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COUNTRY PAPER | DECEMBER 2016

A Case Study on the Development of Technical Guidelines for Greenhouse Gas Reporting in South Africa

FROM VOLUNTARY REPORTING TO MANDATORY DISCLOSURE OF GREENHOUSE GAS EMISSIONS – THE SOUTH AFRICAN EXPERIENCE OF DEVELOPING TECHNICAL GUIDELINES

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WORLD BANK GROUP

Executive Summary

South Africa has a comprehensive climate change response strategy to support the transition to a low- carbon economy and a climate-resilient society. Improving the national Greenhouse Gas (GHG) inventory and implementing a carbon tax are but two elements that form part of this transition. Developing mandatory GHG reporting regulations will support not only the National GHG Inventory but also aid policy formulation, implementation, and legislation while allowing South Africa to meet its reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC).

The proposed mandatory GHG Reporting Regulations require Technical Guidelines for Monitoring, Reporting and Verification of GHG Emissions by Industry. These Technical Guidelines were developed by the Department of Environmental Affairs (DEA) with support from the World Bank's Partnership for Market Readiness. The objective of these Technical Guidelines was to provide emissions reporting guidance to responding companies. Extensive sectoral stakeholder engagements supported the development of these Technical Guidelines, which are based on the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines to streamline the consolidation for a National GHG inventory.

In South Africa, the private sector, especially listed entities, have been involved in voluntary GHG disclosure since 2008 under the Carbon Disclosure Project. The South African National Standards adopted the ISO 14064 series in 2006 and it has been widely used, together with the GHG Protocol Reporting Standards. Under the proposed Technical Guidelines, private companies will have to revise their GHG accounting to align with the methods according to the various activities under one of three tiers.

The experience in calculating and reporting GHG emissions varies significantly across the private sector. Many companies, especially non-listed private companies, companies that only produce for the local or African market, and those companies not forming part of a major international group, have very limited experience in calculating and managing GHG inventories.

South Africa's Technical Guidelines will also form the basis for emissions calculations under the proposed carbon tax bill. At a starting rate of R 120 per tonne[1] CO_2 emitted (with relief mechanisms, the effective rate would be reduced to about R 45 per tonne CO_2 emitted), the emissions reported would have significant financial cost implications for the private sector. Thus, the calculation methodologies and thresholds in the Technical Guidelines require careful analysis.

According to the proposed Technical Guidelines, GHG emissions data will be submitted via an online reporting system, which will form part of the South African Air Quality Information

1 A *tonne* refers to a metric ton.

System, mandated under the existing Air Quality Act, 2004 (AQA). The large GHG emitters are already familiar with this system as they currently submit air quality data using the same system. Alignment of sectoral classification and other reporting platforms may reduce the reporting burden on private companies and increase the use of national data and statistics.

The Technical Guidelines together with the mandatory GHG reporting regulations and the proposed carbon tax bill are still under development. The alignment and specific details are therefore still uncertain, which means their exact financial impact on individual companies cannot yet be calculated. The process of alignment and development of mandatory reporting and the proposed carbon tax is, however, a step forward in future-proofing South African companies for the low-carbon economy.

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AFOLU	Agriculture, Forestry and Other Land Use
AQA	Air Quality Act, 2004
BUSA	Business Unity South Africa
CDM	Clean Development Mechanism
CDP	Carbon Disclosure Project
CO_2	Carbon dioxide
COP	Conference of the Parties
DEA	Department of Environmental Affairs
DEFRA	Department of Environment, Food, and Rural Affairs (United Kingdom)
DRM	Disaster Risk Management
EF	Emission Factor
GHG	Greenhouse gas
GRI	Global Reporting Initiative
HFC	Hydrofluorocarbon
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
ISO	International Organization for Standardization
JSE	Johannesburg Stock Exchange
LULUCF	Land Use, Land-Use Change and Forestry
M&E	Monitoring and Evaluation
MRV	Measurement, Reporting and Verification
MW(th)	Megawatt Thermal
NAEIS	National Atmospheric Emission Inventory System
NCCRP	National Climate Change Response Policy
NCV	Net Calorific Value
NDC	Nationally Determined Contribution
PAMSA	Paper Manufacturers of South Africa
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

1. Project Background and Acknowledgments

This report forms part of a project, initiated by the South African Department of Environmental Affairs (DEA) and funded by the World Bank, regarding the development of Technical Guidelines for greenhouse gas (GHG) emissions reporting in South Africa. The report was prepared by Promethium Carbon, an active carbon and climate change consultancy in South Africa. The Technical Guidelines were initially developed over a 4-month period during which the project team interacted with 28 business associations and individual companies that will be affected by mandatory reporting. The process of developing the Technical Guidelines has in fact taken much longer than 4 months, as the process is still under way. This report describes the lessons learned in building a technical guidance document for mandatory GHG reporting in a country that has shown leadership in voluntary corporate GHG reporting.

The project team wants to extend its gratitude to Pauline Maree Kennedy, Senior Carbon Finance Specialist of the World Bank, who was the funder and project manager of this study, as well as Jongikhaya Witi, Director of the Change Information Directorate of the South African Department of Environmental Affairs, and his team. Recognition is given to Tinus Pulles and Justin Goodwin for their contribution toward the draft National GHG Reporting Regulations. The involvement and engagement of 28 business associations and individual companies was made possible and streamlined through Business Unity South Africa (BUSA). BUSA functions as the main structure through which business and industry communicate with government. A key objective of BUSA is to enable organized business to play a constructive role in the context of South Africa's economic growth, development, and transformation goals.

Many stakeholders provided input during the development of the Technical Guidelines for South Africa, including the following:

- AECI
- National Petroleum Refiners of South Africa (NATREF)
- Afrisam
- Omnia
- Aluminium Federation of South Africa (AFSA)
- Orion Engineered Carbon
- AngloGold Ashanti
- Paper Manufacturers Association of South Africa (PAMSA)
- Arcelor Mittal South Africa
- PFG Building Glass
- Association of Cementitious Material Products (ACMP)
- Sasol
- Business Unity South Africa (BUSA)
- Sephaku Cement
- Chamber of Mines
- Silicon Smelters
- Chemical and Allied Industry Association (CAIA)
- South 32
- Consol Glass
- South African Iron and Steel Institute (SAISI)
- Eskom
- South African Petroleum Industry Association (SAPIA)
- Ferroalloy Producers Association (FAPA)
- University of Johannesburg
- Halberg Guss
- Wispeco Aluminium
- Hulamin
- Zimco Aluminium
- Nampak

2. Background to Calculation and Disclosure of GHG Emissions and Removals

Greenhouse gas (GHG) reporting was first established when the Intergovernmental Panel on Climate Change (IPCC) was formed in 1988. The purpose of the IPCC is to assess "*the scientific, technical and socio-economic information relevant for the understanding of the risk of human-induced climate change.*" As one cannot manage what one does not measure, the need for GHG accounting and reporting at a national level was born. The need to report and manage GHG emissions was further developed with the formation of the United Nations Framework Convention on Climate Change (UNFCCC) at the Rio Earth Summit in 1992.

The private sector became involved in the efforts to calculate and report on GHG emissions in 1997, with the formation of the Global Reporting Initiative (GRI), and later with the formation of the Carbon Disclosure Project (CDP) in 2000. The International Organization for Standardization (ISO) entered the GHG accounting and reporting space with the publication of ISO 14064-1 (*Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*) in 2006.

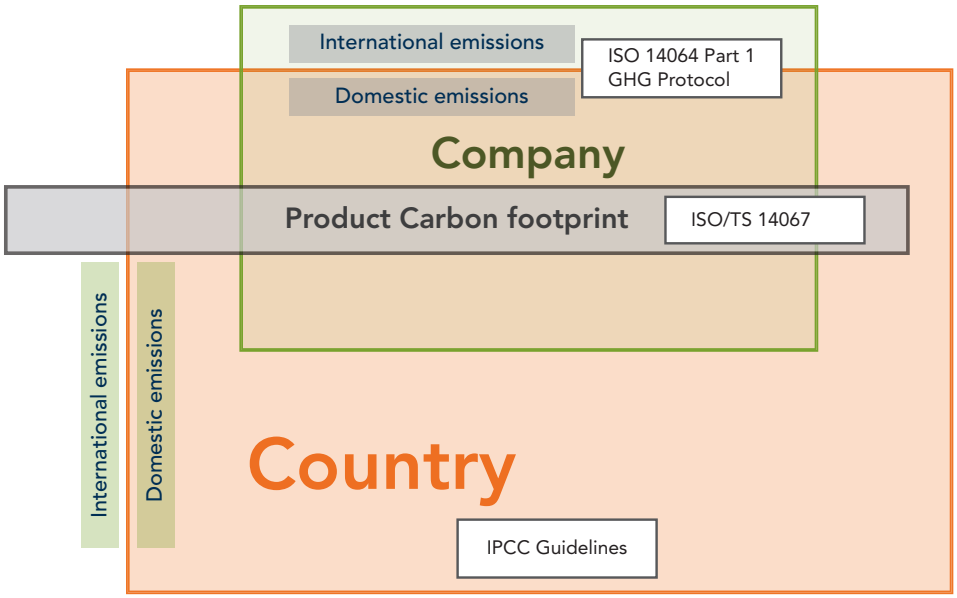
The history of the development of GHG reporting gave rise to the current status quo, where GHG emissions and removals can be calculated and reported on several levels. Each of the levels has its own rules and calculation methods. These levels are:

- **National GHG Reporting.** At this level, all the direct emissions that occurred within the national boundaries of a country within the reporting period are calculated and reported. Provision is also made for the reporting of precursors to GHGs. Reporting at this level is normally done using the guidelines published by the Intergovernmental Panel on Climate Change (IPCC). The most recent relevant guidance was published in 2006.
- **Corporate GHG Reporting.** GHG emissions at this level are reported as direct emissions within the boundaries of a company and indirect emissions that are emitted outside the boundaries of the company as a direct result of the activities of the company. Indirect emissions are split into "energy indirect" and "other indirect emissions." Reporting is normally done in accordance with the GHG Protocol Corporate Accounting and Reporting Standard and ISO 14064:2006. Many corporate reporting systems allow for the mandatory reporting of *direct* emissions and voluntary reporting of *indirect* emissions.
- **Product GHG Reporting.** The life cycle carbon footprints of products are calculated using the ISO technical specification ISO/TS14067, which is in the process of being upgraded to an ISO standard. This calculation includes the cradle to grave emissions associated with the manufacturing, use, and disposal of products, irrespective of the territory or location.

