SUSTAINABILITY INSTITUTE

Edition 4.1 | 2022

CFG: Carbon Footprinting Guide

A practical carbon- and water-footprinting calculation guide focusing on **measuring, monitoring, reporting, verification and carbon tax**

Marco Lotz and Alan Brent

Calculating carbon footprints

Demystifying water footprinting

Covering the basics of carbon tax

see money differently

NEDBANK

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carbon footprinting guide

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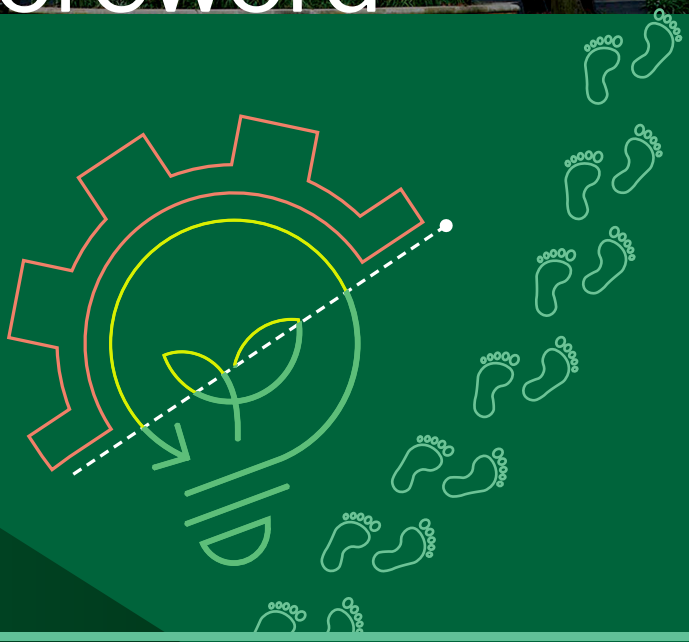

Nedbank's approach to sustainability is integrated and three-pronged: we manage our own impacts, we enable sustainability through our products and **services, and we maximise our positive effects by partnering and collaborating with others.**

Foreword

The environmental imperative, and Nedbank's own Sustainable Development Goal (SDG) journey, has intensified since our initial support of this publication in 2014. The prolonged drought that some parts of South Africa face and the implementation of domestic carbon tax are serious calls to action that cover the spectrum from physical scarcity (water) to government's 'the polluter must pay' approach as in the case of carbon tax.

At Nedbank, we take a three-pronged approach to achieving such integrated sustainability: effectively managing our own impacts, enabling sustainability through our products and services, and collaborating and partnering with others to maximise the positive impact of our sustainability efforts.

> By continuing to support and distribute this guide, we hope to play a small part in the success and longevity of the companies that use it, as they start or enhance their carbon reduction journeys.

Often a carbon and water management journey begins with a few staff members being tasked with the overwhelming duty of plotting the course towards effectiveness for the rest of the organisation. If you are one of those individuals, or even if you are part of a company that is well down its carbon and water use reduction journey, we wish you every success.

We trust that the information, step-by-step guidelines, and thought-provoking case studies will provide a valuable resource and an inspiration to you along the way.

Mike Brown
Chief Executive
Nedbank Group Limited

About the authors

Marco Lotz holds a bachelor's degree in chemical engineering, a master's degree in artificial intelligence, a PhD in engineering management as well as an MBA. His PhD focused on the project management and risk management of greenhouse gas reduction projects. Marco started his career in 2006 and consulted for a wide variety of industries, including steel and cement manufacturing and precious-metal mining and processing, where he was involved in numerous carbon reduction projects. The carbon projects covered the complete spectrum of carbon activities, including carbon footprinting, carbon disclosure projects, carbon-neutral endeavours and revenue-generating carbon reduction projects. These projects also included water- and energy-related matters. He joined Nedbank in 2010 and was appointed as the Nedbank Group Sustainability Carbon Specialist. Marco is a former associate researcher at the University of Stellenbosch Business School and previously at the Tropical Research Institute in Portugal. He is a contributor to various well-known carbon publications and an external review expert for selected academic and other publications.

Alan Brent holds bachelor's degrees in chemical engineering and philosophy (sustainable development), master's degrees in science (environmental engineering), engineering (technology management) and philosophy (sustainable development), and a PhD in engineering management. Since 1995 he has consulted for a variety of industries and in the public sector in South Africa and other countries in the fields of environmental engineering and management. His research focus now revolves around sustainable technology management. Currently, he is Extraordinary Professor of Engineering Management and Sustainable Systems in the Department of Industrial Engineering at Stellenbosch University. He is also the inaugural chair and professor of Sustainable Energy Systems at Victoria University of Wellington in New Zealand.

The authors would like to thank Nedbank Group for its support with this publication.

All emission factors were updated for this version of the compendium and the case study section was changed to include new case study examples.

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The Nedbank Smart Living Guide

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2 Purpose of the guide

By providing step-by-step guidelines and using real-life case studies, this guide is a valuable resource on carbon tax as well as carbon and **water footprinting for companies starting or enhancing their reduction journeys.**

LEGEND

Highlight	Highlighting for referenced terms.
	Specific notes relating to auditing.
	More information related to specific points.
	The key message of a section.
Notes	A space is the '1 000' separator and a comma is used as a decimal separator.

Purpose of the guide

While many of the top 100 companies listed on the Johannesburg Stock Exchange already calculate their carbon footprints and water impacts, this is just the first step in the journey. The world has indeed moved on and stakeholders demand more information and reductions in environmental impact, as opposed to when reporting on impacts was still seen as the responsibility of only corporate leadership a few years ago.

The implementation of domestic carbon tax and being confronted by water shortages daily in South Africa, necessitate that most forward-thinking companies go beyond reporting.

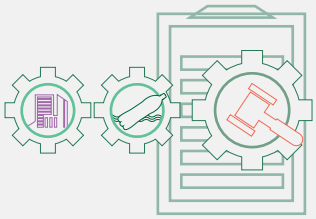
This compendium focuses on carbon footprinting, the domestic carbon tax, and water footprinting.

The pressure to act on these and other environmental matters comes from two primary areas:

- From the top down: With the current South African carbon tax and regulatory developments, it seems we have arrived at a point at which historic environmental externalities will be internalised. This is just a complicated way of saying that companies, and their clients, will be paying for the pollution impacts of their products and services. These environmental impacts will initially involve greenhouse gas emissions and water usage.
- Bottomup: In less than a decade the game has changed in that shareholders are pressurising especially listed companies to:
  - disclose more information regarding their environmental impacts than ever before;
  - disclose more than what government has historically required; and
  - if they cannot avoid polluting, pollute proactively less than what is legally allowed.

Carbon footprinting will become as standard as doing a company's tax return.

THIS GUIDE WILL START BY EXPLAINING THE BASICS OF ENVIRONMENTAL FOOTPRINTING AND CARBON TAX BEFORE LOOKING AT HOW VARIOUS PEOPLE AND ORGANISATIONS ACTUALLY HAVE APPLIED THEIR KNOWLEDGE IN REAL LIFE.

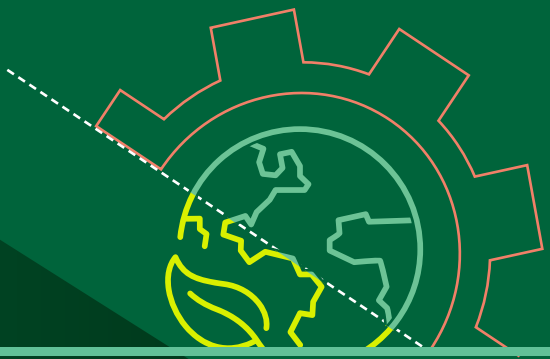


Currently there is much credible information in the public domain regarding carbon footprinting, carbon tax and water impacts, but the information is generally not userfriendly. The main aim of this compendium is to demystify these subjects and help readers grasp the main concepts, as well as guide them to doing the calculations. Throughout the compendium the theory is constantly explained application to a number of real-world cases.

Other aims include the following:

- It is ironic that scientists and engineers are mostly responsible for calculating environmental footprints and carbon tax, while commerce people do the audits.
  This irony has become even more salient with the implementation of carbon tax. If we do not find a way to establish a common ground for the parties calculating the footprints and the parties checking them, we are setting ourselves up for failure. This guide aims to facilitate the building of this bridge between the world of the natural scientist, the engineering professional and the commerce professional.
- While many people in the industry calculating environmental footprints may be well-educated, most of the seasoned practitioners were not taught how to do so at university or college. Students still need to be taught in the field of carbon footprinting so as to be ready for an evolving world where someone is tasked with keeping tabs on the pollution of every company. This compendium aims to fill that teaching gap by using practical examples and easy-to-understand language that is not specific to a single field.
- Case studies are critical to creating a practical vantage point. This compendium will start by explaining the basics of carbon tax and environmental footprinting before looking at how various people and organisations applied their knowledge in real life. Environmental footprinting and carbon tax are not ‘a stable science’ yet – it is too new. So, the thinking has evolved over the past few years can be seen clearly – and understood effectively, by analysing case studies.
- Lastly, this publication will share some views and comments on the pitfalls of the carbon industry and how the proverbial snake oil can be avoided. As stated above, environmental footprinting is a new and evolving science. For this reason we all need to be aware that there may be many cunning salesmen or consultants who are all too happy to take our money without offering very much in return. We all need to approach this issue with our eyes wide open.

3 Climate change



Influenced by climate change, the developing **legislation around environmental impacts will affect your business.**

Background on climate change

The science of climate change has become something akin to a religion. Some people believe climate change exists, while others simply refuse to believe it at all. In many instances this belief, or lack thereof, is not based on an understanding of scientific information or other evidence.

What we do know is this: Currently, these are in excess of a 95% chance that anthropogenic emissions are affecting the earth's climate (some newer reports argue the probability is higher than 99%). It is also widely accepted that, if climate change is happening, we will have less freshwater available, will have higher average temperatures, and live in a generally much more challenging world.

> So even if we swap the statistics around and predict that there is a 5% chance that we are adversely affecting the climate, it would still be well worth our while to combat climate change. For this guide it is assumed that climate change does exist and that it is influenced by human activity.

It should also be stated that the regulation and the business side of climate change do not require 100% proof of its existence or a 100% acceptance rate. We can either benefit from the worldwide developments or be penalised by them irrespective of our individual beliefs on whether climate change exists and whether it is impacted by human behaviour.

For example, your South African electricity bill has already included an 'environmental levy' and carbon tax for a while now that you have to pay.

> You might debate about whether or not climate change exists, but irrespective of which side of the argument you are on, the developing legislative environment will affect your business. Nobody will remain unaffected.

TECHNICAL TERMS

What is a greenhouse gas?

Greenhouse gases (GHGs) have the property of retaining heat. They act like a blanket around the earth, keeping it warm. Within certain limits this is a good thing, as having excessively low temperatures on the earth's surface would also be catastrophic. If too many GHG emissions are emitted, this blanket of insulation around the earth will retain too much heat – having a negative effect on the delicate balance required for fostering and sustaining life (plants, terrestrial animals, sea life, and such).

> It is widely accepted that human-induced activities, such as combusting fossil fuels, are disturbing the GHG balance of the atmosphere. GHG emissions caused by human action are referred to as anthropogenic emissions. One also gets natural GHG emission releases through, for example, volcanic eruptions.

What do the phrases 'GHGs,' 'tonnes of carbon dioxide equivalent' and 'global warming potential' refer to?

There are different GHGs and each type of gas has a certain impact on climate change. It is difficult and complicated to quantify one's GHG emissions as 20 tonnes of gas X and 15 tonnes of gas Y. This may be compared with the difficulty of dealing with different currencies simultaneously. To be able to compare apples with apples it is a good idea to convert different monetary values to the same unit, for example the US dollar (USD). That is exactly the purpose of global warming potential (GWP) and tonnes of carbon dioxide equivalent (tCO_2e).

Take the following example:

Carbon dioxide (CO_2) is a common GHG and is produced when something containing carbon (C) combusts in an atmosphere that contains oxygen (O_2). The chemical reaction is:

$C + O_2 = CO_2$

So, let us then define CO_2 as the common GHG denominator and relate all GHGs to CO_2 in the same sense that one can convert South African rand to US dollar. There should be an exchange rate to get the rand to the equivalent USD.

There is also an 'exchange rate' to determine the impact of different GHGs in terms of the equivalent amount of CO_2. This is called the GWP.

Methane (CH_4) is a GHG and is more potent than CO_2; in other words CH_4 is more detrimental to the atmosphere than CO_2. In fact 1 tonne of CH_4 does the same damage to the atmosphere as 23 tonnes of CO_2 over a 100-year timeframe. The GWP of methane is then 23, and that is the multiplier one needs to convert CH_4 to CO_2e (CO_2 equivalent is abbreviated as CO_2e).

Mathematically, this means:

(Global warming potential) × (tonnes of specific GHG)
= (tonnes of CO_2 equivalent)GWP × (tonnes of specific GHG)
= tCO_2e

So, if one emits 2 tonnes of CH4, then:

$23 \times 2 = 46\ tCO_2e$

> This implies that 2 tonnes of CH_4 emitted into the atmosphere does the same damage as 46 tonnes of CO_2 over 100 years.

The Kyoto Protocol focuses on reducing six GHGs or families of gases. These gases can have a spread of GWP factors depending on different sources. The common GHGs and their GWPs are summarised in the table below.

The most common GHG is CO_2 and hence it is used as the common denominator. Methane is most commonly associated with the rotting of organic matter. Nitrous oxide in the South African context is most prevalent with the production of petroleum-based artificial fertiliser. Some of the other gases are used in refrigerant cycles or emitted during the manufacturing of high-tech electronic components.

Summary of GHGs, their chemical abbreviations and GWPs

GHG common name	GHG abbreviation	Global Warming Potential (GWP)
Carbon dioxide	CO_2	1
Methane	CH_4	21–23, sometimes 25
Nitrous oxide	N_2O	298–310
Hydrofluorocarbons	HFC	650–14 800
Perfluorocarbons	PFC	6 500–23 000
Sulphur hexafluoride	SF_6	22 800–23 900

WHAT is a kilowatt-hour (kWh)?

The abbreviation 'kWh' stands for 'kilowatt-hour', which can be broken down as follows:

'kilo' – means a thousand. Think of a kilogram, which is a thousand grams. This implies that 1 kWh = 1 000 Wh.

'hour' (h) – is a unit of time consisting of 3 600 seconds. The result is that 1 Wh = 3 600 Ws.

'watt' (W) – is a measure of energy use and, in this case, electricity use. So 1 W implies that 1 joule (J) of energy is consumed per second: 1 W = 1 J/s. If you then have a 60 W of light, it means that 60 J of energy is used for every second the light is switched on.

Putting this all together:

1 kWh × 1 000 = 1 000 Wh
1 000 Wh × 3 600 = 3 600 000 J

So 1 kWh is equal to 3 600 000 J.

An amount of 1 joule of work is done to move 1 newton (N) for 1 metre (m), and 1 N is the force required to accelerate 1 kg by 1 m per second squared. **Figure 1 (page 12)** below.

Define 1 newton (N)
1 kilogram accelerating at
1 metre per second squared
1 N = 1 kg x 1 m/s^2

Define 1 joule (J)
Move 1 newton for 1 metre
1 J = 1 N x 1 m

Define 1 watt (W)
Spend 1 joule of energy for every second
1 W = 1 J / 1 s

Define 1 watt-hour (Wh)
Do 1 watt of work for 1 hour
1 Wh = 1 W x 1 h

Define 1 kilowatt-hour (kWh)
Spend 1 watt-hour of power 1 000 times
1 kWh = 1 Wh x 1 000

Figure 1: Visual representation regarding the unit of kilowatt-hour.

Always be in control of your units of measure.

AN EXAMPLE OF HOW TO VIEW ENERGY:

Typically, chocolate would have an energy value of 1 800 kJ/100 g. If you eat a 50 g chocolate bar, you would have consumed 900 kJ.

This implies that you ate:
900 000 / 3 600 000 =0,25 kWh worth of energy

So, joule (J) and its derivatives (kilojoule megajoule, and such) can be converted very easily to watt-hour (Wh) and its derivatives (kilowatt-hour, megawatt-hour, and so forth).

Always be in control of your units of measure.
One of the first subjects engineering students focus on is how to deal with units. One method views all conversion factors as fractions. It is easier to explain with an example.

Let us say it was decided to install an air-conditioning unit of 30 000 BTUs (British thermal units) for 350 square feet of office space. Given that 1 BTU = 1 055 J and 1 ft = 0,3048 m, what is the kilojoule (kJ) per square metre (m^2) that should be installed?

The best way to deal with this is to write the numeric values on one line and keep track of the units directly below the values. Units should then be cancelled out as shown in figure 2.

START

Values: $\frac{30\,000}{350} \times \frac{1\,055}{1}$

Units: $\frac{\text{BTU}}{\text{ft} \times \text{ft}} \times \frac{\text{J}}{1\,\text{BTU}}$

FIRST RESULT

Values: $\frac{30\,000 \times 1\,055}{350} \times \frac{1}{0{,}3048 \times 0{,}3048}$

Units: $\frac{\text{J}}{\cancel{\text{ft}} \times \cancel{\text{ft}}} \times \frac{\cancel{\text{ft}} \times \cancel{\text{ft}}}{\text{m} \times \text{m}}$

SECOND RESULT

Values: $\frac{30\,000 \times 1\,055}{350 \times 0{,}3048 \times 0{,}3048}$

Units: $\frac{\text{J}}{\text{m} \times \text{m}}$

THIRD RESULT

Values: $\frac{30\,000 \times 1\,055}{350 \times 0{,}3048 \times 0{,}3048} \times \frac{1}{1\,000}$

Units: $\frac{\cancel{\text{J}}}{\text{m} \times \text{m}} \times \frac{\text{kJ}}{\cancel{\text{J}}}$

FOURTH RESULT 973 kJ/m^2

Figure 2: Keeping track of units

You will always be in control of your units by following this approach of crossing out units as numerators and/or denominators. This is crucial when switching from one unit to another (feet to metres) and when changing the order of magnitude (joule to kilojoule).

The importance of being in control of your units of measure cannot be overemphasised. This will be a common theme throughout this guide.

Some other commonly used terms you may come across:

- **Life cycle analysis or life cycle assessment (LCA)**

  LCA is also referred to as a cradle-to-grave analysis. During an LCA all steps in producing a product or service and the environmental impacts thereof are taken into consideration. So, if electricity is being generated from coal, the LCA will be done by:
  - looking at the mining of coal and its impacts;
  - then assessing the impacts of transporting the coal;
  - then assessing the impact of the combustion of the coal; and
  - finally looking at the impacts of the ash disposal.

- **The 'control principle', 'gate-to-gate' and 'reporting boundary'**

  The easiest way to explain the 'control principle' is by giving an example. Let's take a glass bottle manufacturer. The manufacturer has control over where input materials are sourced, how the materials are moved to the plant, how the materials are processed, and how the product is manufactured. It has no further control of the product the moment the glass bottle leaves the plant. If the manufacturer then states that its carbon footprint is calculated in accordance with the 'control principle', it implies that the calculation includes all emissions associated with the actions over which it has control.

  It is possible that some input material is delivered to the manufacturing plant by the supplier of the input material. The manufacturer then has no say in or control over how the input material is delivered and how much GHG pollution is associated with the delivery. The supplier might use different transportation options. In this case the carbon footprint can still state that the 'control principle' was followed, but it is crucial to understand what the glass bottle manufacturer was in control of.

  It might be more appropriate for the glass bottle manufacturer to state that the carbon footprint includes all processing from the time the input materials enter through the plant's gate up to the point the finished glass bottles leave through the plant's gate again. This is referred to as 'gate-to-gate' accounting.

  The principle of deciding what to include or exclude in a carbon footprint is referred to as defining your reporting boundary. It is crucial that this is done upfront and truthfully so that the person looking at your carbon footprint knows what has been purposefully included or excluded.

- **Environmental externalities**

  Basically, an environmental externality is a burden the environment bears. For example, let us assume a company produces steam by combusting coal. It has a licence to do this and operating completely within the law.' It is not the company's problem what will happen to the gases and particulates emitted into the atmosphere. It is after all legally compliant. Hence, it is keeping the cost to the environment off its books and completely external.

The alternative would be internalisation of the 'cost' that the environment has to pay on the company's behalf. This internalisation, or paying for pollution caused, is in essence what carbon tax aims to do.

From the example above this might entail switching to a cleaner fuel like gas or adding scrubbers to the company's flue stack over and above the legal-compliance necessities. Eventually, however, any additional cost for the company will be transferred to the enduser (consumer), which is why such cost internalisation is not usually associated with a warm, fuzzy feeling.

- **GHG scopes and direct versus indirect GHG emissions**
  The GHG Protocol (see description below) divides GHGs according to their sources and whether the emitter directly or indirectly emits the GHG.
  The scopes can be defined as:
  - **Scope 1**: All direct GHG emissions. In other words, this will be whatever you combust or emit into the atmosphere yourself.
  - **Scope 2**: Indirect GHG emissions associated with the consumption of purchased electricity, heat or steam. These include basically all forms of energy that you buy in.
  - **Scope 3**: Other indirect emissions. This implies everything else such as '*the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (eg T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.*' (taken verbatim from GHG Protocol.) In following chapters this definition will become clearer as we apply it and give examples thereof.

To understand how the GHG Protocol scopes are defined is important as the Intergovernmental Panel on Climate Change (IPCC) (see description below) focuses on the direct versus indirect emissions definitions and the South African carbon tax will follow the IPCC Guidelines. To summarise:

IPCC GUIDELINES

GHG Protocol definitions

	Scope 1	Scope 2	Scope 3
Direct emissions	This is taxed.		
Indirect emissions		This is not directly taxed.	This is not directly taxed.

It is important to note that someone's indirect emissions will be another party's direct emissions. For example: If I do not own an aeroplane, but I fly on a commercial airline then the airline is combusting fuel on my behalf. The fuel combustion is a direct emission of the airline, and they could be taxed, whereas it is my indirect emission (IPCC Guidelines) and indeed a Scope 3 (GHG Protocol) emission. Now if the airline gets taxed then they will probably pass the tax on to me as the enduser of their service. This is such an important principle that more will be said about this later on.

- **Carbon footprint versus energy audit**

  A carbon footprint calculates the GHG impact of an action, whereas an energy audit calculates the energy required for a specific action. This can be explained by using an example of food and the cooking process:
  - If you boil water with a solar cooker, energy from the sun boils the water and the sun acts as the energy source. As no GHGs were emitted, the carbon footprint of the action will be zero.
  - If food waste rots, it emits methane (CH_4) and it will therefore have a carbon footprint. However, no energy was put into the 'system', or the rotting food, so the energy audit will show a zero value.
  - If you have a braai and use charcoal, energy is transferred to the food from the combustion of the charcoal. In this case there is energy transfer and GHG production as the charcoal is being combusted.

The conclusion is that a carbon footprint is linked to an energy audit:

if the energy transferred has a GHG release; and

by the emission factor of the specific fuel being used.

In the case above charcoal will have a different emission factor than, for example, a gas braai.

