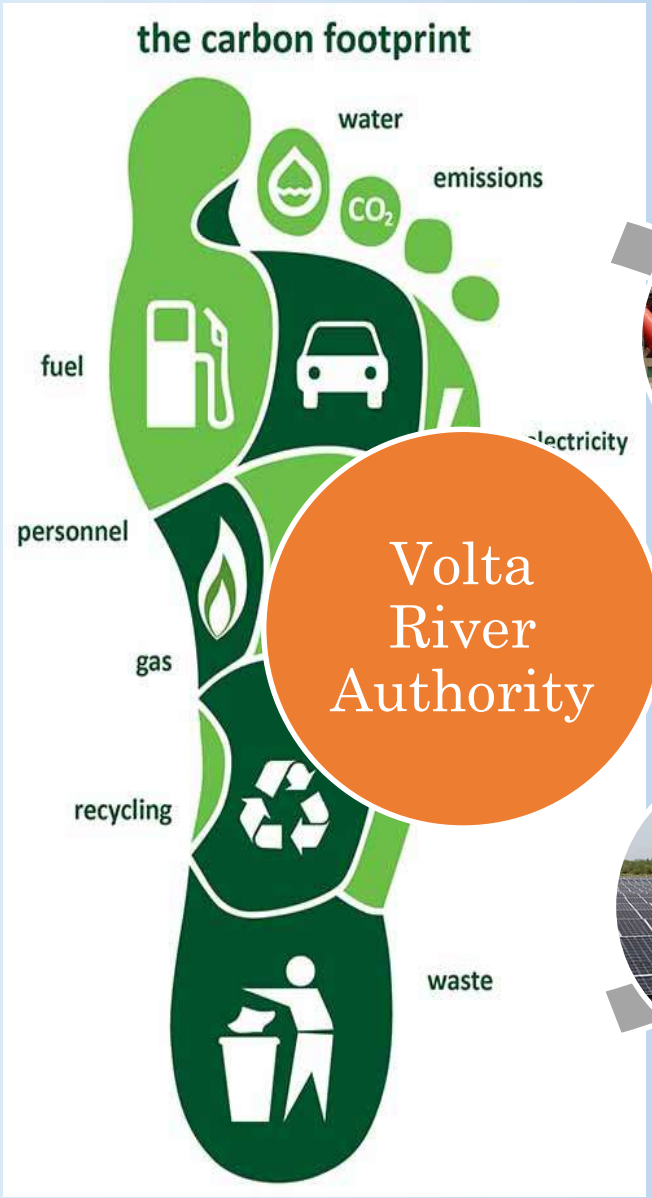
2012-2019

GREENHOUSE GAS INVENTORY REPORT



Electro-Volta House, 28th Feb. Road,
P. O. Box MB 77, Accra, Ghana
Digital Address: GA 145-7445
Email: corpcomm@vra.com
Tel: +233-302 664 941-9
+233-302 318 540

VOLTA RIVER AUTHORITY

CORPORATE ENVIRONMENTAL POLICY STATEMENT

The Volta River Authority (herein referred to as "the Authority") is a public power utility and supplies electricity to industries and mining companies as well as distribution companies in Ghana. The Authority commits to ensuring continuous improvement of environmental performance that minimizes potential impacts of all its operations on the environment in accordance with the principles of sustainable development and complying with national and international environmental protection regulations.

In respect of the above, VRA will:

1. Make environmental considerations a priority in all business planning and decision-making and comply with relevant national and international environmental protection regulations.
2. Take reasonable steps to mitigate the impact of its actions with regard to the development, operation and management of its assets.

VRA will thus pursue the following specific objectives:

a. Develop and implement Environmental Management Systems for all its business units to:

   i. Assess environmental impact of processes, operations and products.
   ii. Focus on pollution prevention and waste reduction.
   iii. Ensure compliance with national/international environmental protection regulations.
   iv. Set annual environmental targets to ensure continuous improvements.
   v. Monitor and report on environmental performance as required to the appropriate stakeholders.

b. Ensure minimum environmental impact of VRA's projects and take adequate steps to mitigate any such anticipated adverse impacts as far as is practicable.
c. Promote environmental awareness and individual sense of responsibility among its employees through print material for distribution, safety meetings, and the corporate website which will continue to be updated, and provide adequate empowerment and training for personnel to perform environmental jobs satisfactorily.
d. Support research efforts on materials, products, processes and pollution reduction techniques that are directly related to its operations.
e. Contribute to the development of public policy and programmes that enhance environmental awareness and protection.
f. Promote open communication on environmental issues.
g. Undertake projects and programmes in collaboration with relevant agencies to preserve the Volta Lake resource, and reasonably restore/mitigate ecological imbalance caused by the creation of the lake.
h. Undertake projects and programmes to mitigate the impact on the livelihood of individuals and communities displaced or affected by VRA's developmental projects.

VRA shall design evaluation procedures for all processes that fall under this policy to ensure that these processes comply. Deficiencies, in the policy or in the evaluation procedure, shall be addressed as required. Each employee of VRA is charged to exercise his or her responsibility on behalf of VRA to assure that the intentions of this Policy Statement are diligently carried out.

Approved: Emmanuel Antwi-Darkwa
CHIEF EXECUTIVE

Date: 18 – 6 – 2019

VOLTA RIVER AUTHORITY

Has this inventory been verified by an accredited third party?
☐ No ☒ Yes (if yes, fill in verifier contact information below and attach verification statement)
Date of verification: 01/20/2020
Verifier: Ghana Environmental Protection Agency
Email: infor@epa.gov.gh
Phone: +233 (0) 30-2662- 690
Address: P. O. Box MB 326, Ministries Post Office, Accra

REPORT DETAILS

Title:	**2012-2019 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 2019 Greenhouse Gas Inventory Report. The report compares GHG emission from 2012 to 2019 and includes a number of internal sustainability targets as well as emissions reduction initiatives achieved. As indicated, the results of our annual GHG inventory allows for the tracking of progress made against our emission targets, measure the impact of implemented reduction initiatives, and identify further reduction opportunities for future action.
Prepared by and for:	Environment & Sustainable Development Department, Volta River Authority Electro Volta House, 28Th February Road P. O. Box MB 77, Accra Digital Address: GA-145-7445 Tel No: +233-302-664941-9 WhatsApp: +233-501-620439 Email: desd@vra.com Web: www.vra.com
Authors:	Environment & Sustainable Development Department, VRA
Lead Authors	1. Mr. Benjamin A. Sackey - E&SDD, VRA 2. Mr. Ulysses Ocran-Hammond - E&SDD, VRA 3. Mr. Godfred Ofosu-Asare - E&SDD, VRA
Specialist Authors:	1. Dr. Daniel Tutu Benefor - Environmental Protection Agency 2. Dr. Samuel Ayesu - Forest Services Division 3. Mr. Kennedy Amankwa - Energy Commission 4. Mrs. Enam Eyiah - reNew Climate Limited 5. Mr. Nana Yaw Anane-Binfoh - Technical Services, VRA 6. Mr. Carl Asoalla - Procurement, VRA 7. Mr. Samuel Ofosu-Boateng - TTPS, VRA 8. Mr. Hans Ofedie - TTPC, VRA 9. Ing. Isaac Kwadwo Owusu - Eng. Services, VRA 10 Mr. Isaac Doe - Technical Services, VRA
Date:	May 2022

DOCUMENT CONTROL SHEET

REPORT TITLE:	**2012-2019 CORPORATE GREENHOUSE GAS INVENTORY REPORT**		
DATE:	May 2022		
REPORT STATUS:	Final Copy		
PROPONENT:	Volta River Authority		
INTERNAL DOCUMENT DISTRIBUTION			
Type	**Recipient Name**	**Location**	**Institution**
Electronic / Hard Copy	Director, Environment & Sustainable Development	Akosombo	Volta River Authority
	Director, Engineering Services	Akuse	
	Manager, Projects	Akuse	
	Manager, Env. & Social Impact	Akosombo	
	VRA Head Office Library	Accra	
Hard Copy	Executive Director	Accra	Environmental Protection Agency

NOTE:

Hard Copies are held and distributed by the Environment & Sustainable Development Department of VRA. Electronic copies of this report are issued in portable document format and posted on the corporate website of the Volta River Authority at www.vra.com.

ACRONYMS & ABBREVIATIONS

AERs	-	Annual Environmental Reports
AHL	-	Akosombo Hotels Limited
APML	-	Akosombo Paper Mill Limited
AR2	-	Second Assessment Report
AR5	-	Fifth Assessment Report
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) 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 2019 Greenhouse Gas Inventory Report.

The report compares GHG emission from 2012 to 2019 and includes a number of internal sustainability targets as well as emissions reduction initiatives achieved. As indicated, the results of our annual GHG inventory allows for the tracking of progress made against our emission targets, measure the impact of implemented reduction initiatives, and identify further reduction opportunities for future action.

This GHG inventory was compiled and written following the guidelines of the World Business Council for Sustainable Development (WBCSD) and World Resources Institute's (WRI) "Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard" (2004). The consolidation of the 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 hundred percent (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) Fourth Assessment Report (AR4) and the 2006 IPCC Guidelines 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).

The total GHG emissions arising from VRA's stationary combustion under Scope 1 for all fuel types for the period 2012 to 2019 is 10,146,944.57 tCO_2e as detailed in Figure 0.1. The total GHG emissions arising from VRA's mobile combustion for same period was 14,176.78 tCO_2e - comprising 595.37 tCO_2e and 13,581.41 tCO_2e from water and road transportation respectively. Annual GHG mission trend for water transportation for the period under review

is shown in Figure 0.2 whilst that for road transportation is summarized by user departments in Figure 0.3.

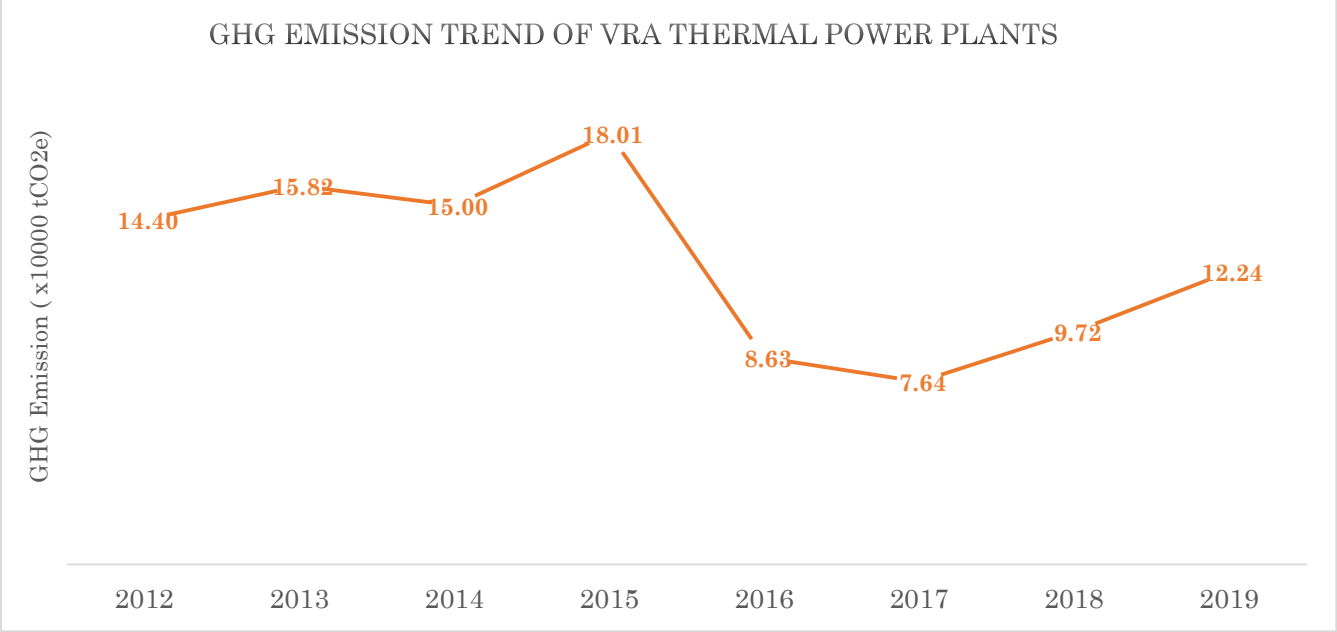


Figure 0.1: GHG Emissions Trend of VRA Thermal Plants (2012-2019)

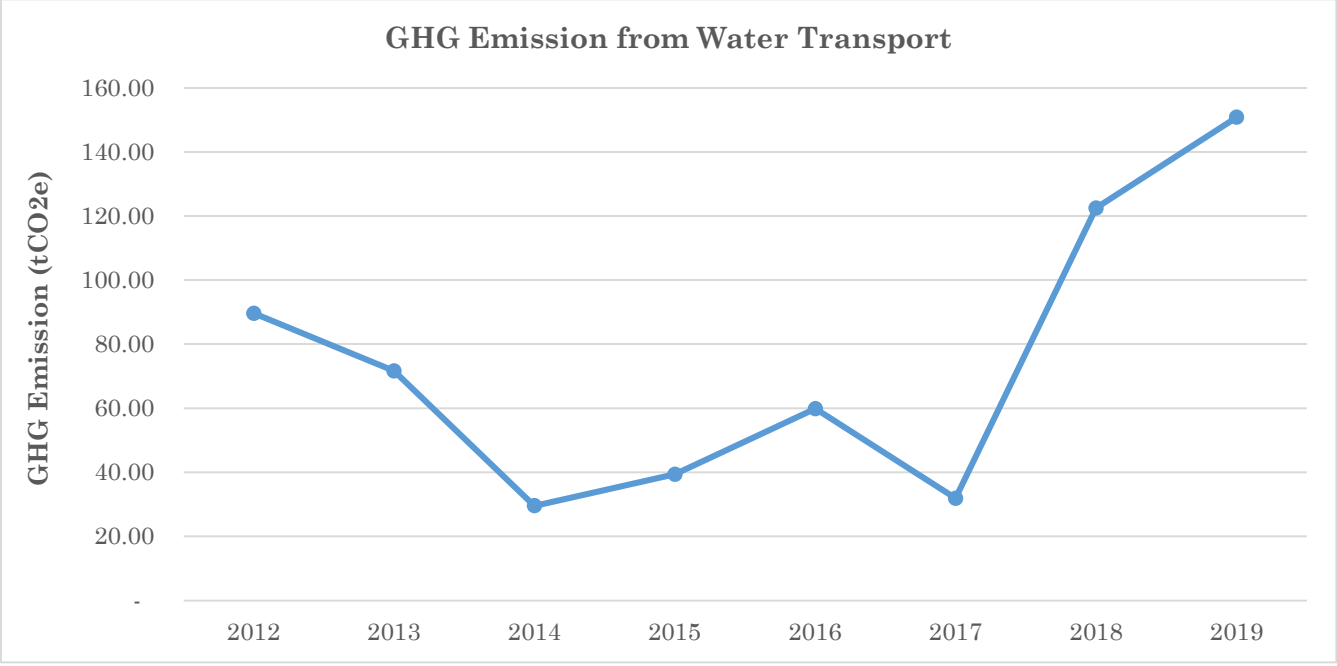


Figure 0.2: GHG Emission Trend from Water Transport (2012-2019)

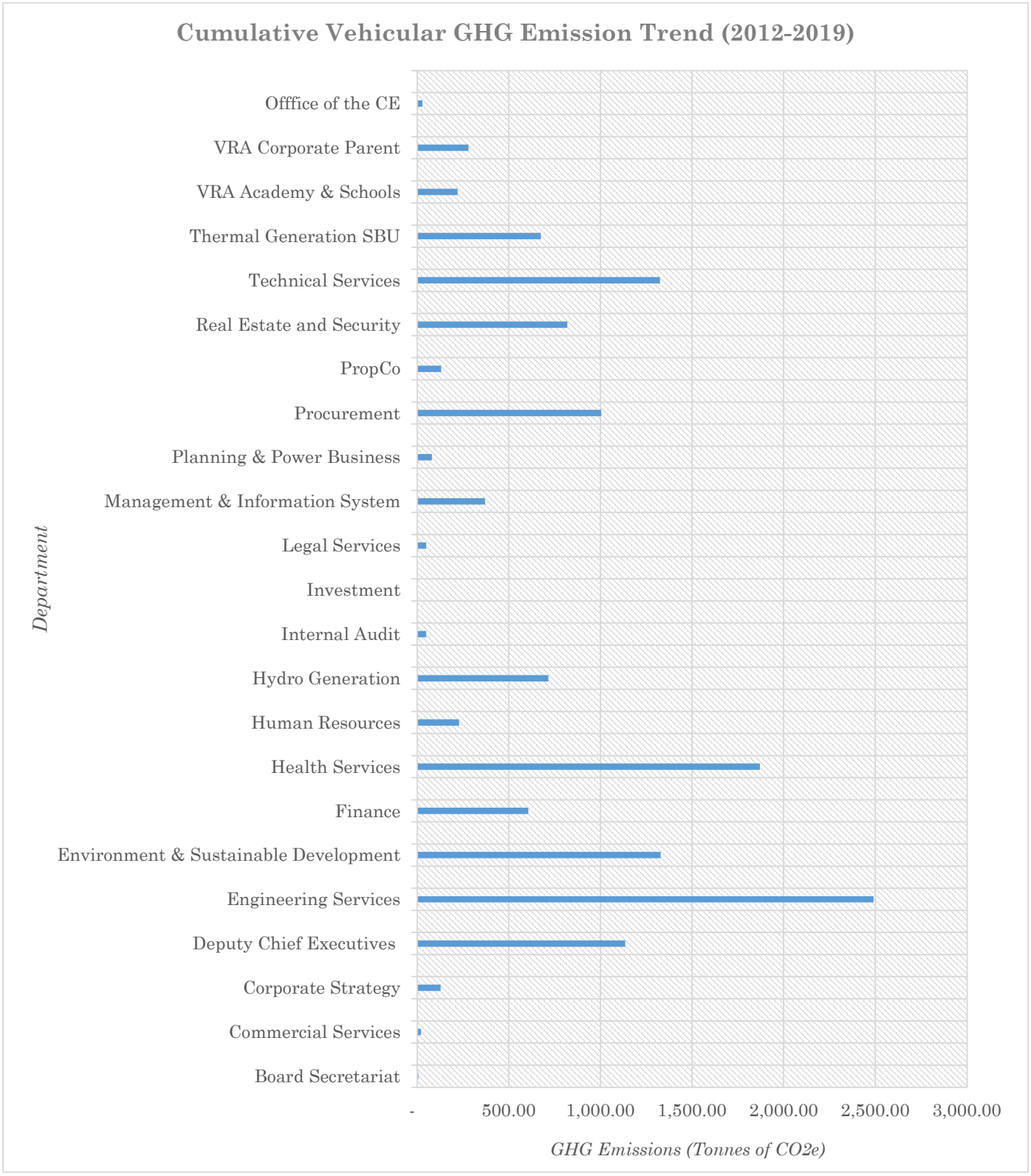


Figure 0.3: Cumulative GHG Emissions by Department (2012-2019)

Subsequently, the total emissions for the year 2019 is 1,225,464.07 tCO2e. A total of 10,161,121.36 tCO2e GHG emissions has been realized from 2012-2019. This is summarized by scope and source category in the table below.