The relationship between the different levels of reporting is shown in figure 1. There are many differences between the methods of calculation at the different levels. Some of the more important issues that need to be kept in mind when attempting to align the different levels of reporting are:

- Countries report only on direct emissions that occur within the boundaries of the country;[2]
- Companies may have emissions in more than one country;
- Companies account for both direct and indirect emissions; and
- Product carbon footprints may span several countries and companies.

FIGURE 1. Levels of GHG Emission and Removal Calculation and Reporting



Note: GHG = Greenhouse gas; IPCC = Intergovernmental Panel on Climate Change; ISO = International Organization for Standardization; ISO/TC = International Organization for Standardization Technical Specification.

The different levels of GHG reporting, as shown in figure 1, have been developed from different perspectives and therefore have differing terminologies. These specific terms, used at the different levels, largely overlap, but in some cases similar terms refer to different concepts. Such differences need to be clearly articulated in a system that aims to integrate the different levels of reporting.

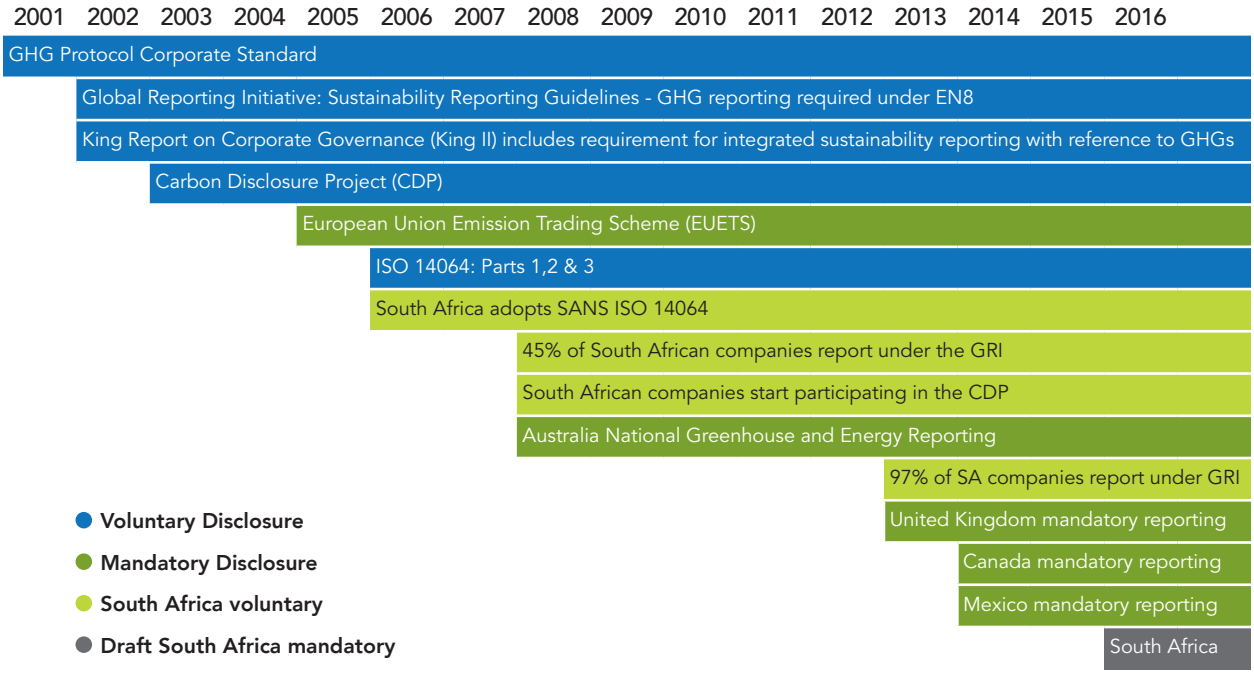
No accounting system will be complete without a system of verification of the data used and calculations made in the accounting system. GHG accounting and reporting systems are no different. Verification systems are developed in parallel with GHG accounting and reporting systems.

2 Note that governments may be party to international obligations that require them to collect and report on other data such as indirect emissions.

Each level of reporting of GHG emissions has its own associated verification requirements. As the purpose of the reporting differs at the different levels, the nature and scope of the verification requirements also differ.

Voluntary reporting of GHGs by the corporate sector predates the introduction of mandatory reporting. There have been numerous developments in voluntary and mandatory reporting since 2001. The timeline presented in figure 2 depicts the key international developments—initially the adoption of *voluntary* guidelines and later the use of these voluntary guidelines in various regions as the basis for *mandatory* reporting.

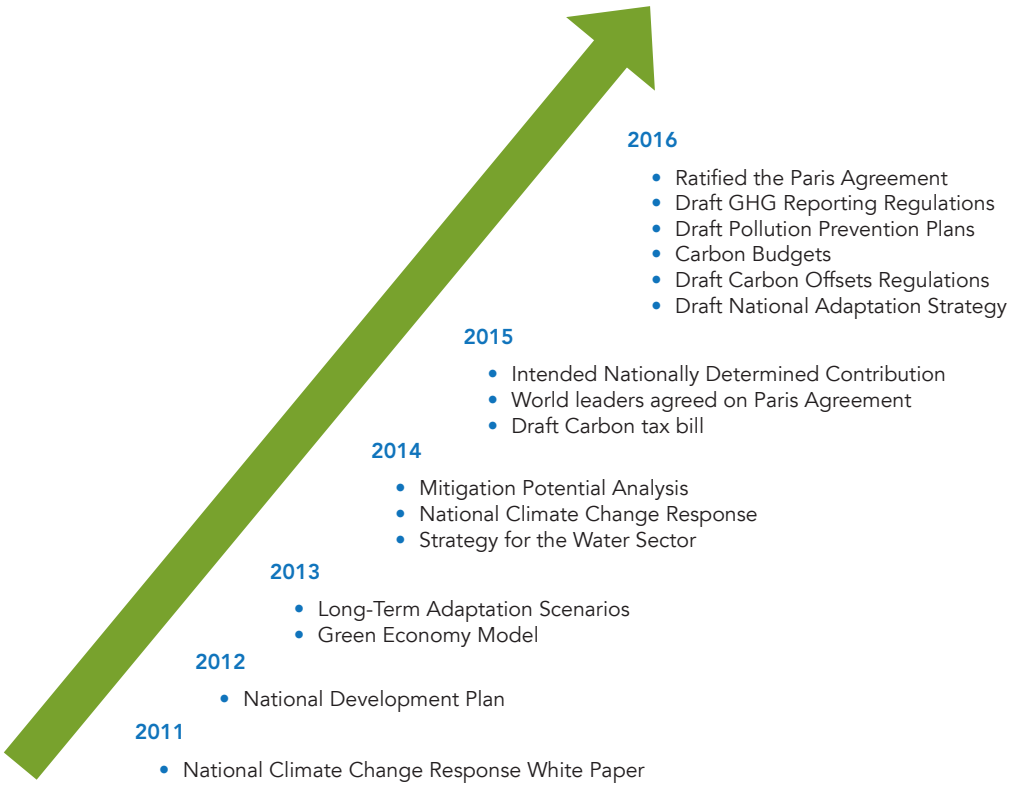
FIGURE 2. International Highlights in GHG Reporting and South Africa's Action



Source: Promethium Carbon.
Note: GHG = Greenhouse gas; GRI = Global Reporting Initiative; SANS ISO = South African National Standard International Organization for Standardization. EN8 refers to the Global Reporting Initiative Guidelines indicator for "total water withdrawal by source."

Apart from developing mandatory GHG reporting during 2016, South Africa has an extensive history of policies and measures that guides the country's climate change response. These policies and measures have been progressively implemented. The major milestones in the implementation of this strategy are shown in figure 3.

FIGURE 3. Transition of South Africa's Climate Change Response



Source: Promethium Carbon.

The publication of the National Climate Change Response White Paper formed the basis for the implementation of the climate change strategy. The National Development Plan of 2012 devotes the whole of chapter 5 to the conversion of the South African economy to a sustainable and equitable low- carbon economy. This was followed by the Long-Term Adaptation Scenarios Project in 2013. The South African government published draft mandatory GHG reporting and a proposed carbon tax bill in 2015, and included international commitments relating to a national GHG trajectory in the country's Intended Nationally Determined Contribution (INDC) submitted to the UNFCCC COP21 in Paris. The Paris Agreement was adopted in December 2015 at COP 21. South Africa ratified the Paris Agreement on November 1, 2016, and the agreement came into effect on November 4, 2016. The Agreement requires all Parties to submit a Nationally Determined Contribution (NDC). While South Africa's INDC will form the basis for the country's NDC, the NDC will need to be more ambitious.

South Africa has developed mandatory GHG reporting regulations to support three objectives:

- To inform policy formulation, implementation, and legislation;
- To meet the country's reporting obligations under the UNFCCC and instrument treaties to which it is bound; and
- To establish and maintain a National Greenhouse Gas inventory.

One of the inferred objectives of the mandatory GHG reporting regulations is to support the proposed carbon tax. The draft carbon tax bill published in November 2015 requires private companies to pay a carbon tax on direct emissions. The bill is linked to the direct emissions as calculated according to the National GHG Reporting Regulations. Although the proposed carbon tax bill allows for companies to calculate their emissions based on any of the three IPCC Tiers, the Tier 1 approach with default emission factors (EFs) will be provided as the calculation basis for all tax-paying entities.

3. Structure and Principles of the Technical Guidelines

Various principles were considered during the development of the Technical Guidelines; aspects such as terminology, verification, and sectoral classification needed to be addressed. Decisions were needed regarding the treatment of these principles in the South African *Technical Guidelines*. Where possible, the *Technical Guidelines* took direction on such principles from the *Draft National GHG Reporting Regulations*. The structure of the Technical Guidelines was also very important—a logical, concise structure was necessary to enable effective application within reporting companies.

