions levels from VRA owned/controlled mobile sources.

Data regarding fuel usage from vehicular sources were sourced from the VRA Oracle Database and provided in Table 4.3. For PROPCo, reported figures include supplementary 2025 data provided by TotalEnergies in addition to internal consumption records. Majority of VRA vehicles are from Asia and South Africa. Data on fuel usage in marine vessels and equipment were sourced from logbooks and presented in Table 4.4. Variations in departmental fuel usage reflect the nature and scale of operational activities within each unit, and was also influenced by the organisational re-alignment implemented in 2025, which covered the restructuring of the Real Estate and Security Services Department and the re-organisation of the Corporate Affairs and External Relations function into a full department.

Table 4-2: Vehicular Fuel Usage in 2025

Department	Diesel (Litres)	Petrol (Litres)
Board Secretariat	946.59	0
Commercial Services	1,299.32	652.33
Corporate Strategy	2,285.89	0
DCEs	4,212.76	2,030.33
Engineering Services	29,110.43	0
Environment & Sustainable Development	6,084.89	1,933.36
Finance & Investment	6,296.01	4,391.08
Human Resources	11,193.34	0
Hydro Generation	23,590.15	7,566.00
Internal Audit	1,824.43	2,467.32
Legal Services	4,850.92	93.73
Management & Information Systems	4,276.82	36.17
Office of CE	5,377.33	1,215.24
Procurement	18,944.73	0
Real Estates and Security	24,701.88	1,440.15
Technical Services	58,610.39	6,897.61
Thermal Generation	23,562.17	0
VRA Academy	24,810.46	1,936.10
VRA Corporate	4,922.61	1,564.82
VRA Health Services Limited	7,470.91	540.00
VRA Property Holding Company Limited	14,937.83	1,923.08
Water Resources & Renewable Energy	7,101.91	0
Strategic Project & New Business	10,614.05	0
Utility Services Department	26,206.97	179.00
CA&ER	7,843.73	2,151.09
VRA International Schools Ltd	6,268.00	54.33

Department	Diesel (Litres)	Petrol (Litres)
TOTAL	**337,344.52**	**37,071.74**

Table 4-3: 2025 Fuel Consumption from Marine Services

Period	Vessels	Diesel Fuel – Liters	Petrol Fuel - Liters
2025	Excavator Liebherr 964	13,800.00	-
	Deeper Generator	2,000.00	-
	Mv Volta Princess	1,200.00	-
	Mv Volta Queen	2,000.00	-
	Mv Onipanua	-	-
	Mv Buffalo	400.00	-
	Landing Craft	-	1,200.00
	Aluminium Boat	-	240.00
TOTAL FUEL CONSUMPTION		**19,400.00**	**1,440.00**

4.5 Scope 3 Emissions

4.5.1 Business Travels – Air

VRA commenced the estimation of its Scope 3 emissions resulting from employee's business travels from year 2023. However as indicated in earlier sections, while Scope 3 emissions are critical to a comprehensive understanding of our environmental impact, this report excludes them from the primary GHG inventory. This is due to our current strategic emphasis on Scope 1 emissions reductions, limitations in data accuracy and availability for comprehensive Scope 3 reporting, and resource constraints and prioritization.

The Scope 3 emissions from employee business air travels have only been provided in this report for indicative and transparency purposes. A tiered approach was applied to quantify these emissions, prioritising higher-quality supplier-specific data where available. Where GHG estimates were provided on the air ticket, the airline's supplier-specific figures were used as the primary data source. Where no estimate was provided, emissions were calculated by multiplying the distance travelled, sourced from flight booking data, by class-specific emission factors from the International Civil Aviation Organization (ICAO) Carbon Emissions Calculator (ICEC), the only internationally approved tool for estimating carbon emissions from air travel.

VRA is committed to expanding its GHG inventory to include Scope 3 emissions in the future. We are actively working on improving our data collection processes and methodologies to ensure accurate and comprehensive reporting.

4.6 GHG Savings from Renewable Power Plants

The "**Tool for GHG Accounting for Energy Projects**", developed by KfW Development Bank has been adopted and this allows for estimating emission savings. For renewable energy projects (solar / wind / hydro / geothermal / bioenergy), this is achieved by calculating the amount of electricity generated annually, on average, by the renewable energy project will be multiplied by and thus compared to the combined grid margin Operating Margin (OM) 75% / Build Margin (BM) 25 % for Solar and Wind, the rest assumes OM⅓ and BM⅔. It is assumed that this amount of renewable electricity displaces electricity that would be generated per the country-specific fuel mix.

The powerhouse equipment at the Hydro Generation Department is connected to a Data logger which logs and records the generation and other parameters from the PV Plants onto an external Secure Digital (SD) card. Data on Annual Energy Generated (MW hours) is utilized for the calculations of the GHG savings, supported by the plant's Project Specific Capacity Factor, Default Capacity Factor, and Default Emission Factor, in the case of solar energy.

The 2.5MW Navrongo Solar Power Station (NSPS) commenced operation in June 2013, and a total of 36,547.45 MWh of electric energy has been generated within the period from 2013 to date. The 6.5MW Lawra Solar Plant (LSP) commenced operation in October 2020, whilst the Kaleo Solar Plant (KSP) was developed in two phases — Phase I (13MW) commenced operation in November 2021 and Phase II (15MW) commenced operation in April 2024. Total energy generated to date by the LSP and KSP is 42,338.90 MWh and 128,163.38 MWh respectively. A total of eight (8) mini solar power off-grid systems are currently under VRA's operations and maintenance. Five (5) systems, with a combined installed capacity of 228.5kWp, were handed over to VRA in July 2018, while three (3) additional systems with capacities of 110 kWp, 72 kWp, and 72 kWp respectively, totalling 254 kWp, were handed over in April 2025. The combined installed capacity of all eight systems stands at 482.5 kWp. A total of 54,570.98 MWh was generated during the period under review. Table 4-4 gives the breakdown of the energy generated by each plant for 2025. The PV power plant utilizes polycrystalline technology, with an expected operational lifetime of 20 years for the grid-connected NSPS and 25 years for the mini off-grid PVs.