Operational Emissions Category	Emissions Source Category	Corporate emissions source	Total emissions in Tonnes CO2e	Percentage of total corporate emissions
Direct Emission Sources	Stationary Combustion	T1	5,758,925.43	56.68%
		T3	135,120.36	1.33%
		TT1PS	2,769,940.59	27.26%
		TT2PS	578,031.79	5.69%
		MRPS	321,269.71	3.16%
		KTPS	583,656.70	5.74%
	Mobile Combustion	Vehicles	13,581.41	0.13%
		Water Transport	595.37	0.01%
Total Emissions from Direct Sources			**10,161,121.36**	100.00%

Stationary combustion contributed 99.86% of total GHG emissions whilst mobile combustion contributed 0.14%. From above, emission from T1 represented the dominant contribution accounting for approximately 57% of the total annual average accountable GHG emissions, and this is followed by TT1PS, which make up 27% of the total annual average. These two thermal power plants have been the most utilized for power generation over the period. T3 was not in operations in 2012, 2016 and 2017 and hence no emissions were recorded. The plant was also not operational for almost half of the year in 2014. MRPS was also not operational in 2013 and decommissioned in 2016. KTPS commenced operation in 2016. GHG emissions from thermal plants rose from 2017 to 2019 due to increase in energy generation (see Table 3.2) as a result of system demand for electricity during the period; the generation of electricity being directly proportional to fuel consumption and amount of GHG released. The increase in GHG emissions from water transport from 2017 to 2019 is also attributable to increase in demand for maritime services by external stakeholders during the period.

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. Centralizing (through the business oracle system) requisite data for the activity data for fuel consumption for mobile emissions, vehicular/water transport, by 2023.
2. Continue with implementation of resource use efficiencies programmes under the Financial Recovery Programme, targeting reduction in paper and fuel usage as well as adoption of video conferencing for meetings.
3. Continue with the "Eco-Friendly Department" awards.
4. Initiate strategies to collate data on fugitive emissions such as Methane from natural gas distribution systems within the Tema Area under Scope 2 and report on outcome by 2023.
5. Initiate strategies to collate data on Hydrofluorocarbon emissions from specifically office Air Condition systems by 2023. Basically, responsible staff will be trained on data collection methods and input into the spreadsheets.
6. Undertake area and ground survey to assess carbon sequestration of VRA Reforestation program to offset VRA's carbon emissions within its carbon accounting programme by 2022.
7. Establish the "Akosombo Plastic Waste Processing & Recycling Centre" for the segregation and processing of plastic bottles within the Akosombo and its environs by 2023.
8. Assess the utilization of the fuel-efficient stoves for riparian communities and estimate carbon savings achieved by 2022.
9. Capacity building of staff using safety meetings to effectively embrace carbon caring values throughout the operation of VRA and report on outcome by 2022.
10. Build capacity of VLTC, AHL, KFL, and NEDCO to publish their own GHG Report by 2023.
11. Inclusion of electric vehicles in the Authority's fleet of vehicles to reduce GHG emissions.

TABLE OF CONTENT

FIGURES

TABLES

1 INTRODUCTION

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 continuity to this commitment, the VRA now presents its 2019 Greenhouse Gas Inventory Report.

The report covers GHG emission from 2012-2019 and includes a number of internal sustainability targets as well as emissions reduction initiatives achieved. As indicated, the results of our annual GHG inventory allows for the tracking of progress made against our emission targets, gauge the impact of implemented reduction initiatives, and identify further reduction opportunities for future action.

This GHG inventory was compiled and written following the guidelines of the World Business Council for Sustainable Development (WBCSD) and World Resources Institute's (WRI) "Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard" (2004). This standard, considered international best practice for organizational GHG accounting, is articulated around the following principles:

- **Relevance**: VRA's GHG inventory appropriately reflects emissions of the Organisation and was compiled in the spirit of serving decision-makers, both internal and external.
- **Completeness:** All material emission sources and activities within the chosen boundary are accounted for and reported, and any exclusions are disclosed and justified.
- **Consistency:** Consistent methodologies are used for meaningful comparisons of emissions over time. Changes to data, inventory boundary, methods, or any relevant factors is transparently documented.
- **Transparency:** All relevant issues are addressed in a coherent manner based on a clear audit trail. Any relevant assumptions are disclosed and appropriate references to the accounting and calculation methodologies and data sources used are made.
- **Accuracy:** Quantification of GHG emissions is systematically neither over nor under actual emissions and uncertainties have been reduced as far as practicable. The achieved level of accuracy should enable decision-making with reasonable assurance as to the integrity of the reported information.

In accordance with the WBCSD/WRI GHG protocol, VRA has selected the Operational Control approach, to define its organizational and operational boundaries. Under this approach, VRA has included in its emissions inventory all sources and sinks over which it has hundred percent (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) Fourth Assessment Report (AR4) and the 2006 IPCC Guidelines 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.

2 REPORTING ENTITY

The Volta River Authority (VRA) was established on April 26, 1961, under the Volta River Development Act, Act 46 of the Republic of Ghana, with the mandate to generate, transmit and distribute electricity. 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. The amendment has the key function of creating the enabling environment to attract Independent Power Producers (IPPs) onto Ghana's energy market. Following the amendment, the transmission function was hived off into an entity, designated Ghana Grid Company (GRIDCo) while VRA's distribution agency, the Northern Electricity Department (NED), has been transformed into the Northern Electricity Distribution Company (NEDCo), a wholly owned subsidiary of VRA.

Over the years, the VRA have strategically diversified its power generation portfolio to take advantage of available sustainable sources of energy, mainly hydro, natural gas, liquefied petroleum products and renewables. Consequently, the VRA as of December 2019 operated a total installed electricity generation capacity of 2,517.5 MW, comprising of 1180MW (46.87%) from the two hydroelectric plants, 2.5MW (0.1%) from one solar power plant and 1335MW (53.03%) from six thermal power plants as detailed in Table 2.1.

Table 2.1: Power Generation Capacity of VRA (December 2019)

POWER PLANT	INSTALLED CAPACITY (MW)
HYDRO	
Akosombo Hydropower Plant	1,020
Kpong Hydropower Plant	160
THERMAL	
Takoradi 1 Thermal Power Plant (T1)	330
Takoradi International Company (TICO)	345
Tema Thermal 1 Power Plant (TT1PP)	110
Tema Thermal 2 Power Plant (TT2PP)	80
Kpone Thermal Power Plant (KTPS)	220
Ameri Power Plant	250
SOLAR	
Navrongo Solar Power Plant	2.5
TOTAL	**2,517.5**

Various departments and outfits are responsible for the variety of activities performed by the company. In fulfilment of its responsibility to provide facilities for its staff as well as assistance for the socio-economic development of the Volta Basin, the VRA also has seven (7No.) non-power subsidiary companies. The Corporate organizational Structure as at close of 2019 is provided in Appendix 1. Additional company information can be located at www.vra.com.

NEDCo became operational in May 2012 and is currently the sole distributor of electricity in the Upper West, Upper East, Northeast, Northern, Savannah, Bono, Bono East, Ahafo, and parts of Ashanti and Oti Regions of Ghana. Aside NEDCo, VRA's regulated customers in Ghana include Electricity Company of Ghana (ECG) and Enclave Power located within the Tema Export Processing Zone. Bulk sales are also made to de-regulated customers (mining/industrial companies) as well as import/export of power with Communauté Electrique du Benin of Togo and Benin, Compagne Ivoirienne d'électricité – La Cote d'Ivoire and SONABEL (Burkina Faso).

The 2019 Annual Report of the VRA indicates that of the 17,890GWh generated nationwide in 2019, VRA generated 11,414GWh, representing 63.8% of total energy generated. VRA's Group revenue from the sale of electricity in 2019 increased by 27% to GH¢4.012 billion over the previous years' sale of GH¢3.16 billion. This was mainly due to the combined effects of a 19.20% increase in the quantity of energy sold and the upward adjustment in tariffs in the regulated market.

3 DESCRIPTION OF EMISSION SOURCES

3.1 INVENTORIES BOUNDARIES

3.1.1 Organizational Boundary

Organizational boundaries represent the distinction of GHG emissions that will be included or not included in an inventory. These boundaries define the portion of emissions for which an organization is responsible. The GHG Protocol Corporate Standard outlines two approaches from consolidating GHG data:

- **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 has selected the "**Operational Control** approach, to define our organizational and operational boundaries. This is to ensure that we focus on emission sources from operations over which it has both interest and control and can implement management actions consistent to its corporate environmental policy objectives. Under this approach, we have included emissions inventory from all sources and sinks over which we have 100% operational control during the reporting period, and these are listed in Table 3.1.

Table 3.1: Power Plants under VRA's Operational Control

#	Commissioning Date	Power Plant	Plant Type	Installed Capacity MW)	Dependable Capacity (MW)	Location
1	1965	Akosombo Hydropower Plant	Hydro	1080	900	Akosombo
2	1982	Kpong Hydropower Plant	Hydro	160	140	Akuse
3	1997	Takoradi 1 Thermal Power Plant	Thermal	330	300	Aboadze
4	2007	Mines Reserve Power Plant	Thermal	80	40	Tema
5	2009	Tema Thermal 1 Power Plant	Thermal	110	100	Tema
6	2010	Tema Thermal 2 Power Station	Thermal	87	70	Tema
7	2013	Takoradi 3 Thermal Power Plant	Thermal	132	120	Aboadze
8	2013	Navrongo Solar Power Plant	Solar	2.5	0	Navrongo
9	2016	Kpone Thermal Power Station	Thermal	220	200	Kpone

Note: Mines Reserve Power Plant was decommissioned in 2016

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. It determines the business activities of the company that generate emissions, which of these activities should be included in the calculation, and how these activities would be classified. Establishing operational boundaries helps to verify that all applicable GHG emission sources are appropriately accounted for, and "double counting" is avoided.

Subsequently, our operational boundary are the locations of the related infrastructure and offices of the nine (9) power generating facilities as listed in Table 3.1 and these are Akosombo, Akuse, Aboadze, Navrongo, Tema, Kpone. It also includes Accra, the country's capital, where company's group head office is located.

As indicated, VRA currently operates seven (7No.) subsidiary companies which are wholly owned by the company. Three of these, the VRA Health Services Limited, VRA International School Limited and Property Management Company were still under direct management of VRA and have been included in this GHG inventory.

3.3 GHG EMISSIONS SCOPE

3.3.1 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:

3.3.1.1 Stationary Combustion

Direct combustion of fossil fuels from the thermal power projects, 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), Liquified Natural Gas (LNG).

3.3.1.2 Mobile Combustion

This involves 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.

3.3.1.3 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.

3.3.2 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 those from purchased electricity and electrical line transmission/conversion losses and includes:

i. Purchased 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.
ii. The natural gas distribution lines associated with thermal power generation facilities at Aboadze, Tema and Kpone.

3.3.3 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'. Indirect Optional sources of information that VRA could provide includes emissions associated with power purchased to meet customer demand and support grid operations. Other indirect sources are employee business travel and full lifecycle/supply chain emissions. Our Scope 3 are included in the following categories:

i. Employee business air travels, both internal and external.
ii. VRA owned Akosombo waste land fill site

iii. Power purchased to meet electricity demand from utility companies in neighboring countries as shown in Table 3-2, averaged 2.17% during the period.

Table 3.2: VRA Generation & Import Data (2012-2019)

Year	Total Generation (GWh)	Total Import (GWh)	Percentage Import
2012	11,082.88	127.67	1.15%
2013	11,357.82	26.95	0.24%
2014	10,460.57	50.72	0.48%
2015	9,052.22	223.24	2.47%
2016	8,151.35	573.77	7.04%
2017	8,117.56	246.80	3.04%
2018	8,619.29	140.97	1.64%
2019	9,800.17	127.41	1.30%
Total	76,641.86	1,517.53	2.17%

Source: Engineering Services Dept.

3.4 EXCLUSIONS

The following sources of GHG emission have been excluded in the current quantification:

3.4.1 Scope 1 – Direct Sources

1. Fugitive emissions such as Hydrofluorocarbon (HFCs) from building Heating Ventilation Air Condition (HVAC) systems and mobile air conditioning sources (vehicles/mobile fleets) as described under Section Scope 1 - Direct Sources 3.2.1. *For air-conditions and refrigeration, VRA intends adopting the guidelines for "**Calculating HFC and PFC Emissions from the Manufacturing, Servicing, and/or Disposal of Refrigeration and Air-Conditioning Equipment (Worksheet Version**), which was developed by ICF Inc, USA, with and for the GHG Protocol Initiative.*
2. Emissions associated with employee transport in their own vehicle and business-related air travels have also been excluded. *The exclusion of these sources is because such data has not been readily available and therefore difficult to incorporate.*

3.4.2 Scope 2 – In Direct Sources

1. With respect to purchased electricity, except for Accra, all VRA offices and facilities utilizes electricity from the company's power plants. In Accra, it is not clear where

exactly it comes from as 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 forms about 30% of the power from Tema. Aside 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.

2. 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 initial stage of the VRA's GHG calculation and reporting. *It is planned that this will might done in future reports following detailed consultation with the EPA.*

3.4.3 Scope 3 – Other indirect Sources

Emission sources under Scope 3 are not mandatory under WRI reporting protocols. Therefore, at this initial stage of reporting, VRA is also not considering optional sources under Scope 3. VRA will however provide information on actions initiated to allow for a holistic view of the organisation's activities in the area of carbon footprint management.

3.4.4 VRA Subsidiary Companies

The underlisted subsidiary companies are also excluded.

1. Northern Electricity Distribution Company (NEDCo), was incorporated in 1997 and became operational in May 2012
2. Akosombo Hotels (AHL), incorporated in 1991, runs the Volta Hotel in Akosombo, a 3-star hotel, restaurant and modern conference/seminar facilities and pleasure activities including cruising on the lake by MV Dodi Princess to promote tourism.
3. Volta Lake Transport Company Limited (VLTC), incorporated in 1970, operates river transportation for passengers, bulk haulage of petroleum products and significant quantities of cement, and cross-lake ferry services along the Volta Lake. responsible for inland water transport on the Volta Lake. The company's current operational stations are Yeji, Dambai, Kete Krachi, Adawso and Akosombo. It operates inland water transportation with a ferry fleet of nineteen (19) made up of passenger vessels/water buses, cargo ferries and barges. The company carries the average of 647,000 passengers and 57,000 cars per year, on all its ferries.

4. Kpong Farms Limited (KFL), incorporated in May 1982, is 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.

These subsidiaries were not directly under VRA Management at the period of reporting. It is planned that by end of year 2021, VRA in collaboration with the EPA will roll out a series of capacity building programme on Corporate GHG Reporting for the Subsidiary companies.

3.4.5 Thermal Power Plants

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:

1. 345MW Takoradi International Company (TICO) owned as a joint venture with TAQA, from Abu Dhabi in the United Arab Emirates.
2. 250MW AMERI Plant currently being operated on a BOOT basis by AMERI Energy.

3.5 Scope of GHG Savings

3.5.1 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 5-10 years' Renewable generation capacity target, taking cognisance of the local and export demand and the system constraints and is being rolled out in two (2) phases.

The Navrongo Solar Power Station was commissioned in 2013, with an installed capacity of 2.5MW, and has since been in operation and CO_2 Equiv. has been assessed. In 2018, the Ministry of Energy formally handed over the underlisted 5 mini solar power off grid to VRA for operation and maintenance:

1. 50KW Perdiatorkope
2. 40.5KW Atigagorme

3. 39KW Wayokope
4. 54KW Aglakope
5. 54KW Kudorkope

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 considerable percentage of air pollutants emissions due to consistent use of thermal power generation to support the exiting hydropower plants.

3.5.2 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 on the operations of the Authority as required by the Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917). Under this policy, VRA in August 2017 commenced an "Office Wastepaper Exchange Programme" with Akosombo Paper Mill Limited (APML), involving the exchange involves the supply of 80 pieces of unwrapped toilet rolls for 1 ton of office wastepaper supplied to APML. 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 source document for reporting purpose.

4 METHODOLOGY

4.1 EMISSION FACTORS

Emission factor refers to the rate at which a pollutant is released into the atmosphere (or captured) because of some process activity or unit throughput. Emission factors convert activity data (e.g., amount of fuel used, kilometers 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.

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 Fifth Assessment Report, 2014 (AR5) values are the most recent. However, discussions with the Ghana EPA indicates that the national inventory utilizes GWP values from the Fourth Assessment Report, 2007 (AR4) and VRA should adopt that for reporting and uniformity purposes. The AR4 has subsequently been adopted for the VRA reporting.

4.3 QUANTIFICATION METHOD

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 represent over 99 percent of the GHG emissions from the stationary combustion of fossil fuels. The GHG Protocol provides tools that present a step by-step guidance and electronic worksheets to help users calculate GHG emissions from specific sources or industries. These tools are consistent with those proposed by the Inter-Governmental Panel on Climate Change (IPCC) for compilation of emissions at the national level (i.e. latest versions of IPCC, 1996). 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 Environmental Protection Agency, VRA has adopted the following GHG quantification tools:

a) World Resources Institute (2015) Stationary Combustion Tool Version 4.1
b) Mobile Combustion GHG Emissions Calculation Tool Version 2.6.
c) Tool for GHG Accounting for Energy Projects, developed by KfW Development Bank
d) Waste Reduction Model (WARM), Version 12 (February 2012),

4.3.1 Stationary Combustions Emissions

The Corporate Accounting and Reporting Standard quantification methodology, "*World Resources Institute (2015) Stationary Combustion Tool Version 4.1*", has been adopted for VRA' s stationary combustion from its thermal power plants. GHG emission estimation is based on activity data (based on fuel consumption) and on the emission factors (whether they are calculated or obtained from official sources) in line with the national strategy for GHG calculations. This tool calculates the CO_2, CH_4 and N_2O emissions for the combustion of fuels in boilers, furnaces, and other stationary combustion equipment. One needs to supply information on the types and amount of fuel burnt as well as the industry sector. Emissions are then automatically calculated using default emissions factors, chosen to reflect this information. The reporting of emissions regarding operations from VRA's thermal power generation power plants is regulated by the EPA, and we are mandated to report on emissions levels on a periodic basis. A Continuous Emission Monitoring System (CEMS) is used at most plants to directly monitor emissions, specifically NOx, SOx, CO and PM_{10}. During the reporting period, direct emissions of CO_2 was not required by the Ghana EPA and therefore not measured. We therefore monitor and report on data on fuel usage (Diesel Fuel Oil / Light Crude Oil / Natural Gas) as well as power generated, and this information is made available in quarterly environmental monitoring progress reports as well as annual environmental reports to the EPA. Data on fuel usage, as indicated in Table 4-1, was utilized in quantifying GHG emission from the stationary combustion plants.