3.1 Structure of the Technical Guidelines

The South African Technical Guidelines broadly consist of three main parts. The first part provides general guidance for all reporting companies and includes sections on:

- Commonalities and differences between the *IPCC Guidelines* and the corporate standard;
- Reporting sectors and thresholds;
- Reporting boundaries;
- General methodology explaining the tiered approach of the IPCC;
- Timeframes for reporting;
- Activity data and emission factors (EFs), including the process to update/suggest EFs specific to South Africa;
- Quality assurance and quality control; and
- Verification requirements.

The second part (Methodological Guidance) includes 31 sections, which provide activity-based, specific guidance to calculating emissions under the *Draft National GHG Reporting Regulations*. The activity-based sections include:

- Stationary combustion;
- Public Electricity Generation;
- Combined Heat and Power;
- Charcoal Production;
- The Oil and Gas Sector (including Petroleum Refining);
- Coal-to-liquids and Gas-to-liquids/ chemicals Processes;
- Aviation Industry;
- Water-borne Navigation;
- Railways;
- Coal Mining;
- Mining and Quarrying;
- Carbon Capture and Storage;
- Cement Production;

- Lime Production;
- Glass Production;
- Ammonia Production;
- Nitric Acid Production;
- Carbide Production;
- Titanium Dioxide Production;
- Soda Ash Production;
- Petrochemical and Carbon Black Production;
- Iron and Steel Production;
- Ferroalloys and Other Metals Production;
- Aluminum Production;
- Magnesium Production;
- Lead Production;
- Zinc Production;
- Pulp and Paper Industry;
- Solid Waste Sector;
- Wastewater Sector; and
- Hydrogen Production.

Most of the above sections were aligned with the *2006 IPCC Guidelines*. However, some activities, for example, hydrogen production, were allocated to new, specific South African codes that were not contained in the *2006 IPCC Guidelines*. Moreover, the petroleum refining IPCC category was expanded to cover the oil and gas sector to reflect the value chain and associated emissions.

A unique characteristic of the South African Titanium Dioxide industry includes the sale of natural rutile as well as high-purity iron. This required revisions of the calculation methodology in the Technical Guidelines to account for process emissions only.

Sectors that are currently not active in South Africa are soda ash production, lead production, and zinc production. However, the South African Technical Guidelines include guidance on these sectors for the purpose of completeness, but these sections did not benefit from any comments or engagement.

During the development of the Technical Guidelines it became apparent that the sections were linked to activities, while the stakeholders were organized by sector. For example, the cement sector may have to report under more than one activity—such as stationary combustion, cement production, solid waste, and wastewater—depending on their emission streams.

Each activity-based section includes the following information:

- **IPCC classification:** This classification was presented in a table format to clarify the classification system, gases, and methodologies used by the IPCC (see table 1 for an example using iron and steel production). The aim of the table is to provide a quick overview of the reporting requirements for each specific activity. The activities were classified according to the following IPCC categories: Energy; Industrial Processes and Product Use (IPPU); Agriculture Forestry and Other Land Use (AFOLU); and Waste. Each activity was given an IPCC code under which emissions would have to be reported.
- **Methodology:** Tier 1, Tier 2, and Tier 3 methodological guidance is provided for each specific activity. In some instances, for example, hydrogen production, Tier 1 methodologies were not available and therefore only Tier 2 and Tier 3 methodologies are provided.

- **Activity data:** Guidance is provided pertaining to the specific activity data that would be required to complete Tier 1, Tier 2, and Tier 3 calculations.
- **Emission factors (EFs):** This includes reference to default IPCC EFs for Tier 1 calculations as well as South Africa–specific EFs for Tier 2 calculations.

TABLE 1. Example of Table Used in Each of the 31 Activity-Based Sections

Sector	Relevant IPCC Code/s	Definition	Relevant IPCC Gases	Tier	Methodology reference	Transitional arrangement applicability
Example: Iron and Steel Production	Energy 1A2a	Fuel combustion activities in the iron and steel sector.	CO_2	2 or 3	Cross reference with the stationary combustion section of the Technical Guidelines.	Yes, option to report on Tier 1 for the first 5 years.
			CH_4	1, 2, or 3		No
			N_2O	1, 2, or 3		No
	Energy 1A1ci	Emissions arising from fuel combustion to produce coke, brown coal briquettes and patent fuel.	CO_2	2 or 3		Yes, option to report on Tier 1 for the first 5 years.
			CH_4	1, 2, or 3		No
			N_2O	1, 2, or 3		No
	Energy 1B1c	Fugitive emissions from Coke production	CO_2	2 or 3	Cross reference with the Iron and Steel Production section of the Technical Guidelines.	Yes, option to report on Tier 1 for the first 5 years.
			CH_4	1, 2, or 3		No
	Industrial Processes and Product Uses 2C1	Iron and steel production process emissions.	CO_2	2 or 3		Yes, option to report on Tier 1 for the first 5 years.
			CH_4	1, 2, or 3		No

The third part of the Technical Guidelines comprises several annexes. The annexes cover EFs, net calorific values, basic information on units, global warming potentials, as well as the IPCC source codes and definitions. EF tables are provided for stationary combustion, fugitive emissions, and Industrial Processes and Product Use (IPPU).

3.2 GHG Reporting in South Africa

The development of the Technical Guidelines for GHG reporting in South Arica involved extensive stakeholder consultation. This process of engaging all identified stakeholders highlighted the

challenges associated with the complexity of the principles of GHG accounting and reporting. Almost all the stakeholders consulted had previous experience with GHG emissions calculation and reporting. However, these experiences had been gained from different perspectives. Companies that had reported extensively on a corporate level found it challenging to understand GHG reporting in the context of national reporting. Similarly, departments that had somehow been involved in national reporting found it difficult to understand the concerns that private sector and industry had regarding capacity and mandatory reporting experience.

With this in mind, it is important to clearly articulate the differences between the principles of GHG accounting at the different levels.

3.2.1 National Level

South Africa has been reporting its national inventory using the *2006 IPCC Guidelines*. The latter provide methodologies for estimating national inventories of anthropogenic GHG emission sources and sinks. They were prepared in response to a request by the UNFCCC. Countries that are parties to the UNFCCC use the *2006 IPCC Guidelines* to prepare their national inventories. The Guidelines provide the basic steps of inventory development and offer general guidance on GHG emissions and removals estimates based on the participating country's understanding. In addition, the Guidelines provide specific guidance on a sectoral basis.

The calculation of national GHG inventories supports the international agreement under the UNFCCC and the Kyoto Protocol. South Africa signed the UNFCCC in 1998 and ratified the Kyoto Protocol in 2002. South Africa's commitment to reducing GHG emissions was represented in the INDC that formed part of the 2015 Paris Agreement. The country signed the Paris Agreement on April 22, 2016.

GHG inventory reporting in South Africa is the responsibility of the Department of Environmental Affairs (DEA) – Directorate of Change Information. The country calculated its first GHG inventory in 1998, using 1990 data. Subsequent inventories retrospectively covered the period 2000–10. The latest national GHG inventory (for 2012) was recently published for public comment. This inventory will be followed by third- party/independent review. It will also be reviewed by the National Committee on Climate Change and the Intergovernmental Committee on Climate Change, and subsequently be sent to the Ministerial Technical Committee (MINTECH) and the Ministerial Political Committee (MINMEC). Finally, cabinet clusters will review the inventory before it is submitted for parliamentary approval.

Input for the various inventories is obtained from other line departments such as the Department of Energy (e.g., energy balances), or through direct requests from key industry associations. The key industries that have supported the national GHG inventory process to date include the cement, steel, ferroalloy, and petrochemical industries. The contribution of the industrial sector to the national GHG inventory was made on a voluntary basis and had no legal implications for the sector as a whole or for individual companies. The data requested by the DEA supported Tier 1 calculations of industry GHG emissions, based on annual production data. Tier 2 and tier 3 methodologies

were developed for the aluminum, coal mining, coal-to-Liquids/gas-to-Liquids, power generation, and iron and steel sectors. As a result, the calculation of South Africa's 2010 inventory was based on a combination of Tier 1, 2, and 3 methodologies. While the regulatory infrastructure for data collection is well-developed in terms of mandates, its implementation is often hampered by lack of capacity within government and the associated costs.

Data collection and reporting to inform the national inventory in the country takes place in the context of strict competition regulations. These regulations dictate that data and information may only be placed in the public domain if this does not:

- Promote unfair competition according to the competition legislation;
- Contravene provisions of the Promotion of Access to Information Act; and
- Contravene provisions of the Statistics Act.

Various monitoring, reporting, and verification processes have been put in place to track the National GHG Inventory more frequently, with the aim of improving the quality and accuracy of that inventory. Many initiatives are currently under way to improve the quality of the South African National GHG Inventory. These initiatives are financially supported through donor funding and are in various stages of implementation (DEA, 2015). Initiatives include projects in three main categories:

- Projects to improve EFs relating to CO_2, CH_4, and N_2O emissions for:
    - Electricity generation
    - Ferrochrome production
    - Aluminum production
    - Transport sector
    - Coal mining
    - Fugitive emissions from processing of fuels in coal-to-liquid or gas-to-liquid facilities
- Projects to mprove national activity data for:
    - Hydrofluorocarbon (HFC) consumption
    - Waste sector
    - Economy-wide fuel consumption
    - National land cover maps
    - Collection of crop management data for various agricultural crops
- Projects to improve methodologies for:
    - National GHG reporting system
    - Reporting guidelines.

Improving the quality of the National GHG Inventory is an important aspect that could be considered when developing technical guidelines for reporting. Technical guidelines should provide a consistent format for providing emission calculation methodologies and EFs in a country. Therefore, as the methodologies or EFs are improved, the Technical Guidelines will need to be updated.

3.2.2 Corporate Level

Globally, various standards and protocols provide clarity and consistency for the quantification, monitoring, reporting, and verification of GHG emissions and/or removals for corporates. These standards or protocols are either used independently or in combination, depending on the reporting requirements.

