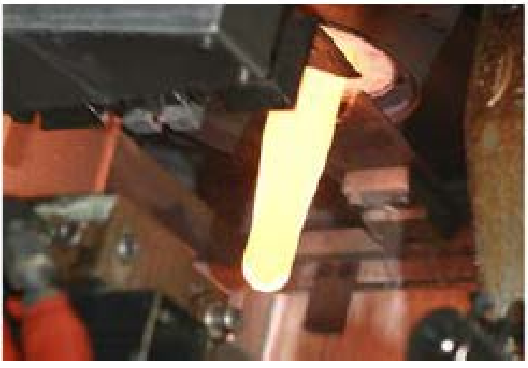
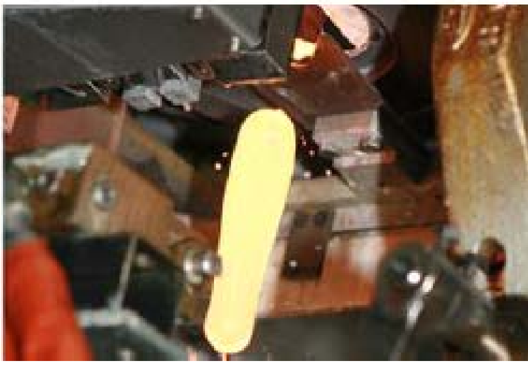
SAB Glass Bottle Manufacturing Plant

Estimated 2020 Carbon Footprint

Based on 2018 design data

July 2018



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1. Introduction

The greenhouse gas inventory calculation presented in this report will allow SAB to assess their greenhouse gas emissions and to make strategic decisions as to how to reduce its footprint at the new Glass Manufacturing facility (the Glass Plant). It would be good governance to set emission reduction targets and compare its performance over the years to this baseline to track progress. By knowing its carbon emissions, SAB and the Glass Plant can comply with carbon emission reporting requirements and anticipate its carbon tax exposure which is expected to come into place in South Africa in 2019.

In this context SAB is voluntarily calculating their greenhouse gas (GHG) inventory for the Glass Plant, also known as a carbon footprint for their expected 2020 operations, based on the 2018 design data. A carbon footprint is a total amount of carbon dioxide and other GHG emissions (expressed in carbon dioxide equivalents, CO_2e) for which an organisation or site is responsible, or over which it has control.

The proposed new Glass Plant is a greenfields development located west of Vereeniging. The plant has been designed according to best practice principles to ensure efficiency and limit environmental impact.

The proposed plant will make green and amber glass bottles with two furnaces. The furnace for green glass with a capacity for melting 390 metric ton of raw materials per daya and a second furnace for amber glass that can melt 530 metric tons of raw material per day.

2. Approach

2.1. Principles to GHG inventory calculations

SANS/ISO 14064-1, *"Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals"* specifies principles and requirements at the organization level for quantification and reporting of greenhouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory.

The following are the basic principles used when performing a carbon footprint and are detailed in the SANS/ISO 14064-1:

RELEVANCE	Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.
COMPLETENESS	Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusion.

CONSISTENCY	Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.
TRANSPARENCY	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
ACCURACY	Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

Apart from the SANS/ISO 14064-1 standard, the Greenhouse Gas Protocol was also used in the calculation of the greenhouse gas inventory.

3. Development of the Corporate GHG Inventory

In accordance with the SANS/ISO 14064-1, the GHG inventory is developed by:

- Setting the boundaries of the inventory;
- Identifying the GHG sources inside the boundary;
- Establishing the quantification method that will be applied; and
- Calculating the emissions.

This process is discussed in detail in subsequent sections.

3.1. Organisational boundary

An organisational boundary is the delineation of the facilities that are included in a company's carbon footprint. The boundary is important as it determines which GHG sources and sinks of the organisation must be included in the footprint calculation, and which are excluded. This is illustrated through an example in Figure 1 below.