- **Vehicle kilometre (vkm) and passenger kilometre (pkm)**

  Assume a domestic flight in South Africa covers a distance of 1 400 km. Vkm refers to 'vehicle km' and in this case it will be 1 400 km. If the pollution for this flight is 20 tCO_2e from the combustion of the fuel, we can calculate that the pollution rate was 14,3 $kgCO_2e$/vkm (kilogram of carbon dioxide equivalent per kilometre the vehicle travelled). To calculate pkm one would need to divide the vkm by the number of passengers on board the vehicle.

For example, if there are 125 passengers on the aeroplane then:

$$pkm = vkm \div 125$$
$$pkm = 14{,}3\ kgCO_2e/vkm \div 125$$

So, the emission rate attributed to an individual would be 0,114 $kgCO_2e$/pkm. Since the individual travelled 1 400 km, the implication is that their pollution for the trip is:

$$\text{Pollution for trip} = 0{,}114\ kgCO_2e/pkm \times 1\,400\ km$$
$$\text{Pollution for trip} = 160\ kgCO_2e$$

- **Normal cubic metres (Nm^3) and standard cubic metres (Sm^3)**

  Volume, temperature and pressure are integrally linked when it comes to gases. For example, if you buy gaseous fuel, you need to know 'how much' you effectively get for your money. To do this, theoretical conditions were defined so that one can compare quantities when dealing with gases. The two most commonly used theoretical gas conditions are:

  - Normal cubic metre (Nm^3): The temperature is specified as 0 °C and the pressure as 1,01325 bar(A). The unit 'bar(A)' denotes absolute pressure in bar as opposed to gauge pressure – that is the pressure a gauge reads over and above the pressure of the atmosphere.
  - Standard cubic metre (Sm^3): The temperature is specified as 15 °C and the pressure as 1,01325 bar(A).

So, if you buy 10 Nm^3, the actual container can have many shapes or volumes, but you know the vendor will need to supply you with the amount of gas that would fill 10 m^3 if the temperature were 0°C and the pressure were 1,01325 bar(A).

The who's-who of climate change

Many organisations have positioned themselves as leaders in the climate change space. However, the most relevant ones you need to know of are:

The Intergovernmental Panel on Climate Change (IPCC)

http://www.ipcc.ch/

Description (taken verbatim from source):

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. The UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC.

The GHG Protocol

http://www.ghgprotocol.org/

Description (taken verbatim from source):

The Greenhouse Gas Protocol (GHG Protocol is the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions. The GHG Protocol, a decade-long partnership between the World Resources Institute and the World Business Council for Sustainable Development, is working with businesses, governments, and environmental groups around the world to build a new generation of credible and effective programs for tackling climate change.

It provides the accounting framework for nearly every GHG standard and program in the world – from the International Standards Organization to The Climate Registry – as well as hundreds of GHG inventories prepared by individual companies. The GHG Protocol also offers developing countries an internationally accepted management tool to help their businesses to compete in the global marketplace and their governments to make informed decisions about climate change.

United Kingdom Department of Environment, Food and Rural Affairs (Defra)

http://www.defra.gov.uk/

Description (taken verbatim from source):

We cover – we make policy and legislation, and work with others to deliver our policies in areas such as:

- the natural environment, biodiversity, plants and animals
- sustainable development and the green economy
- food, farming and fisheries
- animal health and welfare
- environmental protection and pollution control
- rural communities and issues.

This guide (version 4.1) uses the latest available Defra emission factors that can be found at: http://www.ukconversionfactorscarbonsmart.co.uk at the time of the publication (the latest Defra factors used in this publication was version 1.0 of 2021, released in June 2021).

Here you will see that you can pick the emission factor vintage (year) and decide whether to follow the guided wizard-type setup or simply download all 4 000 emission factors and do a search in the produced spreadsheet. Before 2013 Defra mostly published all the emission factors on a spreadsheet with an accompanying report and some narrative that explained how to use it. It is advisable to spend some time getting the hang of the Defra emission factors before delving into some of the more technical calculations. The Defra emission factors are periodically updated, but should remain accurate up to approximately June 2022. Also, remember that the carbon footprint emission factors will remain unchanged for a certain historic period.

This implies that, for example, a 2011 carbon footprint should be calculated using the emission factors relevant to 2011.

It will rarely be appropriate to update the 2011 carbon footprint due to the publication of 2012 emission factors. Interestingly enough, emission factors also do not frequently change much year on year. You can imagine this being the case as the process used to produce petrol and the emissions associated with combusting the petrol do not change much annually.

This said, one will frequently find that car emissions, for example, will generally come down over the years as the fuel efficiency of vehicles increases.

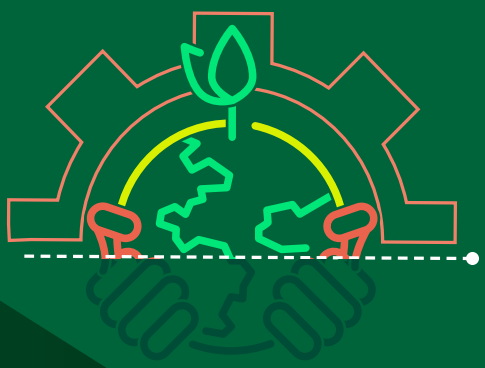
Mervyn E King (as relating to the King III and IV principles)

http://www.mervynking.co.za/

Description (taken verbatim from source):

Mervyn King consults and advises on corporate legal issues. He is recognised internationally as an expert on corporate governance and sustainability. He sits as an arbitrator and as a mediator. He is a founding member of the Arbitration Foundation of Southern Africa and for some eight years was the South African judge at the ICC International Court of Arbitration in Paris.

4 Understanding **the five levels of carbon projects**



When evaluating carbon projects consider **the objectives of the project as well as what outcome you want to achieve.**

Understanding the five levels of carbon projects

Below is a guide to differentiating between possible carbon projects and their motives:

LEVEL 1:

Carbon footprinting

A carbon footprint is a best estimate of the emissions associated with a specific activity. It is generally accepted that a carbon footprint is approximately 90% accurate. (This implies the 'real footprint' is between 90% and 110% of the final calculated value). This guide initially focuses on this level and a major aim is to understand where the approximately 20% swing/inaccuracy comes from and how to reduce it.

LEVEL 2:

External disclosures, such as the Carbon Disclosure Project (CDP)

There are numerous external voluntary environmental-impact disclosures that companies and even individuals can participate in.

The most widely used disclosure is the CDP. This is also a voluntary disclosure scheme through which companies can freely disclose their impact on the environment from a GHG point of view. There is the Water Disclosure Project (WDP), which focuses on the usage of water by various companies and the impact thereof on water resources. (This can also be referred to as the Water CDP.) Both these schemes are global initiatives. The South African leg of the CDP started in about 2006 and the WDP in approximately 2010.

> The CDP and WDP are questionnaire-based, which requires the carbon footprint as input and as well as a lot of narrative to explain the environmental projects that were undertaken, or the lack thereof. The CDP and WDP are viewed as level 2 which builds on the level 1 carbon footprint calculations.

LEVEL 3:

Carbon tax disclosures

It is fair to say that external environmental disclosing is losing its voluntary angle as investors are putting increasing pressure on companies to disclose through these and other channels. The South African domestic carbon tax forces companies that have the potential to pollute a certain amount of GHGs to follow a specific disclosure system, hence this is defined as a next level of disclosure over and above voluntary disclosure. It remains to be seen what will happen to voluntary disclosures if reporting becomes mandatory.

As indicated above, a best estimate carbon footprint is approximately 90% accurate. Of course, once one pays tax, one wants to be more accurate. Imagine the difference on paying income tax on 90% of one's income compared with the income tax paid on 110% of one's income. When it comes to paying tax you want to be as accurate as possible as to pay the correct amount. The guide will explain and expand on the carbon tax impacts and applications.

LEVEL 4:

Carbon neutrality endeavours

Once a carbon footprint has been calculated, disclosed in an annual report and through other channels (CDP, WDP, and such), and all mandatory disclosures and taxes are adhered to, the question is what can be done next? Some companies have taken the leap of faith (or strategic market leadership) to become carbon-neutral.

Being carbon-neutral sounds like a supernatural feat, but the concept is not that complicated. In essence a company will calculate its carbon footprint, reduce wherever possible, and offset the residual carbon footprint by buying emission reduction certificates so that the net result of its carbon footprint is zero. So the company will essentially be adding 'pluses' when calculating its carbon footprint. For example, fuel combustion emissions are added to the emissions associated with paper, and so forth. One can then purchase 'minus' certificates where, for example, someone planted trees, which sequestrated carbon dioxide as biomass. If the 'minuses' and 'pluses' then add up to zero, the company has a net zero GHG impact and that is referred to as carbon neutrality.

> There is one view that carbon neutrality has little or no direct financial benefit and is, in fact, just an expense, as one has to purchase the emission reduction certificates.

THE QUESTION THEN IS WHY DO PEOPLE DO THIS? THERE ARE A NUMBER OF REASONS:

- There is the obvious marketing and communication angle that leads to goodwill and a better reputation in industry.
- In some cases (and this is becoming more important) being carbon-neutral can lead to a company being a preferred supplier or attracting a better class of client. The idea then is that if all possible suppliers have to be tax-compliant and if they are all BEE-compliant (in the South African context), 'green credentials' can be a differentiating factor. 'Green credentials' can then lead to a supplier becoming the preferred supplier. Hence, being carbon-neutral can unlock markets.
- The world is progressively moving towards a low(er) carbon economy. Various pollution disincentives, such as carbon taxes, are being rolled out domestically and developed internationally. Hopefully more and more incentives will also be developed for polluting less – a tax break would be an example. A company that is carbon-neutral out of free will then internalises costs that are not compulsory at this stage. But, by internalising the cost, the company will figure out the reporting, monitoring and verification process before its competitors. If and when these pollution costs/taxes are then formalised in future, the company with experience in carbon neutrality will be better positioned to offer related and derived products and services to the market. The tricky bit at this stage is how to become carbon-neutral with the lowest possible expenses. Remember, a carbon-neutral company has an additional 'unnecessary' expense.

LEVEL 5:

If it is possible for you to reduce your carbon footprint by significant quantities, you might be eligible to sell the emission reduction offsets in some sort of incentive scheme. It is important to note that 'significant quantities' can imply a reduction of 10 000 tCO_2e to 20 000 tCO_2e per annum. Basically, somebody will pay you for your lack of pollution and you will need significant reduction quantities to warrant the paperwork and audit rigour.

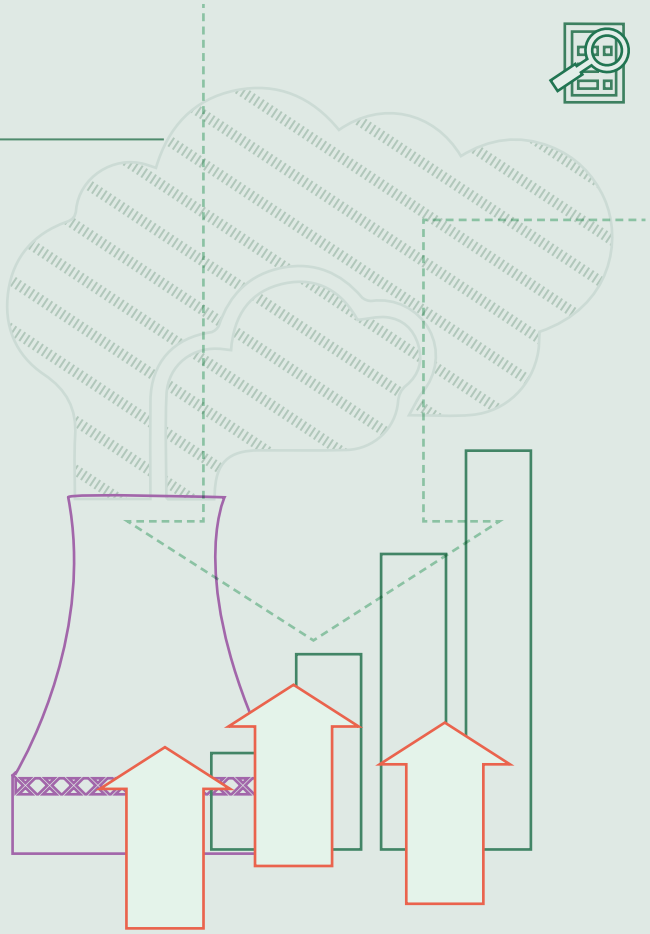
By selling emission reduction offsets we are actually creating a negative virtual commodity. Think about it this way: when you buy an ounce of gold, you get an ounce of gold, and when you buy a tonne of maize, you receive a tonne of maize. When buying emission reduction offsets, you are actually paying for less GHG pollution expressed in tCO_2e. By purchasing 20 tCO_2e one is actually buying a 'certificate' stating that the money will go to the person/company that kept 20 tCO_2e out of the atmosphere.

> Such a system calls for a rigorous audit process to ensure that any moneys paid for GHG reductions did indeed reduce the GHGs in the atmosphere by the stated amount.

It is important to note that if a company sells its GHG emission reduction, its carbon footprint should increase by the emission reduction it sold off. For example, if a company reduces its carbon footprint from 100 000 tCO_2e to 80 000 tCO_2e per annum, it could quantify the 20 000 tCO_2e reduction per annum in an emission reduction offset scheme and sell this to someone. The company that then buys the GHG offsets is the legal 'owner' of the 20 000 tCO_2e reduction. If this company now owns it, surely the original company can no longer claim that its footprint was reduced by 20 000 tCO_2e. If both parties claim the offset, there will be a serious case of double-counting. All that can be said after selling off 20 000 tCO_2e is that money has been received as payment for it, and that is the benefit.

EMISSION REDUCTION INCENTIVE SCHEMES

There are many emission reduction incentive schemes throughout the world. The following is an over-simplification, but serves as a



Broadly, emission reduction incentive schemes can be classified as follows:

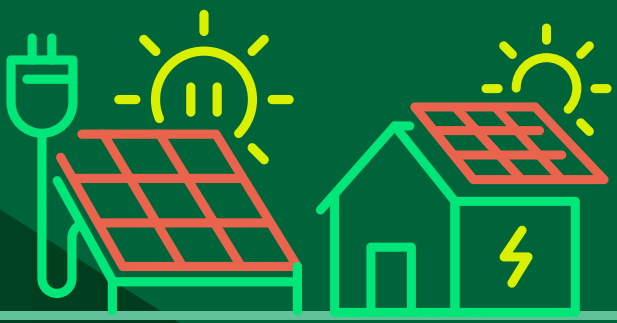
The GHG emission reduction compliance market

Certain developed countries have imposed caps on their GHG pollution. If the country cannot reach its GHG emission reduction target, it can trade emission reduction certificates among countries and/or companies. Examples of such schemes include the European Union Emission Trading Scheme (EUETS) and the Kyoto Protocol's Joint Implementation (JI). Developing countries, such as South Africa, do not have GHG emission caps. This said, we can sell GHG emission reductions to developed countries through the Kyoto Protocol's Clean Development Mechanism (CDM). The United Nations Framework Convention on Climate Change (https://unfccc.int) is the most authoritative source of CDM information, but the amount of information on the website can be overwhelming. Emission reduction units are called certified emission reductions (CERs) and 1 CER is equal to 1 tCO_2e.

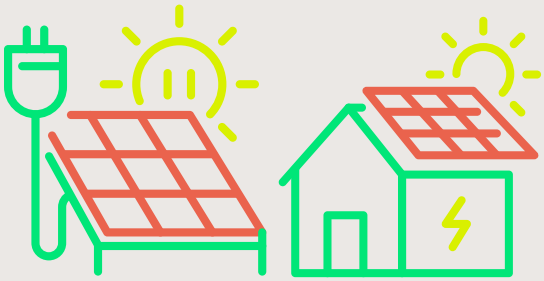
The GHG emission reduction voluntary market

Any other entity can decide to buy and sell GHG emission reductions without being forced to do this. These schemes can be as simple as paying someone to plant a tree on your behalf or it can be quite complicated systems that mimic the compliance market. For example, many airline companies already offer to offset the passengers' GHG emissions for an additional fee. Emission reduction units are broadly referred to as verified emission reductions (VERs) and 1 VER is equal to 1 tCO_2e. Voluntary schemes have been consolidated and structured over the past five years to increase confidence in the real reduction achieved by these schemes.

5 The fundamentals of the South African domestic carbon tax



Readers can use the guide, which also delves **into calculations, to identify applicable parts of the Carbon Tax Act**.



The fundamentals of the South African domestic carbon tax

The history and development of the South African Carbon Tax can encompass a guide or book on its own. In 2009 at the United Nations' 15th Conference of the Parties (COP15) meeting, South Africa pledged to reduce its GHG pollution below 'business as usual' by 34% in 2020 and 42% in 2025 if the necessary development finance was available.

National Treasury summarised the development of the 'Carbon Tax Bill 2018' as follows:

- Carbon Tax Discussion Paper (2010)
- Carbon Tax Policy Paper (2013)
- Carbon Offsets Paper (2014)
- Draft Carbon Tax Bill (2015)
- Draft Regulations on Carbon Offset (2016)
- Draft Carbon Tax Bill (2017)
- Second Draft Carbon Tax Bill and Explanatory Memorandum (2017)
- Parliamentary hearings (March and June 2018)
- Finalisation of the Bill process in November, December 2018 and February 2019

The guide will not spend time on the development of each iteration and will focus on the Carbon Tax Act of 2019 as published in the Government Gazette (23 May 2019, No 42483, Act 15 of 2019). The Carbon Tax Act became effective on 1 June 2019 and the first tax year ended on 31 December 2019. Unfortunately, the Carbon Tax Act is extremely difficult to read for a novice in the field, yet it remains the authoritative source to reference if one gets stuck. Many opinion and interpretation pieces have been published since the Carbon Tax Discussion Paper (2010). It is crucial that the sources one uses are the most recent and not simply another opinion on how it could work.

THIS GUIDE WILL ADD CLARITY AND APPLICATION TO THE CARBON TAX ACT BY POSING THE QUESTIONS THE READER SHOULD ASK TO IDENTIFY THE RELEVANT PARTS OF THE ACT, AND THE FOLLOWING SECTIONS WILL DELVE INTO THE REQUIRED CALCULATIONS. (LINE REFERENCES OF THE ACT WILL BE PROVIDED AS TO REFER TO THE ACT THROUGHOUT THE DISCUSSION BELOW.)

SO, LET US START!

Question 1: 'How much' and/or ' what' should a person pollute as to be tax-liable?

This sounds like a simple question, but it can get technical quickly. There is a list of activities that, if triggered, the tax should be registered for (Section 3, p8, line 15 – 20). The list is published as Schedule 2 on p48 – p63.

It is crucial to note that the trigger for any one of these activities are the installed capacity threshold and not necessarily the amount that was polluted.

For example, let us look at the first column to find IPCC code 1A3a on p48 that states that the threshold for Domestic Aviation is 100 000 litres/year. This implies that if a company or a person can use more than 100 000 litres of Domestic Aviation fuel per year one should register for the tax.

Let us look at another example. Schedule 2 also lists IPCC code 1A1a with the description 'Main Activity Electricity and Heat Production (including Combined Heat and Power Plants)' with a threshold for disclosure of 10 MW(th). This implies that if electricity generation, for example, can use more than 10 MW(th), then one should register for the tax.

The concept of '10 MW(th)' will be explained in the following sections. The carbon tax thresholds will be applicable to GHG emissions arising from the combustion of fuels, emissions from industrial processes and fugitive emissions. This is discussed in Section 4 (p8, line 30). Keep this in mind when assessing whether an entity should register for carbon tax.

Question 2: Who is the person or entity that should register and/or pay the tax?

The tax-paying entity is defined in Section 3 (p8, line 15–20) and, to keep it simple, it is either an individual or a legal entity, like a company, that is registered to pay tax. This is very important as a company might not reach the carbon tax threshold due to the installation of a single standby electricity generation, but if all similar installation of the tax entity (company) are added up then it could reach the threshold for the listed activity.

Question 3: What is the tax rate?

The initial tax rate will be R120/tCO_2e and will escalate from there over time (Section 5, p12, line 33–40).

Question 4: How does the tax break allowances work?

Every listed activity in Schedule 2 not only has a threshold for disclosure, but also provides guidance on the tax break or allowances that could potentially be obtained. This is explained in Part 2, p14 onwards, of the Act, but an example will be easier to follow.

Let us again look at IPCC code 1A1a, defined as 'Main Activity Electricity and Heat Production (including Combined Heat and Power Plants)' and assume that the 10 MW(th) threshold was exceeded and the person, or tax entity, should disclose in accordance with the Carbon Tax Act.

THE ALLOWANCES, OR TAX BREAKS, CAN BE SUMMARISED AS FOLLOWS FROM SCHEDULE 2:

Basic tax-free allowance for fossil fuel combustion emissions:

This is 60% in many cases, implying that 60% of the pollution is tax-exempted.

Basic tax-free allowance for process emissions:

This is zero for the case of standby electricity generators and is normally applicable only to industrial processes.

Fugitive emissions allowance:

This is zero for the case of standby electricity generators and is also more applicable to industrial processes.

Trade exposure allowance:

If a company can make the point that its products or services are trade-exposed and that carbon tax puts an additional burden on it, as opposed to its international competitors, then another allowance of up to 10% can be awarded.

Performance allowance:

If a company can show that it is already polluting less, compared to competitors, then an additional allowance of up to 5% is up for grabs.

Carbon budget allowance:

If a company voluntarily participates in the Department of Environmental Affairs (DEA) carbon budget system then another allowance of up to 5% could be achieved. The carbon budget system is a process in which the carbon footprint and future glide path of how the GHG pollution of that company will be reduced is shared and approved by the DEA. It is crucial to get the DEA to confirm in writing that the taxpayer participated in the carbon budget system to get the Carbon Tax Act allowance.

Offsets allowance:

Certain carbon offsets (emission reduction incentive projects) can also be used to reduce the pollution that is taxed by up to 10%. (Refer to the discussion above regarding 'Level 5: Profit-driven emission reduction incentive projects'.) In short,the tax-paying entity can reduce its tax burden if a qualifying carbon offset can be purchased and cancelled that costs less than the R120/tCO_2e of the tax.

Maximum total allowances:

Lastly, the tax burden percentage can be reduced by up to 90% or 95%, but no more. Guidance on this is also provided in Schedule 2.

Question 5: When is the tax period for which disclosures should be made?

THE FIRST TAX PERIOD WAS 1 JUNE 2019 TO 31 DECEMBER 2019 AND THE FOLLOWING TAX YEARS WILL BE 1 JANUARY OF EACH YEAR AND ENDING ON 31 DECEMBER OF THAT YEAR (SECTION 16, P18, LINE 31–36).

In its simplest form the abovementioned is enough background as to delve into examples and calculations as to make carbon tax and its application more practical. This said, as stated at the start: the Carbon Tax Act remains the authoritative source to reference if one gets stuck.

6 Applying the principles

Understanding all these concepts is one thing, but keeping track of all of them in the context **of your organisation's carbon footprint can be much more complex.**

Applying the principles

The easiest and most practical way of mastering carbon footprint concepts is to apply them, and this section does just that.