Table 4.1: Fuel Usage in VRA Power Plants (2012-2019)

Power Plant	Amount of Fuel Utilised								
	Fuel Type	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
T1	Gas (mmBTU)	3908264	2190365	2049310	15615347	7073154	4961819	8447440	10837956	55083655
	LCO (ltrs)	257577300	358490410	183580690	50975800	109034080	27127110	10718790	0	997504180
	DFO (ltrs)	1003300	988830	641480	458250	609860	333030	593336	0	4628086
	Subtotal	**262488864**	**361669605**	**186271480**	**67049397**	**116717094**	**32421959**	**19759566**	**10837956**	**1057215921**
T3	Gas (mmBTU)	0		778185	338930	0	0	0	0	1117115
	LCO (ltrs)	0	27654720	0	0	0	0	0	0	27654720
	DFO (ltrs)	0	36570	0	0	0	0	0	0	36570
	Subtotal	**0**	**27691290**	**778185**	**338930**	**0**	**0**	**0**	**0**	**28808405**
TT1PS	Gas (mmBTU)	1317219	1758458	3536265	3121148	0	2363056	3693511	4416606	20206263
	LCO (ltrs)	143102248	124932730	138546900	102756300	57476700	61661000	0	0	628475878
	DFO (ltrs)	1131020	664900	642800	473500	139000	86400	0	0	3137620
	Subtotal	**145550487**	**127356088**	**142725965**	**106350948**	**57615700**	**64110456**	**3693511**	**4416606**	**651819761**
TT2PS	Gas (mmBTU)	1560257	1062298	2717206	2420967	308296	0	30960	1299967	9399951
	LCO (ltrs)	0	0	0	0	0	0	0	0	0
	DFO (ltrs)	4645000	3209600	0	0	0	0	0	0	7854600
	Subtotal	**6205257**	**4271898**	**2717206**	**2420967**	**308296**	**0**	**30960**	**1299967**	**17254551**
MRPS	Gas (mmBTU)	0	0	2645692	2401936	0	0	0	0	5047628
	LCO (ltrs)	0	0	0	0	0	0	0	0	0
	DFO (ltrs)	8267300	0	0	0	0	0	0	0	8267300
	Subtotal	**8267300**	**0**	**2645692**	**2401936**	**0**	**0**	**0**	**0**	**13314928**
KTPS	Gas (mmBTU)	0	0	0	0	0	35187	3282665	3351873.96	6669726
	LCO (ltrs)	0	0	0	0	0	0	0	0	0
	DFO (ltrs)	0	0	0	0	3599000	39397800	10622830	16561500	70181130
	Subtotal	**0**	**0**	**0**	**0**	**3599000**	**39432987**	**13905495**	**19913374**	**76850856**

Source: E&SDD – Station's Annual Environmental Reports

T3 was not in operations in 2012, and from 2016 to 2019 and hence no fuel was utilized. Also, the plant was not operational for almost half of the year in 2014 as such no fuel was utilized during the period. MRPS was also not operational in 2013 and decommissioned in 2016. KTPS commenced operation in 2016. It should be noted that anytime natural gas is available, it is automatically the preferred fuel choice for power generation and the use of Light Crude Oil (LCO) is reduced. Except for MRPS in 2012, where Diesel Fuel Oil (DFO) was used as the only source of fuel for power generation, DFO is mainly used as a start-up fuel. MRPS operates only on DFO and Natural Gas and therefore there was no combustion from LCO. With the coming of natural gas on site in 2010, the MRPS was rendered redundant as the TT1PS and TT2PS were rather being utilized for power generation. Power generation on DFO resumed in 2012 due to challenges in gas flows as shown in Figure 6-3. The MRPS was retrofitted to utilize natural gas only in 2013 and therefore there has not been any utilization of DFO on site for power generation since then, until the plant was decommissioned in 2016.

4.3.2 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 enables 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 2.6 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) traveled, 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.

There is a detailed inventory of vehicles owned throughout the company and this is maintained by the Transport Section, under the then Technical Services Department. The Transport Section also tracks information regarding the fleet's fuel usage and distance in kilometers traveled. All departments are required to make available data on fuel usage and distance travelled for their mobile sources to the Technical Services Department, using what is called the "Vehicle Operational Chart". The key challenge was that some were not complying with the reporting requirements and data from such departments were obtained directly from the departments from the source books. During the assessment, some of the departments had sent data to the archives and these were difficult to retrieve, and therefore not assessed. To ensure that going forward vehicular data are properly captured, VRA in 2018 introduced online vehicular fuel request via an oracle data management system. In this regard, vehicular fuel usage by departments is tracked and managed by the oracle data management system. Data regarding fuel usage from the vehicular sources were, thus, sourced from both the vehicular operational chart and the VRA Oracle Database for quantification purposes and provided in Table 4.2. Data not Available (DNA) is indicated in the table. Majority of VRA vehicles are from Asia and South Africa.

Table 4.2: Vehicular Fuel Usage (2012-2019)

Department	Fuel Type	2012	2013	2014	2015	2016	2017	2018	2019
Board Secretariat	Diesel	DNA	DNA	DNA	DNA	DNA	120	DNA	2698
	Petrol	DNA	DNA	55	DNA	DNA	DNA	DNA	111
Commercial Services	Diesel	DNA	DNA	DNA	DNA	DNA	DNA	DNA	5007
	Petrol	DNA	DNA	DNA	DNA	DNA	DNA	DNA	3671
Corporate Strategy	Diesel	405	DNA	2847	4018	9791	12534	8016	5768
	Petrol	38	941	752	1960	639	975	60	87
Deputy Chief Executives	Diesel	DNA	DNA	981	7390	119270	232608	3776	19968
	Petrol	DNA	DNA	829	3494	9620	27234	960	5457
Engineering Services	Diesel	49171	33667	63440	297857	142989	123222	23386	107854
	Petrol	5630	16080	12366	52708	6154	5035	4070	2737
Environment & Sustainable Development	Diesel	44818	18226	43229	50231	36992	76199	23991	85678
	Petrol	1840	20767	33369	34514	35691	6699	826	4593
Finance	Diesel	40863	18019	11616	24542	22772	47823	14187	20888
	Petrol	817	12365	1523	13620	706	1187	235	235
Health Services	Diesel	18384	DNA	60154	30051	22795	63415	31129	3542
	Petrol	4729	DNA	495526	17638	4456	22054	6502	2483
Human Resources	Diesel	5414	5500	5837	2902	4974	9919	16801	26336
	Petrol	DNA	4492	270	1926	432	625	335	1193
Hydro Generation	Diesel	51743	11542	38306	25547	21396	69660	27739	3637
	Petrol	2845	772	1807	1582	497	12789	609	478

Department	Fuel Type	2012	2013	2014	2015	2016	2017	2018	2019
Internal Audit	Diesel	1510	1991	988	730	1063	1530	45	2296
	Petrol	334	1146	2293	4174	961	1079	55	312
Investment	Diesel	DNA	DNA	DNA	DNA	264	100	100	648
	Petrol	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
Legal Services	Diesel	3750	6116	DNA	170	1187	70	38	3536
	Petrol	337	3733	DNA	170	DNA	45	45	504
Management & Information System	Diesel	47762	10532	5111	6487	9164	11639	6829	27960
	Petrol	3719	5516	1082	3532	410	701	75	819
Office of CE	Diesel	DNA	DNA	DNA	DNA	DNA	DNA	DNA	10248
	Petrol	DNA	DNA	DNA	DNA	DNA	DNA	DNA	899
Planning & Power Business	Diesel	6659	6192	1889	5709	438	2544	DNA	DNA
	Petrol	DNA	3429	894	2893	175	510	DNA	DNA
Procurement	Diesel	14427	12196	51328	51783	51149	96007	39272	36755
	Petrol	600	11871	2559	10305	90	734	90	DNA
PropCo	Diesel	DNA	DNA	65	236	9872	32369	4466	1373
	Petrol	DNA	DNA	DNA	DNA	DNA	150	250	267
Real Estate and Security	Diesel	22256	20605	53651	40991	37147	70860	18694	11361
	Petrol	1109	484	DNA	32499	460	1255	DNA	221
Technical Services	Diesel	87138	17278	21194	56548	79125	71114	46792	76787
	Petrol	6204	11594	1164	17788	892	755	1489	6151
Thermal Generation SBU	Diesel	DNA	8012	3597	26594	7985	64716	96695	15583
	Petrol	DNA	6060	1372	16128	1340	2265	6504	746
VRA Academy & Schools	Diesel	9982	746	637	5642	1867	18322	27187	15194
	Petrol	176	746	DNA	60	DNA	45	110	2681
VRA Corporate Parent	Diesel	1070	1238	3124	25558	12177	20353	16953	10897
	Petrol	338	DNA	1661	5089	2340	3190	2199	1321
Grand Total	Diesel	405352	171860	367994	662986	592417	1025124	406096	494013
	Petrol	28716	99996	557522	220080	64863	87327	24414	34966

Source: Oracle database and vehicular operational chart

Marine fleets are maintained by the Environment & Sustainable Development Department (E&SDD). Thus, regards to water transport, E&SDD is responsible for operating marine fleets as well as machinery such as sand/weed dredgers on the Volta Lake System. Data on fuel usage taken from tankers for water transport in liters are recorded in a Bin Card and amount utilized provided in the vessels logbook and reported upon monthly. Source data utilized was primary information from the logbooks and a total of 166,089 liters of diesel fuel was utilized by the marine vessels as shown in Table 4.3 from 2012-2019.

Table 4.3: Marine Fleet Fuel Consumption (2012-2019)

Period	Vessels	Diesel Fuel (Road) - Liters
2012	MV. Ohemaa LX1	5,149
	MV. Tilapia	2,975
	MV. Dodi Princess 1	21,165
	MV. Volta Princess	4,200
	TOTAL	**33,489**
2013	MV. Ohemaa LX1	12,366
	MV. Volta Queen	10,389
	MV. Onipanua	4,000
	TOTAL	**26,755**
2014	MV. Buffalo	817
	MV. Ohemaa LX1	6,232
	MV. Volta Queen	4,000
	TOTAL	**11,049**
2015	MV. Onipanua	1,845
	MV. Buffalo	280
	MV. Volta Queen	8,500
	MV. Volta Princess	2,500
	MV. Ohemaa LX1	1,600
	TOTAL	**14,725**
2016	MV. Ohemaa LX1	1,600
	MV. Volta Queen	11,400
	MV. Onipanua	7,900
	MV. Buffalo	474
	MV. Volta Princess	1,000
	TOTAL	**22,374**
2017	MV. Volta Queen	4,000
	Dipa Generator set	420
	MV. Ohemaa LX1	1,798
	MV. Volta Princess	2,500
	MV. Onipanua	3,000
	MV. Buffalo	209
	TOTAL	**11,927**
2018	MV. Volta Queen	32,400
	MV. Onipanua	9,756
	MV. Ohemaa LX1	1,334
	Dipa Generator set	200
	MV. Buffalo	80

Period	Vessels	Diesel Fuel (Road) - Liters
	MV. Volta Princess	2,000
	TOTAL	**45,770**
2019	MV. Volta Queen	32,873.00
	MV. Onipanua	6,772.00
	MV. Ohemaa LX1	1,344.00
	MV. Dodi Princess	9,499.00
	MV. Volta Princess	5,881.00
	TOTAL	**56,369**
TOTAL FUEL CONSUMPTION		**222,458**

Source: E&SDD - Marine Services Unit Fleet Logbooks

4.3.3 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 calculating carbon emissions as well as emissions 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 21,179.2MWhrs of electric energy has been generated within the period from 2013 to 2019. Again, the 5 mini solar power off grid, totaling 237.5KW was handed over to VRA in July 2018 for operations and maintenance, and a total of 238,397MWhrs was generated during the period from July 2018 to December 2019. Table 4-4 gives the breakdown of the energy generated by each plant from 2012-2019. Years that are Not Applicable (N/A) because the PV plant was not operational is indicated. 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 (2012-2019)

	NSPS	Wayokope	Atigagorme	Kudorkope	Perdiatorkope	Aglakope
Installed Capacity (MW)						
	2.5	0.030	0.0405	0.054	0.05	0.054
Annual Energy Generated (MWh)						
2012	N/A	N/A	N/A	N/A	N/A	N/A
2013	2197.8	N/A	N/A	N/A	N/A	N/A
2014	3843.3	N/A	N/A	N/A	N/A	N/A
2015	3312.3	N/A	N/A	N/A	N/A	N/A
2016	3088.8	N/A	N/A	N/A	N/A	N/A
2017	2725.8	N/A	N/A	N/A	N/A	N/A
2018	2581.7	6.67170	8.807	18.36660	23.3083	23.30830
2019	3429.5	13.3343	25.2166	37.9083	41.3987	40.0772

Source: Hydro Generation Department – Power Generation Data

4.3.4 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 ($MTCO_2E$) and metric tons of carbon equivalent (MTCE) across a wide range of material types commonly found in municipal solid waste (MSW). VRA has adopted the WARM Version 12 (February 2012), instead of the latest Version 15 of May 2019. This is because the GWP values in WARM Version 12 include those from the Intergovernmental Panel for Climate Change (IPCC) Second Assessment Report, which Ghana subscribes to. 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, VRA had by close of 2019, recycled a total 3399Kg (3.747 Short Tons), as shown in Table 4.5.

Table 4.5: Office Wastepaper Recycled

Period	Weight (kg)	Weight (Short Tons)
Aug – Dec. 2017	453	0.499
2018	1630	1.797

2019	1316	1.451
Total	3399	3.747

Source: E&SDD - Office Wastepaper Log sheet

4.4 GREENHOUSE GASES COVERED 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 from the Akosombo waste land fill site

4.5 UNCERTAINTIES IN THE GHG INVENTORY

4.5.1 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 (CH4) from natural gas distribution systems.
2) To avoid double counting, purchased electricity at VRA office facilities in Accra are excluded in the inventory.
3) Scope III emissions were also not included 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. VRA will commence discussions on how to systematical 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 neighboring countries as shown in Table 3.2 have also been excluded in the inventory, as it is considered minimal and of little significance.

4.5.2 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) Second 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 as it is not a requirement by the Ghana EPA. However, it is not practical to perform this exercise for each specific emission source in this inventory. 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.

With respect to actual fuel usage, inputs were obtained from data as 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 source entry is inaccurate. Primary data from the power plants was therefore obtained and crosschecked for use.

In their review comments, ICF International recommended the need to also include CO_2 in the direct measurement as a means of using the data to confirm the calculations. Going forward, facilities with CEMS that can undertake CO_2 measurements, like the KTPP will be used for such confirmatory exercises. Uncertainties in calculating transportation emissions from mobile sources may result from several factors:

- If fuel-based method is used, fuel receipts are incomplete or do not clearly indicate purchases of specific fuel types;
- If fuel-based method is used, conversion of fuel expenditure data to fuel quantity based on fuel price data;
- If distance-based method is used, estimates of distance traveled and/or fuel economy are roughly estimated; and
- Emission factors are not customized to reflect actual conditions (e.g., default CO2 emission factors are used for highway sources, instead of customized factors based on location of fuel purchases).

In general, the use of the fuel-based methods produces less uncertainty than use of the distance-based methods and as indicated, VRA adopted this method. With respect to VRA owned/controlled mobile sources, VRA has allocated logbooks for all its vehicles for recording fuel purchased and distance covered. Drivers are subsequently required to input manually such primary data for compilation at the end of each month. Fuel attendants at VRA owned fuel stations endorsed data on fuel obtained. Thus, data on fuel purchased from VRA fuel stations are all captured in the logbooks. At the end of the month, the respective departments are to compile information in the logbooks and submit returns on fuel usage and distances covered to the owner department. Such secondary data was utilized for the calculations.

The key challenge here is that individuals using the vehicles may not log in the required data especially if the fuel is purchased outside the VRA owned fuel stations and therefore information provided may not be actual. In addition, data may be omitted during the compilation. Again, the secondary information as obtained was utilized without confirmation from the primary source data from the departments or the logbooks. All these could result in data uncertainties. As earlier indicated, the main issue has been that due to the period under consideration, some of the departments had sent data to the archives and these were difficult to retrieve and therefore not included in this report.

VRA in 2016 adopted the oracle-based fuel requisition methodology and all fuel requests are generated online. The exception is fuel purchased outside the VRA system. The data is submitted monthly to the General Services Dept. It is expected that going forward, data on fuel

usage from all departments can be captured accurately and on time using the online based system.

Data of diesel fuel utilized was obtained from the vessels logbooks and utilized for the GHG calculations. This data is cross checked using the Bin Cards at the filling point by all parties prior to inputting. It must be noted that these vessels are available for hiring and clients are expected to purchase their fuel whilst in use. The data obtained is from the use of only VRA's internal activities and there is the need to also compile fuel data usage for external clients for inclusion.

Data on amount of office wastepaper recycled is obtained through weighing at the recycling facility by both parties, and the information provided in monthly reports of the E&SDD using the ***Office Paper Waste Log sheet***. Key assumptions included 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.

4.6 POTENTIAL SOURCES OF GHG SEQUESTRATION

Cognisant of the need to ensure continuous flow of water resources in the Volta Lake basin for sustainable generation of hydroelectricity for 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 the 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 programme, 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 2019, about 1,602 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 close of December 2019, close to 230.1 hectares of forest tree plantation had been established along the Volta Lake and its tributaries to serve as buffer to minimize siltation, water pollution and landslide along the catchment and has also introduced number of interventions as sources of livelihood to the implementers of the project.

VRA has engaged an expert from the Forest Services Division under the Forestry Commission as CAT Member to advise on strategies to calculate the carbon sequestration potential of forest tree species planted and being maintained. The 2008 IPCC Guidelines for National GHG Inventory is to be adopted for calculating the carbon stock, using tree dimensions (girth, wood density, basal area, height, etc.), depending on the tree species and types.