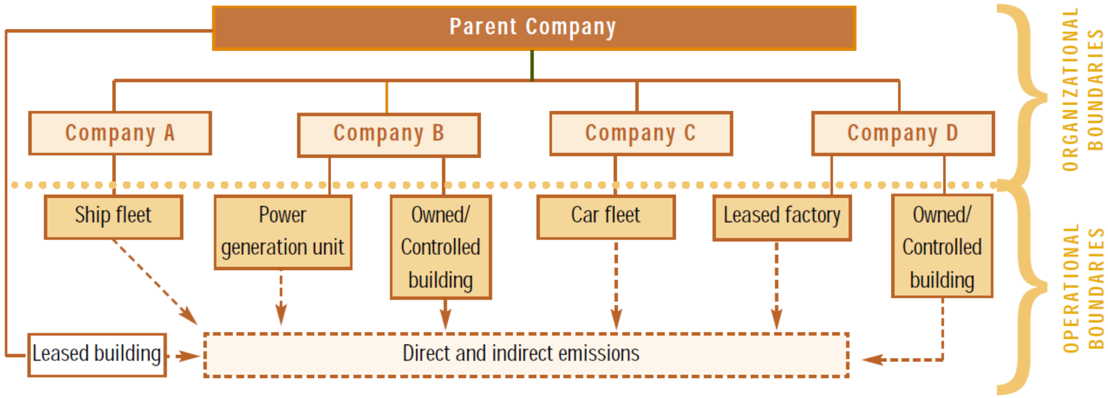

Figure 1 Illustration of organisational and operational boundaries

The ISO standard and GHG Protocol defines two distinct approaches which can be used to define organisational boundaries, the equity share and the control approaches. The control approach is split into financial and operational control.

Equity share approach - *Under this approach, a company would record its emissions according to (pro rata) the equity share it holds in each operation, i.e. according to ownership. This is based on the assumption that the economic risks and rewards for a company are comparable to its ownership share. There may be cases where equity share differs from ownership, in which case the economic share a company has in an operation would override its share of ownership, to better reflect the risks and rewards at stake.*

Financial control approach - *Under this approach a company would record emissions from facilities, sites or operations over which it has financial control i.e. it has the ability to direct the financial and operating policies with a view to gaining economic benefits from its activities. A company accounts for 100% of the emissions of those operations over which they have financial control.*

Operational control approach - *Under this approach, a company would record emissions from facilities, sites or operations over which it or one of its subsidiaries, has operational control i.e. the authority to introduce and implement its operating policies at the operation. A company accounts for 100% of emissions from operations over which it or one of its subsidiaries has operational control.*

The operational control boundary approach has been selected for calculation of the Glass Plant carbon footprint.

3.2. Operational Boundary

An operational boundary is the delineation of the GHG sources (activities that emit GHG's) and sinks (activities that absorb GHG's) that are included in a company's carbon footprint.

The setting of operational boundaries is a two-step process:

Step 1: Identification of the emissions associated with the company's business operation.

Step 2: Classification of the emissions into three categories. These three categories are defined according to *SANS/ISO 14064 Part 1* as direct GHG emissions, energy indirect GHG emissions, and other indirect GHG emissions, but are commonly referred to by The Greenhouse Gas Protocol as Scope 1, Scope 2, and Scope 3 emissions.

Direct GHG emissions are emissions from sources that will be owned or controlled by SAB at the Glass Plant. Energy indirect GHG emissions are emissions resulting from imported electricity consumed by the Glass Plant. Other indirect GHG emissions are the emissions (excluding energy indirect GHG emissions) that occur because of SAB's activities at the plant, but occur at sources owned or controlled by another company. According to the Greenhouse Gas Protocol, other indirect GHG emissions can be classified into two different categories also graphically presented in Figure 2 below:

- Upstream indirect GHG emissions (related to purchased or acquired goods and services); and;
- Downstream indirect GHG emissions (related to sold goods and services).

Figure 2 illustrates the different sources of emissions, as well as the operational boundaries of an organisation. The figure gives a breakdown of the various scopes, including examples of emissions associated to each scope.