Each section has a table that will guide you in terms of where you are in the calculation process. Below is an example of what you can expect:

Step A: Decide on the methodology and set of emission factors that will be used.

Step	Description	Page
A	This step you have completed.	
B	You are at this highlighted step.	28
C	You will do this next.	

The IPCC, GHG Protocol and Defra were introduced in the 'Who's-who of climate change' section. The IPCC Guidelines and GHG Protocol have different carbon footprint calculation methodologies, which can be viewed as different 'recipes' as one will find in baking. It is important to choose the most appropriate recipe or calculation methodology before calculating a carbon footprint. Many other recipes also exist, including the proprietary ISO Standard methodology.

The IPCC Guidelines have another three sets of recipes, referred to as tier 1, tier 2 and tier 3. Tier 2 aims to be more accurate and generally becomes more difficult than tier 1, and tier 3 again surpasses the requirements and strives for more accuracy than tier 2 calculations.

Just like in baking, one can also choose between a variety of potential ingredients, and in carbon footprint calculations the emission factors can be seen as the ingredients. Defra offers UK-based emission factors, but can still be used for generally accepted, standardised sources of pollution, like diesel combustion and the emissions associated with a small petrol car.

The IPCC Guidelines offer not only a 'recipe' or calculation methodology, but also 'ingredients' or emission factors. In many cases the IPCC Guidelines can become quite complex, but are by far the most comprehensive set of recipes and ingredients.

Other, more specific ingredients or emission factors can often be the result of a specific condition in a country or certain vendors supplying the emission factor associated with their service or product. An example of a country-specific emission factor is the emission factor of the national grid and an example of a vendor-supplied emission factor is the emission factor of the paper consumption of a specific vendor.

The result is that we can draw up a matrix of potential recipes and ingredients and the combination of the two will determine what will be baked. As an analogy, the recipe and ingredients of a bread and a croissant can be very similar, but the final result is significantly different.

The table below summarises a matrix of possible combinations:

			Calculation methodology				
			Recipe				
			ISO	GHG Protocol	IPCC Guidelines		
					Tier 1	Tier 2	Tier 3
Emission factor source	Ingredients	Defra					
		IPCC default					
		Country-sourced					
		Vendor-sourced					

For this guide the table above will be simplified as follows:

Emission factors

- We will use all the potential emission factors in the guide and the IPCC factors as published in the Carbon Tax Act.

Methodologies

- Compared with the other methodologies the ISO methodology is more principle-based as opposed to providing exact calculation guidance , and we will therefore not use it.
- The GHG Protocol is arguably the most widely used methodology and we will refer to it.
- The South African carbon tax is based on the IPCC Guidelines, but does not follow the tiers as defined by the IPCC exactly. We will follow the act's adapted version.

This implies that the table of recipes and ingredients can be simplified to:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra		
		IPCC default		
		Country-sourced		
		Vendor-sourced		

For carbon tax purposes we will use one of the IPCC Guidelines as found in the Carbon Tax Act, with the IPCC default factors being the most commonly used. We will use the GHG Protocol with a sensible set of emission factors for most other non-carbon-tax requirements.

Step B: Source the information regarding your consumption

Step	Description	Page
B	Source the information regarding your consumption	30

Step B is universal, irrespective of which carbon footprint methodology or set of emission factors you are using. You should not assume that the carbon footprint information is readily available. Just because an invoice was received and the supplier was paid does not imply you will be able to source easily from the procurement department or from the accounts department how much paper was bought or how many flights were taken. Also, most small companies do not have a dedicated procurement department. In these cases you need to contact the accountant or person who is responsible for paying the supplier.

A good start will be to go to the procurement department (or person) and source the correct numbers, eg how much paper or diesel was used or how many flights taken. In many cases you will need to accept the fact that the numbers you receive will probably be the rand value rather than the actual quantity or units like litres of fuel or boxes of paper. Also, ensure that the information you are sourcing is only the relevant carbon footprint information. For example, if you are sourcing paper procurement information, you should ensure that other stationery supplies are not part of your data set.

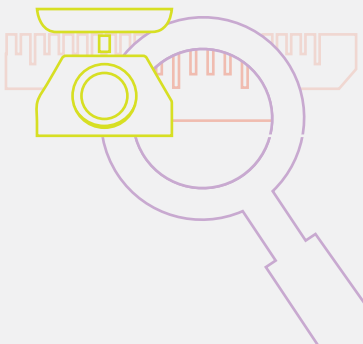
From the procurement department you should also source the names and contact details of the suppliers of your services and products. You should contact the supplier for service and product information and do a reconciliation between the supplier's information and the information you received from your procurement department. Hopefully, key account staff at the various suppliers can help you competently. Most companies are simply too small to have such a formal approach.

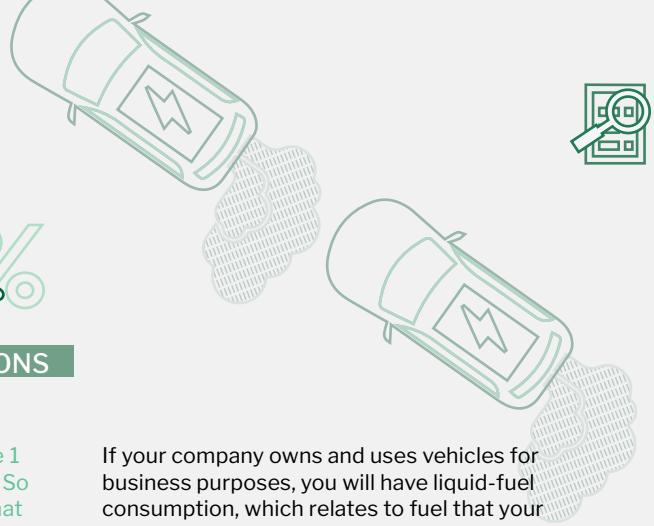
The person calculating the carbon footprint should contact the person who pays the suppliers as the suppliers will also have an impact on the carbon footprint.

If the information reconciles well, you know you have adequate sources of information. If the information does not reconcile well, you will need to resolve this before you can continue. This will also be a crucial check when auditing your carbon footprint.

In most cases it will suffice to determine monthly consumption levels and do monthly reporting. We recommend that you piggyback on accounting information, as the payment process ought to be well-established.

Start by sourcing numbers relating to the carbon footprint, but take note that this will probably be in monetary (rand) value, while you will require consumption (for example tonnes of paper) for carbon footprint purposes.





SCOPE 1

EMISSIONS OR DIRECT EMISSIONS

According to the GHG Protocol, Scope 1 emissions are 'all direct GHG emissions'. So what are these? These are all GHGs that originate from material you combust yourself or vent into the atmosphere. These emissions are also what the IPCC defines as 'direct' emissions, so causing these emissions could make you liable for carbon tax.

Scope 1 emissions can be divided into two broad categories:

- Emissions associated with fuels you combust yourself. These will include:
  - liquid fuels – petrol, diesel, paraffin and others associated with, for example, vehicles; and
  - gaseous fuels – liquid petroleum gas (LPG) and town gas.

- Emissions associated with GHGs you emit into the atmosphere. These can also be called 'fugitive emissions' and include:
  - refrigerant gases used in air-conditioning units; and
  - diverse other gases such as methane from rotting organic matter.

- Emissions originating from the manufacturing or process followed in industry or manufacturing. These are referred to as 'process emissions' and could include:
  - GHG emissions from industrial processes, like cement production or fertiliser production.

However, Scope 1 emissions are more complex as they could also, for example, include SF6 gas releases. SF6 and some other gases are emitted mostly by specialised manufacturing facilities, such as electronic- component producers.

In South Africa most of these gases are not produced in significant quantities. The one possible exception might be N_2O, which is produced by a few fertiliser-producing companies in South Africa.

If your company owns and uses vehicles for business purposes, you will have liquid-fuel consumption, which relates to fuel that your company combusts and emits as combusted gases into the atmosphere. In South Africa these liquid fuels are almost always petrol and diesel (an exception is forklifts, which can also run on gas, and should be dealt with as explained later in this section). The gases emitted contain carbon monoxide (CO), carbon dioxide (CO_2) and some other gases in lower concentrations.

Generators (mostly diesel-run) used during power outages will also count as releasing Scope 1 emissions. Note that it is not important whether the equipment consuming the petrol or diesel is stationary (generator) or able to move (car or truck). Refer to the control principle: the company is in control of the combustion of these fuels and it is therefore irrelevant whether the source of the emissions is moving or not. So, in the case of the generator, you cannot say that the emissions did not take place on the premises of the company (like in the case of a car or truck) and therefore you do not have to include it in your calculations.

It is more problematic when you lease space in a building and the facility managers run the diesel generators as required. Chances are very small that you will be able to obtain reliable data broken down and allocated to your lease. When you calculate your footprint, carefully consider whether it is worthwhile to include these emissions. If you decide to include them, remember that these emissions could be categorised as Scope 3, as you are not in control of the facility (you are leasing it). If you do not include them in your footprint, you should state it explicitly in your list of exclusions and motivate why you excluded them.

Gas as a fuel seems to be making a comeback. At least one reason why gas is being used more frequently, is recent, as well as planned, Eskom electricity price increases. Some restaurants also view gas as hedging their bets against a power outage. Having no electricity in a restaurant can partially be addressed by candles and kerosene lamps, which give a nice ambience. On the other hand, having no heat or refrigeration in the kitchen will lead to losses. It is common to distinguish between liquid fuels and gaseous fuels. This is not necessary when it comes to carbon footprints or carbon tax. The calculations might differ, as one will have different pieces of information available for liquid and gaseous fuels, but the principle remains the same: you buy it and you burn it.

Let us use the example of a fictitious company, called TheCo (Pty) Ltd, where this company has some standby diesel generators, produces ceramic products, and has a charcoal production facility.

Facility	Combustion of fuels		Process emissions	Fugitive emissions
	Diesel generator	Coal boiler	Mineral industry	Solid fuels
1.	Gen 1: 3 MW(e)		Ceramics	
2.	Gen 2: 4 MW(e)			Charcoal production
3.	Gen 3: 5 MW(e)	9 MW(th output)		

SCOPE 1 OR DIRECT EMISSIONS COULD ATTRACT A LIABILITY FOR CARBON TAX, SO WE NEED TO TAKE THIS INTO ACCOUNT. LET US GO THROUGH THE CARBON TAX QUESTIONS POSED ABOVE TO GUIDE US:

Question 1: How much pollution is tax-liable?

Let us start with the diesel generators labelled above with the following consumption:

- Gen 1 has a rated output of 3MW electrical output, abbreviated as 3 MW(e), and consumed 6 000 litres of fuel in the calendar year.
- Gen 2 has a rated output of 4 MW(e) and consumed 5 000 litres of fuel in the calendar year.
- Gen 3 has a rated output of 5 MW(e) and consumed 4 000 litres of fuel in the calendar year.

All the information is not always easily available, so be ready for the following type of discussion:

Hello Procurement and Accounting. It is the 'Carbon Guy/Girl' speaking. Can you please tell me what our petrol and diesel usage was for last year?

It was R250 000.

Uhm, thanks. Do you know how many litres of diesel and petrol were used?

No. Ask the Fleet Manager. He should know.

Unfortunately, this is not good enough when it comes to carbon tax.

Schedule 2 of the Carbon Tax Act lists this as IPCC code 1A1a: 'Main Activity Electricity, and Heat Production (including Combined Heat and Power Plants) with a threshold of 10 MW(th)'. This will be the applicable IPCC code, but our units are in MW(e) and the IPCC code refers to MW(th).

One way to convert this is to look at the manufacturer's guidance where the electrical efficiency of a new diesel generator could be about 45%. (Typically, the efficiency of an older generator is 33%.) This implies that 45% of the heat put into the generator becomes electricity. **Using this data, one can get to the following:**

Generator	Electrical rating [MW(e)]	Efficiency	Approximated thermal input rating [MW(th)]
Gen 1 at Facility 1	3	45%	6,7
Gen 2 at Facility 2	4	45%	8,9
Gen 3 at Facility 3	5	45%	11,1

Looking only at installed capacity, we can see that Gen 3 at Facility 3 by itself exceeds the threshold and will result in a carbon tax disclosure requirement. Contrary to this, Gen 1 at Facility 1 and Gen 2 at Facility 2 do not result in a carbon tax disclosure requirement, but this is a moot point as the tax-paying entity is the TheCo (Pty) Ltd and the sum of the installation is:

6,7 + 8,9 + 11,1 = 26,7 MW(th)

Another, more carbon-tax-appropriate way of converting the threshold to data is to use the following formula:

$$NHI = M_f \times NCV \div 3{,}6 \times 10^6$$

Where:

NHI is the net heat input in MW, and we will use the 10 MW(th) threshold here;

M_f is the mass flow rate in kg per hour of diesel that we want to determine, as it triggers the tax; and

NCV is the net calorific value of diesel, in this case in kJ/kg.

This formula can be found in the Government Gazette of 23 November 2012 (no 35883).

The Carbon Tax Act in Schedule 1 lists the diesel default calorific value as 0,043 TJ/tonne. We need to convert this to kJ/kg, which will be 43 000 kJ/kg.

We then have:

$$10 = M_f \times 43\,000 \div 3{,}6 \times 10^6$$

which results in the mass flow (M_f) being 837 kg/h.

The density of diesel is very close to 0,837 kg/ℓ. The simple rule of thumb, then, is that disclosure for carbon tax purposes should be closely investigated if more than 1 000 ℓ /h of diesel can be used from the combined generator sets. We might be tax-liable for diesel consumption and will have to take it into account when doing the calculations.

The coal boiler at Facility 3 has a rating of 9 MW, with a note stating that it is the 'thermal output'. A boiler is not 100% efficient, so more energy (input energy) should be provided to generate the 9 MW thermal output. Again, as with the diesel generators, hopefully the supplier has some information in this regard, or a more complex approach can be followed, as discussed above. Normally a well-maintained coal boiler will have an efficiency of about 85%.

THIS IMPLIES:

MW thermal input = MW thermal output ÷ efficiency
MW(th input) = 9 ÷ 0,85
MW(th input) = 10,6 MW

This boiler also falls under IPCC code 1A1a – 'Main Activity Electricity and Heat Production (including Combined Heat and Power Plants)', since it exceeds the 10 MW(th) threshold and it could trigger a carbon tax liability. Let us assume the boiler uses 1 000 tonnes of bituminous coal per month (this equates 12 000 tonnes pa for the tax year). This should be sourced from the procurement department and ideally the emission factor can be obtained from the vendor or supplier. The Carbon Tax Act IPCC default emission factor can be used if a more accurate or applicable factor cannot be sourced. More will be said about difficulties relating to such data below.

Emissions associated with the ceramic products are part of Schedule 2, section 2: Industrial Processes and Product use. The IPCC code is 2A4a Ceramics and it is crucial to note that there is no threshold. This means all pollution from the ceramics manufacturing should be considered for carbon tax. Let us assume the ceramic product is magnesite ($MgCO_3$)-based and that 12 000 tonnes of product are produced per month.

TheCo (Pty) Ltd also produces charcoal from wood at 2 000 tonnes per month or 24 000 tonnes per annum. The charcoal is not combusted, but sold as a product. This falls under IPCC code 1B1c2 as charcoal production (fuel wood input). No other fuels used will be taken into account here as these combusted fuels were discussed above. With this in mind, only fugitive emissions will be taken into account.

Question 2: Who is the person or entity that should register and/or pay the tax?

In this case we defined the tax-paying entity as TheCo (Pty) Ltd. The company might have various facilities, or even subsidiaries, but the company will be liable to pay the tax.

Question 3: What is the tax rate?

The initial tax rate will be R120/tCO_2e for the qualifying emissions, which we still need to calculate.

Question 4: How does the tax allowances work?

The best way to answer this is to calculate the tax that TheCo (Pty) Ltd could be liable for.

To do this we will revert to the standard steps as set out below:

Step A: Decide on the methodology and set of emission factors that will be used.

We need to pick an appropriate recipe and the appropriate ingredients. In this case it is predefined as the IPCC guidance, and we have to follow the guidance in the Carbon Tax Act. So, we will need to use the carbon-tax-defined methodology.

This implies that the table of recipes and ingredients gets us to here:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra		
		IPCC default		We need to look at these options as guided by carbon tax.
		Country-sourced		
		Vendor-sourced		

Step B:

Calculate the tax liability per component taking the Carbon Tax Act, emission factors and production data into account.

Step	Description	Page
A	Decide on the methodology and set of emission factors that will be used.	35
B	**Calculate the tax liability per component taking the Carbon Tax Act, emission factors and production data into account.**	35

The formula to calculate tax liability as presented in the Carbon Tax Act looks incomprehensible. Let us try to explain it as follows and build up to more complex formulas:

Tax to pay = [taxable emissions from combusted fuels] × tax rate
+ [taxable fugitive emissions] × tax rate
+ [taxable process emissions] × tax rate

Let us start with the combusted fuels part first, but follow the Carbon Tax Act nomenclature:

$X_1 = <\{[(E - S) \times (1 - C)] - [D \times (1-M)]\}> \times R$

Where:

- **X_1** is the tax payable and for now we are focused on the fuel combusted;
- **E** is the total GHG emissions from fuel combustion in tCO_2e;
- **S** is the Department of Environmental Affairs, Forestry and Fishers' verified and certified sequestrated GHG emissions;
- **C** is the sum of the allowances that can be awarded;
- **D** is the GHG emissions from petrol and diesel;
- **M** is the sum of the allowances that can be awarded; and
- **R** is the tax rate.

Focusing on term E

The fuels combusted were:

What combusted the fuel?	Quantity used	Units	Fuel type
Gen 1	6 000	Litre pa	Diesel
Gen 2	5 000	Litre pa	Diesel
Gen 3	4 000	Litre pa	Diesel
Coal boiler	12 000	Tonnes pa	Bituminous coal

The total diesel used is:
6 000 + 5 000 + 4 000 = 15 000 ℓ pa

The density of diesel is close to 0,837 kg/ℓ, so the kilograms of diesel used are:
15 000 ℓ pa × 0,837 kg/ℓ = 12 555 kg pa

This unit transformation is required as the default emission factor calculation requires units of kilograms and not litres. The tonnes of coal can simply be multiplied by 1 000 to get to kilograms.

If the emission factor for diesel is not known, then the default emission factor must be calculated. This is done as follows:

Diesel emission factor
= ([carbon dioxide emissions] × 1 + [methane emissions] × 23
+ [nitrous oxide emissions] × 296) × default calorific value

The required values for the emission factor calculation can be sourced from Schedule 1, Table 1, of the Carbon Tax Act, and for diesel the values are as follows:

Diesel emission factor = (74 100 × 1 + 3 × 23 + 0,6 × 296) × 0,043

Remember to keep track of your units as discussed earlier.

Diesel emission factor = (74 346,6) × 0,043 = 3 196,90 kgCO_2e per tonne of diesel

We calculated above that we use 12 555 kg diesel pa or 12,555 tonnes of diesel pa so:

Diesel emissions
= 12,555 × 3 196,90
= 40 137,08 kgCO_2e pa

Let us simplify this calculation and just test our answer as follows:

The Defra diesel emission factor is 2,68697 kgCO_2e per litre.

We used 15 000 litres per annum. The emissions should simply be:

Diesel emissions
= 15 000 × 2,68697
= 40 304,55 kgCO_2e pa

The values are very close, so we can be assured that the carbon tax approach was followed correctly. The second approach is so much simpler that one wonders what the benefit of the more complicated carbon tax approach is.

Let us now follow the same prescribed approach for the coal that was combusted in the boiler:

If the emission factor for the bituminous coal is not known, then the default emission factor must be calculated. This is done as follows:

Bituminous coal emission factor
= ([carbon dioxide emissions] × 1
+ [methane emissions] × 23
+ [Nitrous oxide emissions] × 296)
× default calorific value

The required values can be sourced form Schedule 1, Table 1, of the Carbon Tax Act and for bituminous coal they are as follows:

Coal emission factor
= (94 600 × 1 + 1 × 23 + 1,5 × 296) × 0,0243

Remember to keep track of your units as discussed earlier.

Coal emission factor
= (95 067) × 0,0243
= 2 310,12 $kgCO_2e$ per tonne of bituminous coal

Above it was stated that we used 12 000 tonnes per annum, so:

Coal emissions
= 12 000 × 2 310,12
= 27 721 537,2 $kgCO_2e$ pa
= 27 721,54 tCO_2e pa

Again, it is hard to know if this is correct; we can test it with the Defra approach:

- The Defra bituminous coal emission factor is 2 464,95 $kgCO_2e$ per tonne of coal if we assume industrial-type coal.
- We used 12 000 tonnes per annum.
- The emissions should simply be:

Coal emissions
= 12 000 × 2 464,95
= 29 579 400 $kgCO_2e$ pa
= 29 579 tCO_2e pa

The values are again close enough so that we can be assured that the carbon tax approach was followed correctly.

Remember, we are doing all of this to calculate term E, this being the total GHG emissions from fuel combustion in tCO_2e.

This gets us to:

Term E
= Diesel emissions + coal emissions
= 40 137,08 $kgCO_2e$ pa + 27 721,54 $kgCO_2e$ pa
= 67 858,62 tCO_2e

Focusing on term D

Term D is the GHG emissions from petrol and diesel. This we calculated above as 40 304,55 $kgCO_2e$ pa.

Focusing on term R

This is the tax rate at R120/tCO_2e.

Let us insert all the factors that we have to simplify the equation:

$X_1 = <\{[(E - S) \times (1 - C)] - [D \times (1-M)]\}> \times R$

Becomes:

$X_1 = <\{[(67\,858{,}62 - S) \times (1 - C)] - [40\,304{,}55 \times (1-M)]\}> \times 120$

Where:

X_1 is the tax payable and for now we are focused on the fuel combusted;
E is the total GHG emissions from fuel combustion in tCO_2e;
S is the Department of Environmental Affairs, Forestry and Fisheries' verified and certified sequestrated GHG emissions;
C is the sum of the allowances that can be awarded;
D is the GHG emissions from petrol and diesel.
M is the sum of the allowances that can be awarded; and
R is the tax rate.

Focusing on term S

Term S refers to profit-driven emission reduction incentive projects. In essence one can pay another party for their 'lack of pollution' under very specific conditions and reduce one's tax liability. Of course, one would like to pay less than the R120/tCO_2e tax rate for such an offset. The offset allowance for IPCC code 1A1a is 10%, so up to 10% of the emissions can be offset by buying these offsets. For now, let us assume TheCo (Pty) Ltd bought zero credits, so term S becomes zero.
It is easy enough to see the impact of the offsets and the cost by playing around with the S value.

Focusing on terms C and M

We are focusing on the combustion of fuels and we are not mixing different types of emissions, so term C and M will be the same. So, for what allowances will TheCo (Pty) Ltd qualify?