Table 4-4: Energy Generated from Renewable Energy Sources for 2025

	Installed Capacity (MW)	**2025 Annual Energy Generated (MWh)**
NSPS	2.5	2,102.34
LSP	6.5	9,835.60
KSP (Phase I&II)	28	42,381.14
Wayokope	0.03	14.69
Atigagorme	0.0405	15.09
Kudorkope	0.054	55.20
Perdiatorkope	0.05	34.44
Aglakope	0.054	54.61
Aflive	0.11	37.28
Aloekpem	0.072	21.86
Azizakpe	0.072	18.73
Total		**54,570.98**

Source: Water Resources & Renewable Energy Dept – Power Generation Data

4.6.1 GHG Savings for Waste Reduction

VRA has adopted the Waste Reduction Model (WARM), created by the U.S. Environmental Protection Agency (EPA), to help solid waste planners and organizations estimate greenhouse gas (GHG) emission reductions and economic impacts from several different waste management practices. WARM calculates GHG emissions for baseline and alternative waste management practices, including source reduction, recycling, combustion, composting, and landfilling. The model calculates emissions in metric tons of carbon dioxide equivalent (MTCO2E) and metric tons of carbon equivalent (MTCE) across a wide range of material types commonly found in municipal solid waste (MSW). The model has been used to calculate GHG savings from the amount of office wastepaper recycled by VRA (in Short Tons). It is assumed that the office wastepaper, if not recycled will have otherwise been landfilled for decomposing. Under the Office Wastepaper Recycling Programme, a total of 700 kg (0.7716 short tons) of office wastepaper was recycled during the period under review, as shown in Table 4-5.

Table 4-5: Office Wastepaper Recycled

Period	Weight (kg)	Weight (Short Tons)
2025	700	0.7716

Source: E&SDD - Office Wastepaper Log sheet

4.7 Greenhouse Gases Covered and Excluded in the Inventory

The seven main greenhouse gases covered by the GHG Protocol and reported as CO_2e are Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6), and Nitrogen Trifluoride (NF_3). GHGs identified for the VRA's inventory are CO_2, CH_4 and N_2O.

Based on earlier discussion under Chapter 3, the following GHG gases are excluded in this GHG Report.

1. Sulfur Hexafluoride (HF_6) from power transmission and distribution equipment, and Hydrofluorocarbon (HFCs) from building Heating Ventilation Air Condition (HVAC) systems and mobile air conditioning sources (vehicles)
2. Perfluorocarbons and Nitrogen Trifluoride, because given the nature of its business, this class of chemicals is not used in any of VRA's operations in any sizeable amount.
3. Methane emissions from the Akosombo waste landfill site

4.8 Uncertainties In The GHG Inventory

4.8.1 Potential Sources of GHG Emissions Excluded

Uncertainties may exist in the inventory because of the failure to include or properly allocate emission sources within the boundaries of the inventory. Only those emissions believed to be of significant relevance to VRA's operations were included. Those excluded are

1) HFCs and PFCs emissions from refrigeration equipment leaks and Methane (CH_4) from natural gas distribution systems.

2) To avoid double counting, purchased electricity at VRA office facilities in Accra is excluded from the inventory.

3) The majority of Scope 3 emission sources have not been quantified in this inventory. These emission sources were not quantified in the inventory because it was determined that the large effort necessary to estimate their emissions was not warranted by the scale of their potential emissions in relation to the overall inventory. Notwithstanding this, emissions arising from employee business air travel have been estimated and are included in the inventory. VRA will continue discussions on how to systematically gather data and calculate emissions from these sources for inclusion in future reports.

4) Exchange of electricity resulting in the wheeling of power between Ghana and its neighbouring countries as shown in Table 3.2 have also been excluded from the inventory, as it is considered minimal and of little significance.

4.8.2 Uncertainty Associated with Data Sources and Methodology

Uncertainties may also exist in the inventory because of the failure to properly estimate emissions from each source. This issue could pertain to inaccurate emission estimation methods or erroneous input data (e.g., fuel throughput) that were used to estimate emissions. The GHG Protocol specifies that neither assumptions nor methodology should introduce systematic errors that would lead to either high or low estimates of emissions. The methodology generally used to estimate emissions is to apply generally accepted emission factors to translate the amount of activity (e.g., kWh, Volume of fuel) into GHG emissions. One of the most likely sources of systematic error can result from the improper use of emission factors, or the use of inaccurate emission factors. As indicated, this report utilized default emission factors from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories as well as GWP from the Intergovernmental Panel for Climate Change (IPCC) Sixth Assessment Report. The selection of these emission factors was recommended by the Ghana EPA and is based on assumptions regarding their suitability for the specific application.

Any errors resulting from improper use of emission factors could be evaluated in detail through emissions testing of equipment to develop equipment or source-specific emission factors. The VRA currently does not measure CO_2 emissions from its thermal generating plants. This detailed level of evaluation is outside the scope of this inventory. All emission factors used in this inventory are based on commonly accepted practices and best professional judgment to minimize sources of error to the maximum extent possible within the defined scope of the inventory.

Concerning actual fuel usage, inputs were obtained from data recorded by stationary plant facilities during generation. The primary data is recorded at the plant level and made available as part of the Annual Environmental Reports (AERs) that VRA submits to the EPA and the Energy Commission, the national regulatory agencies of the powers sector. The secondary data as provided in the AERs formed the source of this report. Thus, if the information is utilized without confirmation from the source data at the power plant there could be challenges with the data if the source entry is inaccurate. Primary data from the power plants was therefore obtained and crosschecked for use.

In general, the use of the fuel-based method in estimating emissions from vehicular sources produces less uncertainty than the use of the distance-based method and as indicated, VRA utilized the fuel-based method in this quantification. In this regard, VRA has allocated logbooks for all its vehicles for recording fuel usage. Drivers are subsequently required to input manually such primary data for compilation at the end of each month. The key challenge here is that individuals using the vehicles may fail to log in with the required data or provide the right data and this may affect the quantification.