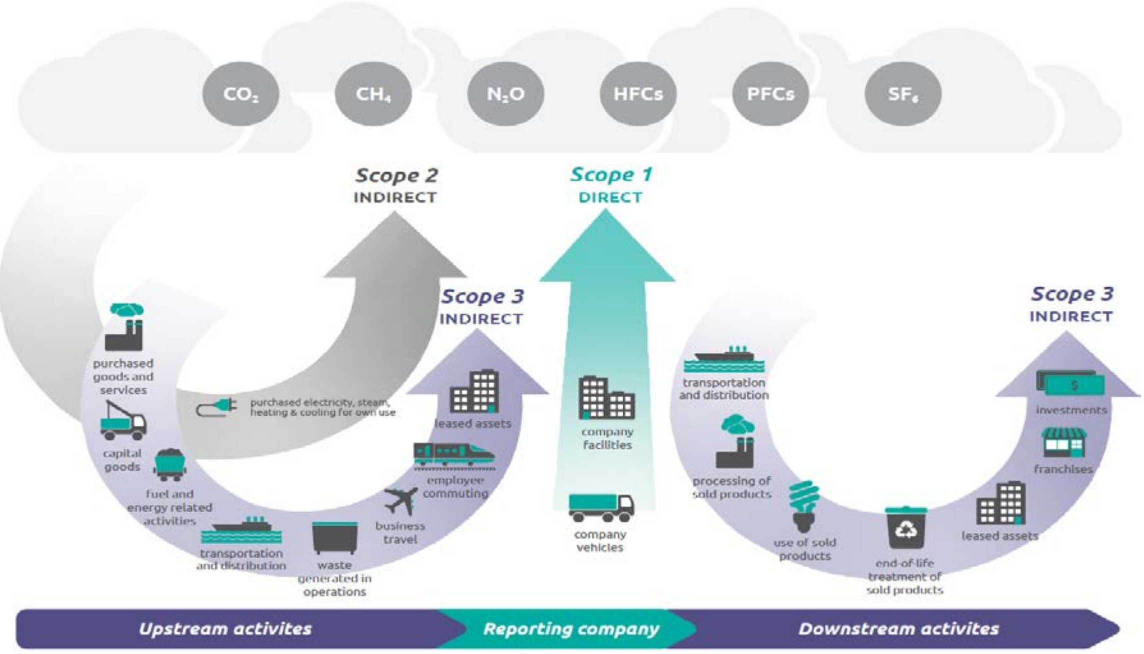

Figure 2: Illustration of different sources of emissions (The Greenhouse Gas Protocol: Corporate Value Chain Accounting and Reporting Standard)

3.2.1. Identification of GHG sources

The identification of greenhouse gas sources is a detailed process. This is to ensure that all significant emission sources are identified for the carbon footprint calculation. The SANS/ISO 14064 Part 1 Standard and The Greenhouse Gas Protocol's 'A Corporate Accounting and Reporting Standard (Revised Edition)' and Greenhouse Gas Protocol Corporate

Value Chain (Scope 3) Accounting and Reporting Standard was applied in addition to identify and quantify emission sources.

The following sources were identified for SAB's Glass Plant:

- **Scope 1 (Direct Emissions):**
  - Emissions from the combustion of gas;
  - Process emissions from the decarbonisation of the raw materials.
  - Onsite mobile diesel transport (not quantified)
- **Scope 2 (Energy Indirect Emissions):**
  - GHG emissions from the generation of imported electricity consumed by the organization;
- **Scope 3 (Other Indirect Emissions[1]):**
  - Upstream mining, processing and transport of raw materials;
  - Upstream processing and distribution of gas;
  - Downstream transport of products;
  - Employee travel emissions;
  - Manufacturing and materials used in the construction of the plant

4. GHG Quantification

4.1. Methodology

The quantification methodology used is based on GHG activity multiplied by an appropriate documented emission factor.

Activity data x Emission Factor = Quantity of GHG Emissions

These emission factors allow for activity data (e.g. litres of fuel used, number of kilometres driven) to be converted into tonnes of carbon dioxide equivalent (CO_2e).