- A basic tax allowance for fossil fuel combustion emissions of 60% is available by default.
- A trade exposure allowance of up to 10% is available and is determined by the value of exports plus imports, divided by the total production by sector. We assume no allowance is awarded here, as the products are not exported.
- The performance allowance basically gives the taxpayer the opportunity to get up to 5% of the tax reduced if they can prove that their performance is better than the industry's. We will use zero for TheCo (Pty) Ltd.
- The carbon budget allowance offers another 5% if the Department of Environmental Affairs, Forestry and Fisheries confirms in writing that the taxpayer participated in the carbon budget system. For now, we assume that TheCo (Pty) Ltd did not participate and cannot claim the 5%.

The result is that TheCo (Pty) Ltd can claim only the default 60% allowance and we will use this as terms C and M.

Let us insert all the factors that we have by now to simplify the equation:

$X_1 = <\{[(E - S) \times (1 - C)] - [D \times (1-M)]\}> \times R$

Becomes:

$X_1 = <\{[(67\,858{,}62 - 0) \times (1 - 0{,}6)] - [40\,304{,}55 \times (1-0{,}6)]\}> \times 120$

X_1 is the tax payable and for now we are focused on the fuel combusted;
E is the total GHG emissions from fuel combustion in tCO_2e;
S is the Department of Environmental Affairs, Forestry and Fisheries' verified and certified sequestrated GHG emissions;
C is the sum of the allowances that can be awarded;
D is the GHG emissions from petrol and diesel;
M is the sum of the allowances that can be awarded; and
R is the tax rate.

Let us simplify:

$X_1 = <\{[67\,858{,}62 \times 0{,}4] - [40\,304{,}55 \times 0{,}4]\}> \times 120$
$= (27\,143{,}45 - 16\,121{,}82) \times 120$
$= R1\,322\,595{,}60$

All the emissions from petrol and diesel are subtracted again, as the price paid at a fuel supplier already includes tax and double taxation is prevented with the subtraction.

If tax has not been paid on the fuel, then term E needs to be zero. So, the tax payable due to fuel combustion will be R1 322 595,60 for the year.

Let us repeat the process for fugitive emissions and follow the Carbon Tax Act nomenclature:

$X_3 = (\{F \times (1 - K)\} \times R$

Where:

X_3 is the tax payable and for now we are focused on industrial emissions;
F is the total fugitive greenhouse gas emissions;
K is the sum of the allowances that can be awarded (let us claim only the basic allowance, which will be 0,1); and
R is the tax rate (this will be R120/tCO_2e).

Focusing on term F

Charcoal production from wood triggers IPCC code 1B1c2 as Charcoal production. Total production of 24 000 tonnes pa and all fugitive emissions must be taken into account. The emission factor for charcoal production can be sourced from Schedule 1, Table 2, as 300 $kgCH_4$/TJ product, and the default calorific value is given as 0,0295 TJ/tonne.

If we multiply these two factors, we get the following:

Methane emissions per tonne
= 300 × 0.0295 = 8,85 $kgCH_4$/tonne of charcoal

We also know that the GWP of methane (CH_4) is 23, so:

Carbon dioxide equivalent emissions per tonne
= 8,85 × 23 = 03,55 $kgCO_2e$/tonne of charcoal

Keep in mind that this is only the fugitive emission component and that the charcoal is not transported or combusted yet. The production of the 24 000 tonnes of charcoal produces the following fugitive emissions:

Fugitive GHG emissions
= 24 000 × 203,55 = 4 885 200 $kgCO_2e$ pa
= 4 885,2 tCO_2e pa

Let us insert all the factors that we have to simplify the equation:

X_3 = ({F x (1 – K)} x R
= [{4 885,2} × (1 – 0,1)}] × 120
= R527 601,60

The tax payable due to fugitive GHG emissions will then be R527 601,60 for the year. The total carbon tax will be:

Tax to pay
= [taxable emissions from combusted fuels] × tax rate
+ [taxable fugitive emissions] × tax rate
+ [taxable process emissions] × tax rate
= $X_1 + X_2 + X_3$
= R1 330 634,88 + R2 705 892,42
+ R527 601,60 = R4 564 128,90

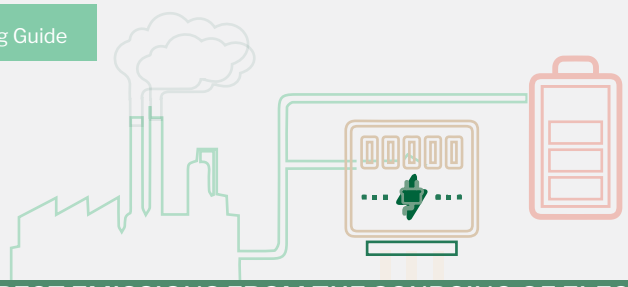
Question 5: What is the tax period for which disclosures should be made?

As discussed, the first tax period was 1 June 2019 to 31 December 2019 Let us assume we are now at the end of a complete tax year and TheCo (Pty) Ltd is liable for the full year. What should be clear from the above is that the IPCC-adapted carbon tax approach can become quite complicated. It is advisable to rather follow an 'emission factor × usage' Defra-like approach if you are not doing the calculations for tax purposes.

From a recipe–and–ingredients point of view this implies:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra	These approaches are mostly quite simple. Stay here if you can.	
		IPCC default		This gets tricky and is most suitable for carbon tax calculations.
		Country-sourced		
		Vendor-sourced		

SCOPE 2



SCOPE 2 OR INDIRECT EMISSIONS FROM THE SOURCING OF ELECTRICITY

According to the GHG Protocol, Scope 2 emissions are indirect GHG emissions resulting from the consumption of purchased electricity, heat or steam. In South Africa Scope 2 emissions can be summarised in one word: Eskom.

There will be no direct carbon tax payable, as this is an indirect source of GHG pollution, so it is not necessary to use the IPCC recipe and ingredients. This makes things a lot simpler. The electricity price included an environmental levy in the past and this has now changed to be carbon tax, which is already incorporated in the price we pay for electricity.

The South African electricity supplier market is dominated by Eskom. Currently, no other electricity suppliers of scale (comparable to Eskom) are operating in the market. Very few companies, except industrial companies, typically buy heat or steam.

Scope 2 emissions are 'processed energy' that you buy. So, you are not burning coal, but rather buying electricity. In the South African context Scope 2 emissions are dominated by Eskom.

In many other countries you would be able to choose your electricity supplier in the same way you can choose a cellphone network service provider in South Africa. Your specific preferences would determine whom you use. You might have a purely cost-driven motive, or you can choose an electricity supplier with a lower grid emission factor, or you can choose a supplier based on maintenance support experience.

This is not the case in South Africa. You would therefore probably focus on Eskom for Scope 2 emissions or indirect emissions from the sourcing of electricity and your usage (MWh) and the Eskom grid emission factor (tCO_2e/MWh) will be the factors of interest

So, what are the steps to calculate a footprint associated with electricity use?

Step A: Decide on the methodology and set of emission factors that will be used.

Let us start again by choosing an appropriate 'recipe' and the appropriate 'ingredients',which we will again call Step A.

We do not need to follow the more complicated IPCC Guidelines as there is no direct carbon tax payable. The simplest methodology or 'recipe' to use will be the GHG Protocol, which will imply that the amount of electricity used will be multiplied with the appropriate emission factor or 'ingredients'.

Now we need to choose the emission factor to use. In the past Defra supplied emission factors for different countries, but later this was taken out. It will not be appropriate to choose the UK"s emission factor when calculating the emissions associated with electricity, as the electricity grids differ greatly. Let us ignore Defra as a possibility for now.

If one argues that South Africa has only one national electricity supplier and that this can be sourced from the vendor (Eskom), then the 'country-sourced' and 'vendor-sourced' emission factors should be the same. This is a good approximation and we will use this as a basis for discussion.

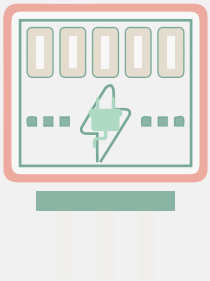
This implies that the table of recipes and ingredients gets us here:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra		
		IPCC default		
		Country-sourced	These will be the same and will be the best option.	
		Vendor-sourced		

Step B:

Source the information regarding your consumption: specific to electricity use (continued from above).

It is important to remember that your source for electricity bills can differ depending on factors such as how much electricity you use and where you are based.



Typically, your billing sources could be any of the following:

- Eskom – This normally applies to larger users such as mines and industries with a direct electricity line coming from Eskom.
- Your local municipality – This typically applies to people and businesses situated in a city or town. This type of billing can assume average usage values with an actual reconciliation every three months or so. This implies that your carbon footprint is run three months or more in arrears.
- Body corporate or other facility managers (for example in a shopping centre) – if the facility managers are doing a proper job, you ought to get electricity consumption data timeously. But if you are leasing space from, for example, a small trust in a one-horse town, you might have some difficulty obtaining information. Smaller entities leasing space may not have the capacity (or sometimes interest) to do more than recover their cost. It is not always practical to have individual electricity meters for all the separate tenants, and then it is important to have a clear understanding of the following:
  - Whether the electricity bill is split between tenants.
    It is not uncommon for an anchor tenant to pick up the complete bill unknowingly.
  - How the bill is split between tenants. Normally, it is based on floor space, but this is not always the most relevant way of allocating electricity use. For example, if your neighbour occupies less office space than you, but also has a chilling room (walk-in fridge), his electricity use may be higher.
  - Whether water, sewage, electricity and sundries are broken down on your invoice. Some property managers will simply give tenants a lumped monthly invoice and it can take some effort to understand how much is for electricity.
- Prepaid electricity – The use of prepaid electricity has become much more common in South Africa.

The billing source options indicated above will most probably give detailed information about monetary spend, but not necessarily about electricity consumption. (The availability of monetary data versus the unavailability of emission-related data is a common thread in this guide.)

There are a variety of possible electricity invoice sources, although Eskom is the primary supplier. For an auditor it is important to understand the sources of the invoices.

These components of an electricity bill could include the following:

- Service and/or network charge – In essence, you pay for the fact that you have electricity at your disposal. The charge is typically a rand value per day. It can be argued that if there are power outages, you should not pay for those days, as electricity was not available. The counterargument is that your house or business was provided with infrastructure and that outages are not the norm – so you should pay for every day.

- Energy charge – Your actual energy consumption will typically be referred to as the 'energy charge'. Your units of measure indicate your use. Use is almost always shown as kilowatt-hour (kWh) or a derivative. [Derivatives could include megawatt-hour (MWh), where 1 MWh is simply 1 000 kWh.] So, if you add all your consumption data in kWh, you will have your actual electricity consumption. Take note of the electricity charge rate and log this as well. This will be explained later on.

- Environmental levy – Your bill will frequently set out an environmental levy. This has been replaced with a back-to-back carbon tax component recently. It will use the same units as the energy charge (R/kWh or derivative), but the amount will frequently be quite small. This means these levies or carbon taxes already exist in some form. The questions that arise from these taxes include the following:
  - Will these environmental levies or carbon taxes be rolled out to more services or products?
  - What should the rate of these levies be?
  - What should the levies be used for?
  - Can the South African economy afford these levies?

The final source of electricity will determine the billing structure and way in which information is broken down on an invoice.

At this stage you should have the following information:

A	B	C	D	E	F
Number	Source	Note	Rand value	Unit price (R/kWh)	Electricity consumption (kWh)
1	Eskom	Consumption of large facilities	2 300	1,63	1 411
2	Local municipality	Average billed	825	1,69	488
3	Facility manager A	Actual billed	790	1,65	479
4	Facility manager B	Lumped levies	1 020	Unknown	Unknown
5	Prepaid electricity	None	1 200	1,69	710

Step C: Take a view on the Eskom grid emission factor.

Step	Description	Page
A	Decide on the methodology and set of emission factors that will be used.	40
B	Source the information regarding your consumption.	41
C	Take a view on the Eskom grid emission factor.	44

The Eskom grid emission factor has been a discussion point and a topic of debate since 2006 when South Africa became a signatory of the Kyoto Protocol[2]. In terms of the Kyoto Protocol and its clean development mechanism (CDM) it is necessary to know what the Eskom grid emission factor is, as this value is required to calculate pollution reduction. For example, if 1 MWh of electricity is used for heating, and solar energy is then used to do the same heating (think of a solar water heater), the emissions from coal associated with that 1 MWh is reduced. If the grid emission factor is 0,8 tCO_2e/MWh, the emissions are reduced by 0,8 tCO_2e. If the grid emission factor is 1,2 tCO_2e/MWh, the emissions are reduced by 1,2 tCO_2e. If a person or company is getting paid for the amount of CO_2e he keeps out of the atmosphere, he would want to make sure he is using the correct (and hopefully) higher grid emission factor.

It is common knowledge that the South African CDM projects that require the use of the Eskom grid emission factor show little consensus and that a spread of values are used. There is typically a 0,86 tCO_2e/MWh to 1,3 tCO_2e/MWh spread of applied values[2].

There are various values that can be used for the Eskom grid emission factor. Carefully consider your options and also disclose your reasoning for deciding on a specific value.

Remember that the Eskom grid emission factor for CDM purposes is calculated by using a prescribed mathematical model. One would think that such a model could have only one possible answer, but the model requires you to make some assumptions. Think of it again in cooking terms: I want to roast a leg of lamb and I have a recipe that I need to follow to the letter. So, I heat the oven, place the leg of lamb in the oven and add salt and spices. But according to the recipe the salt and spices should be added 'to taste'. This is not exact, so it means I might mess up the leg of lamb by adding too much salt and spices. You, on the other hand, add the correct amount of salt and spices and get the lamb just right. We both followed a recipe, but I end up with a mess and you end up with a masterpiece. Calculating the Eskom grid emission factor by using the CDM grid mathematical model is the same concept – the only difference is that everyone who has done the calculation thinks they have ended up with a masterpiece.

As auditor you should focus on the explanation and motivation of the grid emission factor used. Look out for differences in the value applied between different reporting years.

[2] See: Spalding-Fecher, R. 2011. What is the carbon emission factor for the South African electricity grid? *Journal of Energy in Southern Africa*. Volume 22, Number 4. Electricity grid emission factors for South African Clean Development Mechanism projects can also be found at http://cdm.unfccc.int/Projects/projsearch.html.

When determining a carbon footprint, you do not need to calculate the Eskom grid emission factor in line with the CDM methodology. You would think that this ought to make your life easier, but that is not necessarily the case.

One possible approach would be to use the grid emission factor as supplied by Eskom and this will follow the 'vendor-supplied' approach. On page 176 of the Eskom Integrated Report (published 31 March 2019) the following two options are provided (verbatim):

FACTOR 1

Figures are calculated based on total electricity sales by Eskom, which are based on the total available for distribution (including purchases), after excluding losses through transmission and distribution (technical losses), losses through theft (non-technical losses), our own internal use and wheeling.

Thus to calculate CO_2 emissions, divide the quantity of CO_2 emitted by the electricity sales:

220.9Mt of CO_2
÷ 208 319GWh sales
= 1,06 tons per MWh

FACTOR 2

Figures are calculated based on total electricity generated, which includes coal, nuclear, pumped storage, wind, hydro and gas turbines, but excludes the total consumed by Eskom. Thus the quantity of CO_2 emissions divided by (electricity generated less Eskom's electricity consumption):

220.9Mt of CO_2
÷ (218 939GWh generated less 5 980GWh own consumption)
= 1.04 tons per MWh

KEEP THE FOLLOWING IN MIND WHEN DECIDING ON THE EMISSION FACTOR:

- Generally, use the higher emission factor, so that the calculated carbon footprint rather overstates, than understates, the amount of pollution.
- Use a consistent approach (Factor 1 or Factor 2) or consistent emission factor between years so that year-on-year comparisons are more meaningful.

(We will assume that 'tons' in this case is the same as 'tonnes'.)

In this guide it is assumed that the Eskom emission factor is 1,06 tCO_2e/MWh. Adding this to the information you already have and multiplying the assumed grid emission factor by the actual electricity consumption will result in the following:

A	B	C	D	E	F	G	H
Number	Source	Note	Rand value	Unit price (R/kWh)	Electricity consumption (kWh)	Eskom grid emission factor (tCO_2e/MWh)	Pollution from electricity (tCO_2e)
1	Eskom	Consumption of large facilities	2 300	1,63	1 411	1,06	1,50
2	Local municipality	Average billed	825	1,69	488	1,06	0,52
3	Facility manager A	Actual billed	790	1,65	479	1,06	0,51
4	Facility manager B	Lumped levies	1 020	Unknown	Unknown	1,06	Unknown
5	Prepaid electricity	None	1 200	1,69	710	1,06	0,75

All Scope 2 emissions are conceptually calculated in the same manner.

THE GOLDEN RULE IS THAT IF YOU DON'T HAVE INFORMATION OR DATA, YOU SHOULD USE A VALUE HIGHER THAN WHAT YOU THINK THE VALUE POSSIBLY IS.

DEALING WITH EXCEPTIONS

The following are some of the possible exceptions and ways to deal with them:

As always, the golden rule is that if you don't have information or data, you should use a value higher than what you think the value possibly is.

Data sets can be incomplete for various reasons.

Some solutions in these cases are the following:

Try to find historic consumption rates for the facilities for which data is incomplete. With all else being equal, the electricity consumption for similar periods should be comparable.

If the electricity rate is not known, you can use average rates for a region or province or the national average. If at all possible, use as little averaging as possible and keep it granular, ie a regional average is usually better than a national average.

Assume that prepaid electricity has no hire component or availability charge. The implication is that all the money you spent in these cases was for actual electricity consumption. This assumption is necessary as a breakdown of the prepaid tariff is frequently not available.

The rand value, kWh consumption and R/kWh (tariff) are interlinked. You therefore do not need all three bits of information, because if you have two components, you can calculate the third.

As stated earlier, in some cases heat and/or steam can be bought for very specific applications.

What are the steps to calculate your footprint associated with purchased heat and/or steam?

Conceptually, dealing with heat and/or steam bought from a third party does not differ from electricity bought from a third party in the context of carbon footprinting. It is also comparable to how one will deal with regasing refrigerant gases (Scope 1 direct fugitive emissions) discussed earlier.

In short, the third party that supplies the heat and/or steam to you should give you two key pieces of information:

The emission factor of the heat and/or steam that you bought.

The amount of heat and/or steam you bought.

The product of these two values will give you the pollution associated with sourcing the heat and/or steam. As always, be conscious of the units of measurement to ensure that the product of the multiplication produces a meaningful result.

SCOPE 3

SCOPE 3 OR INDIRECT EMISSIONS FROM THE OTHER SOURCES

The GHG Protocol defines Scope 3 emissions as other indirect emissions. That doesn't shed much light, but it goes on to say: 'such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity.' It includes Scope 3 emissions, electricity- related activities (eg technical and distribution losses not covered in Scope 2) outsourced activities and waste disposal.

No domestic carbon tax is payable on these emissions as they are all indirect emissions. This implies that someone else pollutes and we buy the non-energy-related product or service from them.

The easiest way to think about it is that Scope 3 emissions are everything that hasn't been covered yet – it is the 'all else' category. The examples will make this clearer.

In most organisations Scope 3 emissions relate predominantly to business travel and paper.

Let us go directly to the first component of business travel. Let us again start by looking at the various recipes and ingredients that we can use:

Step A: Decide on the methodology and set of emission factors that will be used.

We again do not need to follow the more complicated IPCC Guidelines. The simplest methodology or recipe to use will be the GHG Protocol. This will imply that the quantified service or goods amount will be multiplied with the appropriate emission factor or ingredients.

Next, we need to choose the emission factor to use. Defra could be useful for emission factors of flights or motor vehicle segments based on engine size, as it can be argued that these sources of emissions should closely correlate between the UK and South Africa. Aeroplanes flying around the world use standardised fuels, and cars exported between countries do not require major alterations to be able to combust fuels in most other countries.

On the other hand, paper emission factors could differ more due to the different input fuels used by various production plants across the world. If at all possible, try to get the emission factor from the supplier of the product or service. We will refer to this as 'vendor-sourced.'

This implies that the table of recipes and ingredients gets us here:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra	Apply with sanity and caution.	
		IPCC default		
		Country-sourced	These could be options, especially 'Vendor-sourced.'	
		Vendor-sourced		

CAR RENTAL

Attributing emissions associated with car hire is one of the less contentious parts of a carbon footprint, as most people make the logical link between fuel consumption and GHG pollution. What makes car hire fuel consumption even more tangible is that most people will be familiar with fuelling a car at a fuelling station, but only ever see an aeroplane being refuelled from a distance.

Over the past few years a debate has arisen on just how green some of the hybrid vehicles that have come onto the market really are. No one questions the fact that the fuel consumption during use is low. The issue comes in when one looks at the total emissions associated with the manufacturing and final disposal of the hybrid vehicle and the batteries (see the discussion on life cycle analysis on page 13).

Normally, for carbon footprinting purposes, one looks only at the emissions associated with the fuel used during the use of the car hired.

Over and above this, one normally includes only the emissions associated with the direct combustion of the fuel. In other words, it is not necessary to include the emissions associated with the manufacturing of the liquid fuel (petrol or diesel) and the transportation of the fuel to a fuelling station.

> There are obviously different types of hire vehicles and this will affect the emissions per kilometre. This will be discussed during the calculations.

So, what are the steps to calculate a carbon footprint associated with rental car use?

Step: B

Source the information regarding your consumption: specific to rental car use (continued from step A).

Step	Description	Page
A	Decide on the methodology and set of emission factors that will be used.	47
B	**Source the information regarding your consumption: specific to rental car use.**	**48**
C	Start by drawing up a list of car groups.	49
D	Log the distance travelled during the car hire.	51
E	Calculate the emissions.	51

Car hire differs from air travel in that the distance for which the car will be used cannot be estimated beforehand. One still needs to piggyback on the accounting system information, but the transaction will need to be completed to know the distance travelled during the hire period.

If you have ever hired a car, you will know that a certain amount of money on your credit card will be put on 'hold' by the car hire company.

When you return the car, you will be billed based on:

- the number of days you have had the car;
- the distance you have travelled; and
- their refuelling the car if you have not done so yourself.

With all this information taken into account, your bill can be finalised. It is therefore possible for the car hire company to tell you how far an employee has driven during a specific car hire period, which is crucial for carbon footprinting purposes.

> This also implies that car hire emissions can be calculated only after the transaction has been completed and captured in detail by the accounting system.

Include some information about which department or unit used the hired car if you would like to focus on such a breakdown later on. When the car is picked up, the driver must have his driving licence present, so it is possible to obtain this information from the car hire company.

Auditing note: Check that the client did include this type of information. Take into consideration that in most cases emissions from car hire will be a small part of a carbon footprint.

Step C: Start by drawing up a list of car groups.

Step	Description	Page
A	Decide on the methodology and set of emission factors that will be used.	47
B	Source the information regarding your consumption: specific to rental car use.	48
C	Start by drawing up a list of car groups.	49
D	Log the distance travelled during the rental car use.	51
E	Calculate the emissions.	51

Different car hire companies use different classes to distinguish car groups, but there are general similarities. For example, Avis will have a Chevrolet Spark typically as class MCMR, but it also has more colloquial class names like Group M or Class Economy, with an associated emission value of, for example, 161 gram CO_2/km.