The World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) published the *GHG Protocol Corporate Standard* in 2001. Corporate entities in South Africa have been calculating GHG emissions inventories (carbon footprints) and removals against standards and guidelines since the publication of the ISO 14064 standards in 2006 (box 1) and the subsequent guidance provided in the *GHG Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)*. Corporate GHG inventories have been developed on a voluntary basis, typically by large listed companies.

The ISO 14064 standards have been adopted in numerous countries around the world, including South Africa. In South Africa these standards are used voluntarily—at the request of shareholders or environmental interest groups seeking GHG information. Listed companies, large GHG emitters, and companies that deal directly with the public collect the necessary data and compile GHG inventories. These companies typically also report on wider sustainability metrics, including GHGs, through the Global Reporting Initiative (GRI). Smaller emitters or companies that primarily have a local business-to-business interface have no need or incentive to collect data or calculate a GHG inventory.

Some South African companies started publicly disclosing GHG emissions data back in 2002. This was the result of the inclusion of GHG reporting requirements under the GRI environmental indicator 8 (EN8). By 2006, 45 percent of the companies listed on the Johannesburg Stock Exchange (JSE) reported to the GRI and, by 2011, this figure had increased to 97 percent. Currently, the gases monitored under indicator EN8 include CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6. Companies are required to report separate subtotals for each gas in tonnes[3] and in tonnes of CO_2 equivalent for direct emissions from sources owned or controlled by the company, as well as for indirect emissions from imported electricity heat or steam. Companies reporting under the GRI have to calculate emissions in accordance with the WRI-WBCSD *Greenhouse Gas Protocol: Corporate Accounting and Reporting Standard*.

The Carbon Disclosure Project (CDP) is a voluntary reporting platform for the world's largest companies. The initiative is supported by 822 institutional investors with almost US$100 trillion worth of assets under management. It requires reporting companies to disclose their GHG emissions along with other information such as its governance of climate risks and opportunities to a high level of detail. In 2015, over 3,000 companies globally submitted data to the CDP. The quality of the reporting is very high, as over 50 percent of these companies scored above 96 percent for disclosure in the CDP's evaluation of the submissions. The CDP is the world's largest database of GHG emissions data. By 2015, energy use data, accounting for 26 percent of global anthropogenic GHG emissions, were being reported.

3 A *tonne* refers to a metric ton.

BOX 1. Benefits and Purpose of Quantifying Emissions According to ISO 14064

ISO 14064 benefits organizations, governments, project proponents, and stakeholders worldwide by providing clarity and consistency for quantifying, monitoring, reporting, and validating or verifying GHG inventories or projects. Specifically, the use of ISO 14064 standards can:

- Enhance the environmental integrity of GHG quantification;
- Enhance the credibility, consistency, and transparency of GHG quantification, monitoring and reporting, including GHG project emission reductions and removal enhancements;
- Facilitate the development and implementation of an organization's GHG management strategies and plans;
- Facilitate the development and implementation of GHG projects;
- Facilitate the ability to track performance and progress in the reduction of GHG emissions and/or increase in GHG removals; and
- Facilitate the crediting and trade of GHG emission reductions or removal enhancements.

Users of ISO 14064 may benefit from some of the following applications:

- *Corporate risk management*: for example, the identification and management of risks and opportunities;
- *Voluntary initiatives*: for example, participation in voluntary GHG registry or reporting initiatives as disclosure programs concerning b2b (business to business) or b2c (business to consumers) matters;
- *GHG markets*: for example, the buying and selling of GHG allowances or credits;
- *Regulatory/government reporting*: for example, credit for early action, negotiated agreements or national reporting programs.

Source: International Organization for Standardization (ISO). 2006. *Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*. ISO 14064-1:2006. ISBN: 0-626-17979-3.

The CDP was introduced to South Africa in 2007, when the top 40 JSE companies were invited to participate. The sample size was increased to the top 100 companies in 2008. By 2015, an additional 17 companies not listed in the JSE top 100 had started participating at their own request. The response rate of South African companies is the second highest in the world, after that of the European Union. The historic response rate is shown in figure 4.

FIGURE 4. Response Rate of South African Top 100 JSE-Listed Companies to CDP

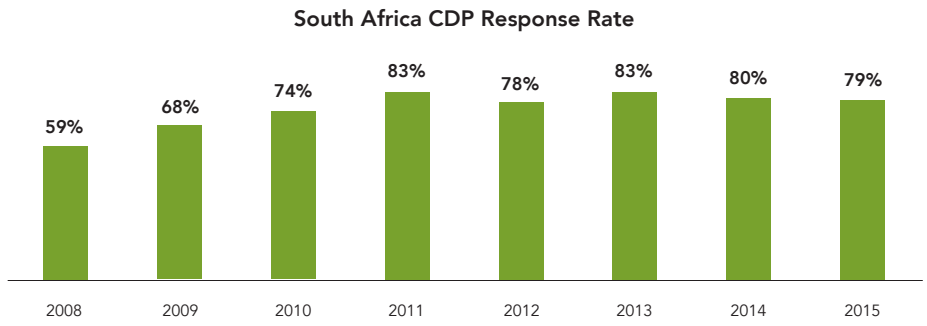


Figure 5 shows the consolidated history of CDP reporting for South Africa. CDP reports are used internally by participating companies to benchmark their climate change performance with peers.

FIGURE 5. South African CDP Reports

Corporate GHG reporting through the CDP is a voluntary process that showcases best practice within business. However, best practices derived from a *voluntary* system should not be used as the basis for the development of national *mandatory* GHG emissions reporting. This is especially important because the methodologies used could vary and the results might thus be misleading. The companies required to report under the mandatory reporting regulations cover CDP participants as well as independent, non-listed entities. The development of GHG reporting in companies that participate in voluntary disclosure has matured over the last 8 years.

3.2.3 Product Level

Companies have increasingly been reporting the emissions associated with the manufacturing of their products. Product GHG reporting differs from corporate GHG reporting because the emissions associated with a product can span more than one company or country, as the full life cycle of the product is assessed.

One example of a standard for the calculation of product carbon footprints is PAS2050: *Specification for the assessment of the life cycle greenhouse gas emissions for goods and services*, published by

the British Standards Institution (BSI) in 2011. It offers organizations a method to deliver improved understanding of the GHG emissions arising from supply chains, its primary objective being to provide a common basis for GHG emissions quantification that will inform and enable GHG emission reduction programs.

ISO/TS 14067 *Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication* was published in 2013. The standard has not been adopted in South Africa as it is only a Technical Specification. However, South Africa is actively participating in the development of ISO 14067, which is expected to be published in 2018.

3.3 Terminology

GHG reporting definitions often differ, depending on the context in which they are used. The stakeholder consultation process followed in this project highlighted that a common understanding of terminology is important when developing a technical guideline. It is therefore imperative to clearly articulate the differences in terminology used at the different levels of GHG accounting. Examples of differences in meaning and non-alignment of terminology at different levels of accounting include the definitions used for indirect emissions, boundaries, conservativeness, default values, and imports and exports.

Table 2 highlights the terminology differences in the various approaches to calculating and reporting GHG emissions.

TABLE 2. Comparison of Approaches for Calculating GHG Emissions for National GHG Inventories and for Corporate GHG Inventories

Definitions used	National GHG reporting[a]	Corporate GHG reporting[b]
Direct/Indirect emissions	Direct emissions in national GHG reporting, according to the IPCC, refer to the sum of the emissions of the Kyoto- specified GHGs emitted within the boundary of the country. The use of the term indirect emissions in national reporting relates to precursors of GHGs. These include CO, N_2O, and volatile organic carbon compounds (VOCs). The latter refer to gases that can convert to GHGs when they are released into the atmosphere. Emissions of these precursor gases are calculated according to special methodologies listed in chapter 7 of the *2006 IPCC Guidelines*. The *IPCC Guidelines* do not account for emissions associated with, for example, electricity imported from another country.	Direct GHG emissions, according to ISO 14064, refer to emissions from sources that are owned or controlled by the reporting company. Indirect GHG emissions refer to emissions that are a consequence of the operations of the reporting company, but occur at sources owned or controlled by another company. For example, emissions associated with the consumption of grid electricity are classified as energy indirect emissions.

Definitions used	National GHG reporting[a]	Corporate GHG reporting[b]
Precursor gases	Gases such as carbon monoxide (CO), oxides of nitrogen (NO_x), non-methane volatile organic compounds (NMVOCs), and sulphur dioxide (SO^2) can be converted to GHGs in the atmosphere. Chapter 7 of the *2006 IPCC Guidelines* provides guidelines for the calculation of the volume of these gases.	Companies that report emissions under the principles of the GHG Protocol Corporate Standard conservatively assume that fuel combustion is complete. Any precursor gases such as CO are therefore assumed to be fully converted to CO_2, and reported as such. Companies do not report NO_x, NMVOCs, and SO_2 in their GHG inventories.
Boundaries	The country is the only relevant boundary and intercountry movement is not accounted for. The *IPCC Guidelines* do not make any provision for the determination of corporate boundaries.	Only GHG emissions from owned or controlled operations are included as direct emissions. Emissions associated with the production of energy (electricity and heat) purchased by a company are reported as energy indirect emissions. Downstream use in the value chain or upstream emissions in raw material components are accounted for as indirect emissions.
Conservativeness	The IPCC provides conservative guidance that would be applicable to most countries. Reporting on a Tier 1 or Tier 2 level provides less accurate estimates than reporting on a Tier 3 level. International review would confirm the appropriateness of the values chosen.	Companies can build their GHG inventory on accurate activity data and conservative emission factors. The accuracy of the results provides the basis for commercial decision making of the journey to the low- carbon economy. Under the CDP, companies can obtain a higher score for verification with an assurance statement.
Default values	The IPCC provides a wide range of default factors. The IPCC default factors are appropriate for the estimation of national inventories in cases where all the emissions associated with a specific activity are calculated using the default factor. South Africa is a developing country and a range of conservative values are available. The IPCC, in some cases, provides Geographic Adjustment Factors for different countries; for example, the carbon black calculation includes a Geographic Adjustment Factor of 130 percent.	The GHG Protocol Corporate Standard requires that companies use appropriate emission factors. Many companies use technology-specific emission factors from a variety of sources including the IPCC, the U.K. Department of Environment, Food, and Rural Affairs (DEFRA), and their own calculations. The appropriateness of the emission factors used in the calculation is reviewed during the verification of the calculation.
Carbon credits sold	Currently, the National Inventory does not take sold emission reductions into account. In the future, Article 6 of the Paris Agreement will allow common accounting.	Companies may decide to disclose carbon credits sold transparently, but this is not mandatory.
Imports and exports	The overall national GHG inventory reflects only emissions within the country. For the cement sector, the IPCC prescribes that the emissions calculated should correct for imports and exports of clinker. The guidance states that emissions from the production of imported clinker should not be included in national emissions estimates as these emissions were produced and accounted for in another country. In the same sense, emissions from clinker that is ultimately exported should be factored into national estimates of the country where the clinker was produced.	A company should report all direct emissions associated with a production facility. Large listed companies may have production facilities in more than one country. Emissions associated with the consumption of products in a country other than the country where the products were produced, are not deducted.