As per international protocol all the GHG reporting is done as CO_2 equivalent, i.e. including all greenhouse gases and not only CO_2. The main greenhouse gas for the Glass Plant are carbon dioxide, and to a lesser extend methane and nitrous oxide. Carbon dioxide is associated with electricity and gas consumption, as well as the decarbonisation of the raw materials. Of the raw materials used there are four sources of greenhouse gas, limestone, dolomite, soda-ash and carbon. As per international protocol, all the greenhouse gases (GHG's) are converted to carbon dioxide equivalents using global warming potentials (GWP).

[1] The organization may quantify other indirect GHG emissions based on requirements of the applicable GHG programme, internal reporting needs or the intended use for the GHG inventory.

4.2. Data Collection and Data Quality

This report is a compilation of the design data available to date, based on the organisational and operational boundary selected.

4.3. Emission Factors

Emission factors have been chosen in order of relevance and accuracy for the various emission sources.

In determination of emissions from electricity usage, a grid emission factor was calculated following the GHG protocol, using data from Eskom. For emission factors applicable to South Africa, the Technical Guidelines published by the DEA were used. For other globally applicable emission factors (e.g. production of diesel) the DEFRA 2017 data sets were used.

A list of all the emission factors and assumptions used for the quantification of emissions is attached as Appendix B Emission Factors to this report.

4.4. Base Year Emissions

According to SANS/ISO 14064:1 (2006), an organisation needs to establish a historical base year for GHG emissions and removals for comparative purposes. This allows for meaningful and consistent comparison of emissions over time. This is the estimated 2020 baseline based on current design data and should be updated once operational.

According to the ISO standard the base year must be recalculated in future years under specific circumstances, e.g.:

a) Changes to the operational boundaries;
b) Changes in the ownership and control of GHG sources transferred into or out of the organisation through:
   - Mergers, acquisitions and divestments;
   - Outsourcing and Insourcing of emitting activities.
c) Changes in calculating methodology or improvements in the accuracy of emission factors or activity data that result in a significant impact on the base year emission data.

4.5. Data Gaps and Uncertainties

The calculation of this carbon footprint was carried out using information received from SAB. As this is a greenfields development and the Glass Plant is yet to be constructed, the data reflect the key activity sources available at this point in the design of the plant.

5. Results and Discussion

This section provides information on the greenhouse gas inventory based on 2018 design data for the 2020 operations of the SAB's Glass Plant.

5.1. SAB's Glass Plant Greenhouse Gas Inventory

The GHG inventory consists of direct and indirect emissions categorised as Scope 1, 2 and 3 emissions. The plant has both energy and process related greenhouse gas emissions. The production of glass is an energy intensive process.

The GHG emission inventory for FY2018 for the Glass Plant is summarized in Table 1:

Table 1: SAB glass bottle manufacturing Plant Inventory for FY2018

Scope	FY2018 Emissions (t CO_2e)[2]
Scope 1 (Direct emissions):	**120 000**
Scope 2 (Indirect energy emissions):	**131 000**
Scope 3: (Other Indirect emissions):	**Not quantified**

5.2. GHG Inventory Evaluation

The greenhouse gas inventory evaluation follows a discussion on Scope 1, 2 and 3 emissions for SAB's Glass Plant.

5.2.1. Direct Emissions (Scope 1)

Sources of direct greenhouse gas emissions at the Glass Plant are the combustion of natural gas and the decarbonasation of raw materials. The gas contributes 75,100 ton CO_2e and the raw material decarbonisation 44,800 ton CO_2e. The greenhouse gas distribution from the various sources is shown in the figure below.