A similar approach will be followed by most car hire companies, so it is very important that you establish:

- which car rental companies you use;
- what classes of cars they have; and
- what the emission levels for those classes are.

It is advisable to compile a single list of car groups and emission factors for all the car hire companies you use. Such a consolidated table will make your life much easier. Draw up an alphabetical car group list of all the car hire suppliers. If you use Company A and Company B, you should have two tables very similar to the following abbreviated table that can be expanded to Z:

Car group	Car Company A			Car Company B		
	Car code	Typical vehicle	Emissions (g CO_2e/km)	Car code	Typical vehicle	Emissions (g CO_2e/km)
A	MDMN	Polo Vivo	202	MDMN	Kia Picanto	149
B	EDMR	Polo hatch	178	CDMR	Hyundai i20	190
C	CDMR	Corolla	184	CCMR	Corolla	203
D	EDAR	Polo sedan	156	IDAR	Chevrolet Aveo	198
E	CDAR	Corolla sedan	203	PVMR	Hyundai H1	282
F	PCAR	BMW 3 sedan	221	SDAR	Chevrolet Cruz	198
G	PDAR	Mercedes C	187	CDMD	Polo Blue Motion	89
H	EXAR	Hybrid	105	FDAR	BMW 320i	205
I						
J	LCAR	Mercedes E	235			
K	IFMR	Hyundai iX35	285			
L						
M	MCMR	Chevrolet Spark	161			
N	LVMR	Kombi	255			
O				PDAR	Mercedes C180	174
P				CFMR	Daihatsu Terios	249

Car groups and emission factors differ between car hire companies. The easiest way of keeping track of this is to assign a specific letter to each car hire company and a specific letter to each car group.

The values could change slightly from year to year and as a general rule over a longer period classes will generally decrease in pollution rates. The values mentioned above are therefore a good starting point and should be viewed only as such. That said, consider updating the hired-car emission factors as part of your annual emission factor update.

Clearly, the lists need some reconciliation if you want to end up with a single list. You can start by:

- ignoring all letters that do not have associated classes; and
- copying across all letters and associated values of classes that are used by only one supplier.

Company A assigns Group H to hybrid vehicles and Group G to expensive German saloons. Company B does exactly the inverse by having a very efficient VW car class as Group G and German saloons in Group H.

You now have two options:

- You can keep both classes separate in your reporting by calling the Company A Group H something like AH and the Company B Group H something like BH.

OR

- You can be conservative and use the biggest emissions associated with the specific class. This is not ideal as the emissions of all the efficient vehicles will effectively be the same as (or even higher than) those of bigger cars.

You should now have the following information:

A	B	C	D	E
Number	Person	Department	Car group	Emissions per km (gram CO_2/km)
1	Joe Soap	Marketing	AA	202
2	John Smith	Production	BA	149
3	Sally Shield	Production	Unknown	Unknown

Step D: Log the distance travelled during the car hire.

Step	Description	Page
A	Decide on the methodology and set of emission factors that will be used.	47
B	Source the information regarding your consumption: specific to car hire.	48
C	Start by drawing up a list of car groups.	49
D	**Log the distance travelled during the car hire.**	**51**
E	Calculate the emissions.	51

As stated previously, it ought to be easy to source this information from the car hire company as it should have been logged to determine your final billing amount.

Step E: Calculate emissions.

Step	Description	Page
A	Decide on the methodology and set of emission factors that will be used.	47
B	Source the information regarding your consumption: specific to rental car use.	48
C	Start by drawing up a list of car groups.	49
D	Log the distance travelled during the car hire.	51
E	**Calculate the emissions.**	**51**

You now have all the information you need to calculate the emissions associated with every car hire transaction. All you need to do is multiply the emission rate (gram CO_2/km) by the distance travelled (km).

Remember to divide that figure by 1 000 to get from grams to kilograms of CO_2.

A	B	C	D	E	F	G
Number	Person	Department	Car group	Emissions per km (gram CO_2/km)	Distance (km)	Total direct GHG emissions (kgCO_2e/km)
1	Joe Soap	Marketing	AA	202	528	106,66
2	John Smith	Production	BA	149	104	15,50
3	Sally Shield	Production	Unknown	Unknown	205	Unknown

DEALING WITH EXCEPTIONS

The following are some of the possible exceptions when it comes to car hire and ways to deal with these exceptions:

As always, the golden rule is that if you don't have information or data, you should use a value higher than what you think the value possibly is. So, when it gets to car hire, this implies the following:

If you do not know what class of car was used, you need to use the general car class or you need to assign a car class with quite a high emission factor. Obviously, it would be unlikely that a normal business commuter would have hired a truck for normal city use. So, let sanity prevail and assign a class of hire vehicle that is relevant. It is a good idea to assign a default value for 'unknown rental car type' from the start so that all your exceptions are dealt with in the same manner.

There is no reason why you should not know how many kilometres the hire vehicle travelled, but sometimes you might not have this data due to poor data quality. In these cases, you could assume the free or included kilometre limit as set by the car hire company. The daily limit is typically between 100 and 200 km. You can then multiply the daily limit by the duration of the car hire (in days) to get to an estimate for the distance travelled.

DOMESTIC AND INTERNATIONAL FLIGHTS

Recent international tax developments have again brought GHG pollution associated with domestic and international flights into focus. These taxes are predominantly based on the taxing of fuel that is used during a journey. Hence there is a driving force to make new aircraft more fuel-efficient. Fuel consumption also relates to low-cost carriers versus premium carriers.

To simplify, low-cost carriers manage their costs as follows:

- Allocating more people per flight, ie cutting back on leg room and the baggage allocation per passenger.
- Ensuring that flights carry more passengers than premium carriers (if a carrier calculates that a flight does not have enough people, it will probably offer passengers a flight at a different time or bump them up to a sister premium carrier).
- Using older aircraft to lower capital expenditure. (Such an aircraft was probably refurbished with some bright-coloured seating – but it probably is an older model. Older aircraft can be less fuel-efficient, so a delicate balance must be struck).
- Ensuring that as much freight as possible is carried.

The implication of the above is that there is no simple rule of thumb to determine whether a low-cost carrier has a lower or higher emission factor.

Think of it this way: if you fly premium carriers, you probably have more space, so fewer people can be accommodated per flight. However, the aircraft will probably be a newer or reconditioned model, which implies that less fuel is being used. Having more space per passenger implies that the GHG pollution can be allocated to fewer people, but using less fuel implies that there is less pollution to allocate to each person. For a low-cost carrier exactly the inverse argument will be followed.

In general, most internationally accepted calculation methods of flight emissions take flight class into account. A first-class flight allocates more space per person than an economy flight and hence a first-class flight results in more pollution. This assumption is crude at best, as illustrated by the argument above.

So, what are the steps to calculate your footprint associated with flights?

Step A: Decide on the methodology and set of emission factors that will be used.

Let us complete this step faster. A simple GHG Protocol or multiplying the distance travelled with an appropriate emission factor will suffice.

Defra could be used as one can assume that aeroplane fuel is standardised between the UK and South Africa. It could otherwise be handy if a vendor supplied one fuel factor or if a country factor is available, but it is not necessary.

Many factors influence the emissions associated with a specific flight. Generally, it is accepted that a higher flight class will have more emissions associated per passenger.

This implies that the table of recipes and ingredients gets us here:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra	Apply with caution.	
		IPCC default		
		Country-sourced	These could be options, especially 'Vendor-sourced.'	
		Vendor-sourced		

Step B: Source the information regarding your consumption: specific to flights (continued from page 54).

Step	Description	Page
A	Source the information regarding your consumption.	54
B	**Source the information regarding your consumption: specific to flights.**	55
C	Start by identifying airport pairs and establish the distance between airports.	56
D	Establish whether you have short-haul or long-haul flights.	59
E	Distinguish between flight classes.	60
F	Calculate the emissions associated with each one-way leg of the journey.	61

To piggyback on the accounting system's information implies that flight information will be logged the moment payment is made. Normally, payment will be made when the flight booking is made. The flight might actually be in a week's or month's time from the date of booking. The month in which the booking is made and paid is the month in which the flight will be reflected as a GHG emission. This is not accurate, but this methodology implies that what is 'excessively included' in the one month will be 'omitted' the next month, ie the difference will come out in the wash.

It would also be possible to base the flight emission allocation on other data, such as flown-flight stubs or additional information from the flight agency or carrier regarding when the individual actually flew. Frankly, obtaining this information will be very difficult and will introduce a postflight lag anyway. The lag implies that, instead of allocating the emissions too early, it will now definitely be allocated after the actual flight. The postflight lag might be just as bad as the preflight emission inclusion from an accuracy point of view. This method is not recommended and can only be warranted if there is a clear reason why including the flights when they are paid is too inaccurate.

Include some information regarding which department or unit undertook the flight if you would like to do a departmental or unit breakdown later on.

Distances between airports are at best a good guess. This is especially true since the flight path can vastly impact the flight distance, even between the same two airports.

Auditing note: Do a spot check on some of the airport pair distances.

Step C: Start by identifying airport pairs and establish the distance between airports.

The airport pair would be the pair indicating the departure airport and the arrival airport. Various websites will be able to approximate the distance between these airports.

Some examples of useful websites for airport pairs include:

http://www.world-airport-codes.com/

http://www.webflyer.com/travel/mileage_calculator/

There are a few things to remember when dealing with these websites:

- The distances between airports are not exact. Use two websites and compare the values given for the same airport pair. The distances ought to be an equivalent ballpark. If they are, use the longer distance. If the distances differ greatly, you will need to keep on searching for better information.
- As the flight path is not known, the distance between airport pairs will in most cases be the theoretical best case. That said, make sure that the distance between the airports take the curvature of the earth into account. For domestic flights the straightline (map) distance between two airports might be sufficient, but this can vastly underestimate the distance when it comes to international travel (see figure 4).
- Every airport across the world has a specific abbreviation that references that airport. Stick to using these internationally accepted abbreviations at all costs. For example, London Heathrow International Airport is abbreviated LHR and Cape Town International Airport CPT. Sticking to these abbreviations will simplify your life if you are dealing with travel agencies to source data.
If the websites do not tie up airport pairs with standard abbreviations or city names, you should consider using one of the other airport pair distance sources.

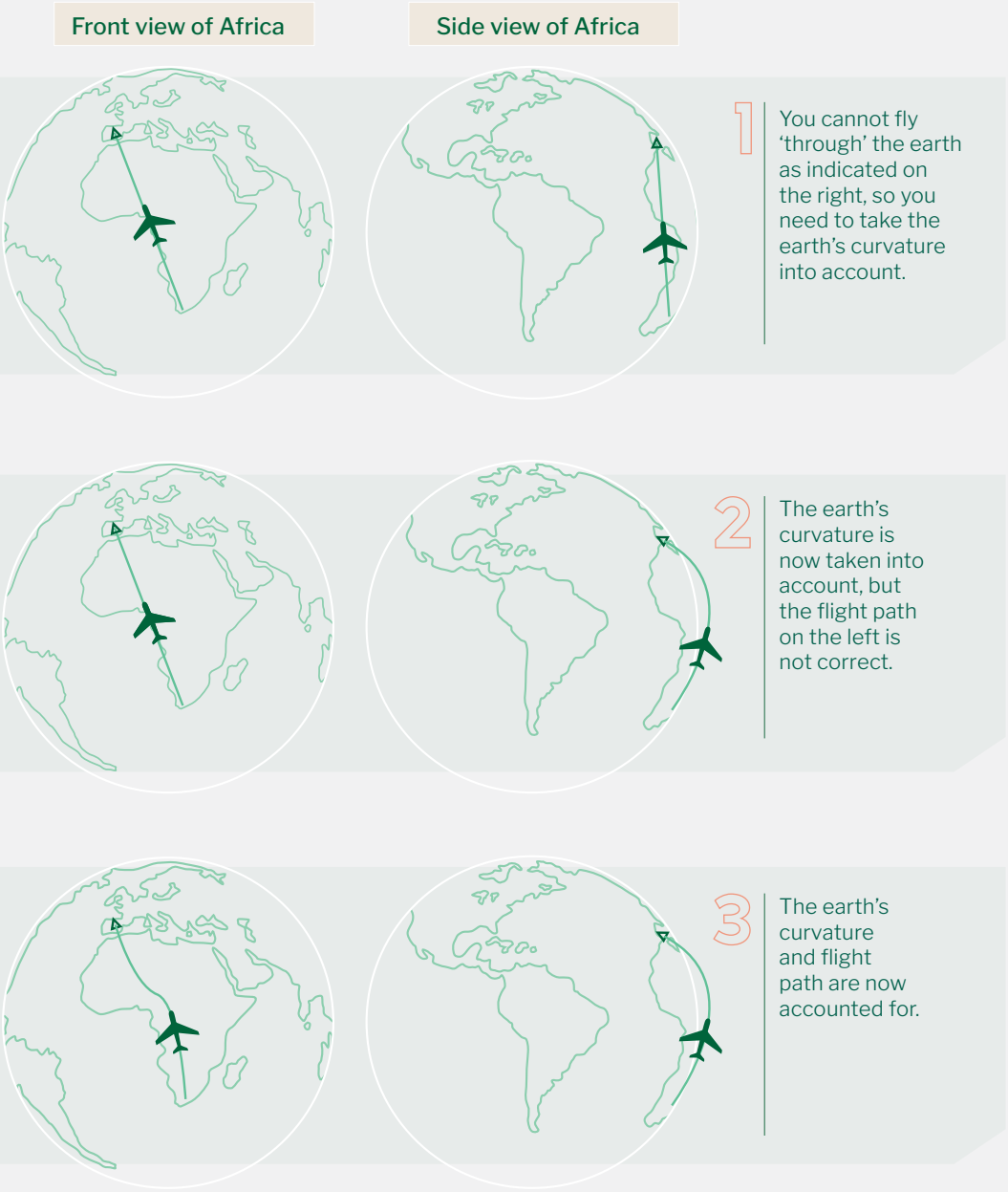


Figure 4: Typical mistakes and remedies when calculating flight distances

Furthermore, airport pairs work both ways, ie the distance of a flight from OR Tambo International Airport (ORTIA, JHB) to London Heathrow International Airport (LHR) is the same distance as the return flight. It sounds trivial, but this implies that you require only half of all possible airport pairs.

It is also easier to deal with all flights as one-way flights. The reason is simple: if the person flies back from London Heathrow International Airport, but flies to Cape Town International Airport, it becomes complicated to subtract half of a return flight from OR Tambo International Airport to London Heathrow International Airport before adding half a return flight from London Heathrow International Airport to Cape Town International Airport. The reason why all flights should be pieced together using one-way flights becomes even more apparent when an individual has multiple-city journeys without returning to the previous destination before flying off to the next city.

Deal with all flights as one-way flights since this is the easiest way to handle multiple-city travelling.

It will not be possible, or advisable, to determine the distance between every possible airport pair in the world. Use the information you obtained from investigating the procurement data to identify the departure airports and destination airports used most frequently. It is a good rule of thumb to see what is the largest percentage of the flight procurement bill that you can capture by referring to the smallest number of airport pairs. This ought to be a good stab at a first airport pair list.

Auditing note: Check the airport pairs that were used and how exceptions are dealt with.

If you are a South African-based company travelling to Europe, your departure airports will probably be Cape Town International Airport and OR Tambo International Airport. You will probably fly to London Heathrow International Airport, Charles de Gaulle (CDG) and a few other airports. Following a hub-and-spoke logic will cut down on the possible airport pairs and will aid you in focusing on the most important pairs. Later on in this section we will discuss how to deal with flights of airport pairs you do not have on your list.

So, at this stage you should now have the following information:

A	B	C	D	E
Number	Airport pair	Distance (km)	Person	Department
1	JHB – CPT	1 300	Joe Soap	Marketing
2	CPT – LHR	9 700	John Smith	Production
3	LHR – HEM (Helsinki)	Unknown	Sally Shield	Production

In this table you will see three flights:

- The first flight is from OR Tambo International Airport to Cape Town International Airport. This example will probably be a standard flight for many South African companies.
- The second flight is from Cape Town International Airport to London Heathrow International Airport. This example illustrates why all flights should be dealt with as one-way trips.
- The third flight is from London Heathrow International Airport to Helsinki-Malmi Airport. This example will illustrate what you should do when journeys have multiple or uncommon city pairings.

Step D: Establish whether you are dealing with short-haul or long-haul flights.

There are various definitions for domestic, long-haul and short-haul flights. This guide uses the October 2016 Defra definitions. But, as you will soon see, it does not make a difference in the case of South Africa.

According to Defra, a United Kingdom-based system:

- domestic flights are only a few hundred kilometres, say less than 400 km;
- short-haul are flights from 400 km to 3 700 km; and
- long-haul flights are flights further than 3 700 km.

Flying from Johannesburg to Cape Town is a distance of approximately 1 300 km and Johannesburg to Durban is 480 km. The implication is that United Kingdom-defined 'domestic flights' are not that relevant in many countries that geographically dwarf the United Kingdom. For South Africa it is recommended that you use Defra short-haul flights for all domestic flights, and Defra long-haul flights for all flights from South Africa going abroad. If the flight is to or from the United Kingdom, then the Defra long-haul emission factors could arguably apply. Obviously, for more accurate results you can keep all possible distance classes as set out by Defra, but some simplification will result in much less work and not much worse (inaccurate) results.

Step E: Distinguish between flight classes.

As stated earlier, the rule of thumb is that business class flights will result in more pollution per traveller compared with economy flights due to the aircraft being able to carry fewer passengers. In the same sense a firstclass flight passenger will pollute more than a business class flight passenger.

If you look at the Defra emission factors, you will be able to associate a certain amount of GHG pollution per passenger kilometre (pkm) with each type of flight. Not all types of flight may be applicable to you – for example, long-haul premium economy data may be too granular. If you reduce classes, make sure you overestimate the emissions and never underestimate values due to simplifications.

There are also other correction factors one could add to the calculation of flight emissions. Let us look at one of the most common ones. This factor is called the uplift factor, which is about 8% or 9%. It aims to compensate for flights not flying in a straight path from origin to destination. Since 2013 the Defra factor has included the 8% additional factor. No other correction factor will be added to the example below and the more contentious radiative-forcing factor will be discussed later.

At this stage you should have the following information

A	B	C	D	E	F	G	H
Number	Airport pair	Distance (km)	Person	Department	Haul	Class	Total direct GHG emissions (kgCO_2e/km)
1	JHB – CPT	1 300	Joe Soap	Marketing	Short	Economy	0.07984
2	CPT – LHR	9 700	John Smith	Production	Long	Business	0.22671
3	LHR – HEM	Unknown	Sally Shield	Production	Long	Unknown	Unknown

Step F: Calculate the emissions associated with each one-way leg of the journey.

A	B	C	H	I
Number	Airport pair	Total direct GHG Distance (km)	Emissions per one-way emissions ($kgCO_2e/km$)	trip ($kgCO_2e$)
1	JHB – CPT	1 300	0,07984	103,79
2	CPT – LHR	9 700	0,22671	2 199,09
3	LHR – HEM	Unknown	Unknown	Unknown

The units in the table above indicate that multiplying the travel distance (column C in km) by the emissions per unit distance travelled (column H in $kgCO_2e/km$) will provide the required result. This will only be the pollution for a one-way trip and the resulting unit is $kgCO_2e$.

DEALING WITH EXCEPTIONS

If your company does not often use flights from London Heathrow International Airport to Helsinki-Malmi Airport, you will probably not have this pair in your airport list. The result is that the distance from London Heathrow International Airport to Helsinki-Malmi Airport will be unknown. You now have to make an assumption about the distance and, being conservative, you have to overestimate the value. Let us assume you estimate it to be the same distance as Cape Town International Airport is to London Heathrow International Airport (9 700 km). If this becomes a commonly flown flight, you will have to include this airport pair in your airport pair list in future.

If you do not know the class of the flight, you will have to assume a higher class than what was actually flown to overestimate the emissions. So, let us assume it was a first-class flight.

The updated table now looks like this:

A	B	C	H	I
Number	Airport pair	Distance (km)	Total direct GHG emissions ($kgCO_2e/km$)	Emissions per one-way trip ($kgCO_2e$)
1	JHB – CPT	1 300	0.07984	103.79
2	CPT – LHR	9 700	0.22671	2 199.09
3	LHR – HEM	9 700	0.3127	3 033.19

If we knew the distance from London Heathrow International Airport to Helsinki-Malmi Airport was 1 850 km, and that the flight was a first-class flight, the result would have been as follows:

A	B	C	H	I
Number	Airport pair	Distance (km)	Total direct GHG emissions ($kgCO_2e/km$)	Emissions per one-way trip ($kgCO_2e$)
1	JHB – CPT	1 300	0.07984	103.79
2	CPT – LHR	9 700	0.22671	2 199.09
3	LHR – HEM	1 850	0.3127	578.46

The overinflated value of the flight from London Heathrow International Airport to Helsinki-Malmi Airport is clearly evident as the two calculations for this flight differ by a factor of five. It is therefore in your best interest to increase the accuracy of your data. Take care not to make assumptions simply to decrease the footprint figure. If you do not have a real value, the assumed footprint should always be larger than when you use real data.

- The atmosphere can be likened to lasagne – the composition is layered and the composition per layer can differ. These different layers have different chemical compositions and react differently to GHGs. So, during a flight, an aeroplane will combust fuel in different atmospheric layers. To accommodate this, the 'radiative-forcing factor' was introduced. In essence, it is a fudge factor (normally between 0,6 and 4) by which you multiply your calculated emissions to account for atmospheric layers. The result of the possible radiative-forcing applied value being widespread implies that the possible pollution of the same flight can differ by more than 600%. Obviously, the resulting effect is that your calculations are pretty useless. Defra 2013 and later recommends a radiative-forcing factor of 90%, which implies that flight emissions should be multiplied by 1,90. There was still no widespread consensus within the South African environment about the use of the radiative-forcing factor by the time this guide went to print. It is therefore recommended that you keep your radiative-forcing factor as 1. This implies that all fuel is combusted at sea level or at least not in the upper layers of the atmosphere. This is a crude assumption, but results in us at least being able to compare different sets of data by assuming that all radiative-forcing factors are 1. Mathematically it implies that multiplying the calculated emission values above by 1 has no effect, ie the calculation is complete as is.
- Assume that extra luggage has no associated emissions.
- Cancelled and missed flights will probably take some time to ripple through the accounting system and by implication there might be a lag in your reporting system from when a flight was included and then removed again. A cancelled flight should be excluded from your reporting. A missed flight implies that you have paid and will probably have to pay again for the same person to be on another flight. Whether the missed flight should be included or not is debatable. In the end the important point is to be consistent: clearly indicate that you either always or never account for missed flights.