In addition, data may be omitted during compilation. To address this, the VRA in 2016 rolled out an oracle-based centralized fuel requisition system that captures data on fuel usage from all departments.

Data on the amount of office wastepaper recycled is obtained through weighing at the recycling facility by both parties, and the information is provided in monthly reports of the E&SDD using the ***Office Paper Waste Log sheet***. Key assumptions included that the paper is produced from 100% virgin material, lack of landfill gas conversion system in place, and default transport distances, as the paper is sourced from various work location areas.

The treatment of radiative forcing is not consistent across this inventory due to the mixed-source approach applied. Airline-supplied estimates sourced from air tickets may or may not incorporate a radiative forcing adjustment, as individual airline methodologies could not be independently verified. For emissions estimated using the ICAO Carbon Emissions Calculator, radiative forcing is explicitly excluded, as ICAO does not apply a Radiative Forcing Index (RFI) or equivalent multiplier pending scientific consensus. As a result, emissions reported under this category reflect primarily direct CO_2 emissions and may underestimate the full climate impact of air travel.

In the 2024 reporting year, Scope 3 emissions from employee business air travel were included in total reported emissions using supplier-provided estimates expressed in kilograms of CO_2e ($kgCO_2e$). In the 2025 reporting year, Scope 3 air travel emissions have been converted and reported in tonnes of CO_2e (tCO_2e) to ensure unit consistency with Scope 1 emissions and align with international reporting conventions.

4.9 Potential Sources of GHG Sequestration

Cognizant of the need to ensure the continuous flow of water resources in the Volta Lake basin for sustainable generation of hydroelectricity for the economic development of Ghana; the global need for reduction of greenhouse gas emissions; and the influence trees have on local climate as well as erosion control, VRA has embarked on various watershed management activities along the Volta Lake. VRA's watershed management activities focus on an integrated approach to the management of the Volta Lake Basin environment, by incorporating environmentally friendly livelihood options into the reforestation and wildfire management activities around the water bodies in the Basin. Current ongoing ones are the Volta Gorge Protection Programme and the Buffer Zone Tree Planting Programme. Activities being undertaken are seedling raising, tree planting, bush fire management, community and school environmental advocacy and education programmes and provision of alternative livelihood programmes, including non-farm activities.

The Volta Gorge is an area of about 5,149.24 hectares bordering the hills before the Akosombo dam. Areas being planted are degraded areas with grassy areas and fire-prone and as of December 2025, about 1,808 hectares of the Volta Gorge area had been planted. Tree species adopted are *Senna siamea* (cassia), *Acacia mangium, Khaya senegalensis (*Mahogany), *Cedrella odorata,* and *Leuceana leucocephala*.

The Buffer Zone Reforestation Programme, which started in 2007 is being implemented in collaboration with forty (40) communities within three (3) riparian Districts and these are the South Dayi, Kpando and Biakoye in the Volta Region. As at the close of December 2025, about 440 hectares of forest tree plantation had been established along the Volta Lake and its tributaries to serve as buffers to minimize siltation, water pollution and landslide along the catchment areas.

The VRA Carbon Accounting Team member drawn from the Forestry Commission will lead the strategy for calculating the carbon sequestration potential of forest tree species planted and being maintained under the Programme. The 2006 IPCC Guidelines for National GHG Inventories will be adopted for calculating carbon stock, using tree dimensions (girth, wood density, basal area, height, etc.), depending on tree species and type.

5 RESULTS OF GHG QUANTIFICATION

5.1 EMISSIONS SUMMARY AND ANALYSIS

GHG emissions summary resulting from VRA's operations for the year 2025 is as presented in Table 5-1 below.

Table 5-1: VRA's 2025 GHG Emissions (in tCO_2e) by Scope

Operational Emissions Category	Emissions Source Category	GHG Emission Source	2025	% of Scope	% of Grand Total
Scope 1	Stationary Combustion	T1	514,956.01	26.45%	26.44%
		TT1PS	583,994.92	30.00%	29.99%
		ATPS	621,939.45	31.95%	31.95%
		KTPS	224,406.91	11.53%	11.53%
	Mobile Combustion	Vehicles & Marine Equipment	1,126.24	0.06%	0.06%
	Scope 1 - Total		**1,946,423.53**	**100.00%**	**99.98%**
Scope 3	Business Travels	Air travels	323.07		
	Scope 3 - Total		**323.07**	**100.00%**	**0.02%**
Grand Total			**1,946,746.60**	—	**100.00%**

Note: '% of Scope' shows each source's share within its respective scope. '% of Grand Total' shows each source's share of all reported emissions. Given that Scope 1 accounts for 99.98% of total emissions, these two figures are near-identical for all Scope 1 sources.

The total GHG emissions from VRA's operations for the year amounted to 1,946,746.60 tCO_2e, reflecting the carbon-intensive nature of electricity generation activities. Direct emissions (Scope 1) totaled 1,946,423.53 tCO_2e, representing 99.98% of the total recorded emissions during the reporting period. These emissions were dominated by stationary combustion from thermal power plants as illustrated in Figure 5-1. ATPS was the largest contributor, recording emissions of 621,939.45 tCO_2e, representing 31.95% of Scope 1. TT1PS followed with 583,994.92 tCO_2e (30.00%), while T1 contributed 514,956.01 tCO_2e (26.45%). KTPS recorded the lowest emissions among the stationary combustion sources at 224,406.91 tCO_2e (11.53%). The observed ranking reflects differences in generation output, fuel consumption, plant dispatch, operating hours, and overall operational efficiency across the facilities during the year.