Note: a. National GHG reporting under the United Nations Framework Convention on Climate Change.
b. Corporate GHG reporting under ISO 14064-1 and *The GHG Protocol – A Corporate Accounting and Reporting Standard.*

3.4 Sectoral Classification of GHG Emissions

Sectoral classification is important for both identifying the companies required to report under national mandatory reporting and providing sector-specific guidance on how to calculate GHG emissions.

3.4.1 Sectoral classification system

In designing the South African Technical Guidelines, the selection of a sectoral classification system to base the guidance on was an important consideration. Sectoral classifications of GHG emissions are important for several reasons, for instance, for obtaining activity data and for identifying suitable carbon auditors.

Four major sectoral classification systems are currently being used in South Africa:

- National GHG Inventory
- Standard Industrial Classification (SIC)
- Investor Driven Initiatives such as the Johannesburg Stock Exchange (JSE)
- UNFCCC Clean Development Mechanism (CDM)

The National GHG Inventory is calculated based on the *2006 IPCC Guidelines*, which divide emission sources into four broad categories: (i) Energy; (ii) Industrial Processes and Product Use (IPPU); (iii) Agriculture, Forestry and Other Land Use (AFOLU); and (iv) Waste. The classification system used in the *Technical Guidelines* followed the *Draft National GHG Reporting Regulations*, which are based on the *2006 IPCC Guidelines*. The *Draft Regulations* are based on the *2006 IPCC Guidelines* to ensure they align with the National GHG Inventory. South Africa has also based its Draft Carbon Tax Bill on the *2006 IPCC Guidelines*.

Some South African government departments, including the Department of Trade and Industry, the Department of Energy, and Statistics South Africa, classify the South African economy according to the Standard Industrial Classification Codes (SIC). Last year, the Department of Energy published draft energy reporting regulations based on 5th Generation SIC codes. The SIC classification is based on the following 10 main activities:

- Agriculture, Forestry and Fishing
- Mining and Quarrying
- Construction
- Manufacturing
- Transportation and Public Utilities
- Wholesale Trade
- Retail Trade
- Finance, Insurance and Real Estate
- Services
- Public Administration

Investor-driven initiatives such as the CDP align their sectoral classification with the JSE and the Global Industry Classification Standard (GICS), which also identifies ten sectors:

- Energy
- Materials
- Industrials
- Consumer Discretionary
- Consumer Staples
- Health Care
- Financials
- Information Technology
- Telecommunication Services
- Utilities

The UNFCCC Clean Development Mechanism (CDM) classifies sectors in line with 15 scopes stipulated by Annex A of the Kyoto Protocol. Sectoral scopes 1–9 are linked to industrial sectors while scopes 10–13 are based on sources of GHG emissions. These scopes are used both for classifying emission reduction projects and for accreditation of carbon auditors. There is partial alignment between CDM scopes and the 2006 IPCC Guidelines' categories. The sectoral scopes are the following:

1. Energy industries (renewable/non-renewable sources)
2. Energy distribution
3. Energy demand
4. Manufacturing industries
5. Chemical industries
6. Construction
7. Transport
8. Mining/mineral production
9. Metal production
10. Fugitive emissions from fuels (solid, oil, and gas)
11. Fugitive emissions from halocarbons and sulphur hexafluoride
12. Solvent use
13. Waste handling and disposal
14. Afforestation and reforestation
15. Agriculture

A recent addition from DEA is the request to report under the Harmonized Commodity Description and Coding System when reporting emissions to the National Atmospheric Emission Inventory System (NAEIS). Data providers will be requested to include the harmonized system code that is relevant to their activities.

Each sectoral classification used in South Africa has been developed with a specific function in mind, and these functions differ between uses. Alignment of sectoral classifications can be beneficial for national and international policy alignment and tracking of progress. For example, if both energy and GHG were reported on using the same sectoral classifications, then comparisons could be drawn between energy consumption and the associated GHG emissions. However, when aligning sectoral classifications, one should be mindful of the multiple functions that the collected data would need to fulfil. Alignment would also reduce the reporting burden for companies as well as support the analysis and use of the data by other departments. Companies typically use IT

reporting platforms for data collection. These reporting platforms are complex and often aligned with corporate reporting requirements. It can be costly to make changes to these platforms to accommodate new reporting formats.

3.4.2 Sector-based guidance for GHG calculations and reporting

The *South African Technical Guidelines* are not the first to provide sector- or activity-based guidance on GHG calculations and emissions reporting for South African companies.

Large emitting companies, with operations across various jurisdictions worldwide, prefer consistency in reporting to assist in interpretations and benchmarking. Industries such as cement, steel, aluminum, and chemicals have developed sophisticated tools and calculations under the World Business Council for Sustainable Development (WBCSD). These tools provide default EFs and specify the boundaries of reporting for each of the industries. Continuous improvement and refinement of these sector-specific tools not only provide greater accuracy but also promote improved data collection, calculation methods, and transparency.

An example of the data improvement efforts is the "Getting the Numbers Right" (GNR) initiative of the cement sector. GNR is a voluntary, independently managed database of CO_2 and energy performance information on the global cement industry. The database delivers uniform, accurate, and verified data so the industry can understand its own current and future performance potential. Key drivers of emissions and performance are also included. The database also provides policy makers with current performance data to aid their analysis and decisions. All South African–based cement companies participate in this initiative or use the calculation methods for benchmarking purposes.

Similarly, the South African iron and steel industries have been participating in and calculating GHG inventories in accordance with international, peer-reviewed calculation methodologies. These cover not only *production*-related emissions but the whole product life cycle—in support of progress toward a circular economy.

Both the cement and iron and steel industries in South Africa are good examples that show a high level of maturity in GHG calculations and emissions reporting. Several companies within these industries are already calculating their GHG emissions on a mass balance approach,[4] which will prepare them for the Tier 3 methodology prescribed in the *Technical Guidelines*.

3.5 Verification of GHG Emissions

The ISO 14064 Part 3 standard (*Specification with guidance for the validation and verification of greenhouse gas assertions*) deals with the verification of GHG emission reduction calculation and disclosure. The standard was adopted by the South African Bureau of Standards in 2008. It was,

4 The *mass balance approach* generally measures the carbon exiting the process through products and entering the process through feedstocks, calculates the difference between these two values, and assumes that unaccounted for carbon is either directly released or oxidized and released as CO_2

however, only the ambition of companies to further improve their CDP disclosure and performance scores that accounted for the widescale adoption of verification through assurance statements in 2012. The latter require compliance against a range of verification protocols, but the CDP does not require the verifiers or the verification team to be accredited at this stage.

The proposed trading of carbon offset credits against the proposed carbon tax provided the basis for the South African Accreditation Services (SANAS) to develop an accreditation program for verifiers under ISO 14065 (*Greenhouse gases – Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition*) in 2013. The delay in the implementation of the carbon tax and offset scheme has resulted in several enquiries for entities to become accredited verifiers, but to date no accreditation has been processed or granted. If companies submit unverified data for carbon tax calculations, they run the risk of being required to pay carbon tax based on data that may be flawed. It is therefore expected that most companies will submit verified emissions data on which their carbon tax will be based.

The carbon credit market, especially the CDM, generated validation and verification initiatives to cater to more than 7,500 registered projects worldwide, including 60 projects registered in South Africa. These validation and verification entities were accredited by the UNFCCC. Although most of these validators and verification entities operate internationally, two companies in South Africa—of which only Carbon Check remains operational—obtained the Designated Operational Entity status.

South Africa's *Draft National GHG Emission Reporting Regulations* state that DEA may verify and validate GHG information submitted by data providers, if the department believes the information is not transparent, complete, or correct. The *Technical Guidelines* state that verifiers from the department should be administratively independent of the data providers' operations to ensure objectivity and impartiality during the verification process. The *Technical Guidelines* were drafted with the understanding that data providers would incur all costs in connection with compliance in terms of verification.

4. From Voluntary to Mandatory GHG Reporting

Significant aspects that need to be considered when moving from voluntary to mandatory greenhouse gas (GHG) reporting are the following:

- Methods used to calculate emissions may differ between voluntary and mandatory GHG reporting; bridging the gap between different methods is important for data providers.
- The introduction of reporting thresholds for mandatory reporting is important, as it allows data providers to be organized by size.
- The specific structure of mandatory reporting requires a legal architecture and reporting platform to manage large amounts of data from various data providers.
- Regular reviews of mandatory GHG reporting programs are important to ensure methodologies and emission factors (EFs) are relevant to data providers.
- Reporting and accounting of emissions from mitigation initiatives.

4.1 Calculation Tools and Options

Both the national GHG inventory and the corporate GHG inventory processes are well established and supported by their respective institutional capacities in both the Department of Environmental Affairs (DEA) and the corporate sector.

The Intergovernmental Panel on Climate Change (IPCC) provides for a tiered approach to the calculation of emissions at the national level. The generic global default value is used on Tier 1, with company-specific emission factors (EFs) being used on Tier 3. Tier 2 is an intermediate approach, with country- or technology-specific default EFs being used. On a *country* level, such a Tier 1 approach is the simplest and provides a fair representation. However, on a *company* level, the technology, and in most cases the fuel sources, inputs, and outputs are well-known—mass balance calculations (Tier 3 approach) being a part of the process control.