5 RESULTS OF GHG QUANTIFICATION

Summary of results obtained for GHG quantifications during the period under review are discussed below.

5.1 STATIONARY COMBUSTION

Table 5.1 presents a summary GHG emissions arising from VRA's stationary combustion for the period 2012 to 2019. A comparison of the trend in GHG emissions for the same period is summarized in Figure 5.1. The total GHG emission for the eight-year period was 10,146,944.57 Tonnes CO_2 Equiv. The detailed spreadsheet calculations for GHG estimations from stationary combustion of the various thermal power plants are provided as Appendix 2.

Table 5.1: Summary of GHG Emissions from thermal plants in Tonnes CO_2 e (2012-2019)

Year	Electricity Generation (Fuel Combustion) - All GHGs in Tonnes CO2e					
	T1	T3	TT1PS	TT2PS	MRPS	KTPS
2012	875,380.46	-	437,271.52	104,918.44	22,203.15	-
2013	1,024,736.81	68,932.49	416,937.56	71,559.89	-	-
2014	580,085.70	46,106.63	556,097.91	160,991.55	156,754.42	-
2015	1,053,305.12	20,081.24	441,962.99	143,439.70	142,312.14	-
2016	692,107.12	-	143,436.30	18,266.21	-	9,665.69
2017	362,397.90	-	293,718.54	-	-	107,893.86
2018	528,775.02	-	218,836.56	1,834.35	-	223,023.67
2019	642,137.30	-	261,679.20	77,021.65	-	243,073.49
Sub-total	5,758,925.43	135,120.36	2,769,940.59	578,031.79	321,269.71	583,656.70
				Grand Total	**10,146,944.57**	

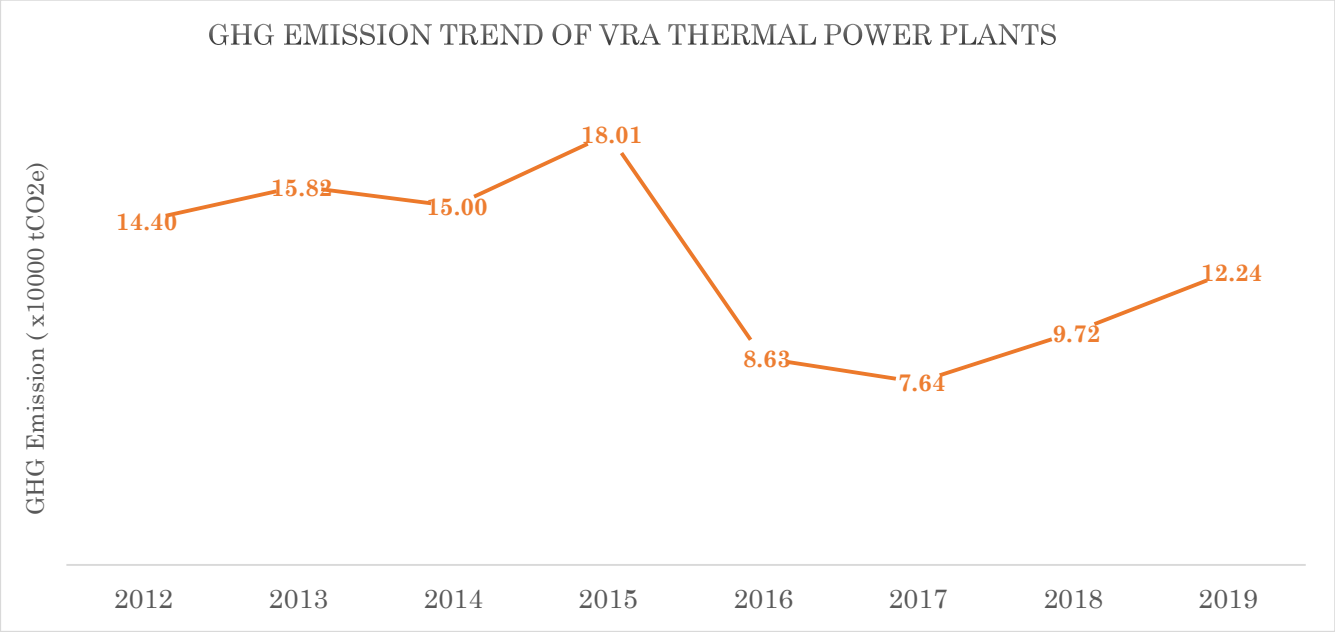


Figure 5.1: GHG Emissions Trend of VRA Thermal Plants (2012-2019)

The trend in GHG emission is affected by the availability of the power plant and the fuel mix used for power generation during the period. The low GHG emissions recorded in 2016 and 2017 is attributable to the unavailability of T3 and MRPS in 2016 and 2017 respectively. The relatively low GHG emissions in 2018 and 2019 is attributable to the predominant use of natural gas for power generation instead of light crude oil. GHG emissions rose from 2017 to 2019 due to increase in energy generation (see Table 3.2) as a result of system demand for electricity during the period; the generation of electricity being directly proportional to fuel consumption and amount of GHG released.

5.2 VEHICLE COMBUSTION

The total GHG emissions for emissions arising from vehicle combustion of fuel on road is 13,581.41 Tonnes CO_2 Equiv. A breakdown of the emission contributed by each individual department is provided in Table 5-2 and Figure 5-2. The detailed spreadsheet calculations for GHG estimations from mobile combustion from diesel and petrol are respectively provided as Appendix 3.

Table 5.2: Cumulative Mobile Combustion GHG Emissions (2012-2019)

Department	GHG Emissions (Tonnes CO_2e)
Board Secretariat	7.92
Commercial Services	21.74
Corporate Strategy	128.48

Department	GHG Emissions (Tonnes CO_2e)
Deputy Chief Executives	1,135.80
Engineering Services	2,490.37
Environment & Sustainable Development	1,329.45
Finance	606.87
Health Services	1,871.18
Human Resources	228.97
Hydro Generation	716.49
Internal Audit	50.69
Investment	2.98
Legal Services	50.77
Management & Information System	371.85
Planning & Power Business	80.66
Procurement	1,004.15
PropCo	131.00
Real Estate and Security	819.34
Technical Services	1,324.92
Thermal Generation SBU	675.48
VRA Academy & Schools	221.65
VRA Corporate Parent	281.19
Office of the CE	29.47
Grand Total	**13,581.41**

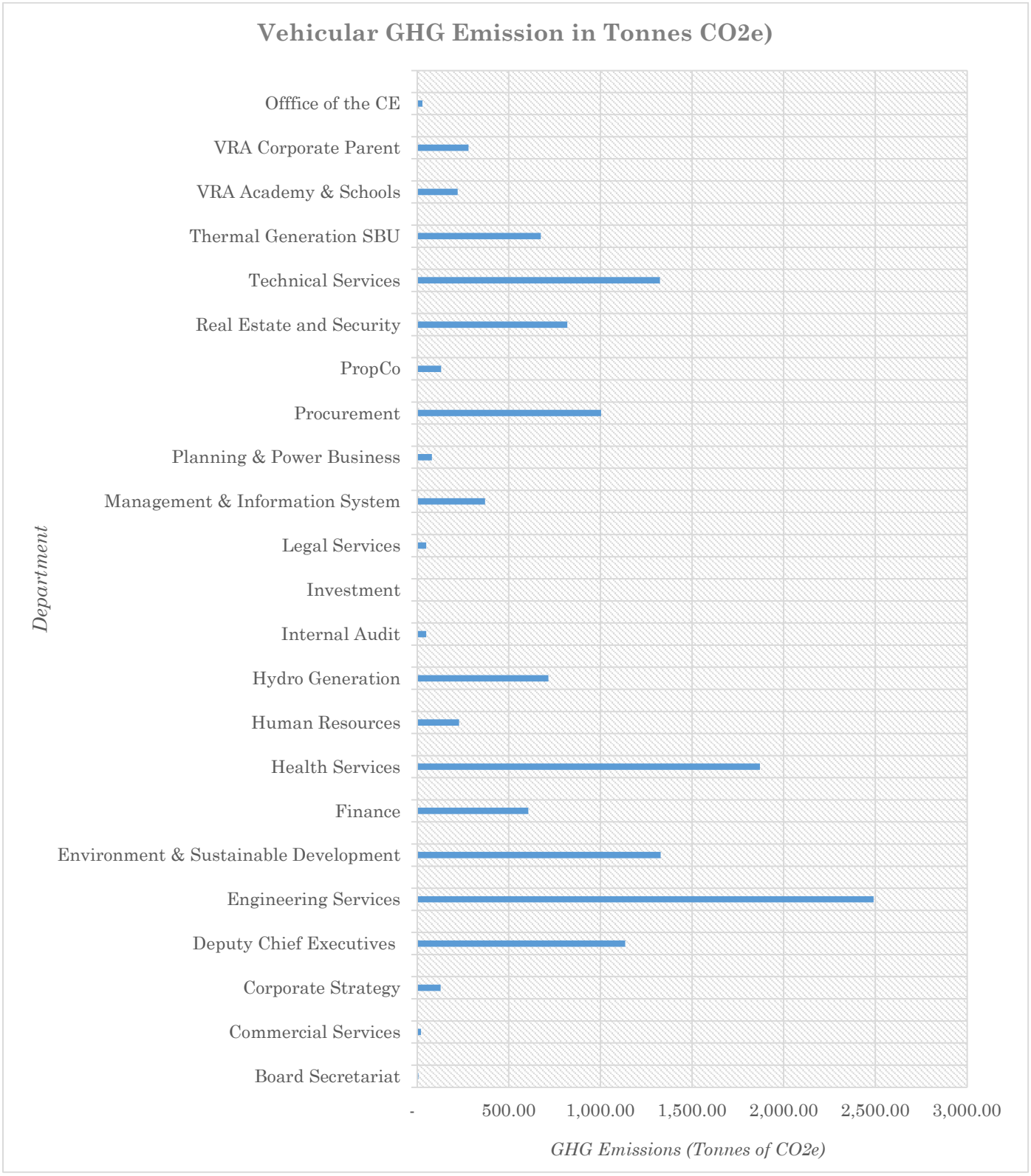


Figure 5.2: Cumulative Mobile GHG Emissions in Tonnes CO_2 Equiv. (2012-2019)

5.3 WATER TRANSPORT COMBUSTION

The total GHG emissions for emissions arising from water transport is 595.37 Tonnes CO_2e from 222,458 liters of diesel fuel utilized as detailed in Table 5.3. The increase in GHG emissions from 2017 to 2019 is attributable to increase in demand for maritime services by external stakeholders during the period.

Table 5.3: GHG Emission from Water Transport (2012-2019)

Period	**Diesel Fuel Utilized (Liters)**	**GHG Emissions (Metric Tonnes CO_2e)**
2012	33489	89.63
2013	26755	71.61
2014	11049	29.57
2015	14725	39.41
2016	22374	59.88
2017	11927	31.92
2018	45770	122.50
2019	56369	150.86
Total	**222,458**	**595.37**

5.4 RENEWABLE POWER PLANTS

Specific capacity Factor, Default Capacity Factor and Default Emission Factor of the 2.5MW Navrongo Solar Power Stations has been determined to be 16%, 15.5% and 0.509 tCo2/MWh. Based on data on Annual Energy Generated (MWh) from 2013 – 2019 totaling 21179.2MWh, GHG Savings for the period is 10,791 tCO_2e.

5.5 WASTE MANAGEMENT PRACTICES

Under the Office Wastepaper Recycling Programme, VRA had by close of 2019, recycled a total 3399Kg (3.747 Short Tons), as shown in Figure 5-3. Assuming this amount of office paper will have been landfilled, instead of recycled, the total emission savings was 15.096 $MTCO_2e$.

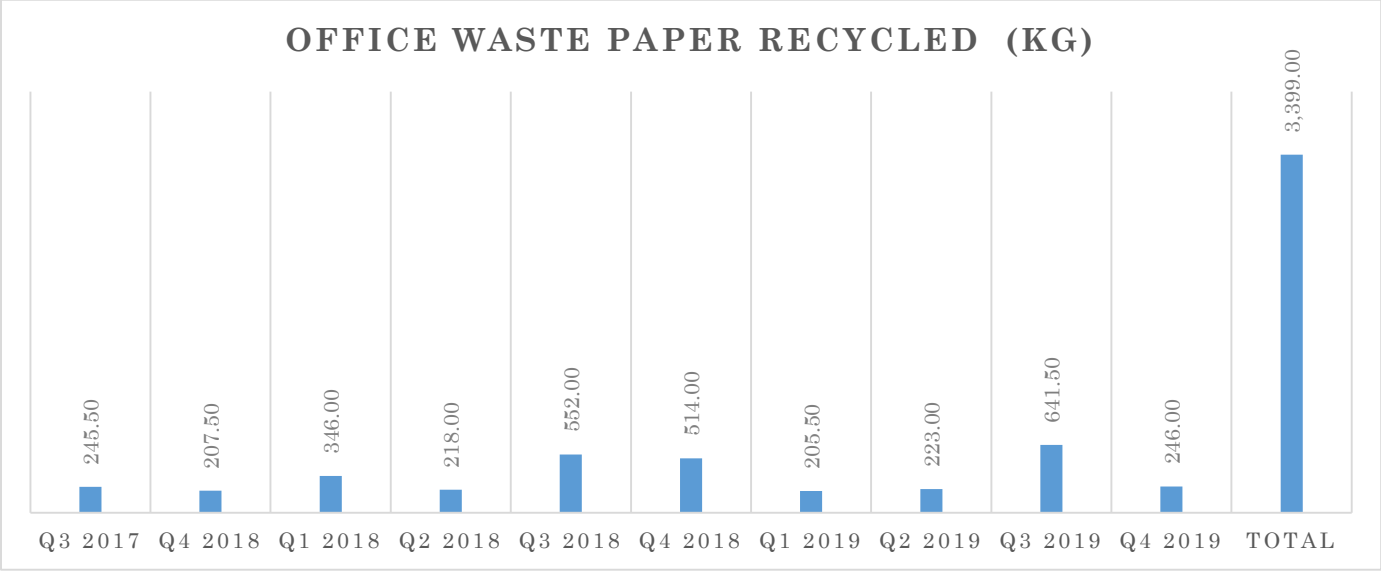


Figure 5.3: Data on Office Wastepaper Recycled by VRA (Kg)

5.6 SUMMARY

5.6.1 GHG Emissions

Overall, the total GHG emissions for the year 2019 is 1,225,464.072 tCO_2e. A comparison of the overall GHG emissions from 2012 to 2019 is as provided in Figure 5.4.

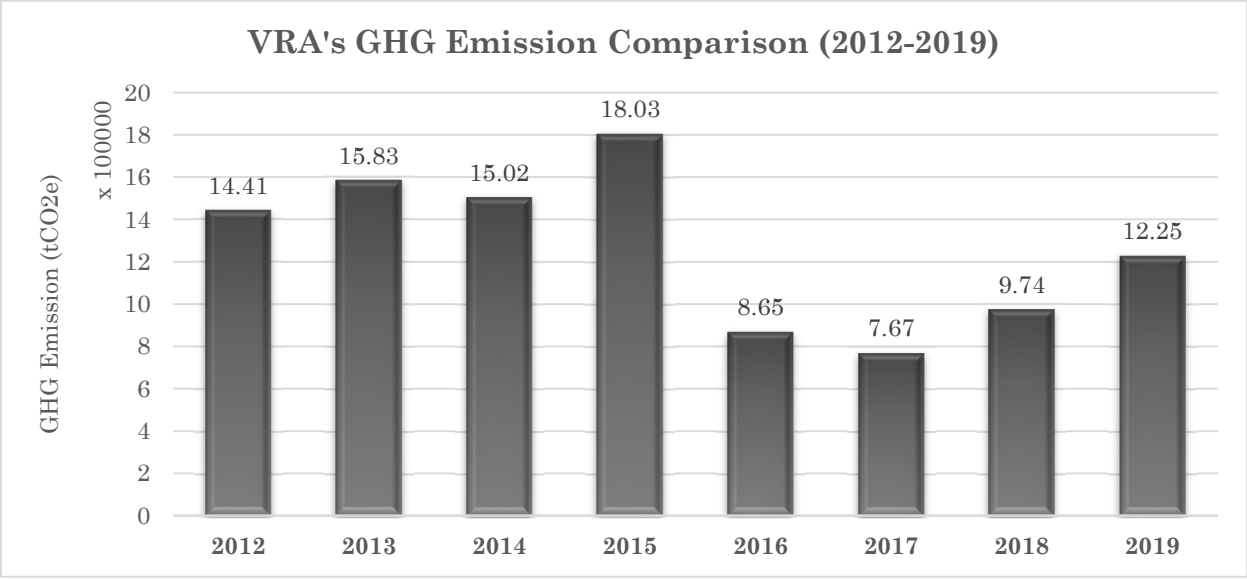


Figure 5.4: VRA's GHG Emission Comparison for 2012-2019

Thus, the total GHG emissions from 2012-2019 is 10,161,121.36 tCO_2e. VRA's GHG emissions are broken down by scope and source categories in Table 5.4 and further illustrated in in Figure 5-4. Stationary combustion contributed 99.86% of total GHG emissions whilst mobile combustion contributed 0.14%.