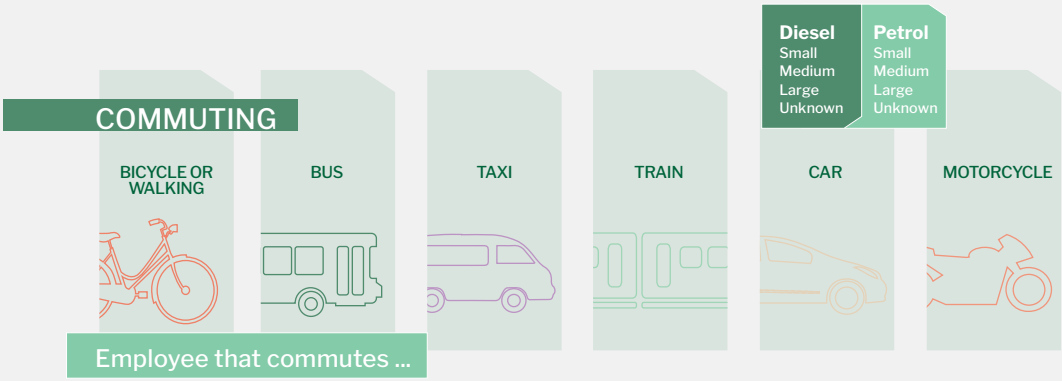


Figure 5: Graphical representation of the information that should be obtained by a staff commuting survey.

Please note that commuting is not business travel. Business travel is driving from home or from the office to a client. Commuting refers to employees' travels between home and the office daily.

Very few companies include staff commuting in their carbon footprint. Think carefully if you want to include this. If it is included once, it will be very difficult to remove from future reporting.

The first question to ask is whether a company should in fact account for the commuting of its staff in its carbon footprint. From a control principle point of view the answer is surely not, as the employer has no control over the distance the staff members travel to the office. Once it is included in the company's footprint, it will be very difficult to take out in future years. One viewpoint in support of including all staff commuting is that it leads to a more complete carbon footprint for the company.

Taking commuting, or any other previously included component, out of the footprint could send the wrong message to the market. The company could be seen as shirking its responsibility.

If you want to include staff commuting, you would probably have to send out a survey to all your staff members to ascertain staff commuting behaviour. To incentivise staff a lucky-draw prize could be offered for completing the survey.

You should also realise by now that commuting is not a direct source of emissions as staff members pollute to get to the office and it is not the workplace itself that pollutes. The result is that carbon tax does not look at commuting as a source of pollution related to the employer.

Commuting is a bit of a curve ball for most auditors. This section will guide your thinking if you need to audit a commuting footprint.

BUSINESS TRAVEL IS DRIVING FROM HOME OR FROM THE OFFICE TO A CLIENT. COMMUTING REFERS TO EMPLOYEES TRAVELING BETWEEN HOME AND THE OFFICE EVERY DAY.

As with any questionnaire the aim is to be able to extract the most information with the fewest possible questions. The process to obtain the most information with the fewest questions can be broken down as follows:

Step 1: Ascertain the mode of transport being used.

Question 1: How do you normally get to the office?

Answer by selecting one option:

☐ Walking or cycling ☐ Bus ☐ Taxi ☐ Rail ☐ Car ☐ Motorcycle

Obviously walking and cycling have no emissions and a zero value should be assigned to these entries. Bus, taxi and rail emission factors are provided in the Defra emission factor guidelines, but some biased interpretation is required for the South African conditions, which could include the following:

Consider using the highest bus emission factor (0.11774 $kgCO_2e/pkm$) as it is quite probable that buses in South Africa are less efficient than the ones used in the United Kingdom.

This can be assumed to be true as buses in the United Kingdom are legally bound not to emit more than a prescribed limit. Such legislation, and their enforcement, are not so strict in South Africa.

Taxis in South Africa are also not comparable to taxis in the United Kingdom. South African taxis are mostly minibuses and Defra will offer you many options for dealing with this form of transport. One option is to look at the passenger road transport conversion factors by market segment. And if you choose an unknown-fuel multipurpose vehicle, you could reasonably assign an emission rate of 0.18031 $kgCO_2e/vkm$.

Remember also that this is the vehicle pollution rate (vkm) and your staff commuter can be responsible only for his portion. For the sake of simplicity let us assume that the average taxi will have an average of 10 occupants at any time.

The emission factor per taxi commuter should then be:

$0.18031\ kgCO_2e/vkm \div 10$
$= 0.018031\ kgCO_2e/pkm$

There may be other well-motivated options. As always, overestimate if you are uncertain and always log your assumptions.

Rail in South Africa will predominantly be above ground. By using the Defra emission factors, you can argue that you need to use the light rail and tram options or basically pick the highest above-ground rail pollution rate. This will be an emission rate of 0.03549 $kgCO_2e/pkm$.

Step 2: Quantify the emission factor for the mode of transport.

Question 2.1: If a car, does it run on petrol or diesel?

Answer by selecting one option:

- ☐ Petrol
- ☐ Diesel
- ☐ Unknown

Question 2.2: If a car, is it small, medium or large (defined by engine capacity)?

Answer by selecting one option:

- ☐ Small (petrol engines of 1,4 ℓ and smaller, and diesel engines of 1,7 ℓ and smaller).
- ☐ Medium (petrol engines of 1,4–2,0 ℓ and diesel engines of 1,7–2,0 ℓ).
- ☐ Large (petrol and diesel engines bigger than 2,0 ℓ).
- ☐ Unknown.

Defra defines the engine size for small, medium and large cars on its website and in the 2016 emission factors for these vehicles.

Question 2.3: If a motorcycle, is it small, medium or large [defined by engine capacity as cubic centimetres (cc) and assuming all motorcycles are petrol]?

Answer by selecting one option:

- ☐ Small (petrol engines of 125 cc and smaller).
- ☐ Medium (petrol engines 125–500 cc).
- ☐ Large (petrol engines bigger than 500 cc).
- ☐ Unknown.

Defra defines the engine size for small, medium and large motorcycles in Annexure 6 of the 2012 emission factors. Other downloadable Defra emission factors are not that specific about engine sizes, but in separate documentation the segmentation is defined.

At this stage you should have the following information:

A	B	C	D	E
Number	Type of transport	Subtype	Engine size detail	Emissions ($kgCO_2e$/vkm)
1	Walking/Bicycle			0
2	Bus			vkm NA
3	Taxi			0,18031
4	Rail			vkm NA
5.1		Car Petrol	Small	0,14946
5.2			Medium	0,18785
5.3			Large	0,27909
5.4			Average	0,17431
5.5		Diesel	Small	0,13758
5.6			Medium	0,16496
5.7			Large	0,20721
5.8			Average	0,16843
5.9		Unknown	Average	0,17148
6.1		Motorcycle	Small	0,08306
6.2		Petrol	Medium	0,10090
6.3			Large	0,13245
6.4			Unknown	0,11355

Up to now we have used emission rates associated with every kilometre that the vehicle travelled, ie vehicle kilometres (vkm). If you were a transport company using this accounting method for determining your carbon footprint, you would be well on your way to the answer. However, this section deals with the commuting of staff members.

> Therefore, we have to transform the vehicle kilometres to some type of passenger kilometer measure. In essence this means that up to this point we have used the emission factor of a bus, train, car, etc, assuming it only had one passenger. Obviously, if 10 people used a specific form of transport, each person should only account for one-tenth as part of his footprint. (Refer to the discussion on taxis.)

So, you need to divide the per vehicle kilometre emission factor by the people per vehicle to get to the per passenger kilometre. In the case of minibus taxis in South Africa you will need to make a calculated guess about the capacity per vehicle and usage. This was done above.

For cars and motorcycles you will need to include another question in your questionnaire:

Question 2.4: How many people are travelling in/on your vehicle?

Answer by selecting one option:

☐ One ☐ Two ☐ Three ☐ Four ☐ Five

Step 3: Ascertain how far and how frequent each commuter is travelling.

Question 3.1: How many days per week do you go to the office?

Most people will not know how many days they come to the office on an annual basis or they will simply state '365', which is unlikely. If you ask people how often they come to the office per week, then most people will give you an answer of between three and five. Flexible working practices imply that even fulltime employees do not always go to the office five days a week. If some state that they come to the office five days a week, it is reasonable to assume that their office working days per annum will be between 220 and 230 days. (In most cases it is assumed that a work year consists of 220 working days.) If the answer was less than five days, it is suggested that you work out a number between 220 and 230 days, say 225 days. So, if the person answered that he goes to the office three days a week, assume he goes to the office:

Office days = 3 ÷ 5 × 225 = 135 travelling days

Question 3.2: How far in kilometres is your one-way trip to the office?

It is preferable to ask the one-way distance and then multiply it by two to get to return trips. You could also ask the return-trip distance, but, whatever your preference, make sure that the questionnaire participant has no doubt about what you are asking.

You now have all the information to calculate the total distance travelled per commuting entry.

Illustration of the typical information that a staff-commuting survey could capture:

A	B	C	D	E	F	G
Number	Type of transport	Subtype	Engine size detail	Emissions ($kgCO_2e$/vkm)	Typical number of users per unit	Allocated emission factor ($kgCO_2e$/pkm)
1	Walking/Bicycle			0	NA	0
2	Bus			vkm NA	NA	0,11774
3	Taxi			0,18031	10	0,01803
4	Rail			vkm NA	NA	0,03549
					Number of people in vehicle	
5.1	Car	Petrol	Small	0,14946	2	0,074730
5.2			Medium	0,18785	2	0,093925
5.3			Large	0,27909	3	0,093030
5.4			Average	0,17431	2	0,087155
5.5		Diesel	Small	0,13758	1	0,137580
5.6			Medium	0,16496	2	0,082480
5.7			Large	0,20721	3	0,069070
5.8			Average	0,16843	2	0,084215
5.9		Unknown	Average	0,17148	3	0,057160
6.1	Motorcycle	Petrol	Small	0,08306	1	0,083060
6.2			Medium	0,10090	1	0,100900
6.3			Large	0,13245	1	0,132450
6.4			Unknown	0,11355	1	0,113550

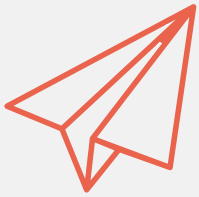
Step 4: Calculate the emissions associated with every commuting entry.

You have the emission factor per passenger kilometre and the distance as entered by the commuter/passenger. Multiplying these two values will give you the pollution per commuting entry.

The table below shows one example per possible entry:

A	B	C	D	E	F	G	H	I	J	K
No	Type of transport	Subtype	Engine size detail	Emissions ($kgCO_2e$/vkm)	Typical number of users per unit	Allocated emission factor ($kgCO_2e$/pkm)	Days per week	Distance one-way (km)	Total annual distance (km)	Emissions $kgCO_2e$
1	Walking/Bicycle			0	NA	0	5			0
2	Bus			vkm NA	NA	0,11774	5	20	8 800	1 036,11
3	Taxi			0,18031	10	0,01803	5	15	6 600	119,00
4	Rail			vkm NA	NA	0,03549	5	42	18 480	655,86
					Number of people in vehicle					
5.1	Car	Petrol	Small	0,14946	2	0,074730	5	22	9 680	723,39
5.2			Medium	0,18785	2	0,093925	5	40	17 600	1 653,08
5.3			Large	0,27909	3	0,093030	5	34	14 960	1 391,73
5.4			Average	0,17431	2	0,087155	5	38	16 720	1 457,23
5.5		Diesel	Small	0,13758	1	0,137580	5	29	12 760	1 755,52
5.6			Medium	0,16496	2	0,082480	5	28	12 320	1016.15
5.7			Large	0,20721	3	0,069070	5	4	1 760	121,56
5.8			Average	0,16843	2	0,084215	5	22	9 680	815,20
5.9		Unknown	Average	0,17148	3	0,057160	5	52	22 880	1 307,82
6.1	Motorcycle	Petrol	Small	0,08306	1	0,083060	5	17	7 480	621,29
6.2			Medium	0,10090	1	0,100900	5	24	10 560	1 065,50
6.3			Large	0,13245	1	0,132450	5	65	28 600	3 788,07
6.4			Unknown	0,11355	1	0,113550	5	21	9 240	1 049,20

PAPER



Paper consumption is a very emotional issue, as consumers will quickly speak to the supplier of a product or service if they feel that they are receiving too much paper correspondence. It is also fair to say that paper was one of the first consumables, and in fact products in general, to face environmental pressure with a view to lowering use.

One of the main reasons why paper use faces such a backlash could stem from the fact that it is a tangible consumable. Electricity, on the other hand, gets used freely and people do complain about the monthly bill; the billows of smoke going up in Mpumalanga seem far away and much less tangible compared with the piece of marketing paper received through snail mail.

In many cases the reaction can be compounded by clients' frustration and disgust with paper use. Imagine a company sends out a statement with only one side printed on and then indicates that its fees will be increased. Clients could feel strongly that the fees could be reduced if less money were spent on paper, printing and postage. It should be remembered, though, that South African legislation, for example the Consumer Protection Act, requires that a certain amount of information be sent out to clients. However, printing on only one side of a statement may be much harder to justify.

In the South African context, most companies' emissions associated with paper use will be less than 5% and, in many cases, less than 3%. Only when companies are responsible for massive amounts of printing per individual will paper add up to a significant part of the carbon footprint. Examples of companies that may print significant amounts per client are universities that have thousands of students, with possibly thousands of pages being printed per student per year.

Paper consumption is a very emotional part of a carbon footprint because it is highly visible to consumers. The pollution and environmental damage associated with electricity (for example) are less visible since the power station is often far away from the user and not noticed by consumers.

It can be argued that plantations for pulp and paper use sequestrate carbon and are continuously replanted so that the paper-and-pulp industry is in a perpetual semisteady state of sequestration. is in a perpetual semi-steady state of sequestration.

THIS IS TRUE, BUT THIS ARGUMENT CONVENIENTLY DOES NOT DISCUSS:

the energy use while processing the wood to paper or pulp;

the transportation of the harvested wood and, in the end, of the paper to the end user; and

the influence of dyes and inks used and energy associated with printing.

Simply put: Arguing that paper has no environmental impact due to the associated plantation sequestration is a moot argument. If paper were indeed carbon-negative (where the net result is more carbon is absorbed than what is released), paper manufacturers would be able to sell a product that can be used and that can reduce a carbon footprint. If this were the case, surely a marketing campaign would have conveyed the message by now?

Generally speaking, paper producers and suppliers are more energy-, water- and GHG-conscious than many other industries. This can be attributed in part to the pressure they were subjected to before this pressure was exerted on most other companies.

This pressure also caused paper producers and suppliers to be in a position where they can quite easily answer questions and supply data related to their water and energy use and GHG-associated production levels. Most paper producers are even willing to disclose this on a per-plant basis.

So, what are the steps to calculate a footprint associated with the use of paper?

No domestic carbon tax is payable on these emissions as they are all indirect emissions. This implies that someone else pollutes and we buy the non- energy-related paper product.

Let us again start by looking at the various recipes and ingredients that we can use:

Step A: Decide on the methodology and set of emission factors that will be used

We again do not need to follow the more complicated IPCC Guidelines, and the simplest methodology or recipe to use will be the GHG Protocol. This will imply that the quantified service or goods amount will be multiplied by the appropriate emission factor or ingredients.

Next, we need to choose the emission factor to use. As stated earlier, paper emission factors could differ from those provided in Defra due to the different input fuels used by various production plants across the world. If at all possible, try to get the emission factor from the supplier of the product or service. We will refer to this as 'vendor-sourced.'

This implies that the table of recipes and ingredients gets us here:

			Calculation methodology	
			Recipe	
			GHG Protocol	IPCC Guidelines as found in the Carbon Tax Act
Emission factor source	Ingredients	Defra		
		IPCC default		
		Country-sourced	These could be options, especially 'Vendor-sourced.'	
		Vendor-sourced		

Step B: Source the information regarding your consumption: specific to paper.

As mentioned earlier, monthly reporting and piggybacking on the accounting system's information are advised. This implies that paper consumption will be logged the moment a payment is made, as if the paper was consumed the moment payment happened. This is most probably not the case, but the result is that you can link your data to the accounting system. It is important to include some information on which department or unit consumed the paper if you would like to do a departmental or unit breakdown later on.

The other two options available when logging paper consumption will be the following:

- Logging the paper the moment the order is placed. The problem with this is that the order might change, be cancelled or not be delivered in total. Keeping track of these scenarios could be difficult.
- Logging the actual use of paper. For this a reporting system is required where each printed page can be linked to the person who printed it.

> This information should then be rolled up to department level and later to company level. This would be a good system, but is not always available in all companies.

Furthermore, disconnecting the flow of the money (when the paper is paid for) and the flow of paper (when the paper is used) means that a reconciliation between paper used and paper paid can be problematic.

Auditing note: Check which logging convention is followed when dealing with paper and that this convention is applied consistently.

Step C: Limit what you include in your paper footprint to what matters.

So, in theory the palm-sized paper squares frequently used by people do add to your carbon footprint, but the amount is negligible. Following on the reconciliation in Step B, it will now be useful to see which paper products contribute the most to your carbon footprint. Look at the money paid per product or order amount per product. You should then compile a list that is as short as possible but still captures as much paper use as possible.

Typically you can start by accounting for:

- A4 paper (differentiate between colours). In most cases this will be the predominant paper product used.
- A3 paper (differentiate between colours).
- A5 paper (differentiate between colours).
- Plotter paper.
- Other.

The list should not be longer than 20 to 30 items, but more than 80% should be captured, based on the procurement bill and the number of items ordered. Also, remember to compile this list by looking at historic annual data to exclude any seasonal ordering that may be attributed to a specific project.

1 Limit which paper products you include in your paper footprint to track the most relevant consumption.

Step D: Carry over the other required information.

Other bits of information you will shortly require include the following:

- You need to know who the manufacturer of a specific paper product was. This is not that hard to determine in South Africa as there are a limited number of paper product manufacturers that can deliver at scale.
- You need to keep track of whether the paper product is a virgin product or a recycled product.

If the paper manufacturer is not known, a conservative (high) emission factor should be used for paper production.

At this stage you should have the following information:

A	B	C	D	E	F	G	H
Number	Paper product	Number ordered	Unit	Colour	Manufactured by	Recycled	Ordered by
1	A4	5	Boxes	Default white	Mondi	No	Marketing
2	A3	3	Reams	Green	Sappi	Yes	Production
3	Plotter paper	2	Rolls	Default white	Sappi	No	Production

Step E: Calculate the mass of paper per order.

Typically, there is a mass unit associated with paper products. For example, an A4 page suited for printing typically weighs 80 grams/square metre (gsm). The unit A4 refers to the size of the paper product. With these two additional data points you will be able to calculate the mass of the product.

So, expanding on the previous table from left to right, you should now have the following:

A	H	I	J	K	L	M	N
Number	Ordered by	Product width (cm)	Product length (cm)	Grams per square metre (gsm)	Sheets per unit	Area (m^2)	Paper mass (kg)
1	Marketing	21,0	29,7	80	2 500	779,63	62,37
2	Production	29,7	42	100	500	187,11	18,71
3	Production	42	1 000	60	1	8,40	0,50

DOING THE CALCULATION FOR THE A4 EXAMPLE:

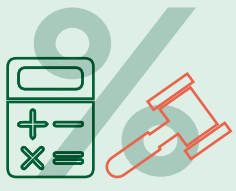
Product width × product length
= 21,0 × 29,7 = 623,7 cm^2

Divide this by 100 and another 100 to go from cm^2 to m^2 = 0,06237 m^2

This is the surface area per sheet and we have five boxes and each box has 2 500 sheets.

The total area for this order is therefore:

Area per page
× number of boxes
× pages per box
= 0,06237 × 5 × 2 500
= 779,63 m^2



The A4 boxes all have a paper mass of 80 gsm, which means that the mass is:

Total area of order
× mass per square unit of paper
= 779,63 × 80 = 62 370,4 g

Divide by 1 000 to get to kg
= 62,37 kg

What is clear from the example above is that you have to keep your wits about you when it comes to the units. It is recommended that you do the calculation steps as illustrated above and do not combine too many steps – especially when starting out.

Always keep track of the units of measurement used.

Later you will develop a feel for some of these measures so that you will instinctively know whether, as a ballpark figure, they are correct or not.

So, for example, if we pick up a box of paper, we could guess it weighs more than 10 kg and less than 20 kg. We can then use this estimation to do the calculation below:

The calculation of the surface area per sheet and per box is illustrated below.

Remember, a box has 2 500 sheets. The total area for this order is therefore:

Area per page × pages per box = 0,06237 × 2500 = 155,93 m^2

And at 80 gsm the mass per box equates to:

Total area per box × mass
= 155,93 × 80 ÷ 1 000 per square unit
= 12,47 kg

So, the 12,47 kg of paper per box 'feels' right.

You should develop a 'feeling' for carbon and related values so that you will be able to spot way-out answers intuitively with practice.

Step F: Determine the emission factor for the paper you are using.

Let us get back to the point about the availability of information provided by paper manufacturers. In South Africa two players, namely Mondi and Sappi, dominate the paper and pulp industry. Both of these companies are extremely forthcoming when asked about the carbon footprint, water impact and energy used in producing their products.

Here are some useful tips to keep in mind when dealing with their information:

- Ignore the associated Eskom emissions as supplied by the paper manufacturer. Rather recalculate the emissions associated with Eskom electricity.
- Rather work in MWh as this will simplify the next step to get from electricity to GHG emissions.
- Assume that the Eskom emission factor is 1,06 tCO_2e/MWh. This emission factor was explained in detail in the section on electricity.
- It is quite common for recycled paper to have a higher emission factor than virgin paper. This 'feels wrong', but if you think about it, it makes perfect sense. To recycle paper is quite energy-intensive, as you need to chop up used paper and make a 'soup' out of it. The paper is then bleached and treated to get rid of inks, and then you need to get the paper into flat paper sheets again. Some of these steps, like bleaching, are not as prevalent when producing virgin paper. Ironically enough, from a GHG perspective recycled paper in many cases pollutes more than virgin paper. However, do remember that recycled paper can have other benefits, such as keeping a reusable resource out of a solid landfill.

Step G: Calculate the GHG emissions associated with each transaction.

You now have all the information you require to do the carbon footprint calculation relating to paper consumption. It is advisable to do the calculation per entry or transaction as opposed to lumping everything together and then doing the conversion from tonnes of paper to tCO_2e only at the end.

Doing the calculation per entry or transaction leads to a granular understanding of the data.

For example, one will then be able to pick up that a box of A4 paper weighs about 12 kg and the GHG pollution associated with it is typically between 24 and 36 kgCO_2e.

Remember, the paper emission factors used below are indicative and you should probably tweak them for your application.

IF YOU DO NOT KNOW WHO THE SUPPLIER OF THE PAPER WAS, EITHER USE ONE OF THE HIGHER PAPER EMISSION FACTORS OF SUPPLIERS OR USE YOUR AVERAGE PAPER CONSUMPTION EMISSION FACTOR.