[2] GHG emissions in South Africa were estimated to be 579 million tCO_2e in 2010. (Department of Environmental Affairs, 2013)

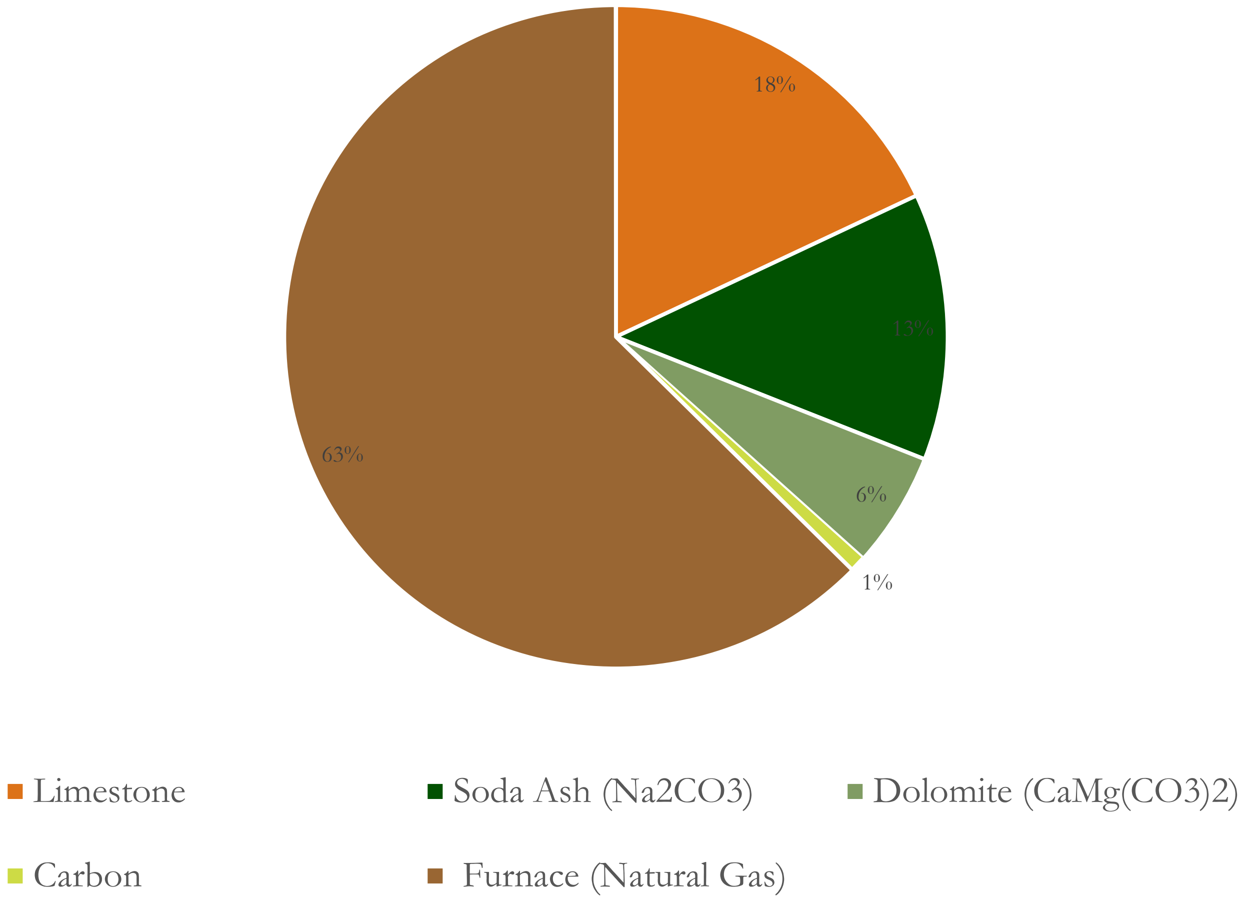

Figure 3: The distribution of direct emissions

5.2.2. Indirect Energy Emissions (Scope 2)

Indirect energy (scope 2) emissions arise from the purchasing of electricity by SAB for their own use at the Glass Plant. The high grid emission factor of 0.98 ton CO_2/MWh results in high scope 2 emissions. Electricity consumption estimated supplied by SAB was provided as one total. Both energy efficiency and self-generation of renewable energy on-site could reduce scope 2 emissions.

5.2.3. Other Indirect Emissions (Scope 3)

Indirect emissions are emissions that occur as a result of SAB's business but are not under your direct control. The calculation of other indirect (scope 3) emissions allows companies to assess their entire value chain emissions impact and identify the most effective ways to reduce emissions. These are potentially cost-effective and immediate emission reduction solutions. Because the Glass Plant is not yet operational, scope 3 emissions were not quantified.