Table 5.4: Summary of Corporate GHG Emissions breakdown by Scope and Source Category

Operational Emissions Category	Emissions Source Category	Corporate emissions source	Total GHG Emissions (tCO2e)	Percentage of total corporate emissions
Direct Emission Sources	Stationary Combustion	T1	5,758,925.43	56.68%
		T3	135,120.36	1.33%
		TT1PS	2,769,940.59	27.26%
		TT2PS	578,031.79	5.69%
		MRPS	321,269.71	3.16%
		KTPS	583,656.70	5.74%
	Mobile Combustion	Vehicles	13,581.41	0.13%
		Water Transport	595.37	0.01%
Total Emissions from Direct Sources			10,161,121.36	100.00%

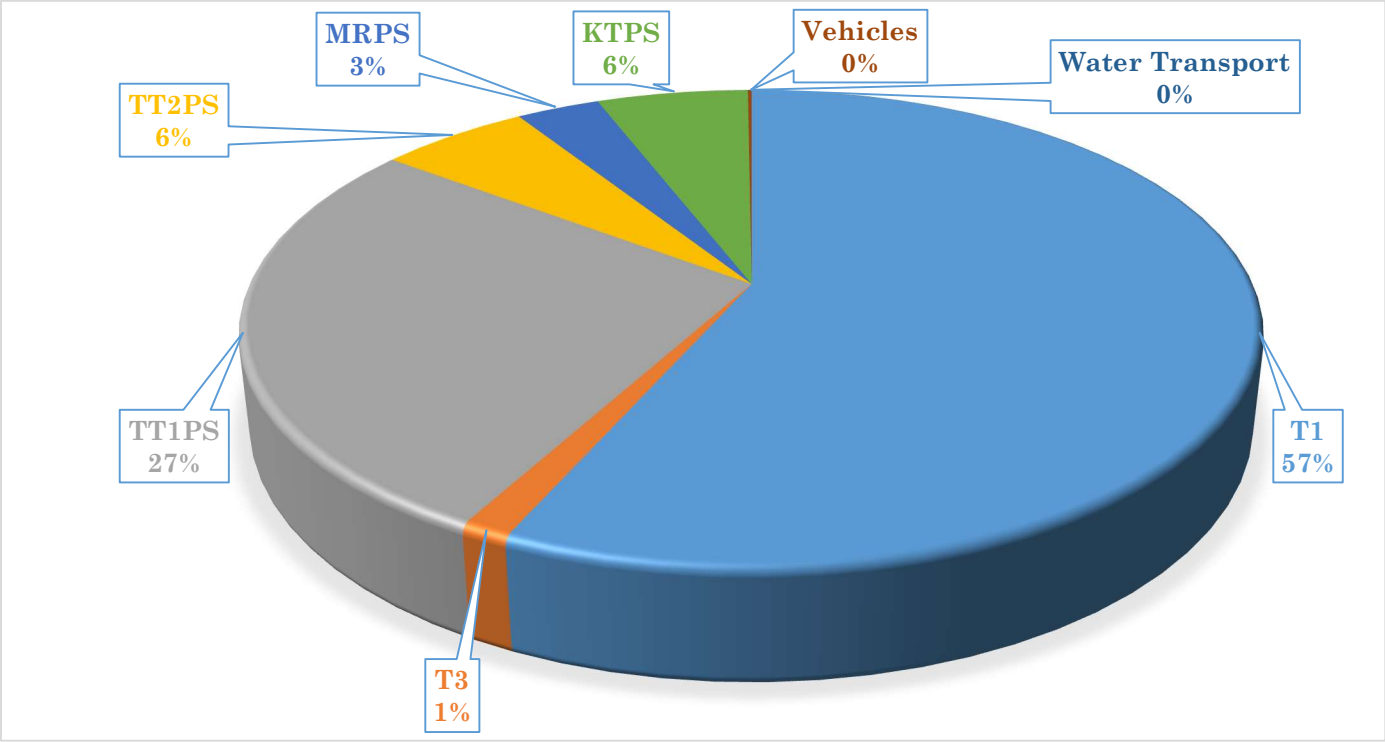


Figure 5.5: Cumulative Shares of VRA Scope 1 GHG Emissions (2012-2019)

5.6.2 GHG Emissions Savings

Total GHG Savings from our conservation programmes from the 2.5MW Navrongo Solar Power plants and office wastepaper recycled amounted to 10,806.09 Tonnes CO_2 Equiv. as detailed in Table 5.5 below.

Table 5.5: Summary of GHG Emission Savings

Source	Annual GHG Emission Savings (tCO_2e)
Navrongo Solar Power Station	10,791.00
Office Wastepaper Recycled	15.096
Total	10,806.096

6 EMMISION TRENDS

6.1 GHG EMISSIONS TRENDS FROM POWER PLANTS

Figure 6-1 shows the eight-year trend of GHG emissions from the various stationary combustion of fuel plants in VRA. Emission from T1 represented the dominant contribution accounting for approximately 56.68% of the total annual accountable GHG emissions, and this is followed by TT1PS, which make up 27.26% of the total GHG emissions. These two thermal power plants were most utilized for power generation during the period.

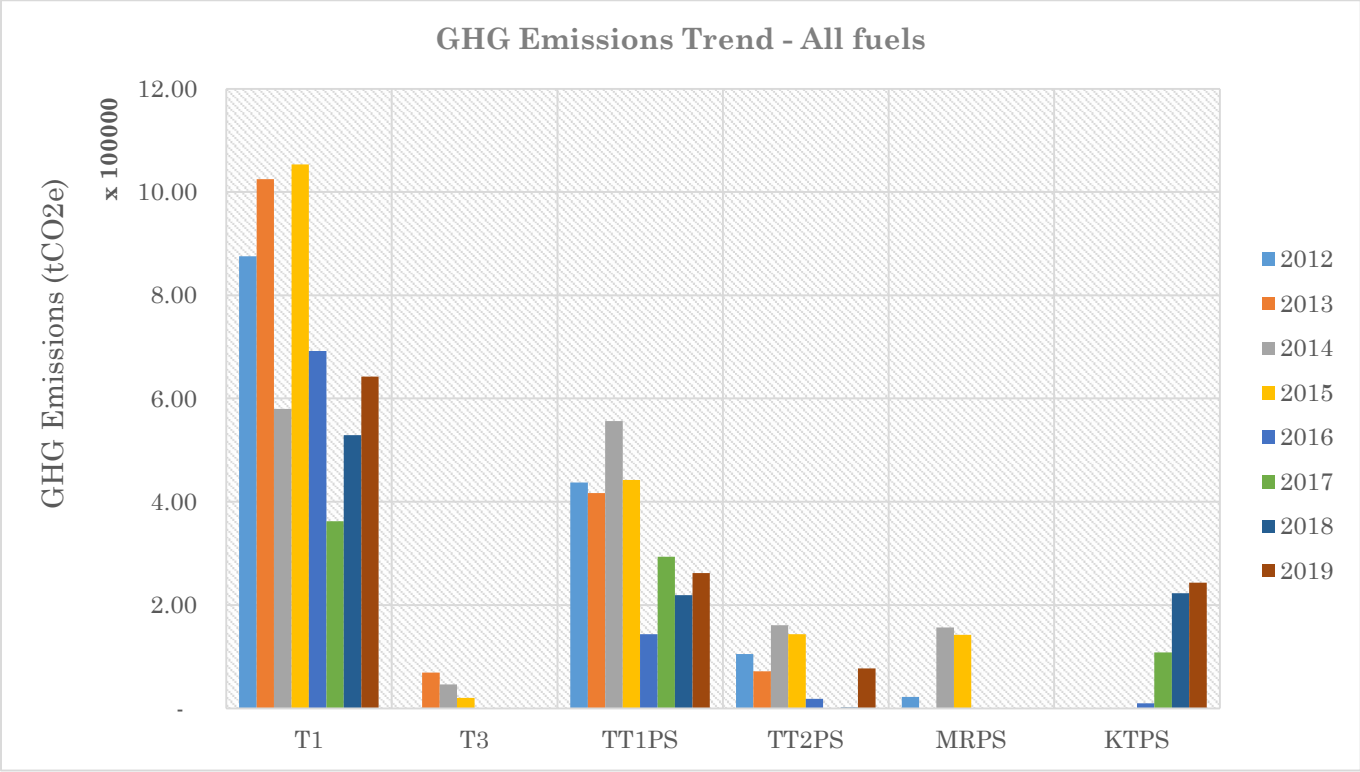


Figure 6.1: GHG Emissions trend from VRA Stationary Combustion Plants

T3 was not in operations in 2012, and from 2016 to 2019 and hence no emissions were recorded. The plant was also not operational for almost half of the year in 2014. MRPS was also not operational in 2013 and decommissioned in 2016. KTPS commenced operation in 2016.

Emission trends of the combustion plants from the different fuel sources are shown in Figure 6-2, Figure 6-3 and Figure 6-4. To help assess plant efficiency, the specific GHG emissions per energy generated for each power plant was also determined and this is provided in Table 6.1. We must note that the total power generated is based on all the fuel sources combined and not segregated, and therefore results may vary widely.

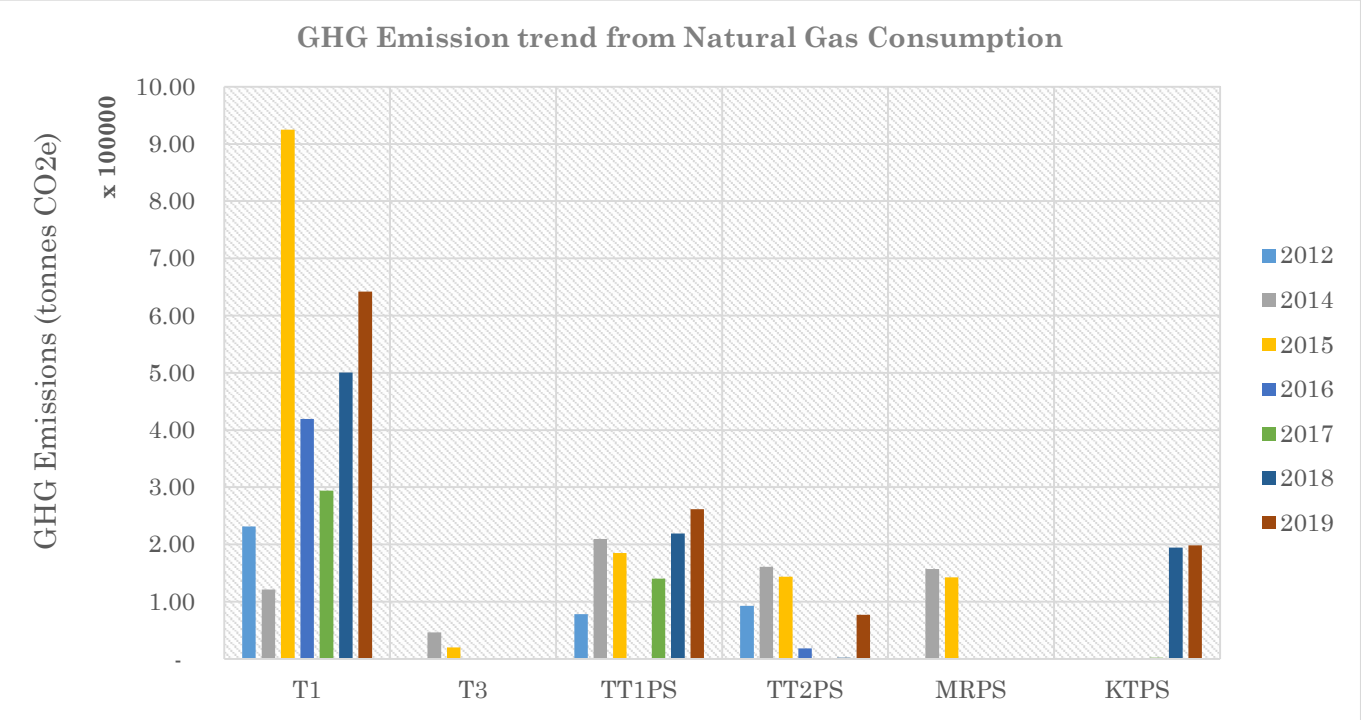


Figure 6.2: GHG Emission trend from Natural Gas Consumption (2012-2019)

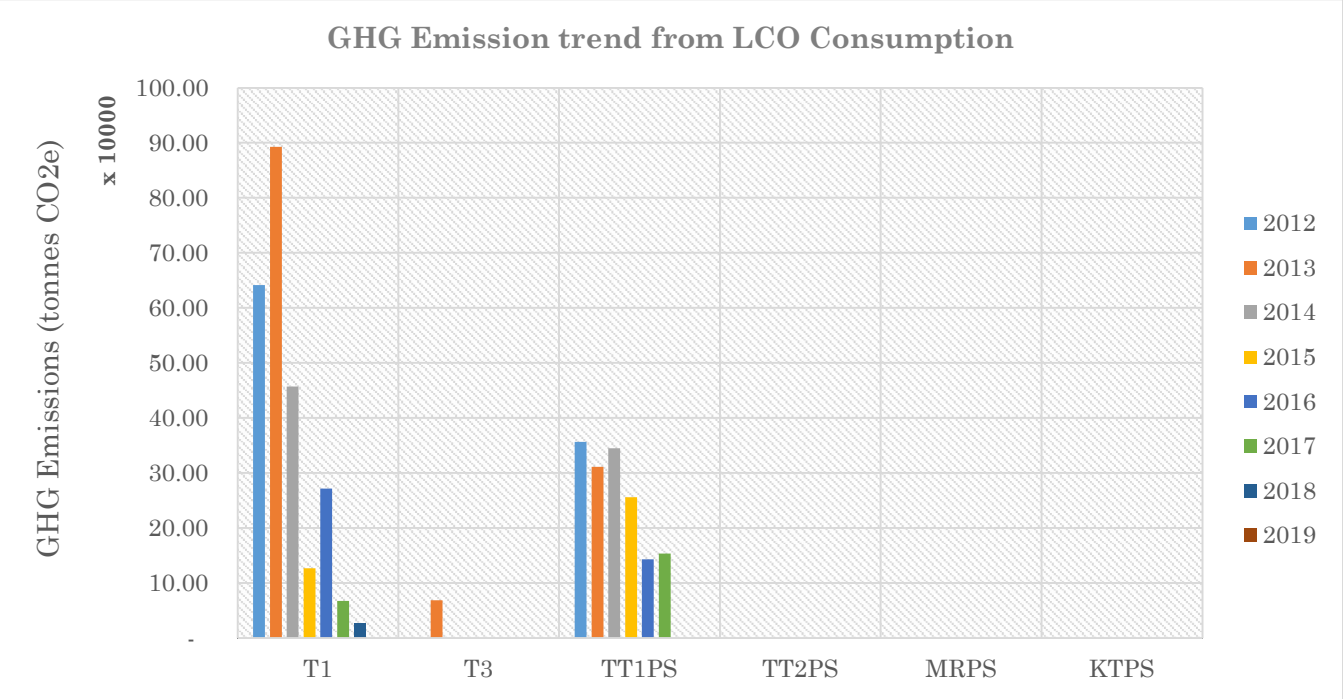


Figure 6.3: GHG Emission trend from LCO consumption (2012-2019)

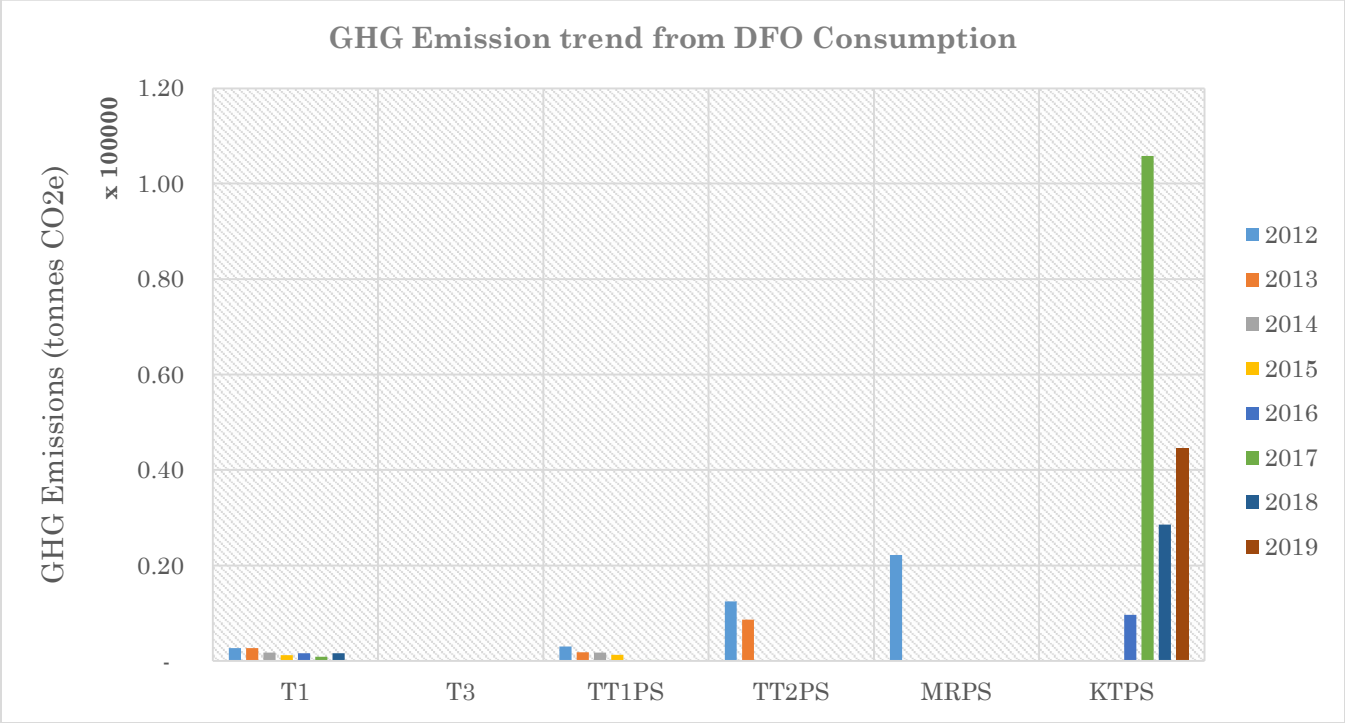
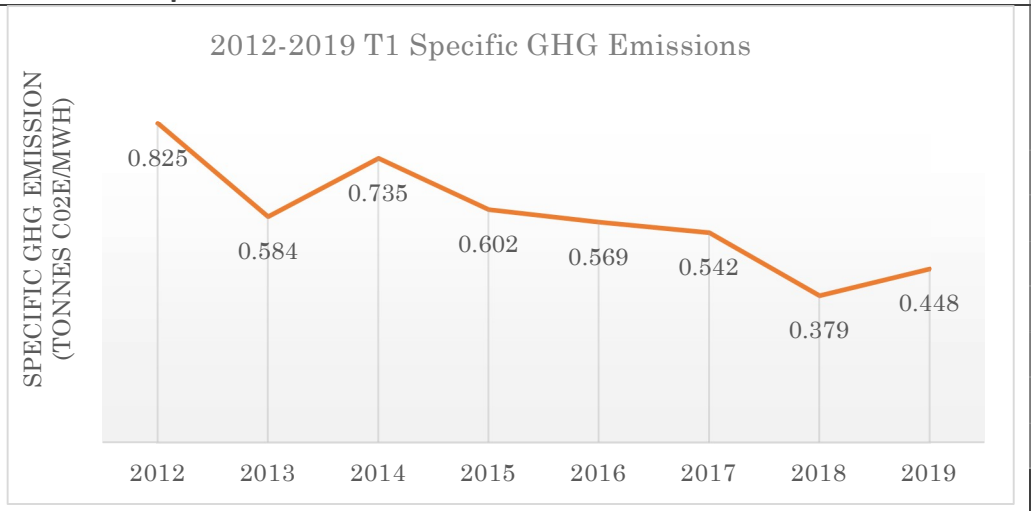