South Africa's *Draft Regulations* allow companies (for specific activities and gases, in accordance with the Draft Regulations) to report on a Tier 1 level for the first 5 years, after which most companies should improve their reporting to Tier 2 or 3. Tier 2 or 3 calculations will promote the reporting of significantly different values than Tier 1, as the accuracy of emissions calculation is seen to increase from Tier 1 to Tier 3. Global default EFs can provide very different values because they do not consider the specific technologies, the age of the facilities, boundaries, and fuel sources. Therefore, global default EFs may not always be appropriate for South African companies.

Two examples of challenges with global default EFs in the South African context are:

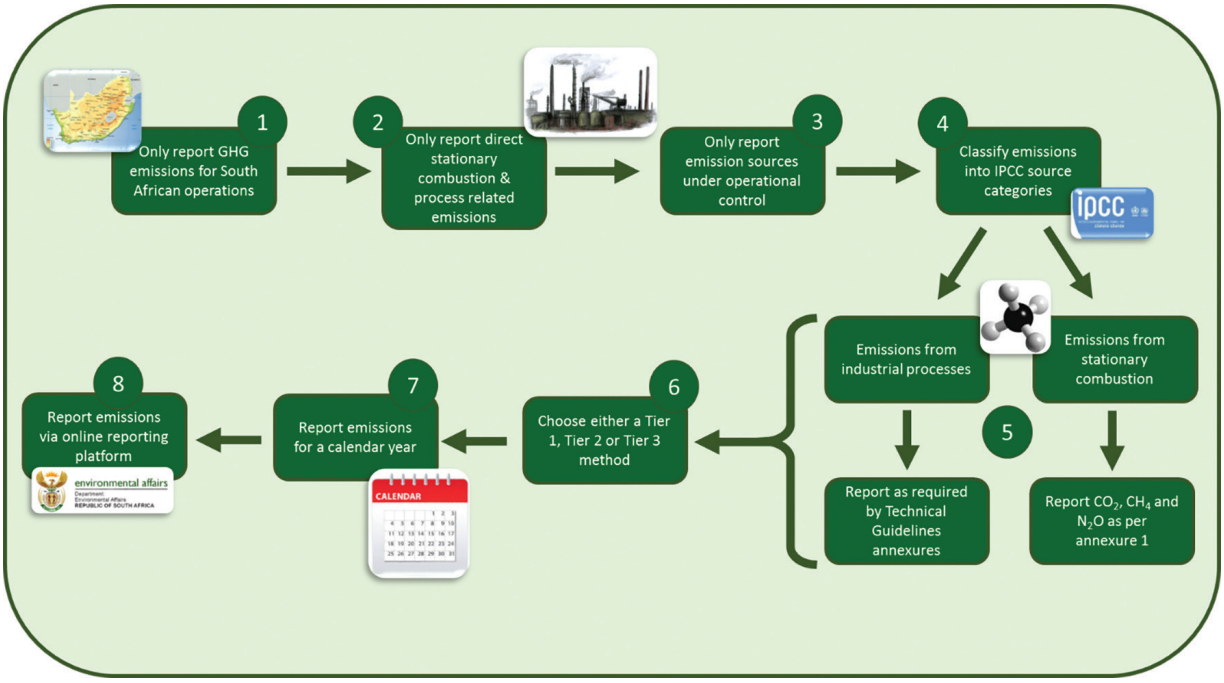
- The Tier 1 EF for ferrosilicon is based on the use of coal as a reductant. However, it is standard practice in South Africa to use wood-based charcoal as a reductant; this reduces the emissions from ferrosilicon production by 75 percent.
- The Tier 1 methodology for calculating emissions from ethylene production requires the use of a Geographic Adjustment Factor of 130 percent, which leads to the overestimation of emissions. The Geographic Adjustment Factor is applied to account for the regional variability in steam cracker operating efficiency.

The South African *GHG Reporting Regulations* address the above challenges by encouraging data providers to move toward a high tier method over a 5-year period.

Conversion of a company GHG inventory into a compliant inventory for mandatory reporting is a complex process (see figure 6, which applies to most companies). However, the procedure for cement companies would include an additional step: deducting import and export volumes prior to calculation. While the IPCC only provides guidance on deducting import and export volumes from the cement sector, it is worth considering other material sectors that have a high proportion of exported emissions such as steel.

Step 1 may be relatively simple for companies (data providers) to take because company GHG inventories are often calculated separately (by country) if a company has operations in more than one country. Company GHG inventories typically only report on significant emissions. A company's significant emissions may not necessarily align with the thresholds set by mandatory GHG reporting. Company GHG inventories are reported according to either financial or operational control. Thus, reporting companies that use *financial* control will need to adjust to *operational* control for mandatory GHG reporting. Classifying emissions according to the IPCC source categories is a new concept for many companies, especially where process and combustion emissions are generated in the same installation. Special consideration would be necessary when converting direct (scope 1) emissions from company GHG inventories to IPCC source categories. As to step 6, data providers have a period of 5 years during which Tier 1, 2, or 3 methods may be used. After this period, data providers are requested to move toward Tier 2 and 3 methods. Step 7 may pose a challenge for companies, as company GHG inventory reporting normally follows a company's specific financial year. Finally, some companies may be familiar with step 8, as they may have previously reported air quality emissions data to the online reporting platform (NAEIS).

FIGURE 6. Process Flow Diagram for Moving from Corporate GHG Reporting to Mandatory GHG Reporting



Note: IPCC = Intergovernmental Panel on Climate Change.

The *Draft Technical Guidelines* require that carbon dioxide, nitrous oxide, and methane be reported for stationary combustion to achieve completeness at the national reporting level. However, nitrous oxide and methane emissions from fossil fuel combustion are negligible and often below the detection limit of industry equipment. Reporting companies may be required to pay carbon tax on these emissions, which would be impractical as they can only be calculated on a Tier 1 approach.

The latest *Draft GHG Reporting Regulations and Technical Guidelines* include a process to revise EFs. This element will be key to avoiding underestimating and overestimating emissions, and thus the possibility of not paying carbon tax for actual emissions or paying carbon tax for non-existent emissions.

4.2 Legal Architecture and Reporting Platform

A robust legal architecture forms the basis of an effective reporting program. The legal architecture is important as it provides the legislation that mandates companies to report. It also provides rules and regulations that specify how the legislation should be implemented. The South African *Technical Guidelines* are being developed under the *National Greenhouse Gas Emission Reporting Regulations*. These regulations fall within the National Environmental Management: Air Quality Act of 2004 (AQA). However, the *Technical Guidelines* themselves are not a legislative instrument. This means that the Department of Environmental Affairs (DEA) is not mandated to undergo stakeholder

engagement for the *Technical Guidelines*; as a result, the latter can be easily updated. This was a concern for data providers because it implied the Technical Guidelines could be adjusted without consultation. Yet DEA reassured stakeholders that each update of the *Technical Guidelines* would be subject to stakeholder consultation. Discussions are ongoing regarding the publication of the *Technical Guidelines* as an official government document, through official processes, since it forms the basis of other regulations such as the carbon tax.

In addition to a robust legal architecture, a reporting platform must be developed to collect the data reported by companies. Internet-based emissions reporting is already a component of the South African Air Quality Information System, and is mandated under the existing AQA. The system is referred to as the National Atmospheric Emissions Inventory System (NAEIS). DEA plans to use NAEIS to collect data in accordance with the *Draft National GHG Emissions Reporting Regulations*. Ideally NAEIS should be adapted so that it aligns with the *South African Technical Guidelines*. Consideration also needs to be given to whether activity data or emissions or both should be reported through NAEIS. Companies may be less comfortable reporting activity data than reporting emissions.

4.3 Reporting Thresholds

Reporting programs need to take into account cost- and capacity-related constraints that affect the responding companies. Thresholds are often used to decide which companies are required to report, and aim to reduce the administrative costs for government and prevent smaller company's emissions from flooding the system.

The *South African Draft National GHG Reporting Regulations* and associated *Technical Guidelines* have reporting thresholds set for the different IPCC sectors. After the initial thresholds were published, several stakeholders requested that the thresholds be revised so that they would align with the draft energy reporting regulations. As a result, for most of the sectors, the threshold is based on a 10 MW thermal installation. However, specific thresholds have been included for other sectors—for instance, a 2 million litres/day threshold for domestic wastewater treatment and discharge, and a 4 million bricks/month threshold for brick manufacturing. If thresholds are particularly low for a given activity, this could entail unnecessary and unfair reporting burdens for some companies.

4.4 Review of Mandatory GHG Reporting Program

The mandatory reporting program consists of more than just the *Technical Guidelines*. It includes the *Draft GHG Reporting Regulations* as well the online reporting platform and the national GHG inventory.

For the *Technical Guidelines* to be effective and user-friendly, they will be revised on a regular basis to incorporate developments regarding industry-specific methodologies and EFs. The review process allows for the department to consider new objectives and improvements in methodological

guidance. In some cases it may be beneficial to include a *formal* review process in the reporting regulations that specifies *who* should conduct the review and *how* often this should be done.

The *Draft Regulations* make provision for a review process of the EFs. Therefore, if industry develops country- or site-specific EFs, these can then be submitted to DEA for formal review and inclusion in the *Technical Guidelines*. Site-specific EFs would typically be used on a Tier 2 level. Data providers have a grace period of 5 years before they are required to report on a Tier 2 or 3 level.

The formal process for continuous improvement of the mandatory GHG reporting program should maintain a certain level of consistency to allow companies to develop institutional capacity in meeting the regulatory requirements. Making frequent changes without due stakeholder consultation will not give the required certainty needed for companies to report.

4.5 Reporting and Accounting of Emissions from Mitigation Initiatives

Several internationally prescribed calculation methods for measuring, verifying, and reporting on mitigation initiatives exist. These include carbon credit standards such as the UNFCCC Clean Development Mechanism (CDM), the Verified Carbon Standard (VCS), and ISO 14064 Part 2. National GHG inventories use *2006 IPCC Guidelines* and do not consider carbon credit processes in the country. Under the Paris Agreement, allowance is made for the use of internationally transferred mitigation outcomes toward Nationally Determined Contributions (NDCs) to ensure double counting is avoided. Furthermore, the Paris Agreement states that emission reductions resulting from mitigation initiatives shall not be used to demonstrate achievement of a country's NDC if these emission reductions have already been used by another country. The Paris Agreement encourages countries to incentivize and facilitate participation in mitigation initiatives by both public and private entities.