A	E	F	G	N	O	P
Number	Colour	Manufactured by	Recycled	Paper mass (kg)	Paper emission factor (tCO_2e/tonne paper)	Emissions per order (kgCO_2e)
1	Default white	Supplier A	No	62,37	1,8	112,27
2	Green	Supplier B	Yes	18,71	2	37,42
3	Default white	Supplier B	No	0,50	3	1,50

DEALING WITH EXCEPTIONS

The following are some of the possible exceptions when it comes to paper consumption and ways to deal with them. As always, the golden rule is that if you do not have information or data, you should use a higher value than what you think the value possibly is. So, when it gets to paper consumption, this means the following:

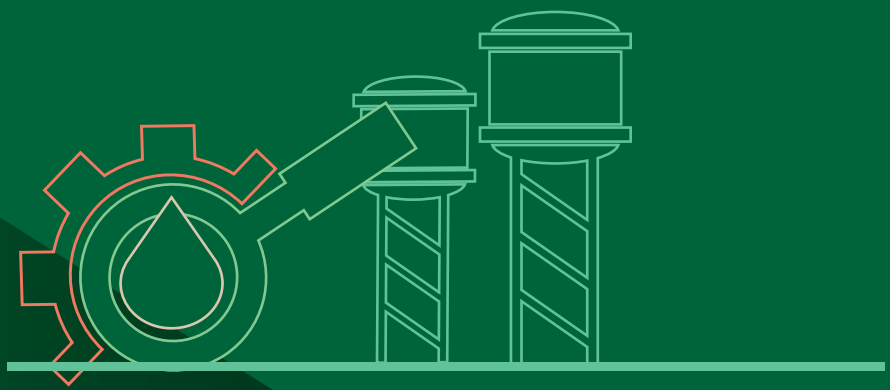
If you do not know who the supplier of the paper was, either use one of the higher paper emission factors of suppliers or use your average paper consumption emission factor.

If you do not know the unit that was ordered, assume a reasonable or higher default.

This means that, if you only know that an order consisted of five units, it could have been reams or boxes.

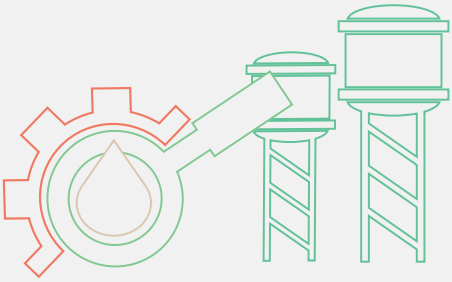
As a worst-case scenario, you then have to assume that it would have been boxes. The usage will then be inflated, which underlines the importance of quality data.

7 Water footprinting



The approach followed in this guide is to discuss the major ideas and pitfalls of water footprinting **and guide the reader to deciding on an approach that is best suited to your application.**

Water footprinting



There are numerous sources that claim that they are the custodians of the 'real,' or 'world-standard' or 'complete' guide to water footprinting. This is problematic as it can be argued that many of the water footprinting approaches share a common understanding, yet the nuances of each lead to some of the approaches being more universal or applicable when compared with other approaches.

Let us start by discussing some key concepts:

What is 'direct,' 'indirect,' 'embedded' and 'virtual' water?

Luckily, in this case the meaning and implication is straightforward as 'direct water use' will be the water that an entity uses itself. So, if I take a shower, the water used is my direct water use. The water used in the manufacturing of the soap I used will be an example of 'indirect water use', as I did not make the soap myself.

The 'indirect water' can also be referred to as 'embedded water' or 'virtual water.' Often the 'embedded water' or 'virtual water' use of an item is much higher than the 'direct water' use. One example often quoted is that of beer. Depending on the reference used, it takes 300 litres of water to produce 1 litre of beer.

This accounts for all the water required to produce the ingredients of beer and for the manufacturing process. Obviously, 1 litre of beer does not weigh or take the volume of the embedded 300 litres of water used. This can seem very confusing initially and the best way to think about it is that, just as in carbon footprint accounting, you will need to decide on a reporting boundary. In the reporting boundary you will then state what you will include and exclude in your reporting. In most cases this will mean steering clear of poorly defined concepts and ensuring that your reader knows exactly what you are reporting on. For example, you can decide in a beer manufacturing plant to only use the gate-to-gate principle and exclude the water used to grow the hobs. This could be an incomplete footprint, but at least your reader will know exactly what you considered during your water footprint calculations.

What is meant by the different colours of water like 'Blue Water?'

The following are the major water colours used with a common definition of each:

- Blue-water is usually defined as surface and groundwater reservoirs, and is usually seen as pristine or clean water.
- Green-water usually refers to rainwater and the moisture in soil associated with the cultivation of crops. So, Green-water is not yet taken up into Blue Water reservoirs.
- 'Grey-water' is associated with household, office or industrial wastewater that is relatively free of solids, but will contain soaps, detergents, etc. It is generally accepted that it will not contain raw or untreated sewage.
- Black-water commonly refers to sewage.

Looking at the above, you should see that this system of allocating colours to the quality of waste has three major drawbacks:

- There is no 'exchange table' like the GWPs that one can use to get overall equivalent water use. This implies you cannot say 1 litre of Blue-water is equal to 2 litres of Grey-water. This limitation implies that all water can be treated the same in a footprint although pristine, potable water makes up less than 1% of the water sources on Earth!
- There is no real indication of the source of the water with only mild associations like Green-water being associated with rain and soil water. Surely one would like to know if water is rainwater or comes from a borehole, for example.
- There is also no specific list of ingredients that constitute each colour. This implies that rainwater, which should be Green-water, could be defined as Grey-water if it is contaminated by agricultural pesticides and fertiliser by the time it gets to a river. Obviously, this can result in massive confusion if different entities account for rainwater running into a river differently.

So, what should one then do?

The best approach is to disclose all water uses as mass balances indicating the uses of each sources and how they are discharged from a facility. Let us go back to the stepwise procedure followed in the carbon footprint section, apply it to water footprinting and see what happens.

Step A: Decide on the methodology that will be used.

If one wants to, one can follow the colour-based approach, as discussed above, but steer clear of the pitfalls by ensuring that all information is disclosed to the reader. In this example we will use a 'source to use' approach outlined below and represent it graphically as to be as forthcoming as possible.

Step B: Source your consumption information.

Billing information should be available for potable water or water sourced from the municipality. Exactly the same data limitations as discussed in the carbon footprint section may apply here.

These could include the following:

- Water use is estimated, and a reconciliation is done periodically.
- The cost is the water is known, but the actual kilolitre consumption is possibly on the invoice and not in the accounting system or even worse also not on the invoice.

> Refer to the Scope 1 or 'direct- emissions' discussion regarding liquid fuels on possible options of how to estimate the consumption if the available data is of poor quality.

The indirect water that was used in a best case can be sourced from the supplier of the goods that it refers to, but most suppliers will not have this information readily available.

Some keen deductions from the supplier's annual reports or environmental reports could be useful. Remember, whether indirect water should be included depends on the reporting boundary that you decided on. In the explanatory example used here the 'source to use' also implies that one should distinguish where the water comes from how it is used and how it exits a facility.

Potential sources of water include:

- Municipal water
- Rainwater harvesting
- River water and/or seawater
- Borehole water

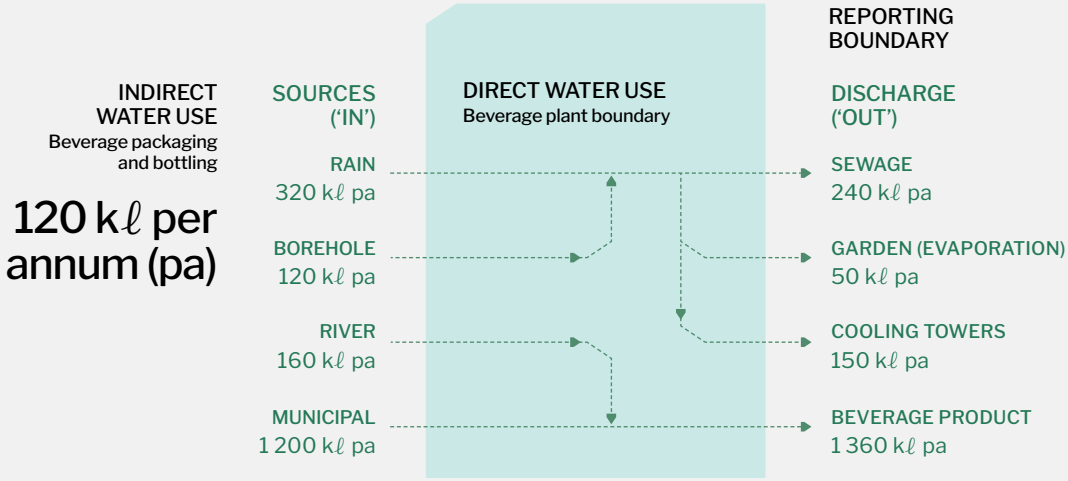
Potential uses of water include:

- For a beverage manufacturer the water is an ingredient of the product.
- Some water exits a facility as sewage.
- Water evaporation in cooling towers is a common occurrence.
- Gardening and landscaping require water use.

Step C: Present your data to the reader clearly.

Step	Description	Page
A	Decide on the methodology that will be used.	80
B	Source your consumption information.	81
C	Present your data to the reader clearly.	82
D	Set targets or actions based on the data.	83

Keeping all of above in mind can be very difficult, so the easiest way is to present this graphically. Let us use the example of a beverage production plant and present it as follows:



The following can be deduced from above:

- Regarding the boundary
  - The 'indirect water' is limited to the water use associated with beverage packaging and bottling (120 kℓ pa).
  - The 'direct water' comes from the sources on the left ('In') and all sources can be accounted for on the right ('Out').
- Some sources are combined (rainwater and borehole extraction) and used for a variety of purposes (sewage, gardening and cooling towers). Some water treatment could be required to achieve this. The beverage product is made from a combination of river and municipal water.

> Arguably, the approach followed above gives much more clarity about the water use when compared to a simple and confusing colour-based approach.

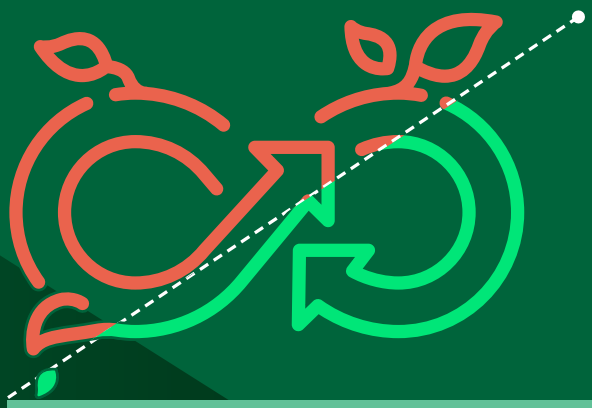
Step D: Set targets or actions based on the data.

Setting targets will be discussed in the case study section in more detail, but it is appropriate to discuss some concepts for water targets at this stage.

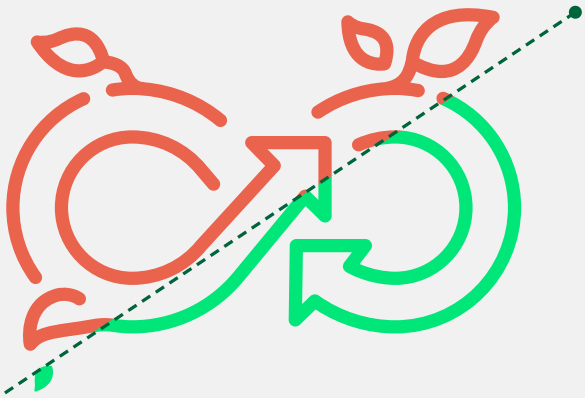
The two main approaches to target setting for the beverage plant example can be summarised as follows:

- For 'indirect water use':
  Vendor selection will already contain many aspects, including price and black economic empowerment status. Another criterion, with an associate weight, could be the environmental impact of the vendor/supplier. By doing this the supplier with the lowest environmental impact could be favoured and this could reduce the indirect water use over time.
- For 'direct water use':
  A commonly used approach is to aim for the highest possible percentage of water to exit as the beverage product. Currently, 1 360 kℓ per annum of the 1 800 kℓ per annum water use exits as the beverage product. This equates to 75,6%, which can be considered to be quite good. Future targets can be based on the water percentage or kilolitre use.

8 Case study of footprints



Looking at case studies is crucial as it allows us to understand the different ways in which various organisations **apply seemingly similar sets of rules**, yet end up with **different results**.



A GUIDE TO ENGAGING WITH THE CASE STUDIES

You now have a good working knowledge of how to calculate the various components of a carbon footprint and water usage disclosure or footprint.

It is therefore time to investigate a few practical footprint case studies. Some of the case study sources are very comprehensive documents as they often refer to annual reports or sustainability reports.

To traverse these documents it is advisable to do a word search (for example 'carbon') to be directed to the most relevant sections. During the case study discussions all page references are based on the page number in documents and not the PDF page number.

Discussion regarding the selection of case studies and sources of information

The selection of the case studies has evolved over the years and throughout the development of this guide. Initially, the Carbon Disclosure Project (CDP) breakdown of the South African economy was used to develop a variety of case studies.

This approach was still followed approximately, but the development of the case studies has shown that companies that either do not disclose to the CDP, or companies that do not disclose fully to the CDP, could still offer valuable insight.

With this in mind, each case study was selected to illustrate specific aspects or to show the interaction between case studies. The following is a summary of the case study topics and the companies or sources of information used. For ease of reference the specific source document or website was included as a footnote that the reader can access to follow the conversation.

The table below uses a matrix to match the chosen case studies as they relate to the identified topics:

Number and topic	AB InBev	Arcelor Mittal	AVIS Budget Group	Barloworld	BAT	Distell	Eskom	FirstRand	Sasol	Nedbank	Netcare	Redefine Prop	SAB Miller	Standard Bank	Sun International	Truworths	Vodacom
1 General					X	X					X						
2 Where is sustainability positioned?				X										X			
3 Carbon neutrality			X	X						X							
4 Auditing				X								X					X
5 Carbon standard and methodology										X							X
6 Scope 1		X															X
7 Estimated carbon tax revenues		X					X		X								
8 Scope 2															X		
9 Scope 3		X								X		X					
10 Targets and normalisation					X						X						
11 Comparisons	X									X		X					
12 Disclosure																	
13 Water as a product input and measuring efficiency	X																
14 Thinking about Eskom and water use							X										
15 What can you do in your company?											X					X	

The rest of this section will focus on discussions relating to these topics.

Topic 1:
General

SUSTAINABILITY

> The term 'sustainability' is reaching the point of overuse. There are many different definitions and a variety of applications, such as 'sustainable development' or 'sustainable business'.

A commonly used definition of 'sustainability' is one made up of three aspects – people, planet, and profit. Distell adapts this approach on page 8 of its 2019 sustainability report[1]. Distell states that these aspects act as pillars and that the pillars are aligned with the key areas along its value chain, being promoting responsible drinking, achieving transformation, managing its supply chain sustainably and empowering communities.

In Netcare's 2019 annual integrated report[2], sustainability has a focus on environmental resources, such as water and energy, and has been recognised as a key priority included in its strategy. And although environmental sustainability is defined as a strategic priority, no explicit link is made between environmental, economic and social sustainability.

CONCLUSION

Distell is a brewing and beverage company and Netcare is a healthcare company. These industries are quite different, yet, as can be seen from above, all consider themselves to be active in the broader sustainability field.

SELF-ASSESSMENT

How does your company define 'sustainability'; does it include the three pillars of sustainability in its definition?

How do you rate the sustainability of your company based on its products or services? In other words, how sustainable is the company you work for?

[1] https://www.distell.co.za/Investor-Centre/annual-report/
[2] https://www.netcare.co.za/InvestorReport/Netcare_annual-2019/documents/annual_integrated_report_2019.pdf

Topic 1:
General

SUSTAINABILITY

Sustainable product and sustainable company

It is commonly accepted that tobacco is detrimental to one's health. Can tobacco then be considered as a sustainable industry?

British American Tobacco (BAT) also has a large agricultural footprint, and agricultural activities can have adverse environmental impacts. It is generally accepted that agriculture is a major user of water, and that a land use change from forestry to agriculture will reduce sequestrated carbon. For this reason there are ever-increasing pressures on agriculture to focus on sustainability. How does the impact of tobacco tie up with BAT's group strategy?

For guidance see the 2018 BAT sustainability report[3]. A strong focus is placed on sustainable agriculture and farmer livelihoods and we encourage you to look at this report.

CONCLUSION

A company can be considered a sustainable company even if its current product offering does not consist of sustainable products only. This statement is time-dependent and the sustainable company should shift its suite of products to sustainable product offerings.

SELF-ASSESSMENT

Can you tell the difference between the sustainability of your company and that of its products (or services)?

Does the sustainability of various product (or service) ranges differ?

[3] https://www.bat.com/group/sites/UK__9D9KCY.nsf/vwPagesWebLive/DOAWWEKR/$file/Sustainability_Report_2018.pdf

Topic 2:
A company's view on sustainability and placement within a company

A COMPANY'S VIEW ON SUSTAINABILITY

Most companies agree that sustainability has different aspects. For example, Barloworld[4] says that sustainability requires the integration of activities to address economic, environmental, and social aspects. Standard Bank[5] focuses its reporting on the impact it has on stakeholders and on societies, economies, and the environment. This is referred to as the SEE focus and has six impact areas, including financial inclusion and job creation.

> By adopting this triple bottom line accounting approach (financial, social and environmental) to sustainability and corporate governance, a company is well-placed to understand and manage the material issues, risks and opportunities of all these aspects.

The focus on these aspects is ever-changing and could be affected by the type of company. A classic example is the emphasis that mining companies place on the social aspect of sustainability, as this could be a major concern to these companies.

Where sustainability is positioned in the company
The people or unit responsible for sustainability could also be in different parts of an organisation, which leads to interesting results. The sustainability unit can most frequently be found as part of the corporate social investment (CSI) unit, the strategy unit or the compliance unit. Imagine looking at a company's organogram from left to right and looking for the sustainability unit. The resulting impact can be summarised as follows:

Sustainability situated in:	Pros	Cons
CSR	The company will be able to leverage the need for public exposure to do projects that are real and on the ground.	By its very nature these projects are quite unsustainable as many of the projects will cease the moment funding ceases.
Strategy	Being part of the strategy unit could be beneficial to ensure that sustainability is seen as a business imperative that can unlock future markets.	Frequently, there can be a disconnect between strategy and its ground-level application. This is especially true if the strategy is not reflected in stakeholders' scorecards.
Compliance	There will be much pressure to meet the requirements of internal or external audits, which will increase the likelihood of achieving results.	There can be an overemphasis on complying to the letter, but not in principle. External disclosures could be very time-consuming.

[4] https://www.barloworld.com/sustainability/overview/
[5] https://www.standardbank.com/sbg/standard-bank-group/why-we-matter/report-to-society

Topic 2:
A company's view on sustainability and placement in a company

A COMPANY'S VIEW ON SUSTAINABILITY

> Barloworld recognises the importance of including sustainable development in strategic planning processes. This is reflected in the establishment of the risk and sustainability committee, which has been one of the board's six advisory committees since 2016[6].

The risk and sustainability committee also helps in drafting, updating and managing the Barloworld climate change policy[7].

Another key aspect is looking at a company's organogram from top to bottom and looking for the sustainability unit. It could be that the sustainability unit is so embedded that it can struggle to get buy-in from top management. This could result in the sustainability unit being ineffective and frustrated.

As far back as 2016 the CDP South Africa Climate Change Executive Summary[8] stated that South African companies continue to integrate climate change strongly into their governance procedures. These companies are also typically the companies that are setting targets and taking action.

CONCLUSION

There are different views of where sustainability should be hosted in a company. Sustainability can be successfully hosted by a variety of departments as long as:

- the reporting line to the company's executive committee or board of directors is short;
- there are centralised decision-makers and decentralised business unit experts with know-how of individual business units; and
- the hosting unit views sustainability as a key objective and not an add-on.

SELF-ASSESSMENT

Where is the sustainability unit in your company?

What is the reporting line in your company and is it the correct reporting line?

How long is the reporting line in your company?

What is the impact of the positioning of your company's sustainability unit on performance of GHG-reducing actions?

Is sustainability seen as a risk or as an opportunity?

[6] http://www.barloworld-reports.co.za/integrated-reports/ir-2016/pdf/full-integrated.pdf
[7] https://www.barloworld.com/pdf/sustainability/policies/environmental/barloworld_climate_change_policy.pdf
[8] http://www.nbi.org.za/wp-content/uploads/2016/10/CDP-Climate-Change-2016-Executive-Summary.pdf

Topic 3:

Carbon neutrality

> Nedbank's carbon-neutral journey can be traced back as far as 2009[9] and this has been maintained ever since[10]. Nedbank became 'Africa's first and only carbon-neutral bank'.

This implies that its remaining Scope 1, Scope 2 and Scope 3 emissions are offset after GHG reduction initiatives. (To refresh your memory, see the technical-terms section for a definition of carbon neutrality).

The Avis Budget Group, a well-known car hire company, is also carbon-neutral and states that it has offset its emissions since 2008[11]. The Avis Budget Group also offers offsetting opportunities to their clients if they decide to participate[12]. By doing this the pollution impact of the fuel used can be 'cancelled out'. Avis Budget Group is part of Barloworld, but not all of Barloworld is carbon-neutral.

The control principle

- Application
  According to the Carbon Protocol, companies usually offset only their direct GHG emissions, namely the Scope 1 emissions. Nedbank decided to account for all the emissions from operations that it has control over and also staff commuting, over which it does not have direct control.

  This reporting boundary is frequently referred to as the operational-control approach and clearly defines what was included and excluded. Although Nedbank continues to work towards further reduction and eventual elimination of Scope 1 and Scope 2 emissions from its facilities, the bank does not claim that its entire debtors book (clients borrowing money from Nedbank) is carbon-neutral. This implies that money lent to clients by Nedbank can result in significant GHG production. Consider the application of the control principle (see the technical terms section) when you think about this matter. Similarly, Avis does not offset the emissions associated with the use of its rental fleet, although it does offer this as an additional service.

CONCLUSION

Distell's carbon neutrality is mostly based on the concept that the GHG pollution the organisation is in control of should be zero. It can be argued that carbon neutrality becomes truly effective when all companies follow this principle.

For example, Avis does not offset the pollution associated with the use of its hire fleet, but Nedbank will offset its use of hire cars. Nedbank again does not offset the pollution associated with what the bank funds. Such side-by-side carbon neutrality of many companies (if not all) will negate the GHG pollution exclusion the control principle introduces.

SELF-ASSESSMENT

Please consider the following:

The similarities and differences between the Avis Budget Group's and Nedbank's approaches to carbon neutrality. How would your company approach achieving a carbon-neutral status if it chose to do so?

The value and meaning of a carbon-neutral bank, or any other company, taking into consideration that the debtors book is not carbon-neutral. Take the control principle into consideration.

[9] https://www.brandsouthafrica.com/investments-immigration/economynews/nedbank-carbon-neutral-170909
[10] https://www.nedbank.co.za/content/dam/nedbank/site-assets/AboutUs/Sustainability/Supporting%20Documents/2018%20Sustainable%20Development%20Review.pdf
[11] https://www.cape-epic.com/news/179/avis-rent-a-car/
[12] https://avisbudgetgroup.com/wp-content/uploads/2019/01/2018-Global-Environmental-Report.pdf

Topic 3:
Carbon neutrality

THE CONCEPT OF A 'CARBON-NEUTRAL' STATUS

- **What's in a name?**
  Some carbon consulting companies can use a concept – in this case 'carbon-neutral' – and attempt to make a propriety standard out of it, or create a logo that clients can use. One example is the Carbon Protocol's Carbon Neutral Programme that tries to act as an independent third-party verifier and grants the use of its standardised carbon-neutral logo for members to portray their carbon-neutral status. Also, look at Avis's historic approach,[13,14] which stated it obtained CarbonNeutral® accreditation. The altered concept of carbon neutrality was transformed into a registered proprietary logo, by writing it as one word and including capital letters.