Figure 6.4: GHG Emissions of VRA Stationary Combustion Plants from DFO Combustion

Table 6.1:Specific GHG Emissions (metric ton CO2e / MWH)

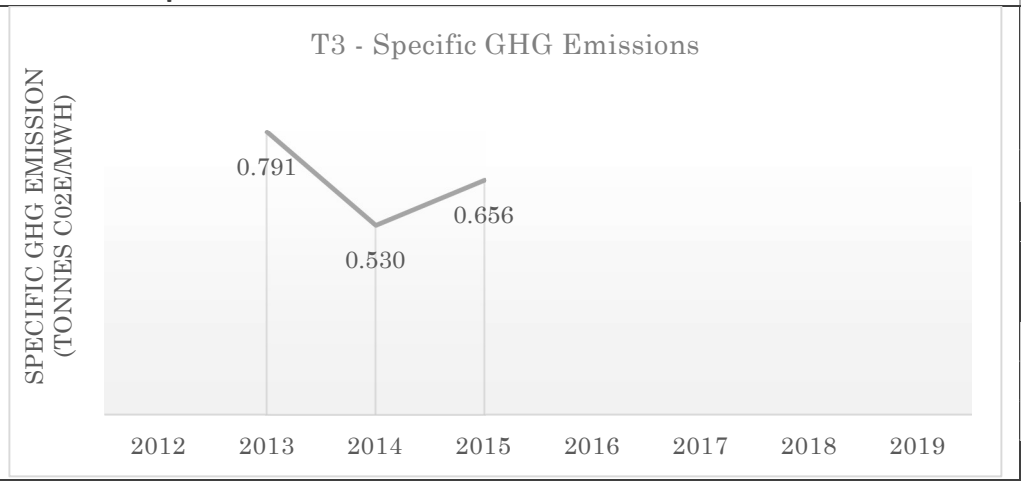
2012-2019 T1 Specific GHG Emissions

Year	Energy Generated (MWH)	Total emissions (tonnes CO2e)	Specific GHG Emissions (tonnes CO2e /MWH)
2012	1,061,020.00	875,380.46	0.825
2013	1,755,087.60	1,024,736.81	0.584
2014	789,582.83	580,085.70	0.735
2015	1,750,399.68	1,053,305.12	0.602
2016	1,215,715.49	692,107.12	0.569
2017	668,594.00	362,397.90	0.542
2018	1,393,933.62	528,775.02	0.379
2019	1,431,977.00	642,137.30	0.448



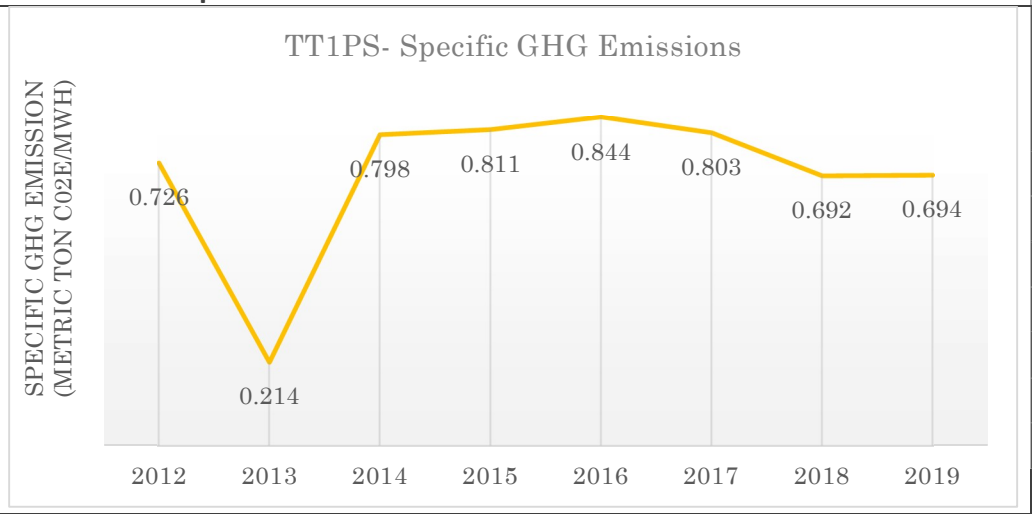
2012-2019 T3 Specific GHG Emissions

Year	Energy Generated (MWH)	Total emissions (tonnes CO2e)	Specific GHG Emissions (tonnes CO2e /MWH)
2012	Not in Service		
2013	87,122.00	68,932.49	0.791
2014	87,061.00	46,106.63	0.530
2015	30,619.00	20,081.24	0.656
2016	Not in Service		
2017			
2018			
2019			



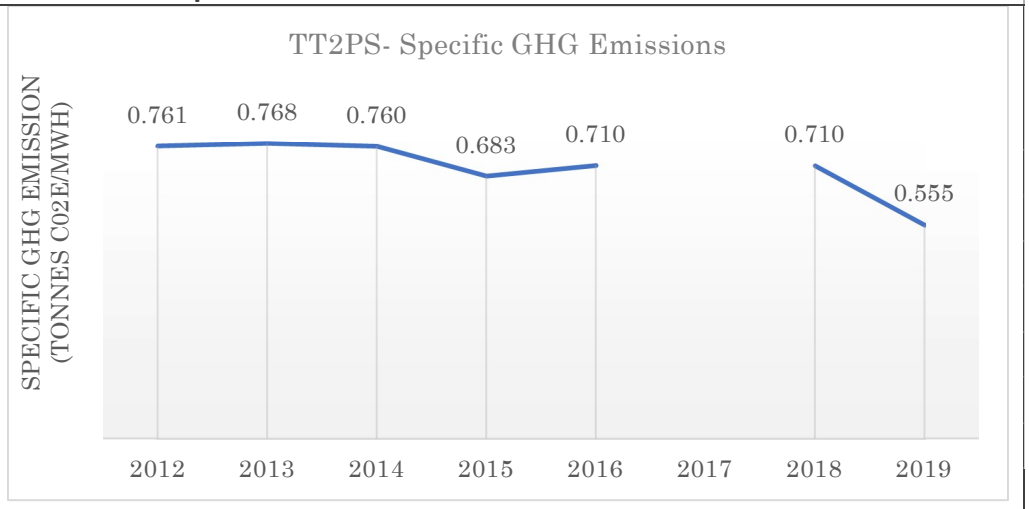
2012-2019 TT1PS Specific GHG Emissions

Year	Energy Generated (MWH)	Total emissions (tonnes CO2e)	Specific GHG Emissions (tonnes CO2e /MWH)
2012	602,710.00	437,271.52	0.726
2013	1,946,070.00	416,937.56	0.214
2014	697,050.00	556,097.91	0.798
2015	544,730.00	441,962.99	0.811
2016	169,944.00	143,436.30	0.844
2017	365,630.00	293,718.54	0.803
2018	316,040.00	218,836.56	0.692
2019	376,954.00	261,679.20	0.694



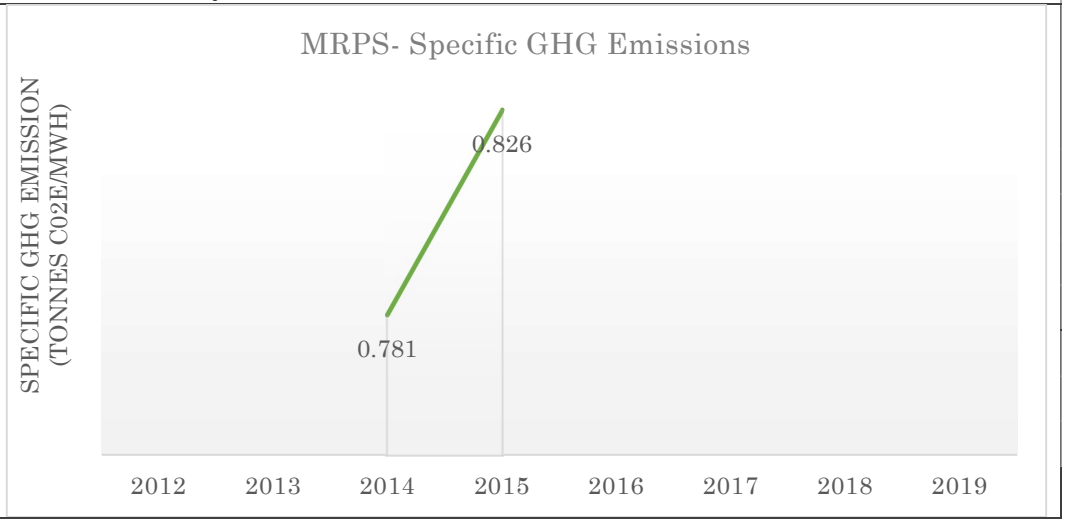
2012-2019 TT2PS Specific GHG Emissions

Year	Energy Generated (MWH)	Total emissions (tonnes CO2e)	Specific GHG Emissions (tonnes CO2e /MWH)
2012	137,889.00	104,918.44	0.761
2013	93,158.40	71,559.89	0.768
2014	211,703.00	160,991.55	0.760
2015	210,152.10	143,439.70	0.683
2016	25,713.50	18,266.21	0.710
2017	-	-	-
2018	2,584.00	1,834.35	0.710
2019	138,692.00	77,021.65	0.555



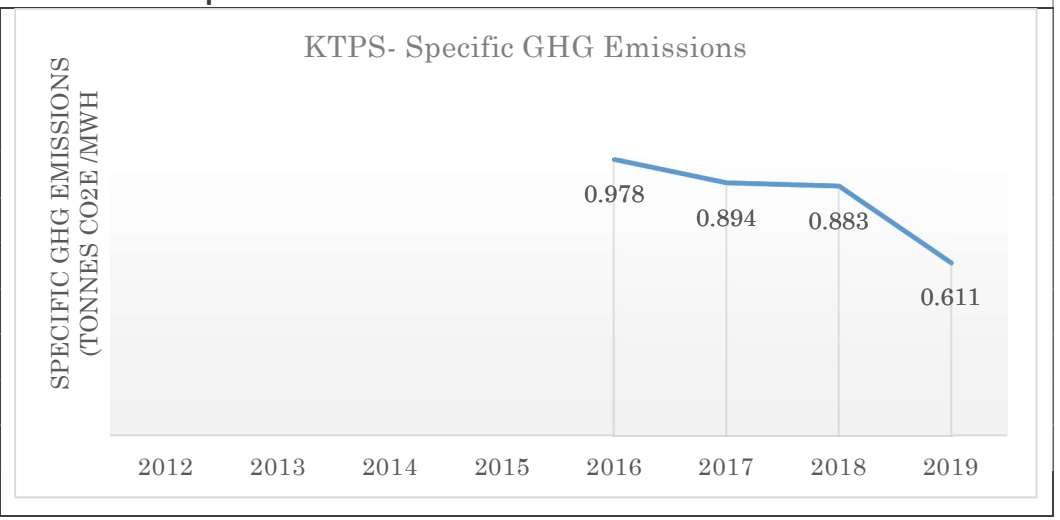
2012-2019 MRPS Specific GHG Emissions

Year	Energy Generated (MWH)	Total emissions (tonnes CO2e)	Specific GHG Emissions (tonnes CO2e /MWH)
2012	Not in Service		
2013			
2014	200708.300	156746.603	0.781
2015	172220.100	142305.041	0.826
2016	Not in Service		
2017			
2018			
2019			



2012-2019 KTPS Specific GHG Emissions

Year	Energy Generated (MWH)	Total emissions (tonnes CO2e)	Specific GHG Emissions (tonnes CO2e /MWH)
2012			
2013			
2014			
2015			
2016	9887.20	9665.688	0.978
2017	120671.10	107893.858	0.894
2018	252524.000	223023.666	0.883
2019	397710.000	243073.490	0.611



6.2 GHG Emissions Trends From Water Transport

GHG emission trend from water transport is as provided in Figure 6.5.

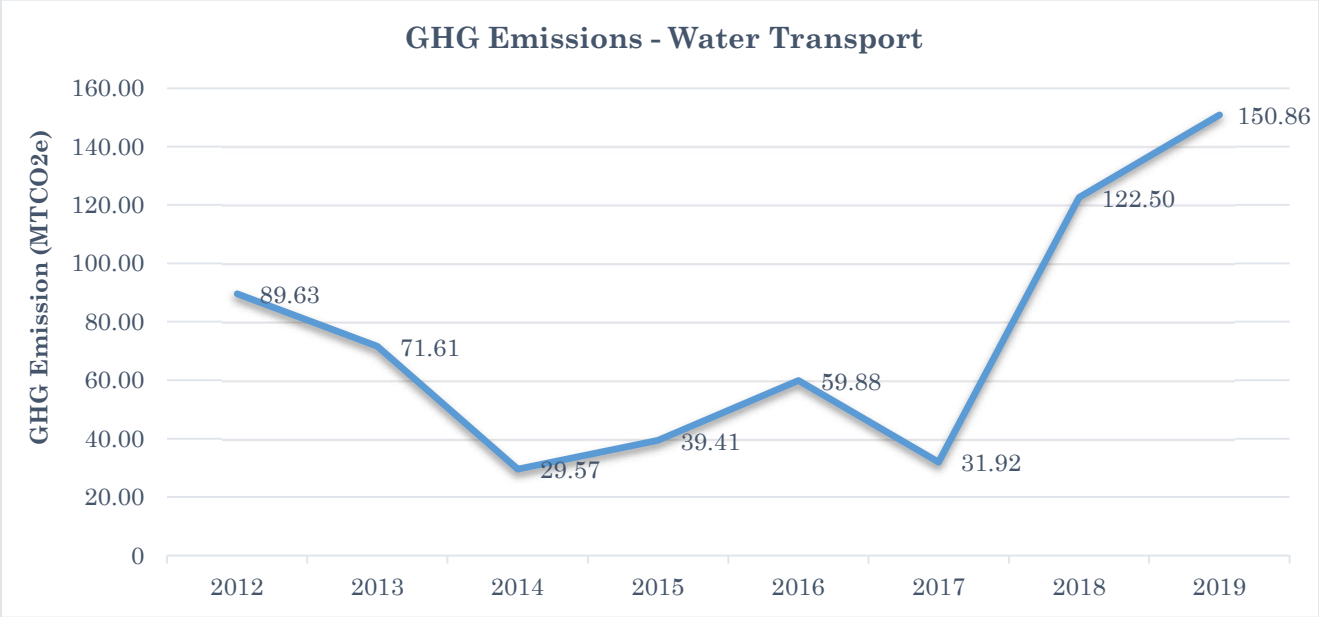


Figure 6.5: GHG Emission Trend from VRA's Water Transport (2012- 2019)

6.3 GHG Emissions Trends From Vehicle Combustion

The trend GHG emissions from mobile sources from the various departments is provided in Figure 5.2. It must be noted that the functions of the departments in VRA are diverse, and this determine fuel usage by each of them. Subsequently, there cannot be a comparison between the various departments with respect to GHG emissions. In view of this, the average GHG emission for the seven-year period has been calculated and presented in the table. VRA under its 2018 Corporate Financial Recovery Plan has initiated a target of 15% reduction in transport/travel costs. Under this initiative, all departments are to identify meetings/activities that can be undertaken through video conferencing and not to travel but use the video conferencing facilities instead. It is expected that this initiative will help reduce associated GHG emission going forward and information on this will be provided in subsequent reports.

7 DATA MANAGEMENT

7.1 ADMINISTRATIVE MANAGEMENT

A twelve (12) 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 is 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 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.

7.2 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 quarterly/annual basis provides 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 signed by VRA and APML provides source data for progress reporting of office wastepaper recycled by E&SDD.

7.3 DATA MANAGEMENT

Th Director, E&SDD through Manager, Environment and Social Impact (ESI) is responsible for coordinating the collection of inventories for all data required and maintain this information in relevant format, 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 and then
- Fuel utilised by company vehicles is received from all departments via the Technical Services Department, using the either the "***Vehicle Operational Charts***" or the Oracle E-Business Suite. That for marine fleets are provided by E&SDD through the marine Logbooks.
- Waste office paper from the various VRA outfits is transported to Akosombo, mainly through the mail van and stored at the Environment & Social Impact (ESI). The waste office paper, when in sufficient volumes, are then transported to the Akosombo Paper Mill. The volumes are then weighed and recorded on a signed Waste Transfer Notes, which is then reported in monthly progress reports of E&SDD.
- 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 either are 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 is 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.

7.3.1 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.

7.3.2 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.

8 CONSERVATION PROGRAMMES AND PROJECTS

8.1 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 cognisance of the local and export demand and the system constraints and is being rolled out in phases. So far, the 2.5 MW Navrongo Solar Power Plant has been operational since 2013 and emission savings till date, estimated at 10,791.00 Tonnes CO_2 Equiv has been discussed. Other planned renewable energy projects are listed in Table 8-1 and the Annual GHG Emissions savings estimated at 98,808 Tonnes CO_2 Equiv for the solar power projects (122.584MW) and 98.077 Tonnes CO_2 Equiv for the wind power projects (75MW).

Table 8.1: GHG Savings from VRA's Proposed Power Projects

Project	
17MW	Solar (Kaleo, Lawra) – Phase 1 (commissioned in 2019)
15 MW	Solar (Kaleo, Lawra) – Phase 2 (commissioned in 2021)
60MW	Bongo Solar Power Project (Feasibility study ongoing)
0.448MW	Akuse Residential & Institutional Office Buildings Solar PV Rooftop Project (Construction planned for 2021 Q4)
0.057MW	Head Office Solar Car Park (Construction planned for 2021 Q4)
0.079MW	Head Office Rooftop Project (commissioned in 2020)
75MW	Wind Power Project -1 (Anloga, Srogbe, Anyanui) Construction expected to commence by Q4 2021 and commissioned in Q1 2023
50MW	Solar Power Component - Pwalugu Multipurpose Dam (Construction planned for 2024)

8.2 TREE PLANTING PROGRAMMES

As indicated in Section 4.6 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 2019, about 1,602 hectares of the Volta Gorge area had been planted, whilst 230.1 hectares of forest tree plantation established under Buffer Zone Project. Thus, the total area covered is 1832.1 ha.

VRA is yet to calculate the carbon sequestration potential of its tree planting programme. However, considering the type of species being planted, it is estimated that 28 tCO_2e is sequestrated annually per hectare Thus, the total 49,394.8 tCO_2e could be sequestrated annually. (*Source: VRA - Immediate Opportunities Ecosystem Services Trading Enam Eyiah, reNew, 2020*).

VRA intends to utilise both aerial and ground survey 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.