Emissions from mobile combustion sources, comprising company-owned vehicles and marine equipment, amounted to 1,126.24 tCO_2e, equivalent to 0.06% of Scope 1. These emissions were associated with the consumption of petrol and diesel used to support operational, logistical, and administrative activities and represented a negligible proportion of total Scope 1 emissions. Indirect emissions (Scope 3) for the reporting year were limited to employee business air travel and totaled 323.07 tCO_2e. These emissions were derived from the aggregation of individual air travel-related emissions and constituted an immaterial share of VRA's overall emissions profile (0.02% of VRA's total 2025 GHG emissions).

Overall, the 2025 GHG emissions profile confirms that VRA's emissions are overwhelmingly driven by thermal power generation, with ATPS and TT1PS accounting for the largest share of Scope 1 emissions. This highlights the importance of prioritising efficiency improvements, operational optimisation, and targeted mitigation measures at higher-emitting plants, alongside the progressive transition toward lower-carbon and renewable energy sources in support of VRA's long-term emissions reduction objectives.

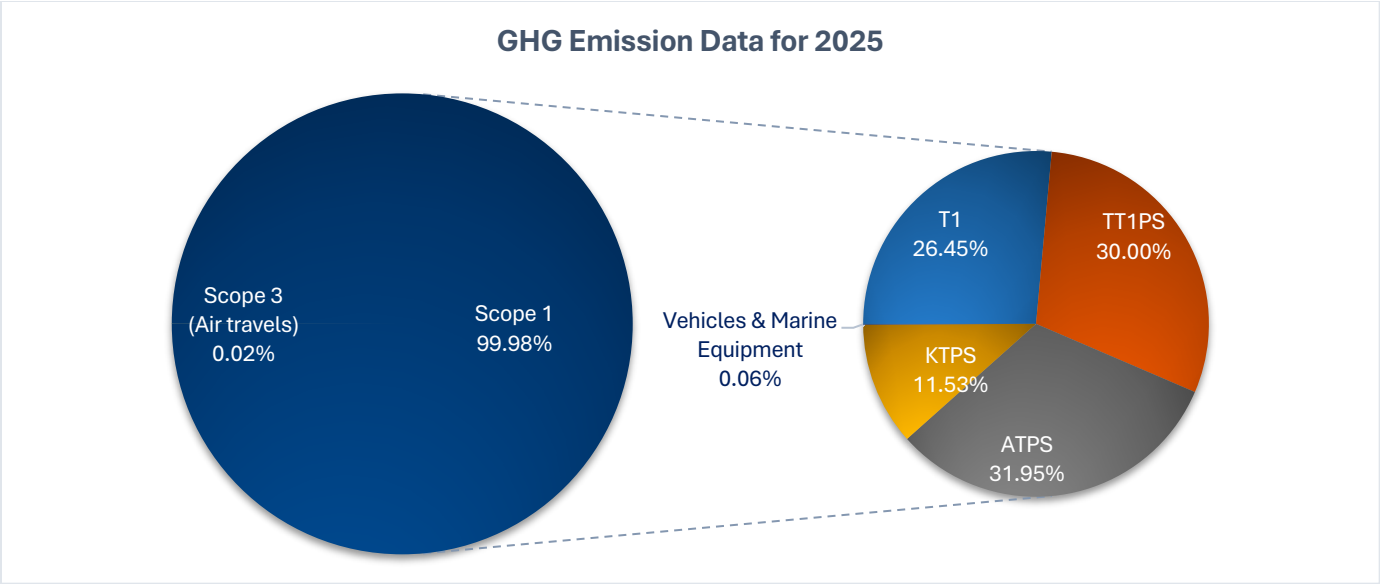


Figure 5-1: VRA's 2025 GHG Emissions (tCO_2e)

As shown in Figure 5-2, total GHG emissions in 2025 increased by 5.66% (104,258.68 tCO_2e) from the 2015 baseline (1,842,487.92 tCO_2e). This rise is primarily attributed to higher generation output in 2025 (12,976.79 GWh compared to 9,055.51 GWh in 2015).

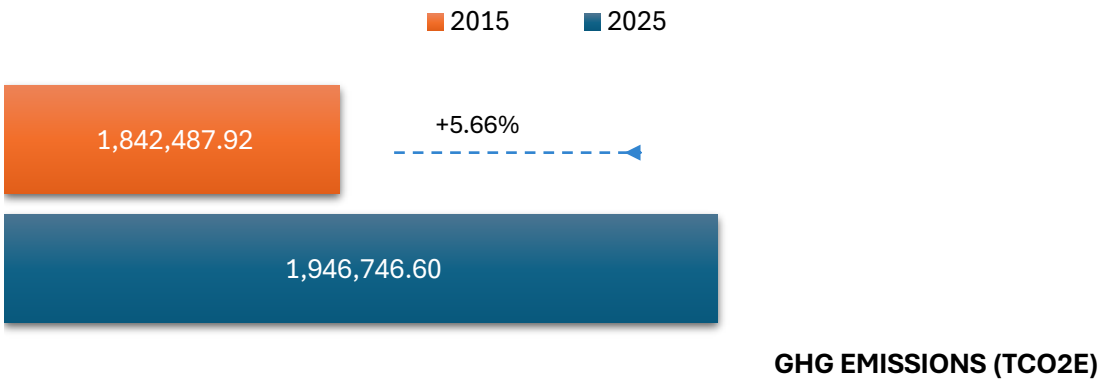


Figure 5-2: Comparison of 2025 GHG Emissions with Baseline Year

5.2 Trend Analysis

5.2.1 Specific GHG Emissions

2025 GHG Emissions expressed as a unit of production (per megawatt-hour of electricity generated) and compared with previous years and the baseline year (2015) to assess the efficiency and environmental impact of VRA's operations is as shown in Figure 5-3 below.