5. Pilot Studies on Application of Draft Technical Guidelines in South Africa

The primary purpose of conducting the pilot test of the South African *Technical Guidelines* was to understand the readiness of companies to report, and to determine if the *Technical Guidelines* were robust enough for mandatory reporting. The pilot test also allowed the authors of the *Technical Guidelines* to understand what methodologies companies are currently using to report emissions, and to determine whether these methodologies align with Tier 1, Tier 2, or Tier 3. The latter element also looked at the readiness of companies to move to higher tier methods. Moreover, reporting thresholds were assessed during the pilot test, to determine if companies were comfortable with the level at which thresholds had been set. Finally, the pilot test highlighted areas in which the department could possibly provide more support to responding companies.

Due consideration was given to the selection of companies for participation in the pilot test. Owing to time and financial constraints, only two companies were chosen to take part in the pilot test for the South African *Technical Guidelines*—one company that has no experience whatsoever in GHG reporting and a mature GHG reporting company.

The carbon black manufacturing industry has no historical GHG baseline or experience in calculating and reporting GHG emissions. On the other hand, the cement industry has a history of *voluntary* reporting, with complex but mature GHG inventories over several years aligned with international best practice. In addition to the two case studies, company and national reporting on emissions from biofuels were compared.

Companies were willing to participate as long as the case studies did not mention actual emissions data, as these can be linked to activity data. The competition law in South Africa is strict and sharing activity data may actually be classified as anticompetitive behavior. This potential issue was resolved by using percentages (rather than absolute figures) to give an indication of the difference in emissions calculations between Tier 1, Tier 2, and Tier 3.

5.1 Industry Pilot Study Analysis

Boxes 1 and 2 discuss the challenges encountered and valuable lessons learned during the two pilot studies introduced above.

BOX 2. Carbon Black Industry Pilot Study

South Africa's carbon black manufacturing industry comprises only one carbon black producer, which supports the automotive and tire manufacturing industry. The local tire industry also imports a portion of its carbon black. This is a small manufacturer in South Africa that is not listed on the Johannesburg Stock Exchange. However, it is part of a global group that is listed on the New York Stock Exchange. This manufacturer does not participate in the Carbon Disclosure Project (CDP).

This carbon black manufacturer has been operating in South Africa since 1959 and makes use of the furnace black process technology. Currently, the feedstock (Heavy Fuel Oil) is imported. In the context of South Africa's development plan and support of small businesses, this carbon black company currently supplies steam to the local municipality sewage works, a dry cleaner, and a catalytic converter plant. The nature of the business requires air quality permits and associated monitoring and reporting, though this is limited to the measuring and reporting of particulate matter (PM), polycyclic aromatic hydrocarbons (PAH), sulphur oxides (SO_X), nitrous oxides (NO_X), carbon monoxide (CO), and sulphur dioxide (SO_2).

The direct emissions can be calculated in accordance with the *2006 IPCC Guidelines* on all three Tiers. The Tier 3 calculation estimates the highest emissions, followed by Tier 2, and the lowest emissions estimate is Tier 1. The Tier 3 methodology overestimates emissions because it does not deduct the emissions that are incorporated into the carbon black product.

This carbon black manufacturer would typically need to report emissions under two different categories of the *Technical Guidelines*:

- Stationary combustion (fossil such as HFO); and
- Petrochemical and Carbon Black Production.

One of the methodological lessons that emerged from this pilot study concerns the appropriateness of country adjustment emission factors for mandatory reporting. Country adjustment factors such as the Geographic Adjustment Factor in fact seem to penalize South African companies, and thus their inclusion in the *Technical Guidelines* should be reassessed.

The activity data are generally available to perform emissions calculations. However, challenges remain in selecting the boundary for emissions associated with joint infrastructure. The carbon black manufacturer has partial ownership of a boiler (offsite—used to facilitate transport of raw materials to the production facility).

BOX 3. Cement Industry Pilot Study

South Africa's cement industry is represented by the Association of Cementitious Material Producers. A widely used tool to calculate GHG emissions in the industry is the World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative Tool (http://www.ghgprotocol.org/calculation-tools/cement-sector). The WBCSD tool for cement is based on the *1996 IPCC Guidelines*, which would need to be updated to the *2006 IPCC Guidelines* to align with the *Technical Guidelines*. In 2012, South African cement companies participated in the Cement Sustainability Initiative "Getting the Numbers Right" (GNR), which was a voluntary, independently managed database of CO_2 and energy performance information on the global cement industry.

For the *GHG National Inventory*, the cement industry has been collating some activity-based data as and when requested. These data only represented historical data and are not publicly available, to avoid any concerns about anticompetitive behavior.

Half of the direct emissions in the cement industry are derived from the production of clinker. In the Tier 1 method, emissions are based on clinker production estimates inferred from cement production data, correcting for imports and exports of clinker. The IPCC specifies that emissions from the production of imported clinker should not be included in national emissions estimates, as these emissions are produced and accounted for in another country. Similarly, exports are deducted.

Tier 2 links more closely with the WBCSD tool calculation, as emissions are estimated *directly* from clinker production data (rather than clinker production inferred from cement production), together with a national or default emission factor (EF). The default calcination EF (corrected for CaO and MgO imports) is 525 kg CO_2/ton clinker, according to the WBCSD tool. This cement company makes use of tires as a fuel alternative for coal. The EF of tires is 85 kg CO_2/GJ, according the WBCSD tool, while the IPCC's EF for coal is 96 kg CO_2/GJ, that is, almost 13 percent higher. To avoid overestimation, the cement companies would need to calculate their emissions from tires on a Tier 3 level, considering the carbon content of tires.

The Tier 3 approach relies on plant-specific data. Both Tier 2 and Tier 3 include a correction for Cement Kiln Dust (CKD).

A cement company would typically need to report emissions under three different categories of the *Technical Guidelines*:

- Stationary combustion (fossil or alternative fuels such as tires);
- Cement production process emissions; and
- Mining and quarrying of the raw material.

One of the methodological lessons learned was that the *Technical Guidelines* prescribe that emissions associated with the exporting of the product should be deducted. However, for national reporting purposes, doing so would result in the company's actual emissions not being accurately reflected.

The activity data are generally available to calculate emissions. However, the specific breakdown into the above three categories may initially be difficult.

5.2 Estimating GHG Emissions from Biofuels

The way in which the GHG emissions associated with the combustion of biofuels are reported, differs between reporting programs. In the combustion of fossil fuel–based diesel, the associated GHG emissions are accounted as direct emissions of about 2.6 $kgCO_2$/litre of diesel combusted.

Biofuels are fuels that are generated from a biomass feedstock and can be used as a substitute for conventional fuels produced from fossil origins. Biomass can be a sustainable renewable resource to produce fuels if the whole value chain is managed appropriately. However, there is international controversy surrounding biofuels linked to unsustainable agricultural practices and a concern related to food security and agricultural subsidies.

The *Biofuels Industrial Strategy* of the Republic of South Africa was first published by the Department of Minerals and Energy in 2007. This strategy outlines the government's approach to policy, regulations, and incentives with respect to biofuels. The *Biofuels Strategy* promotes the blending of biofuels in both gasoline and diesel production. In line with this strategy, the Department of Energy promulgated the *Regulations Regarding the Mandatory Blending of Biofuels with Petrol and Diesel* to regulate the mandatory blending of bio-ethanol or biodiesel with petroleum gasoline or petroleum diesel respectively, to produce a biofuel blend that may be sold in South Africa. On September 30, 2013, the Minister of Energy released a media statement announcing that the *Regulations on Mandatory Blending* would be effective from October 1, 2015.

Although biodiesel can be derived from a sustainable, renewable resource, it is not considered carbon-neutral by the Intergovernmental Panel on Climate Change (IPCC) for the following reasons:

- The harvesting and regrowth of bioenergy crops can result in carbon dioxide (CO_2) emissions and removals;
- Land use changes caused by biomass production can result in GHG fluxes;
- Additional emissions that are estimated and reported in the sectors where they occur:
    - Processing and transportation of the biomass;
    - Direct methane and nitrous oxide emissions from the biomass combustion;
    - Production and use of fertilizers and liming if used in the cultivation of biomass.

The IPCC and the U.K. Department for Environment, Food and Rural Affairs (DEFRA), in line with the GHG Protocol, both provide guidance on how to accurately report the emissions from biodiesel.

On a *national* level, the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* state that CO_2 emissions from biodiesel combustion must be excluded from total energy sector emissions and should be clearly reported as a memo item within the energy sector. This method avoids double counting in the national inventory, as CO2 emissions and removals from the use of biomass for energy (including biofuel) are included in the Agriculture, Forestry and Other Land Use (AFOLU) sector. The *South African Technical Guidelines* align with the *2006 IPCC Guidelines*, stating that CO_2 emissions from biomass fuels are to be reported separately and should not be included in the sector totals.

At a *company* level, according to the DEFRA guidance, the CO_2 emissions from burning of biofuels should be accounted for as *outside of scopes* (not scope 1, 2, or 3[5]). This is justified mainly by the fact that the CO_2 emissions released through the combustion of biofuels are broadly determined to have a net value of zero, since the fuel source itself absorbs the equivalent amount of CO_2 during the growth phase.

Table 3 specifies the Emission Factors (EFs) for biodiesel, according to the IPCC and the U.K. DEFRA, compared to the EFs for fossil fuel–based diesel.