8.3 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 to 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 down-stream 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 from the power output of gas turbines and of the steam turbine without the need of 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 Uni. 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.

8.4 Cleaner Cooking Solutions through adoption of fuel-efficient stoves

Our Climate Smart Stove project aims to minimize the harvesting and utilization of trees as firewood in the Volta Lake basin. The Authority in 2016 successfully piloted this fuel efficient and energy saving improved domestic cook stoves in twenty-one (21) riparian communities. As at close of 2019, a total of four hundred and twenty (420) cook stoves had been constructed. The provision of these fuel-efficient domestic cook stoves, termed, "Climate Smart Stoves" is to complement our 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 economical 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". VRA in 2019 provided funding for two MPhil students and one PhD student at the Institute of Environmental & Sanitation Studies (IESS) of the University of Ghana, to undertake an assessment of the health, environmental and economic impacts of the "climate smart stoves". The research will involve a detailed assessment of the carbon savings of the stoves.

8.5 RESOURCE USE EFFICIENCY

VRA has embarked on a three year (2018-2020) Financial Recovery Plan basically to help:

a. Achieve a sustainable level of profitability that exceeds VRA's aggregate financial performance during the period of 2012 – 2016 and
b. Attain a composite financial performance that is comparable to electricity producers in the international industry

Under this Plan, the underlisted targets have been set for all departments to achieve resource use efficiency:

- Reduction in paper usage
- Reduction in transport / travel costs
- No. of video conferencing organized

To achieve the above, a paperless system, using "**Laserfiche"** as well as a "**Skype for Business**" app for virtual meetings have been made available to staff. The implementation of these is geared towards reducing administrative costs and will in addition, invariably also reduce GHG emissions and corporate carbon footprint.

8.6 MOST ECO-FRIENDLY DEPARTMENT AWARDS

VRA in 2019 instituted the "**Most Eco-Friendly Department"** awards and this has been incorporated in 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.

8.7 PET SEGREGATION & PROCESSING PROGRAMME

Under the Corporate Solid Waste Segregation Programme, VRA intends embarking on the segregation and disposal of Polyethylene Terephthalate (PET) bottles or plastic drinking bottles, targeting Akosombo and its environs. This will involve the setting up a "**Waste Plastic Recycling Center"** in Akosombo to serve all VRA facilities (including institutional houses), the Akosombo community and its environs. The procurement process to solicit for a partner company for a collaboration is ongoing and is expected to be completed by close of 2021. The partner company will be required to process waste PET Bottles, in the first instance, as well as any other plastic waste that may be required.

The recycling effort of VRA is to be incentivized through a waste exchange programme to be determined by the amount of plastic waste generated and recovered. The Partner Company will be required to provide VRA with the quantitative data of the amount of plastic recovered in tonnes relying solely on the United Nations Framework Convention on Climate Change assessment standards. This information is expected to feed into the Corporate Annual GHG Inventory Report as well as the Sustainability Report.

9 PLANNED IMPROVEMENTS

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

1. Centralizing (through the business oracle system) requisite data for the activity data for fuel consumption for mobile emissions, vehicular/water transport, by 2023.

2. Continue with implementation of resource use efficiencies programmes under the Financial Recovery Programme, targeting reduction in paper and fuel usage as well as adoption of video conferencing for meetings.

3. Continue with the "Eco-Friendly Department" awards.

4. Initiate strategies to collate data on fugitive emissions such as Methane from natural gas distribution systems within the Tema Area under Scope 2 and report on outcome by 2023.

5. Initiate strategies to collate data on Hydrofluorocarbon emissions from specifically office Air Condition systems by 2023. Basically, responsible staff will be trained on data collection methods and input into the spreadsheets.

6. Undertake area and ground survey to assess carbon sequestration of VRA Reforestation program to offset VRA's carbon emissions within its carbon accounting programme by 2023.

7. Explore GHG savings from reduced rate of deforestation or forest degradation within the catchment area of the Volta Lake as a result of VRA's social interventions.

8. Establish the "**Akosombo Plastic Waste Processing & Recycling Centre**" for the segregation and processing of plastic bottles within the Akosombo and its environs by 2023.

9. Assess the utilization of the fuel-efficient stoves for riparian communities and estimate carbon savings achieved by 2023.

10. Capacity building of staff using safety meetings to effectively embrace carbon caring values throughout the operation of VRA and report on outcome by 2023.

11. Build capacity of VLTC, AHL, KFL, and NEDCO to publish their own GHG Report by 2023.

12. Inclusion of electric vehicles in the Authority's fleet of vehicles to reduce GHG emissions.

10 REFERENCES

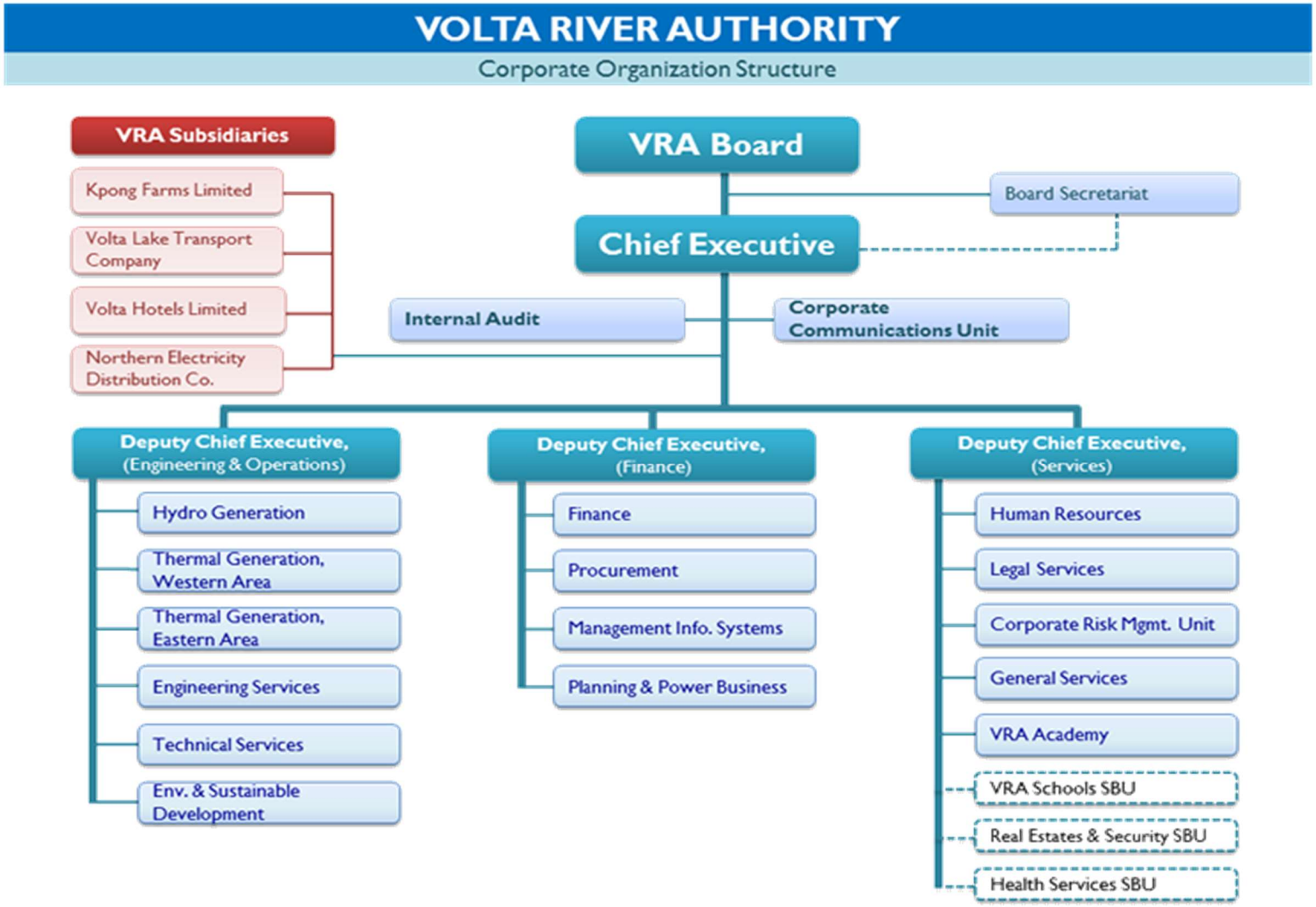
1. Annual Environmental Reports (2012-2019) for Takoradi 1Thermal Power Station
2. Annual Environmental Reports (2012-2014) for Takoradi 3 Thermal Power Station
3. Annual Environmental Reports (2012-2019) for Tema Thermal 1 Power Station
4. Annual Environmental Reports (2012-2019) for Tema Thermal 2 Power Station
5. Annual Environmental Reports (2016-2019) 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 (2015). GHG Protocol tool for stationary combustion. Version 4.1.
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 2	-	GHG Emission Calculation Sheets for Stationary Combustion Thermal Power Project
Appendix 3	-	GHG Emission calculating Sheet for Mobile Combustion

APPENDIX 1

VRA CORPORATE ORGANIZATIONAL CHART



APPENDIX 2

GHG EMISSION CALCULATION SHEETS FOR STATIONARY COMBUSTION THERMAL POWER PROJECT

1) Takoradi 1 Thermal Power Station (T1)

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2012-T1	Gaseous fossil	Natural gas	3908263.62	mmBtu	231334.462	4.124E+00	4.124E-01	231560.436
2012-T1	Liquid fossil	Crude oil	257577300	litres (l)	638913.280	2.615E+01	5.230E+00	641125.507
2012-T1	Liquid fossil	Gas/Diesel oil	1003300	litres (l)	2685.324	1.087E-01	2.174E-02	2694.522
2013-T1	Gaseous fossil	Natural gas	2190365.2	mmBtu	129650.147	2.311E+00	2.311E-01	129776.793
2013-T1	Liquid fossil	Crude oil	358490410	litres (l)	889225.424	3.639E+01	7.279E+00	892304.352
2013-T1	Liquid fossil	Gas/Diesel oil	988830	litres (l)	2646.596	1.071E-01	2.143E-02	2655.660
2014-T1	Gaseous fossil	Natural gas	2049310.29	mmBtu	121300.951	2.162E+00	2.162E-01	121419.441
2014-T1	Liquid fossil	Crude oil	183580690	litres (l)	455366.761	1.864E+01	3.727E+00	456943.461
2014-T1	Liquid fossil	Gas/Diesel oil	641480	litres (l)	1716.916	6.951E-02	1.390E-02	1722.797
2015-T1	Gaseous fossil	Natural gas	15615346.54	mmBtu	924289.695	1.648E+01	1.648E+00	925192.566
2015-T1	Liquid fossil	Crude oil	50975800	litres (l)	126444.045	5.175E+00	1.035E+00	126881.855
2015-T1	Liquid fossil	Gas/Diesel oil	458250	litres (l)	1226.502	4.966E-02	9.931E-03	1230.703
2016_T1	Gaseous fossil	Natural gas	7073154.23	mmBtu	418667.850	7.463E+00	7.463E-01	419076.816
2016_T1	Liquid fossil	Crude oil	109034080	litres (l)	270455.982	1.107E+01	2.214E+00	271392.432
2016_T1	Liquid fossil	Gas/Diesel oil	609860	litres (l)	1632.285	6.608E-02	1.322E-02	1637.876
2017_T1	Gaseous fossil	Natural gas	4961819.19	mmBtu	293695.585	5.235E+00	5.235E-01	293982.475

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2017_T1	Liquid fossil	Crude oil	27127110	litres (l)	67288.037	2.754E+00	5.508E-01	67521.020
2017_T1	Liquid fossil	Gas/Diesel oil	333030	litres (l)	891.352	3.609E-02	7.217E-03	894.405
2018_T1	Gaseous fossil	Natural gas	8447440.4	mmBtu	500013.374	8.913E+00	8.913E-01	500501.801
2018_T1	Liquid fossil	Crude oil	10718790	litres (l)	26587.658	1.088E+00	2.176E-01	26679.718
2018_T1	Liquid fossil	Gas/Diesel oil	593335.7	litres (l)	1588.058	6.429E-02	1.286E-02	1593.498
2019_T1	Gaseous fossil	Natural gas	10837956.12	mmBtu	641510.653	1.144E+01	1.144E+00	642137.298
					Total GHG emissions from fossil fuels (tonnes CO2e):			**5,758,925.43**
					Total CO2 emissions from biomass (tonnes):			**-**

2) Takoradi 3 Thermal Power Station (T3)

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2013-T3	Liquid fossil	Crude oil	27654720	litres (l)	68596.759	2.808	0.562	68834.274
2013-T3	Liquid fossil	Gas/Diesel oil	36570	litres (l)	97.879	0.004	0.001	98.215
2014-T3	Gaseous fossil	Natural gas	778185	mmBtu	46061.634	0.821	0.082	46106.628
2015-T3	Gaseous fossil	Natural gas	338930	mmBtu	20061.643	0.358	0.036	20081.240
					Total GHG emissions from fossil fuels (tonnes CO2e):			**135,120.356**
					Total CO2 emissions from biomass (tonnes):			**-**

3) Tema Thermal 1 Power Station (TT1PS)

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2012-TT1PS	Gaseous fossil	Natural gas	1317219.1	mmBtu	77967.661	1.390E+00	1.390E-01	78043.822
2012-TT1PS	Liquid fossil	Gas/Diesel oil	1131019.56	litres (l)	3027.165	1.226E-01	2.451E-02	3037.533
2012-TT1PS	Liquid fossil	Crude oil	143102248	litres (l)	354961.119	1.453E+01	2.906E+00	356190.165
2013-TT1PS	Gaseous fossil	Natural gas	1758457.6	mmBtu	104085.057	1.855E+00	1.855E-01	104186.730
2013-TT1PS	Liquid fossil	Crude oil	124932730	litres (l)	309892.139	1.268E+01	2.537E+00	310965.135
2013-TT1PS	Liquid fossil	Gas/Diesel oil	664900	litres (l)	1779.600	7.205E-02	1.441E-02	1785.695
2014-TT1PS	Gaseous fossil	Natural gas	3536265.4	mmBtu	209315.474	3.731E+00	3.731E-01	209519.939
2014-TT1PS	Liquid fossil	Crude oil	138546900	litres (l)	343661.706	1.407E+01	2.813E+00	344851.629
2014-TT1PS	Liquid fossil	Gas/Diesel oil	642800	litres (l)	1720.449	6.965E-02	1.393E-02	1726.342
2015-TT1PS	Gaseous fossil	Natural gas	3121148	mmBtu	184744.215	3.293E+00	3.293E-01	184924.678
2015-TT1PS	Liquid fossil	Crude oil	102756300	litres (l)	254884.125	1.043E+01	2.086E+00	255766.657
2015-TT1PS	Liquid fossil	Gas/Diesel oil	473500	litres (l)	1267.319	5.131E-02	1.026E-02	1271.660
2016_TT1PP	Liquid fossil	Crude oil	57476700	litres (l)	142569.345	5.835E+00	1.167E+00	143062.989
2016_TT1PP	Liquid fossil	Gas/Diesel oil	139000	litres (l)	372.032	1.506E-02	3.012E-03	373.307
2017_TT1PP	Gaseous fossil	Natural gas	2363056	mmBtu	139871.908	2.493E+00	2.493E-01	140008.538
2017_TT1PP	Liquid fossil	Crude oil	61661000	litres (l)	152948.384	6.260E+00	1.252E+00	153477.965
2017_TT1PP	Liquid fossil	Gas/Diesel oil	86400	litres (l)	231.249	9.362E-03	1.872E-03	232.041
2018_TT1PP	Gaseous fossil	Natural gas	3693510.8	mmBtu	218623.004	3.897E+00	3.897E-01	218836.561
2019_TT1PS	Gaseous fossil	Natural gas	4416606.4	mmBtu	261423.835	4.660E+00	4.660E-01	261679.201

Total GHG emissions from fossil fuels (tonnes CO2e):	**2,769,940.586**
Total CO2 emissions from biomass (tonnes):	**-**

4) Tema Thermal 2 Power Station (TT2PS)

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2012-TT2PS	Gaseous fossil	Natural gas	1560257	mmBtu	92353.344	1.646E+00	1.646E-01	92443.557
2012-TT2PS	Liquid fossil	Gas/Diesel oil	4645000	litres (l)	12432.305	5.033E-01	1.007E-01	12474.887
2013-TT2PS	Gaseous fossil	Natural gas	1,062,298	mmBtu	62878.574	1.121E+00	1.121E-01	62939.996
2013-TT2PS	Liquid fossil	Gas/Diesel oil	3,209,600	litres (l)	8590.469	3.478E-01	6.956E-02	8619.892
2014-TT2PS	Gaseous fossil	Natural gas	2717206	mmBtu	160834.439	2.867E+00	2.867E-01	160991.547
2015-TT2PS	Gaseous fossil	Natural gas	2420967	mmBtu	143299.724	2.554E+00	2.554E-01	143439.703
2016_TT2PP	Gaseous fossil	Natural gas	308,296	mmBtu	18248.382	3.253E-01	3.253E-02	18266.208
2018_TT2PP	Gaseous fossil	Natural gas	30960	mmBtu	1832.557	3.267E-02	3.267E-03	1834.347
2019_TT2PP	Gaseous fossil	Natural gas	1299967	mmBtu	76946.490	1.372E+00	1.372E-01	77021.653
					Total GHG emissions from fossil fuels (tonnes CO2e):			**578,031.79**
					Total CO2 emissions from biomass (tonnes):			**-**

5) Mines Reserve Power Station (MRPS)

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2012-MRPS	Liquid fossil	Gas/Diesel oil	8267300	litres (l)	22127.3623	0.8958	0.1792	22203.1508
2014-MRPS	Gaseous fossil	Natural gas	2,645,692	mmBtu	156601.4462	2.7915	0.2791	156754.4187
2015-MRPS	Gaseous fossil	Natural gas	2,401,936	mmBtu	142173.2580	2.5343	0.2534	142312.1367
					Total GHG emissions from fossil fuels (tonnes CO2e):			**321,269.7062**
					Total CO2 emissions from biomass (tonnes):			**-**

6) Kpone Thermal Power Station (KTPS)