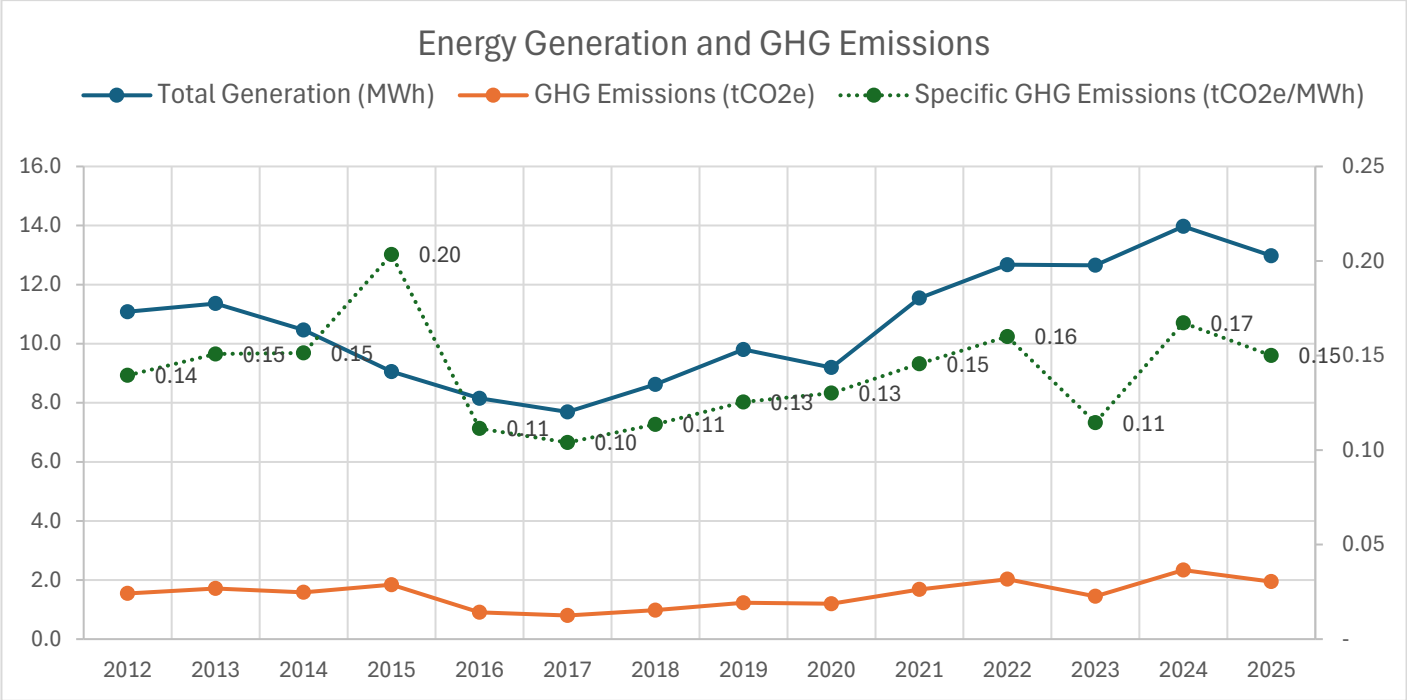


Figure 5-3: Trend analysis of Specific GHG Emission for 2012-2025

Although total GHG emissions in 2025 were significantly higher than in 2015, the emission intensity declined from 0.20 tCO_2e/MWh in 2015 to 0.15 tCO_2e/MWh in 2025. This reduction in intensity is largely due to the increased use of natural gas instead of crude oil or diesel fuel oil for power generation.

5.3 GHG Emissions Savings

5.3.1 Solar Power Plants

The Specific Capacity Factor, Default Capacity Factor and Default Emission Factor of the VRA's Solar Power Plants have been determined to be 16%, 15.5% and 0.509 tCo2/MWh respectively. Consequently, and based on data on Annual Energy Generated (MWh) from 2013 – 2025 totaling 208,032.39 MWh, GHG Savings for the period is 105,990.87 tCO_2e as detailed in Table 5-2 below.

Table 5-2: GHG Emission Savings from Solar Power Plants

Year	Annual Energy Generation (MWhrs)					Annual GHG Emission Savings (tCO2e)
	NSPP	LSP	KSP	Mini-Grids	Total	
2013	2,197.80	***	***	***	2,197.80	1,120.00
2014	3,843.30	***	***	***	3,843.30	1,958.00
2015	3,312.30	***	***	***	3,312.30	1,688.00
2016	3,088.80	***	***	***	3,088.80	1,574.00
2017	2,725.80	***	***	***	2,725.80	1,389.00
2018	2,581.70	***	***	80.46	2,662.16	1,356.34
2019	3,429.50	***	***	157.94	3,587.44	1,827.76
2020	3,160.10	***	***	137.86	3,297.96	1,680.27
2021	2,987.60	5,388.20	836.50	129.71	9,342.01	4,759.65
2022	2,554.60	8,706.00	18,996.30	89.09	30,345.99	15,460.93
2023	2,379.38	9,375.09	21,193.04	47.93	32,995.45	16,810.80
2024	2,184.20	9,034.00	44,756.40	87.75	56,062.35	28,563.12
2025	2,102.34	9,835.60	42,381.14	251.91	54,570.99	27,803.00
Total	**36,547.45**	**42,338.90**	**128,163.38**	**982.65**	**208,032.39**	**105,990.87**

***Not Operational

5.3.2 Waste Management Practices

Under the Office Wastepaper Recycling Programme, a total of 700 kg (0.7716 short tons) of office wastepaper was recycled during the period under review, as shown in Table 4-5. Assuming this amount of office paper will have been landfilled, instead of recycled, the total emission savings was 3.08 $MTCO_2E$. Thus, the total GHG Savings from our Renewable energy programme and office wastepaper segregation programme during the period is 27,806.08 tCO_2e as detailed in Table 5-3 below.

Table 5-3: Summary of Year 2025 GHG Emission Savings

Source	GHG Emission Savings (tCO2e)
Solar Power Station & Mini Grids	27,803.00
Office Wastepaper Recycled	3.08
Total	27,806.08

6 DATA MANAGEMENT

6.1 ADMINISTRATIVE MANAGEMENT

A twelve-member Carbon Accounting Team (CAT) led by the Director Environment & Sustainable Development Dept. has been formally appointed by the Chief Executive to be responsible for developing the Corporate Greenhouse Gas Emission Inventory Report on an annual basis under the ongoing CFMP. The team includes four (4) external individuals who have been engaged to provide technical backstopping in various areas to the CAT.