TABLE 3. Emission Sources and Factors for Biodiesel and Fossil Fuel–Based Diesel According to IPCC and the U.K. DEFRA

Emission source	Emission Factor ($kgCO_2e$/litre)		Where to report this	
	DEFRA	IPCC	Company inventory	National inventory
CH_4 and NO_x emissions associated with the combustion of biodiesel	0.0195	1.6–2.6[a]	Direct emissions	Outside of total direct emissions (memo item)
CO_2 emissions associated with the combustion of biodiesel	2.4921		Outside of total direct emissions	Outside of total direct emissions (memo item)
Biodiesel indirect (scope 3 or well-to-tank) emissions from extraction, refining, and transportation	0.5464		Other indirect emissions	If in South Africa, it will be included in the AFOLU sector for agriculture, and the Energy sector for processing and transport.
All GHG emissions associated with the combustion of fossil fuel–based diesel	2.6024	2.67	Direct emissions	Mainly the Transport sector.
Fossil fuel–based diesel indirect (scope 3 or well-to-tank) emissions from extraction, refining, and transportation	0.5785		Other indirect emissions	If in South Africa, it will be included in the Energy sector or the Industrial Process and Product Use sector.

Note: AFOLU = Agriculture, Forestry and Other Land Use; DEFRA = Department of Environment, Food, and Rural Affairs; IPCC = Intergovernmental Panel on Climate Change.
a. The range in the biodiesel emission factor for IPCC depends on the Net Calorific Value (NCV) of diesel applied.

Although the terms vary somewhat, the guidance on biodiesel emissions reporting provided by the 2014 *DEFRA Emission Factors for Company Reporting* aligns with the IPCC's guidance. Net Calorific Values (NCVs) of biodiesel vary, based on the production process (ranging from 27 TJ/Gg to 44 TJ/Gg). Biodiesel can be produced either through transesterification or through a biomass-to-liquids process using synthol technology—this accounts for the range of the EFs.

5 World Resources Institute and World Business Council on Sustainable Development. 2004. *The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard, Revised Edition, Revised edition*. USA..

For a company to account for biodiesel in line with both the *Technical Guidelines* of the Department of Environmental Affairs (DEA) and the Carbon Disclosure Project (CDP), the following reporting method is suggested:

- Direct (scope 1) emissions should only include the CH_4 and NO_x emissions linked with biodiesel combustion.
- Memo item or note to direct (scope 1) emissions should include the CO_2 emissions linked with the combustion of biodiesel. However, these emissions should not be included in the total direct emissions.
- Other indirect (scope 3) emissions should include the emissions associated with the production of feedstock, and the refining and transportation of biodiesel, typically based on a default EF, in accordance with table 3. (Note this is not relevant for *mandatory* GHG reporting)

5.3 Removal of Emissions and Accounting for Sequestration Potential

GHG emissions removal and associated carbon sequestration is important to national level GHG emissions inventories. Similarly, for companies in biomass-based industries, for example, forestry, carbon sequestration is a material part of the company's GHG inventory.

The GHG Protocol Corporate Standard does not include consensus methods for sequestered carbon quantification. The Standard suggests that in some cases quantification methods used in national inventories can be adapted for corporate-level quantification of sequestered carbon. The *2006 IPCC Guidelines, Volume 4 Agriculture, Forestry and Other Land Use* provide guidance on how to account for carbon sinks for national inventories.

The Paper Manufacturers of South Africa (PAMSA), together with the University of Stellenbosch and the Institute for Commercial Forestry Research, are in the process of developing techniques to estimate net carbon sequestration at the Tier 2 level using available data from local studies and international literature.[6] These techniques were developed as the international default values for Tier 1 methods from the *2006 IPCC Guidelines* and do not reflect specific local conditions. They therefore lack the desired accuracy for South African carbon accounting and the related proposed carbon tax. While the report to be published by the above three entities is still in the drafting stage, it should be recognized as the first in a series to build more sophisticated models for carbon sequestration calculations in South Africa over the next 3 years.

DEA is currently in the process of developing rules and Measurement, Reporting and Verification (MRV) guidelines for reporting of emission sources and sinks for land-based activities.

6 Ben du Toit, Steven Dovey, Thomas Seifert, Philip Muyambo, and Deon Malherbe. 2016. *Carbon sequestration in South African plantation forests. Progress report number 1: Techniques to estimate net carbon sequestration at the Tier 2 level using available data from local studies and international literature.* February. Department of Forest and Wood Science, University of Stellenbosch, and the Institute for Commercial Forestry Research, Pietermaritzburg. Report prepared for PAMSA.

6. Stakeholder Consultation during Development of Technical Guidelines

Formal stakeholder engagement formed part of the development of the *Technical Guidelines* and was initiated by the Department of Environmental Affairs (DEA). The *Technical Guidelines* went through two public commenting processes, the first lasting 60 days and the second lasting 30 days. The Business Unity South Africa (BUSA) organized the industry bodies to take part in the stakeholder consultations. BUSA is a confederation of business organizations that includes chambers of commerce and industry, professional and corporate associations, and unisectoral organizations. It represents South African business in forums on macroeconomic and high-level issues that affect the country at the national and international level. BUSA's function is to ensure that business plays a constructive role in the country's economic growth, development, and transformation, and to create an environment in which businesses of all sizes and in all sectors can thrive, expand, and be competitive.

Sectors to be affected by the *Technical Guidelines* were contacted through BUSA and invited to sector-specific workshops, which were held over a 2-month period. A stakeholder report was drafted to document all individual stakeholder meetings and workshops. Stakeholder consultation is essential to securing buy-in, developing a practical methodology, and avoiding costly appeals later in the process.

Primary feedback from the stakeholder engagement specified that the Intergovernmental Panel on Climate Change (IPCC) is often difficult to navigate. Stakeholders therefore suggested that the *Technical Guidelines* simplify and explain the IPCC's approach. One of the main functions of the sector-specific workshops was to explain that companies may have to report under more than one IPCC category.

Stakeholders raised issues having to do with the use of generic Net Calorific Values (NCVs) and densities. The South African Petroleum Industry Association provided NCVs and densities specific to South Africa. Further engagement allowed for alignment between the *Technical Guidelines* thresholds and the *Draft Energy Reporting Regulations*.

Stakeholders felt that the IPCC default emission factors (EFs) for methane and nitrous oxide from stationary combustion were too high. Companies have found that these emissions are below the detection limit of measuring equipment, which makes it difficult for them to report those emissions on a higher tier. DEA requested that these emissions nevertheless be reported for completeness of the National GHG Inventory, but realized the figure would be an overestimation.

GHG emissions from road transport, fire protection, air conditioning, and refrigeration should be estimated on a national level through national surveys. Although the emissions from road transport can be obtained through national mandates and statistics, fuel combustion for on-site transport cannot easily be disaggregated.

For wastewater treatment, it was proposed that the entity responsible for reporting should be the license holder of the wastewater treatment plant. That would be in line with the operational control reporting approach. A different entity may have a management contract but not any operational control. Most wastewater treatment facilities being under government control, only a small number would be covered by private companies. Wastewater treatment license conditions require monthly reporting of data to the Department of Water and Sanitation, and it is suggested that this be dealt with on a national level. Possible double reporting issues raised concerns about reporting burdens and DEA is working to minimize these issues. The stakeholders felt that companies do not have experience in reporting emissions from wastewater treatment facilities.

The IPCC Waste Model was designed for national solid waste disposal sites, and is based on estimates linked to population and waste per capita, which are not appropriate at a *company* level. Stakeholders therefore suggested that emissions from solid waste disposal be estimated on a national level. This is still under discussion.

Stakeholders were concerned about reporting emissions from railways on-site and felt that the reporting requirement should be restricted to public rail infrastructure to allow the tracking of progress toward a lower-carbon economy. Product and material may be transported on-site or underground by conveyor, trucks, or train. With the exclusion of reporting on liquid fuel for mobile transport, reporting on diesel locomotives would result in overestimation of emissions and double taxation. This conclusion is particularly relevant to the mining and metals industries.

7. Conclusions

Overall, the use of IPCC-based methodologies is a viable approach to obtaining company-specific GHG inventory data. However, for some countries, the use of the ISO 14064 standards (in countries where these have been adopted as national standards) may simplify the implementation of mandatory GHG regulations.

Furthermore, the development of systems that can efficiently address multiple needs and functions poses a significant challenge to the introduction and establishment of corporate GHG inventories in South Africa. Corporate GHG inventories can be integrated with emission reduction initiatives and policies by adopting reporting procedures similar to the ones used in financial accounting.

Aligning GHG reporting with SIC codes would be beneficial in terms of integrating national and international policy, tracking progress made, and obtaining actual activity data (to reduce the reporting burden of affected companies). In South Africa, the SIC codes already form the basis of the *Draft Regulations Regarding Registration, Reporting on Energy Management and Submission of Energy Management Plans*. The alignment of the mandatory GHG reporting and the energy reporting regulations would therefore make it easier for the affected companies to report their GHG emissions and energy use. It should be noted that the multiple functions to be fulfilled by the collected data should be duly considered when seeking to align sectoral classifications.

Specific methodologies and default emission factors (EFs) are of serious concern where the GHG inventory data form the basis of carbon tax liabilities, because the financial implications of the tax can affect the competitiveness of sectors and companies. The Geographic Adjustment Factors in particular could unfairly burden companies in specific sectors. Where the GHG inventory data are only used to comply with policies and tracking programs, the use of specific methodologies and default EFs is less critical. The mandatory *GHG Reporting Regulations* give responding companies a 5-year period during emissions may be calculated on a Tier 1, Tier 2, or Tier 3 level, after which companies are encouraged to report on Tier 2 or Tier 3 levels (as these are more accurate). This approach essentially encourages companies to move away from Tier 1 calculations and the associated Geographic Adjustment Factors.

Care should be taken in both the reporting of GHG emissions and the calculation of the associated carbon tax to avoid an unfair burden on companies involved in exporting products. This is especially relevant to South African producers of steel and fuel. The IPCC only allows for a deduction of emissions associated with exports in the cement industry.

Nitrous oxide and methane emissions from fossil fuel combustion are often below the detectable limit of equipment and sufficient consideration must be given to this when developing technical guidelines.

In terms of the case studies conducted, it seems apparent that the activity data for estimating emissions are available. However, their conversion to IPCC categories may be difficult at first.

Industries such as cement and iron and steel are very mature, with most companies already calculating their emissions on a mass balance approach (Tier 3).

To ensure progress toward a low-carbon economy, government, industry, and other stakeholders will all need to collaborate to overcome the technological and economic challenges involved in this transition. The role of industry has to be considered in the context of a progressive industrial policy, and government has to engage with industry when developing mandatory GHG reporting.

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