USER SUPPLIED DATA					GHG emissions (tonnes)			
Source ID	Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
2016_KTPP	Liquid fossil	Gas/Diesel oil	3599000	litres (l)	9632.695	3.900E-01	7.800E-02	9665.688
2017_KTPP	Gaseous fossil	Natural gas	35187	mmBtu	2082.758	3.713E-02	3.713E-03	2084.792
2017_KTPP	Liquid fossil	Gas/Diesel oil	39397800	litres (l)	105447.897	4.269E+00	8.538E-01	105809.066
2018_KTPP	Gaseous fossil	Natural gas	3282664.61	mmBtu	194304.562	3.464E+00	3.464E-01	194494.364
2018_KTPP	Liquid fossil	Gas/Diesel oil	10622830	litres (l)	28431.920	1.151E+00	2.302E-01	28529.302
2019_KTPP	Gaseous fossil	Natural gas	3351873.96	mmBtu	198401.140	3.537E+00	3.537E-01	198594.944
2019_KTPP	Liquid fossil	Gas/Diesel oil	16561500	litres (l)	44326.722	1.795E+00	3.589E-01	44478.546
					Total GHG emissions from fossil fuels (tonnes CO2e):			**583,656.70**
					Total CO2 emissions from biomass (tonnes):			**-**

APPENDIX 3

GHG EMISSION CALCULATING SHEET FOR MOBILE COMBUSTION

1. Gasoline/Petrol Vehicles

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
Board Secretariat	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	55.00	Litre	0.125	0	0	0.125	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	110.76	Litre	0.252	0	0	0.252	0
Commercial Services	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3670.74	Litre	8.338	0	0	8.338	0
Corporate Strategy	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	38.00	Litre	0.086	0	0	0.086	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	941.00	Litre	2.138	0	0	2.138	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	752.29	Litre	1.709	0	0	1.709	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1959.87	Litre	4.452	0	0	4.452	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	638.72	Litre	1.451	0	0	1.451	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	974.79	Litre	2.214	0	0	2.214	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	60.00	Litre	0.136	0	0	0.136	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	86.51	Litre	0.197	0	0	0.197	0
Deputy Chief Executives	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	829.00	Litre	1.883	0	0	1.883	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3493.51	Litre	7.936	0	0	7.936	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	9620.00	Litre	21.852	0	0	21.852	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	27234.28	Litre	61.864	0	0	61.864	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	960.00	Litre	2.181	0	0	2.181	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	5457.39	Litre	12.397	0	0	12.397	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
Engineering Services	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	5630.00	Litre	12.789	0	0	12.789	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	16079.97	Litre	36.526	0	0	36.526	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	12365.76	Litre	28.089	0	0	28.089	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	52707.56	Litre	119.728	0	0	119.728	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6154.18	Litre	13.979	0	0	13.979	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	5034.93	Litre	11.437	0	0	11.437	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	4070.00	Litre	9.245	0	0	9.245	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2736.67	Litre	6.216	0	0	6.216	0
Environment & Sustainable Development	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1840.00	Litre	4.180	0	0	4.180	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	20767.00	Litre	47.173	0	0	47.173	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	33368.64	Litre	75.798	0	0	75.798	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	34513.61	Litre	78.399	0	0	78.399	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	35691.18	Litre	81.074	0	0	81.074	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6699.01	Litre	15.217	0	0	15.217	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	826.00	Litre	1.876	0	0	1.876	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	4593.16	Litre	10.434	0	0	10.434	0
Finance	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	817.00	Litre	1.856	0	0	1.856	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	12365.15	Litre	28.088	0	0	28.088	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1522.74	Litre	3.459	0	0	3.459	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	13620.41	Litre	30.939	0	0	30.939	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	706.00	Litre	1.604	0	0	1.604	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1187.00	Litre	2.696	0	0	2.696	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	235.00	Litre	0.534	0	0	0.534	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	235.24	Litre	0.534	0	0	0.534	0
Health Services	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	4729.00	Litre	10.742	0	0	10.742	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	495525.60	Litre	1125.609	0	0	1125.609	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	17637.67	Litre	40.065	0	0	40.065	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	4456.21	Litre	10.122	0	0	10.122	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	22053.63	Litre	50.096	0	0	50.096	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6502.00	Litre	14.770	0	0	14.770	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2482.90	Litre	5.640	0	0	5.640	0
Human Resources	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	4492.03	Litre	10.204	0	0	10.204	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	270.00	Litre	0.613	0	0	0.613	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1926.00	Litre	4.375	0	0	4.375	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	432.00	Litre	0.981	0	0	0.981	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	625.00	Litre	1.420	0	0	1.420	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	335.00	Litre	0.761	0	0	0.761	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1193.28	Litre	2.711	0	0	2.711	0
Hydro Generation	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2845.00	Litre	6.463	0	0	6.463	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	772.24	Litre	1.754	0	0	1.754	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1807.00	Litre	4.105	0	0	4.105	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1582.00	Litre	3.594	0	0	3.594	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	497.00	Litre	1.129	0	0	1.129	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	12789.27	Litre	29.051	0	0	29.051	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	609.00	Litre	1.383	0	0	1.383	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	478.10	Litre	1.086	0	0	1.086	0
Internal Audit	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	334.00	Litre	0.759	0	0	0.759	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1146.00	Litre	2.603	0	0	2.603	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2293.00	Litre	5.209	0	0	5.209	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	4173.78	Litre	9.481	0	0	9.481	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	960.85	Litre	2.183	0	0	2.183	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1078.57	Litre	2.450	0	0	2.450	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	55.00	Litre	0.125	0	0	0.125	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	312.02	Litre	0.709	0	0	0.709	0
Legal Sevices	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	337.00	Litre	0.766	0	0	0.766	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3733.11	Litre	8.480	0	0	8.480	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	169.70	Litre	0.385	0	0	0.385	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	45.00	Litre	0.102	0	0	0.102	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	45.00	Litre	0.102	0	0	0.102	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	503.88	Litre	1.145	0	0	1.145	0
Management & Information System	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3719.31	Litre	8.449	0	0	8.449	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	5515.61	Litre	12.529	0	0	12.529	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1082.00	Litre	2.458	0	0	2.458	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3531.68	Litre	8.022	0	0	8.022	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	410.00	Litre	0.931	0	0	0.931	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	701.00	Litre	1.592	0	0	1.592	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	75.00	Litre	0.170	0	0	0.170	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	818.58	Litre	1.859	0	0	1.859	0
Procurement	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	600.00	Litre	1.363	0	0	1.363	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	11871.30	Litre	26.966	0	0	26.966	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2559.00	Litre	5.813	0	0	5.813	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	10305.00	Litre	23.408	0	0	23.408	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	90.00	Litre	0.204	0	0	0.204	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	734.18	Litre	1.668	0	0	1.668	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	90.00	Litre	0.204	0	0	0.204	0
PropCo	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	150.00	Litre	0.341	0	0	0.341	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	250.00	Litre	0.568	0	0	0.568	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	267.09	Litre	0.607	0	0	0.607	0
Real Estate and Security	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1109.00	Litre	2.519	0	0	2.519	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	484.44	Litre	1.100	0	0	1.100	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	32499.16	Litre	73.823	0	0	73.823	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	460.00	Litre	1.045	0	0	1.045	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1255.00	Litre	2.851	0	0	2.851	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	221.23	Litre	0.503	0	0	0.503	0
Technical Services	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6204.20	Litre	14.093	0	0	14.093	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	11593.98	Litre	26.336	0	0	26.336	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1164.00	Litre	2.644	0	0	2.644	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	17788.09	Litre	40.406	0	0	40.406	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	892.40	Litre	2.027	0	0	2.027	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	755.00	Litre	1.715	0	0	1.715	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1489.00	Litre	3.382	0	0	3.382	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6151.26	Litre	13.973	0	0	13.973	0
Thermal Generation SBU	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6059.86	Litre	13.765	0	0	13.765	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1372.00	Litre	3.117	0	0	3.117	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	16127.79	Litre	36.635	0	0	36.635	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1340.00	Litre	3.044	0	0	3.044	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2265.00	Litre	5.145	0	0	5.145	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	6504.00	Litre	14.774	0	0	14.774	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	746.00	Litre	1.695	0	0	1.695	0
VRA Academy & Schools	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	176.00	Litre	0.400	0	0	0.400	0
	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	745.90	Litre	1.694	0	0	1.694	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	60.00	Litre	0.136	0	0	0.136	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	45.00	Litre	0.102	0	0	0.102	0
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	110.00	Litre	0.250	0	0	0.250	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2680.80	Litre	6.090	0	0	6.090	0
VRA Corporate Parent	2012	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	338.00	Litre	0.768	0	0	0.768	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1661.29	Litre	3.774	0	0	3.774	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	5088.89	Litre	11.560	0	0	11.560	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2340.00	Litre	5.315	0	0	5.315	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3190.12	Litre	7.247	0	0	7.247	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit	Fossil Fuel CO2 (metric tonnes)	CH4 (kg)	N2O (kg)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2018	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2199.00	Litre	4.995	0	0	4.995	0
	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	1321.22	Litre	3.001	0	0	3.001	0
Planning & Power Business	2013	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	3428.80	Litre	7.789	0	0	7.789	0
	2014	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	894.00	Litre	2.031	0	0	2.031	0
	2015	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	2893.18	Litre	6.572	0	0	6.572	0
	2016	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	175.00	Litre	0.398	0	0	0.398	0
	2017	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	510.00	Litre	1.158	0	0	1.158	0
Office of CE	2019	Other	Road	Scope 1	Fuel Use	Gasoline/Petrol	899.21	Litre	2.043	0	0	2.043	0
									Total GHG			2539.321	0

2. Diesel Vehicles

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
Board Secretariat	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	120.00	Litre	0.321	0	0	0.321	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	2698.13	Litre	7.221	0	0	7.221	0
Commercial Services	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5007.39	Litre	13.401	0	0	13.401	0
Corporate Strategy	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	405.00	Litre	1.084	0	0	1.084	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	2846.81	Litre	7.619	0	0	7.619	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	4018.45	Litre	10.755	0	0	10.755	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	9790.78	Litre	26.203	0	0	26.203	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	12534.34	Litre	33.546	0	0	33.546	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	8016.00	Litre	21.453	0	0	21.453	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5768.12	Litre	15.437	0	0	15.437	0
Deputy Chief Executives	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	981.00	Litre	2.625	0	0	2.625	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	7390.21	Litre	19.779	0	0	19.779	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	119270.45	Litre	319.207	0	0	319.207	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	232607.67	Litre	622.534	0	0	622.534	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3776.00	Litre	10.106	0	0	10.106	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	19967.66	Litre	53.440	0	0	53.440	0
Engineering Services	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	49171.00	Litre	131.598	0	0	131.598	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	33666.75	Litre	90.103	0	0	90.103	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	63439.71	Litre	169.785	0	0	169.785	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	297856.56	Litre	797.162	0	0	797.162	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	142988.73	Litre	382.685	0	0	382.685	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	123222.11	Litre	329.783	0	0	329.783	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	23386.00	Litre	62.589	0	0	62.589	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	107854.00	Litre	288.653	0	0	288.653	0
Environment & Sustainable Development	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	44818.00	Litre	119.948	0	0	119.948	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	18226.18	Litre	48.779	0	0	48.779	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	43229.25	Litre	115.696	0	0	115.696	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	50231.47	Litre	134.436	0	0	134.436	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	36991.54	Litre	99.001	0	0	99.001	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	76198.86	Litre	203.933	0	0	203.933	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	23991.00	Litre	64.208	0	0	64.208	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	85677.92	Litre	229.302	0	0	229.302	0
Finance	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	40863.40	Litre	109.364	0	0	109.364	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	18018.56	Litre	48.224	0	0	48.224	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	11615.60	Litre	31.087	0	0	31.087	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	24542.29	Litre	65.683	0	0	65.683	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	22771.52	Litre	60.944	0	0	60.944	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	47822.83	Litre	127.990	0	0	127.990	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	14187.00	Litre	37.969	0	0	37.969	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	20887.58	Litre	55.902	0	0	55.902	0
Health Services	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	18383.95	Litre	49.201	0	0	49.201	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	60153.50	Litre	160.990	0	0	160.990	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	30051.19	Litre	80.427	0	0	80.427	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	22795.03	Litre	61.007	0	0	61.007	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	63414.59	Litre	169.718	0	0	169.718	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	31129.00	Litre	83.311	0	0	83.311	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3542.17	Litre	9.480	0	0	9.480	0
Human Resources	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5414.00	Litre	14.490	0	0	14.490	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5500.03	Litre	14.720	0	0	14.720	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5836.80	Litre	15.621	0	0	15.621	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	2902.00	Litre	7.767	0	0	7.767	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	4974.00	Litre	13.312	0	0	13.312	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	9919.20	Litre	26.547	0	0	26.547	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	16801.00	Litre	44.965	0	0	44.965	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	26336.10	Litre	70.484	0	0	70.484	0
Hydro Generation	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	51743.00	Litre	138.481	0	0	138.481	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	11541.58	Litre	30.889	0	0	30.889	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	38306.00	Litre	102.519	0	0	102.519	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	25547.00	Litre	68.372	0	0	68.372	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	21396.00	Litre	57.263	0	0	57.263	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	69659.75	Litre	186.432	0	0	186.432	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	27739.00	Litre	74.239	0	0	74.239	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3637.23	Litre	9.734	0	0	9.734	0
Internal Audit	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1510.00	Litre	4.041	0	0	4.041	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1991.00	Litre	5.329	0	0	5.329	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	987.94	Litre	2.644	0	0	2.644	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	729.75	Litre	1.953	0	0	1.953	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1062.92	Litre	2.845	0	0	2.845	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1529.66	Litre	4.094	0	0	4.094	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	45.00	Litre	0.120	0	0	0.120	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	2295.51	Litre	6.144	0	0	6.144	0
Investment	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	264.00	Litre	0.707	0	0	0.707	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	100.00	Litre	0.268	0	0	0.268	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	100.00	Litre	0.268	0	0	0.268	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	647.65	Litre	1.733	0	0	1.733	0
Legal Services	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3750.00	Litre	10.036	0	0	10.036	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	6116.11	Litre	16.369	0	0	16.369	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	169.70	Litre	0.454	0	0	0.454	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1187.25	Litre	3.177	0	0	3.177	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	70.00	Litre	0.187	0	0	0.187	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	38.00	Litre	0.102	0	0	0.102	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3535.67	Litre	9.463	0	0	9.463	0
Management & Information System	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	47761.99	Litre	127.827	0	0	127.827	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	10531.57	Litre	28.186	0	0	28.186	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5110.72	Litre	13.678	0	0	13.678	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	6486.72	Litre	17.361	0	0	17.361	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	9164.28	Litre	24.527	0	0	24.527	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	11638.98	Litre	31.150	0	0	31.150	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	6829.00	Litre	18.277	0	0	18.277	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	27960.22	Litre	74.831	0	0	74.831	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
Procurement	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	14427.00	Litre	38.611	0	0	38.611	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	12196.30	Litre	32.641	0	0	32.641	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	51328.00	Litre	137.371	0	0	137.371	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	51783.00	Litre	138.588	0	0	138.588	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	51149.48	Litre	136.893	0	0	136.893	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	96007.39	Litre	256.947	0	0	256.947	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	39272.00	Litre	105.105	0	0	105.105	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	36754.85	Litre	98.368	0	0	98.368	0
PropCo	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	65.00	Litre	0.174	0	0	0.174	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	236.00	Litre	0.632	0	0	0.632	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	9871.97	Litre	26.421	0	0	26.421	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	32368.59	Litre	86.629	0	0	86.629	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	4466.00	Litre	11.952	0	0	11.952	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1373.11	Litre	3.675	0	0	3.675	0
Real Estate and Security	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	22256.00	Litre	59.564	0	0	59.564	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	20605.48	Litre	55.147	0	0	55.147	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	53650.90	Litre	143.587	0	0	143.587	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	40991.25	Litre	109.706	0	0	109.706	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	37146.57	Litre	99.416	0	0	99.416	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	70859.68	Litre	189.644	0	0	189.644	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	18694.00	Litre	50.031	0	0	50.031	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	11361.16	Litre	30.406	0	0	30.406	0
Technical Services	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	87137.69	Litre	233.209	0	0	233.209	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	17277.68	Litre	46.241	0	0	46.241	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	21194.00	Litre	56.722	0	0	56.722	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	56548.25	Litre	151.342	0	0	151.342	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	79125.24	Litre	211.765	0	0	211.765	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	71113.85	Litre	190.324	0	0	190.324	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	46792.00	Litre	125.231	0	0	125.231	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	76787.45	Litre	205.508	0	0	205.508	0
Thermal Generation SBU	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	8011.86	Litre	21.442	0	0	21.442	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3597.00	Litre	9.627	0	0	9.627	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	26593.79	Litre	71.174	0	0	71.174	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	7985.00	Litre	21.370	0	0	21.370	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	64716.32	Litre	173.202	0	0	173.202	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	96695.00	Litre	258.787	0	0	258.787	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	15582.88	Litre	41.705	0	0	41.705	0
VRA Academy & Schools	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	9982.00	Litre	26.715	0	0	26.715	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	745.90	Litre	1.996	0	0	1.996	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	637.28	Litre	1.706	0	0	1.706	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5642.00	Litre	15.100	0	0	15.100	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1867.00	Litre	4.997	0	0	4.997	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	18322.00	Litre	49.036	0	0	49.036	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	27187.00	Litre	72.761	0	0	72.761	0
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	15193.74	Litre	40.663	0	0	40.663	0
VRA Corporate Parent	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1070	Litre	2.864	0	0	2.864	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1238	Litre	3.313	0	0	3.313	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	3123.73	Litre	8.360	0	0	8.360	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	25558.25	Litre	68.402	0	0	68.402	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	12177	Litre	32.590	0	0	32.590	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	20352.75	Litre	54.471	0	0	54.471	0
	2018	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	16953	Litre	45.372	0	0	45.372	0

Source Description	Inventory Year	Region	Mode of Transport	Scope	Type of Activity Data	Activity Data			GHG Emissions				
						Fuel Used	Fuel Amount	Unit of Fuel Amount	Fossil Fuel CO2 (metric tonnes)	CH4 (kilograms)	N2O (kilograms)	Total GHG Emissions, exclude Biofuel CO2 (metric tonnes CO2e)	Biofuel CO2 Emissions (metric tonnes)
	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	10896.628	Litre	29.163	0	0	29.163	0
Planning & Power Business	2012	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	6659.4	Litre	17.823	0	0	17.823	0
	2013	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	6192.01	Litre	16.572	0	0	16.572	0
	2014	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	1889	Litre	5.056	0	0	5.056	0
	2015	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	5708.5	Litre	15.278	0	0	15.278	0
	2016	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	438	Litre	1.172	0	0	1.172	0
	2017	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	2544	Litre	6.809	0	0	6.809	0
Office of the CE	2019	Other	Road	Scope 1	Fuel Use	On-Road Diesel Fuel	10248.1	Litre	27.427	0	0	27.427	0
											Total GHG	**11042.094**	**0**