The Terms of Reference for the CAT are as follows:

a) To calculate net Greenhouse Gas (GHG) emissions of the Authority on an annual basis.

b) Prepare annual "***GHG Emission Inventory Report***" for the Authority in line with international standards for Executive consideration and approval for public disclosure.

c) Develop and make recommendations on strategies for reducing the Authority's Carbon footprint for Executive approval for implementation.

d) Evaluate the Authority's planned power projects and advise Management on which project can be presented as a candidate for carbon trading and financing.

The Secretariat for the CAT is within E&SDD and some key staff have been co-opted to assist with associated administrative responsibilities.

6.2 ACTIVITY DATA

The following source data have been utilized for capturing GHG calculations and inventory:

a. Environmental Progress Reports for the various power plants that VRA submits to the Ghana EPA on a quarterly/annual basis provide data for fuel usage as well as power generated and consumed at each plant.

b. Procurement Department is responsible for purchasing fuel and each department reports on their fuel usage to the General Services Department, using what is called a "***Vehicle Operational Chart"***, and these data are eventually stored as part of records by both departments.

c. Marine Logbooks are used for recording fuel utilized by marine fleets, and this provides source data for water transport combustion.

d. Office Paper Waste Log sheet provides source data for progress reporting of office wastepaper recycled by E&SDD.

6.3 DATA MANAGEMENT

The Director, E&SDD through Manager, Environment and Social Impact (ESI) is responsible for coordinating the collection of inventories for all data required and maintaining this information in the relevant formats, such as reports, electronic files and calculation spreadsheets.

The specific steps of the process are as follows:

a) **Data Receipt**

- Data on the amount of fuel consumed and energy produced from the power stations are recorded by the operational team and made available by the respective departments through their Quarterly Environmental Monitoring Progress reports and annual environmental reports to the Director, E&SDD.
- Fuel utilised by company vehicles is received from all departments via the Technical Services Department, using either the "***Vehicle Operational Charts***" or the Oracle E-Business Suite. That for marine fleets is provided by E&SDD through the marine Logbooks.
- Waste office paper from the various VRA outfits is transported to Akuse via the mail van and stored at the VRA Engineering Building Office Complex. When sufficient volumes have accumulated, it is transported to Shinefeel Ghana Company Limited, where it is weighed on a weighing bridge. Shinefeel provides toilet rolls to VRA in exchange on a per-tonne basis. The transaction is documented through a completed Toilet Roll Waste Paper Purchase Form with VAT invoice, and both parties sign an Office Waste Paper Exchange – Toilet Roll Receipt Form. Transactions are reported in the monthly progress reports of E&SDD as and when exchanges occur.
- All the data received are then inputted into spreadsheet files and saved to a directory under the 'Corporate Carbon Footprint' folder in the Corporate One Drive.
- DATA REVIEW AND MANIPULATION – spreadsheets are accessed and reviewed for the relevant information. In some cases, the data are sorted, totaled, and formatted to facilitate entry into the inventory spreadsheet. The data also is reviewed during this step to evaluate the overall magnitude to identify any obvious errors or omissions.
- DATA ENTRY – data is entered in the draft-working version of the GHG inventory. During this step, an additional review for data reasonableness and completeness is performed. Any obvious errors or omissions are addressed directly with the data manager by phone or email, as needed. All the data sources are either entered directly into the inventory or are used for further calculation of the necessary data points required to develop the overall inventory.
- QA/QC AND TECHNICAL REVIEW – where data entry is required, a double check and a reverse double check are always performed. A double-check review is simply another review of the numbers entered in the working draft version of the inventory, while a reverse double check is an evaluation of the data entered against the working draft version of the inventory to ensure all data points are included. Once the review is completed, the draft version is circulated to the Carbon Accounting Team within the company; feedback is used to modify the inventory as needed.

6.3.1 Data Collection Process Quality Assurance

The owners of data identified in the previous section are responsible for maintaining data quality assurance. Every effort would be made to ensure that the data reported are accurate and complete. Manager ESI will evaluate the data, once collected, to ensure that it is reasonable and consistent with past years. Manager ESI will also conduct and document QA checks during the production of the inventory. All possible errors as well as the QA/QC actions used to maintain

accuracy will be defined and documented as part of the process for collecting the GHG data. Any departures from these data quality measures (i.e., non-compliance events) would be communicated. Any inconsistencies and large, unexpected changes from the previous year's data would be sufficiently explained when the data is transmitted. The Manager, ESI will also compare the current year's data for each source category to the previous year's data to identify any large, unexpected variations. Data will be reviewed, and all calculations validated to ensure that calculations are correct.

6.3.2 Frequency

The VRA GHG Reports are to be updated on an annual basis. Annual inventories will be published and on VRA's Corporate website (www.vra.com). VRA will continue to use and update the inventory template in future years to remain as consistent as possible.

7 CARBON OFFSET AND REDUCTION STRATEGIES

7.1 VRA's Renewable Energy Development Programme

In line with national actions in the renewable energy sector, VRA in February 2010 adopted a Renewable Energy Generation Policy in order to develop and operate RE plants in an efficient, cost-effective and environmentally sustainable manner. To achieve the purpose set out in the VRA RE Generation Policy, the Renewable Energy Development Programme (REDP) was formulated. The VRA REDP sets a 5-10 years' Renewable generation capacity target, taking cognizance of the local and export demand and the system constraints and is being rolled out in phases. Details of planned renewable energy projects are as listed in Table 7-1.