6. Emission reduction opportunities

There are numerous ways to reduce the estimated emissions, some would require a design change and other linked to awareness and optimising resource use.

Apart from improving sustainability and aligning with the global decarbonisation commitment under the Paris Agreement reducing direct emissions will reduce carbon tax. Under the current design of the carbon tax bill in South Africa, the Glass facility will pay about R 5,2 million per year on the direct emissions. This calculation is based on the R120 per ton CO_2e emitted with the basic 60% tax-free allowance, and a 10% additional allowances for the process emissions.

Regarding direct emissions any switch away from fossil fuel would reduce greenhouse gas emissions. Blending in biogas has a lower greenhouse gas effect for the same heating value. Renewable alternatives can be hybridised with or without storage.

Indirect emissions reduction projects upstream or downstream of Glass could be used as offsets under the current design of the carbon tax. In addition cost savings and efficiency improvements in the SAB's sphere of influence can support cost containment while supporting the journey of South Africa to a low carbon and climate resilient society.

7. Conclusion

The greenhouse gas emission inventory was estimated based on design data and therefore no verification took place. The calculations are done in accordance with SANS/ISO 14064 and the Greenhouse Gas Protocol. The carbon footprint was calculated for the 2020 year.

Decisions in the design process can still reduce the direct and indirect emissions. Early engagement with suppliers and off-takers could result in mutually beneficial projects in terms of reducing greenhouse gases in the supply chain and ensuring long term sustainability.

Appendix A: Activity Data

Design data provided and used in the calculation

Table 2: Activity data

Activity	Green Glass	Amber Glass	Unit
Mass of Glass	530	390	tons/day
Electricity consumed	57 924 989	75 270 897	kWh/year
Natural Gas Consumption (Net heating Value)	1 337 451		GJ/year

Table 3: Raw material usage

Activity	Green Glass	Amber Glass	Unit
Sand	54.30	53.40	%
Soda Ash (Na_2CO_3)	13.00	11.70	%
Limestone	14.80	18.20	%
Phonolite	10.01	11.02	%
Dolomite ($CaMg(CO_3)_2$)	5.91	3.02	%
Sodium Sulphate	-	0.518	%
Hematite	0.201	-	%
Filter Dust	1.63	0.776	%
Chromium Oxide	0.000	1.409	%
Copper Oxide	0.330%	-	%

Global warming potential (GWP) used in the calculation

The same values are used in this footprint as required for mandatory reporting in South Africa. These are based on 2006 IPCC guidelines and are:

Table 4: Global warming potentials

CH_4	23	ton CO_2/ton CH_4
N_2O	296	ton CO_2/ton N_2O

The plant is assumed to operate for 90 % of the year.

Appendix B Emission Factors

	Value	Unit	Source
Direct Emission Factors			
Natural gas (Stationary combustion) - CO_2	56 100	kg CO_2/TJ	SA Technical Guidelines TG-2016.1
Natural gas (Stationary combustion) - CH_4	1	kg CH_4/TJ	SA Technical Guidelines TG-2016.1
Natural gas (Stationary combustion) - N_2O	0.10	kg N_2O/TJ	SA Technical Guidelines TG-2016.1
Calcium Carbonate ($CaCO_3$)	0.43971	t CO_2/t Carbonate	IPCC Guidelines Table 2.1 Volume 3 Chapter 2.4
Dolomite ($CaMg(CO_3)_2$)	0.47732	t CO_2/t Carbonate	IPCC Guidelines Table 2.1 Volume 3 Chapter 2.4
Soda Ash (Na_2CO_3)	0.41492	t CO_2/t Carbonate	IPCC Guidelines Table 2.1 Volume 3 Chapter 2.4
Carbon	3.66667	t CO_2/t Carbonate	Calculated – 44/12 (Molar Mass CO_2/Molar Mass Carbon)
Energy Indirect Emission Factors			
Electricity - South Africa	0.98	tonne CO_2/MWh	Eskom Annual Report 2017