Table 7-1: Planned Renewable Power Projects

	Project
60 MW	Bongo Solar Power Project (EIA Study concluded, Environmental Permit obtained)
0.448 MW	Akuse Residential & Institutional Office Buildings Solar PV Rooftop Project
75 MW	Wind Power Project -1 (Anloga, Srogbe, Anyanui) (EIA Study concluded, Environmental Permit obtained)
60 MW	Solar Power Component - Pwalugu Multipurpose Dam
68 MW	Sawla Solar Power Project
20 MW	Sherigu Solar Power Project
20 MW	Zebilla Solar Power Project
95 MW	Loagri Solar Power Project
5 MW	Akuse Floating Solar Power Project

Annual GHG emissions savings are estimated at 234,544 tCO_2e per year for the solar power projects (328.45 MW) and 98.077 tCO_2e per year for the wind power projects (75MW).

7.2 Tree Planting Programmes

As indicated in Section 4.9 VRA is engaged in two major tree planting programmes along the Volta Lake known as the Volta Gorge Reforestation Project and the Buffer Zone Project. Tree species adopted are *Senna siamea* (cassia), *Acacia mangium, Khaya senegalensis (*Mahogany), *Cedrella odorata,* and *Leuceana leucocephala*. As at close of 2025, about 1,808 hectares of the Volta Gorge area had been planted, whilst 440 hectares of forest tree plantation established under Buffer Zone Project. Thus, the total area covered is 2,248 ha.

VRA is yet to calculate the carbon sequestration potential of its tree planting programme. VRA intends to utilize both aerial and ground surveys to capture data on the tree dimensions for use in calculating the amount of carbon sequestrated by this plantation. The reduction in the amount of carbon emissions can then be measured and used to offset VRA's carbon emissions within its carbon accounting programme.

7.3 Energy Efficiency & Fuel Switch

Simple cycle power plants (SCPP) use fuel and compressed air in gas turbines, which drive a generator producing electrical energy. The hot exhaust gases are released into the environment without further use of the containing energy in form of heat. The purpose of combined cycle power plant (CCPP) is to utilize the energy from the hot turbine exhausts for steam generation in a downstream heat recovery steam generator (HRSG). This steam is used for power generation in a steam turbine. Therefore, the total electrical power generation capacity of a CCPP is made up of the power output of gas turbines and the steam turbine without the need for additional fuel.

VRA currently plans, under the KTPS Phase 1 - Stage 2 development, to convert the Gas Turbine Generating Units into a 330MW Combined Cycle Unit. The Project Idea Note submitted to CDM operational entity for the West Africa Region as a CDM Programme Activity Design Document in May 2011 estimated the GHG annual savings at 400,000 Tonnes of CO_2 Equiv.

7.4 Cleaner Cooking Solutions through adoption of fuel-efficient stoves

VRA's Climate Smart Stove project aims to minimize the harvesting and utilization of trees as firewood in the Volta Lake basin. The VRA in 2016 successfully piloted these fuel-efficient and energy-saving improved domestic cook stoves in twenty-one (21) riparian communities. Accordingly, a total of five hundred and five (505) cook stoves have been constructed in collaboration with the Asuogyaman District Fisheries Commission who provide the technical backstop for the stoves. The provision of these fuel-efficient domestic cookstoves, termed, "Climate Smart Stoves" is to complement VRA's commitment to ensuring the communities minimize the consumption of firewood and re-enforce attitudinal change among the community members. These stoves are built from clay, which is locally available in the area, and accommodates two (2) cooking pots with an elevated chimney primarily designed to remove the smoke from the cooking area. The use of the CSS has shown to have immense economic and health benefits to users as it contributes to financial savings of the families and the reduction in exposure of wood smoke, heat, and fire burns from open fires, which mostly affect women and children that are engaged in this activity.

An assessment of the Climate Smart Stoves by the Council for Scientific & Industrial Research showed that an efficiency in terms of fuelwood savings of 51.45% and processing rate of 76.6%. According to the CSIR, this performance met international requirement of a minimum of 40% fuel saving. The CSIR results also show an estimated annual carbon savings of 664 kg CO_2 per stove as against the traditional "3-Legged Cook Stoves".

7.5 Resource Use Efficiency

VRA in 2020 embarked on a four-year Sustainability Plan to help VRA achieve its financial and operational sustainability in the period 2021 to 2025, with the primary objective of maintaining VRA's position as a market leader in the Ghana power market. Under the Plan, the underlisted targets were set for all departments to achieve resource use efficiency:

- Reduction in paper usage
- Reduction in transport / travel costs
- The adoption of video conferencing for meetings, and
- The digitization of our Internal business processes and operations.

To achieve the above, a paperless system, using "**Laserfiche"** as well as "**Microsoft Teams**" have been adopted in all operations of VRA. The implementation of these is geared towards reducing administrative costs and will in addition, invariably also reduce GHG emissions and corporate carbon footprint.

7.6 Most Eco-Friendly Department Awards

VRA in 2019 instituted the "**Most Eco-Friendly Department"** awards and this has been incorporated into the annual Corporate Safety Awareness Day Celebration, held each year on the third Thursday of November. The awards involve using the average vehicular emissions data for the preceding three years as baseline for which department's annual performance is compared to that of the award year. As fuel usage requirements differ for each department due to the separate workloads, the use of annual percentage reduction of the baseline data has been adopted.

8 PLANNED IMPROVEMENTS – STATUS OF IMPLEMENTATION

The following actions are to be pursued to improve future data capture and reporting as well as reduce GHG emissions:

No.	Activity	Status
1.	Centralizing (through the business oracle system) requisite data for the activity data for fuel consumption for mobile emissions, vehicular/water transport.	Completed
2.	Institute the "Eco-Friendly Department" awards.	Completed
3.	Capacity building of staff using safety meetings to effectively embrace carbon caring values throughout the operation of VRA.	Ongoing
4.	Implementation of resource use efficiencies programs under the Corporate Sustainability Plan, targeting a reduction in paper and vehicular fuel usage, the adoption of video conferencing for meetings, and the digitization of our Internal business processes and operations.	Ongoing
5.	Build the capacity of AHL and VLTC to publish their own GHG Report by 2027.	Completed
6.	Build the capacity of KFL to publish their own GHG Report by 2027.	Yet to commence
7.	Undertake area and ground survey to assess carbon sequestration of the VRA Reforestation program to offset VRA's carbon emissions within its carbon accounting program by 2027.	Ongoing
8.	Initiate strategies to collate data on Hydrofluorocarbon emissions from specifically office Air Condition systems by 2027.	Ongoing
9.	Inclusion of electric vehicles in the Authority's fleet of vehicles to reduce GHG emissions.	Yet to Commence

9 REFERENCES

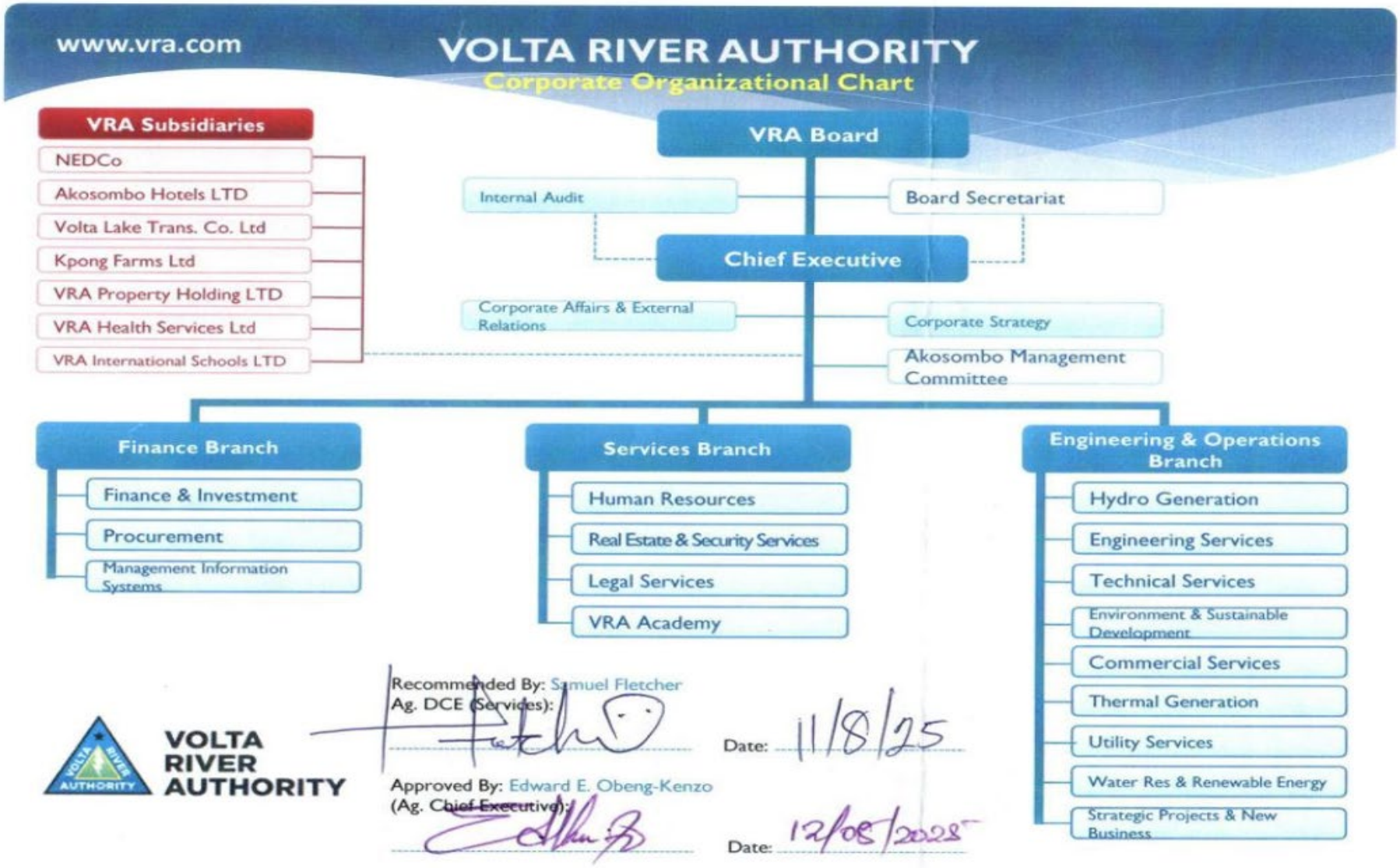
1. Annual Environmental Reports (2012-2025) for Takoradi 1Thermal Power Station
2. Annual Environmental Reports (2012-2014) for Takoradi 3 Thermal Power Station
3. Annual Environmental Reports (2012-2025) for Tema Thermal 1 Power Station
4. Annual Environmental Reports (2012-2025) for Tema Thermal 2 Power Station
5. Annual Environmental Reports (2016-2025) for Kpone Thermal Power Plant
6. Annual Environmental Reports (2012-2015) for Mines Reserve Power Plant
7. Greenhouse Gas Inventory Guidance: Direct Fugitive Emissions from Refrigeration, Air Conditioning, Fire Suppression, and Industrial Gases; USEPA, November 2014
8. Intergovernmental Panel on Climate Change (IPCC). 2007. IPCC Fourth Assessment Report - Working Group I Report "*The Physical Science Basis*."
9. International Organization for Standardization (ISO), 2006: "14064-1 Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals".
10. World Resources Institute (2024). GHG Protocol tool for stationary combustion. Version 4.2.
11. WRI/WBCSD, The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition). 2004, World Resources Institute and World Business Council for Sustainable Development. Available at: http:// www.ghgprotocol.org / standards /corporate standard.

APPENDIX

Appendix 1 - VRA Corporate Organizational Chart

APPENDIX 1

VRA CORPORATE ORGANIZATIONAL CHART



VOLTA RIVER AUTHORITY

Recommended By: Samuel Fletcher
Ag. DCE (Services): ..... Date: 11/8/25

Approved By: Edward E. Obeng-Kenzo
(Ag. Chief Executive): ..... Date: 12/08/2025