CONCLUSION

In an industry that is still evolving, certain concepts and interpretations are open for discussion, which could lead to uncertainties and discomfort. Part of the sustainability journey is to traverse these uncertainties. You can fulfil a crucial role in your company by guiding the thinking that should lead to action.

SELF-ASSESSMENT

The following questions should be posed regarding the concept of carbon neutrality:

- What is the implication of the transformation of the concept carbon neutrality? Although this is a defined concept, could the proprietary nature of the derived name or the use of a logo imply whatever that specific company wants it to imply?
- Could someone register the term 'CarbonFootprint' and define it as he or she sees fit?
- Was Avis carbon-neutral due to its CarbonNeutral® accreditation? (See page 49 of Barloworld's 2011 integrated report, which clearly states 'CarbonNeutral® accreditation status' and not that Avis is carbon-neutral).
- Does using a logo or a registered proprietary name add extra value to the process of becoming carbon-neutral? How does this compare to verifying your company's footprint, purchasing the required amount of carbon offsets and disclosing that the company is now carbon-neutral?

[13] https://avisbudgetgroup.com/wp-content/uploads/2019/01/2018-Global-Environmental-Report.pdf
[14] https://www.cape-epic.com/news/179/avis-rent-a-car/

Topic 3:
Carbon neutrality

PICKING PROJECTS FOR CARBON-NEUTRAL STATUS

- **Which projects to support**
  Companies differ with regard to the type of carbon offsets they buy. The Avis Budget Group states that it engages with several leading global offset providers, including those that focus on generating offsets through wind and solar power[15]. Nedbank gives more detail of the actual projects that it supported[16]. The projects that are supported are in line with Nedbank's understanding of the need for strong social and environmental sustainability interconnectedness.

  One question to think about when planting trees, and embarking on bamboo projects is the water requirements: how water-conscious are these plants and where does the water come from? Another point to consider is whether the trees will still be there in five or 10 years. How will this affect the carbon-offsetting status?

CONCLUSION

Carbon neutrality is an evolving concept and there are different views on it. It stands to reason that there are even more diverse views on how to achieve carbon-neutral status and which projects to support compared to the views in this guide.

SELF-ASSESSMENT

What criteria should you consider when supporting a carbon offset project?

Criteria to be considered could include:

- Location – Africa, South Africa, global, etc.
- Mechanism – planting trees oneself or purchasing offsets from an established emissions reduction programme.
- Quantity of offsets and scale – this could lead to economies of scale.
- Type of technology – hydroelectricity, energy efficiency, etc.
- External signoff by various nongovernmental organisations.

[15] https://avisbudgetgroup.com/wp-content/uploads/2019/01/2018-Global-Environmental-Report.pdf
[16] https://www.nedbank.co.za/content/nedbank/desktop/gt/en/aboutus/green-and-caring/our-operational-footprint0/carbon-offset-projects.html

Topic 3:
Carbon neutrality

THE BENEFITS OF BEING CARBON-NEUTRAL

> Being carbon-neutral comes at a cost, since the remainder of the carbon footprint, after carbon emissions reduction measures have been implemented, needs to be offset by purchasing carbon credits.

Hence, it is interesting to look at what the main drivers for companies to achieve carbon neutrality are. Reasons for obtaining a carbon-neutral status include the following:

- Increasing pressure from investors and from employees and customers.
- The need to manage environmental risks and opportunities, specifically those related to climate change.
- The reputation of being carbon-neutral sends out a strong message of corporate social responsibility.
- Revenue opportunities, and at the same time carbon neutrality, generate a competitive advantage in relation to a national and globally low-carbon and resources-constrained economy.
- Being carbon-neutral implies the implementation of a sound carbon management system throughout an organisation. Carbon management, including measurement, monitoring and capturing of emissions data, is very much needed when anticipating an increasing amount of reporting requirements and regulatory risks such as carbon tax.

Following this summary of benefits associated with being carbon-neutral, it is important that companies are clear on what benefit they are trying to achieve. All the carbon-neutral companies we considered had different motivations for reducing carbon emissions and becoming carbon-neutral.

Nedbank has built a culture of differentiation by being Africa's first and only carbon-neutral bank. This gives the company a competitive advantage by attracting clients who identify with green products and services and the bank's brand. Avis has acknowledged that carbon neutrality is linked to a good corporate social investment reputation by positively influencing customers' attitudes towards the Avis brand and increasing the amount of business with those customers.

CONCLUSION

> Carbon neutrality can be seen as a step in a company's low-carbon journey that could have competitive, reputational or even financial advantages. Becoming carbon-neutral should be done by first reducing the company's carbon emissions as much as possible through efficiency and environmental management, before offsetting the residual credits.

SELF-ASSESSMENT

Please consider the following for your own company:

The value of the company's carbon-neutral status, including:

- strategic value;
- marketing value; and
- in-house learning that could lead to products or services to clients.

What advantage would becoming carbon-neutral give your company?

- Think about any other companies in your sector that may already be carbon-neutral.

Topic 4:
Auditing

THE AUDITING OF A CARBON FOOTPRINT

> One of the concerns with carbon footprint auditing is that it is adding another auditing layer and additional reporting to the duties of companies.

Some argue that an auditing empire is being built, with auditing houses enjoying a benefit as the audit of a carbon footprint does not reduce the footprint by a single tonne. The contrary view is that an external audit is crucial to checking whether the environmental and carbon footprint claims made by a company can be substantiated.

Deciding on which carbon auditor to use was, and is, a difficult choice. This was already addressed in 2014 by the National Business Initiative's (NBI's) *A Primer on Selecting an Assurance Provider*[17]. (This is a voluntary coalition of South African and multinational companies committed to working towards sustainable growth and development in South Africa.) To date this publication remains authoritative and an update is necessary.

The following is stated in this document:

'Reporting of sustainability information and greenhouse gas (GHG) emissions is about building trust. You are trying to provide information to your stakeholders which will allow them to make effective decisions. The greater the level of stakeholder trust in your organisation's processes and data, the greater the level of comfort they will have in making those decisions. In order to reinforce this decision process many companies seek third party assurance, effectively increasing the credibility of their publically [sic] reported information.'

Other benefits to auditing and verifying your company's carbon footprint are given in the NBI document:

- Companies use GHG emissions and carbon footprinting data to make strategic decisions. It can be considered a governance function to verify this data. An additional level of comfort is given to internal decision-makers. It enables them to gain a better understanding of how to mitigate identified risks effectively.
- Stakeholders are looking for reliable data and verified information to inform their investment decisions.
- Integrated and sustainability reports are published in the public domain. Assurance by a third party can verify the data and help mitigate the reputational risks of publishing incorrect information.
- Some mandatory and voluntary GHG programmes emphasise the need for assurance by including it in their reporting frameworks. For example, the CDP scoring methodology only allocates leadership status to those companies that can demonstrate verification of both Scope 1 and Scope 2 emissions. By achieving leadership status with the CDP programme, your company can gain increased rankings and increased value with investors.
- First-party assurance is provided by your company's internal audit department. This allows you to monitor controls and data gathering throughout the year and spot errors early. Third-party assurance is verification of your data by an external, independent provider. This is typically conducted once a year to confirm that your company's data and processes are correct. The NBI document agrees with the value of having both.

[17] https://www.nbi.org.za/wp-content/uploads/2016/06/NBI_A-Primer-for-Assurance-in-South-Africa-January-2014.pdf

Topic 4:
Auditing

DISCUSSION

Redefine's[18] 2018 sustainability report states that its 2017 carbon footprint was independently verified and that they used the GHG Protocol Corporate Accounting and Reporting Standard. The verification performed applied the ISO14064-3 International Standard for GHG verifications and a limited assurance was achieved.

Barloworld[19] states that the following are some of the assured non-financial indicators for the period 1 October 2018 to 30 September 2019:

- Energy
  - Fuel consumption – petrol and diesel.
  - Grid electricity consumption (MWh).
  - Non-renewable energy consumption (GJ).
- Carbon emissions (tCO_2e)
  - Scope 1 including emissions by primary energy source.
  - Scope 2 emissions.
  - Scope 3 hired fleet emissions – Avis Budget South Africa.
- Water
  - Water withdrawals.

Compare the approach with the 2016 approach that obtained external assurance[20]. Do you think there is a difference between an internal, but independent, audit and an external audit?

Vodacom states[21] in its CDP report for the period 1 April 2018 to 31 March 2019 that external assurance was obtained for Scope 1 and Scope 2 emissions. Do you think it is required to get assurance on Scope 3 emissions?
What is the difference between limited and reasonable assurance? (For more information on limited and reasonable assurance refer to the discussion at the end of this guide on 'Picking your carbon auditor'.)

CONCLUSION

Auditing does add external validity, but a balance should be struck between reporting for audit purposes and taking real action to lower the carbon footprint.

SELF-ASSESSMENT

The following questions can be posed:

- What value will carbon footprint auditing add to your company?
- If an auditing firm calculates a carbon footprint, is it explicitly assumed to have passed the audit or should a second audit firm also do an audit?
- Can one justify the cost of a carbon footprint audit if that cost can be used for lowering the footprint?
- How do you select your carbon footprint auditor? (Refer to the discussion at the end of this guide regarding carbon consultants and auditors.)

[18] https://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=2ahUKEwjg-Ynp_J3nAhVbVBUIHaWJCkEQFjABegQIBBAB&url=https%3A%2F%2Fwww.redefine.co.za%2Fdownload-file%2FRedefine-ESG_Single-pages.pdf&usg=AOvVaw1dUtulljvcyf9cDLq8a9fX

[19] https://www.barloworld-reports.co.za/integrated-reports/ir-2019/pdf/ir2019.pdf

[20] http://www.barloworld-reports.co.za/integrated-reports/ir-2016/pdf/full-integrated.pdf

[21] https://www.vodacom.com/pdf/social-report/cdp-report-2019.pdf

Topic 5:
Carbon standard and methodology

THE CARBON STANDARD AND METHODOLOGY APPLIED

The guide discussed the methodological approach above and used the analogy of methodologies being recipes and emission factors being the ingredients. Another word that can be used for 'methodology' is 'standard'. Below is just a brief overview and the sections of the guide referring in more detail to the possible approaches that should be reviewed.

Using internationally recognised GHG methodologies and/or standards promote consistency and transparency in reporting. Businesses are able to measure and report their GHG emissions consistently within different operations and compare their results with those of the rest of the world. Using a recognised standard also assists external auditing as auditors will know what they are looking at.

The GHG Protocol, developed by the World Resources Institute (WRI) and the World Business Council on Sustainable Development (WBCSD), is an often-used global standard to measure, manage and report GHG emissions. Carbon tax followed the IPCC approach as discussed earlier in the guide. The implication is that most carbon footprints to date followed a methodology that is not a 100% match for what will be required for carbon tax submissions. For example, Vodacom[22] followed the GHG Protocol. This approach is also followed by Nedbank[23]. The bank states that the GHG Protocol (Corporate Accounting and Reporting Standard, revised edition) was used and that external experts were consulted where no clear guidance or guidance applicable to SA was available.

CONCLUSION

Use the guide to establish whether the IPCC Guidelines should be followed as required by carbon tax. The GHG Protocol is typically easier to apply and, as it is widely used, aids in comparing footprints from various companies.

[22] http://www.vodacom-reports.co.za/integrated-reports/ir-2019/pdf/sustainability-report.pdf

[23] https://www.nedbank.co.za/content/dam/nedbank/site-assets/AboutUs/Information%20Hub/Integrated%20Report/2021/2020%20Nedbank%20Group%20TCFD%20Report%20(spreads).pdf

Topic 6:
Scope 1

SCOPE 1 EMISSIONS

Vodacom[24] has an interesting carbon footprint, as its Scope 1 emissions as a percentage are relatively high. For Nedbank, and most facilities-based institutions, Scope 1 emissions are frequently below 1%. For Vodacom Scope 1 emissions were 8% in 2019. Vodacom states that they predominantly result from power generation at network sites. Keep in mind that some of the Vodacom network sites can be in remote areas and could use substantial amounts of diesel for electricity production.

Another, and even more unique Scope 1 polluter, is the steel-making processes of ArcelorMittal[25]. During these processes 86% of all GHG emissions are produced as Scope 1 emissions. More will be said about steelmaking and carbon tax implications in the next section. The steel-making processes are very well defined and massive amounts of coal and energy are required. Changing these processes could require much research and adaptation over time.

CONCLUSION

Scope 1 emissions are usually a small part of an overall footprint. There are some exceptions as indicated above. Mostly, one should then focus on percentage changes in Scope 1 emissions year on year.

SELF-ASSESSMENT

The following questions can be posed with regard to Vodacom:

- One possible Scope 1 emission source can be standby diesel generators at cellphone-based stations. What could other Scope 1 emissions include?
- Can you calculate what the emissions would have been if electricity had been used instead of diesel, and what the impact on the footprint would be?

The following question can be posed with regard to ArcelorMittal:

- How much of the Scope 1 emissions were emitted in South Africa?
- What happens to the South African steel industry if other countries do not impose the same type of carbon taxes?

The following questions should be posed in relation to your company's Scope 1 emissions:

- Which Scope 1 components will be most relevant?
- Will the Scope 1 emissions comprise a large part of your emissions?

[24] http://www.vodacom-reports.co.za/integrated-reports/ir-2019/pdf/sustainability-report.pdf
[25] https://annualreview2018.arcelormittal.com/~/media/Files/A/Arcelormittal-AR-2018/AM_ClimateActionReport_2018.pdf

Topic 7:
Estimated carbon tax revenue

SCOPE 1 EMISSIONS

> What do you think will be the carbon tax revenue per annum for the JSE Top 100 companies? Many people have asked this question. Let us try and answer it.

Most people do not want to troll through all the annual reports, and they soon discover that the carbon disclosure programme (CDP) can provide the data. However, the CDP data was never intended for this purpose, so it is not the best source. Be that as it may, let us fall into the trap and use the 2018 CDP data. An NBI report on the 2018 CDP data indicated the declared Scope 1 emissions from many of the JSE Top 100 companies[26].

Let us add up (approximately) all the Scope 1 emissions, but exclude Eskom. The reason is that Eskom had the environmental levy, which was replaced with a carbon tax component, so the utility works a bit differently compared with private or listed companies. The value is ±71,3 million tCO_2e.

So, what will the tax revenue be? The lowest possible income will result if all companies get allowances adding up to 90%. The highest possible income will result if all companies can claim only the typical default of 60%. The result is as follows:

	Low estimate	High estimate	Unit
Estimated Scope 1 emissions		71 300 000	tCO_2e
Allowances	90% deduction	60% deduction	
Tax-eligible emissions	7 130 000	28 5200 000	tCO_2e
Tax rate	120		R/tCO_2e
Estimated tax revenue	±R860 000 000	±R3 400 000 000	Rand

This is quite a bit of money!

[26] https://www.nbi.org.za/wp-content/uploads/2019/06/NBI_CDP-South-Africa_Climate_change_Report_2018.pdf

Topic 7:

Estimated carbon tax revenue

The following is important to note:

- Sasol accounts for about 78% of Scope 1 emissions for the data that is available, and they will surely have a large tax bill, but other heavy Scope 1 emitters might not have disclosed their information. ArcelorMittal South Africa is an example of a company whose Scope 1 emissions we do not have from the CDP data, but it will also have a large tax bill.
- Eskom pollutes almost three times as much as the companies that were taken into account above. This is massive. Eskom states in its 2019 (31 March) integrated report[27] that 208 319 GWh of electricity were sold. What will the carbon tax revenue be if carbon tax, which will replace the environmental levy, is levied at a rate of 3,5c/kWh or R35 000/GWh?
  The answer is ±R7 300 000 000 for the 2018–2019 year if the full year had been taxed.

Obviously, these numbers are far from the final tax amounts that will be paid, but this gives one an idea of the impact and scale of the calculations that can be done.

CONCLUSION

The revenue potential of carbon tax is enormous. The revenue is also set to increase over time as the allowances decrease and the tax rate increases.

SELF-ASSESSMENT

The total Scope 1 or direct emissions of South Africa is concentrated in a few companies. Can you compile a list of the top polluters and the percentages of the total direct emissions they are responsible for?

Hint: Eskom represents ±40% of all the pollution and Sasol ±10%. Keep in mind that the CDP data is not complete.

[27] http://www.eskom.co.za/IR2019/Documents/Eskom_2019_integrated_report.pdf

Topic 8:
Scope 2

SCOPE 2 EMISSIONS

> Refer to the GHG Protocol regarding the accounting of electricity and other components of Scope 2 emissions. In short, electricity will normally slot in under Scope 2 emissions, but electricity grid losses should not be accounted for by the end user, or they should be included in the Scope 3 emissions of the end user.

Sun International's 2018 Scope 2 emissions[28] – mainly electricity consumption – make up a majority (92,3%) of the company's carbon footprint. This is typical of many carbon footprints in South Africa. What is not common is Sun International's 2016 view of what should be included in Scope 2 emissions (electricity from owned buildings) and Scope 3 emissions (electricity from leased operations that fall outside the definition of financial control)[29]. The approach changed over time, but the reporting boundary and view on Scope 2 and 3 were clearly disclosed.

Now that you know that electricity, as a Scope 2 emission, is frequently the biggest part of a carbon footprint? The question is: What can be done to reduce electricity consumption?

CONCLUSION

> In South Africa Scope 2 emissions consist predominantly of emissions associated with Eskom electricity. The source of information is therefore a simple matter, but there are still different views on what should be included in Scope 2 emissions. It is therefore important to disclose explicitly what you include as part of your Scope 2 emissions.

SELF-ASSESSMENT

Look at Sun International's carbon footprint and the energy management initiatives implemented to reduce its Scope 2 emissions.

Relating to your company:

- What would the percentage of your Scope 2 emissions be?
- What initiatives will be most relevant when reducing the Scope 2 emissions of your company?

[28] https://ir2018.suninternational.com/our-game-plan/environmental/
[29] http://ir.suninternational.com/ir_2016/pdf/sections/Sustainability/Sun_International_IAR2016_Environment_report.pdf

Topic 9:
Scope 3

SCOPE 3 EMISSIONS

Scope 3 emissions are by far the most debated of all. As a starting point, refer to the GHG Protocol and read the explanation of what should or could be included in Scope 3 emissions.

Some companies report on Scope 3 emissions and indicate whether Scope 3 emissions are increasing or decreasing. Nedbank's Scope 3[30] emissions include commuting, this being staff travel to the office and back.

Redefine's 2019 ESG report[31] also indicates that staff commuting was included in the Scope 3 emissions. Furthermore, Scope 3 emissions comprised electricity and business travel. This is unusual as electricity is normally reported under Scope 2 emissions. In Redefine's case the electricity reported under Scope 3 is that purchased and consumed by tenants, and not directly by the company itself. The company is not in control of the amount of electricity used. Refer to the discussion of the control principle in the Scope 1 section of the guide.

Less is known about the ArcelorMittal Scope 3[32] emissions as stated:
Using world steel methodology, data covers Scope 1 and Scope 2 CO_2 emissions, as well as those Scope 3 emissions covering purchased preprocessed materials or intermediate products.

CONCLUSION

There is very little consistency between companies in what is included in Scope 3 emissions. It is important that the same Scope 3 components are included in your company's carbon footprint every year for you to be able to draw a comparison.

It is also very important to make sure what you are willing to disclose in your Scope 3 emissions as it will be very difficult to remove one of the Scope 3 components once you have reported on it during a previous year.

SELF-ASSESSMENT

Consider the following questions:

- Nedbank and Redefine include staff commuting in its Scope 3 emissions. Is this an emission source that should be included? Keep the control principle in mind.
- Which Scope 3 emissions could ArcelorMittal possibly have? And should more detail have been provided or is it insignificantly small?
- What will your company include in Scope 3 emissions and what is most relevant?

30 https://www.nedbank.co.za/content/dam/nedbank/site-assets/AboutUs/Information%20Hub/Integrated%20Report/2021/2020%20Nedbank%20Group%20TCFD%20Report%20(spreads).pdf

31 https://www.redefine.co.za/view-file/esg_view_10_jan.pdf

32 https://annualreview2018.arcelormittal.com/~/media/Files/A/Arcelormittal-AR-2018/AM_ClimateActionReport_2018.pdf

Topic 10:
Targets and normalisation

REDUCTION TARGETS

Target setting in the GHG space is very contentious as this puts pressure on businesses to reduce their carbon footprint, while probably still being asked to increase output. This is especially true if the targets are communicated externally.

In short, companies strive to do more with less. The World Economic Forum[33] also advocates for target setting following the Task Force on Climate-related Financial Disclosures (TCFD) process map.

In the past many companies did their target setting haphazardly. The reality is that target setting can be done only after a company has obtained a granular view of its carbon footprint and has investigated various reduction options. It is surprising how many companies simply slot in reduction targets during the annual reporting process. Unfortunately, such a haphazard approach to target setting could lead to a lack of buy-in from the production or facility managers of an organisation. Imagine the conflict that can arise if a unit is held accountable for a target it did not help set and does not buy into.

To set an appropriate target a company needs to pay attention to the following:

- Deciding on a 'base year' or 'base amount of pollution/consumption' against which all future progress will be measured. It is important to choose this measure very carefully. If the base year were chosen after certain reduction initiatives were introduced, the actions would not show up as reduction initiatives in future. Deciding on a base year too far back can also be detrimental in that carbon footprint data would probably have increased in detail and accuracy over time. An old carbon footprint base year could therefore imply incomplete information.

- Understanding external pressures on target setting, such as CDP reporting and other 'green reporting' initiatives, as these pressures often influence target setting. This could possibly include TCFD pressure in the near future.

Refer to the self-assessment to follow, which references the targets set by specific companies.

CONCLUSION

GHG reduction targets are more often than not set in a haphazard manner at annual reporting times or purely to score as high as possible during external reporting. This is dangerous as such target setting could focus on the wrong aspects of the carbon footprint. Careful planning must go into target setting and deciding on the base year against which future carbon footprints will be compared.

[33] http://www3.weforum.org/docs/WEF_Creating_effective_climate_governance_on_corporate_boards.pdf

Topic 10:
Targets and normalisation

ABSOLUTE VERSUS INTENSITY REDUCTION TARGETS

Absolute reduction targets involve reducing actual or gross emission amounts over time.

The reduction could be expressed as a percentage compared with that of a previous year (eg emissions reduced by 15% compared with the 2010 figures). Or it could be expressed as a measured amount (eg emissions reduced by 1 000 tonnes compared with the 2010 figure).

Absolute targets are useful as they provide an explicit target (a specified quantity of GHGs emitted) to aim for and to measure against.

Disadvantages include that absolute targets may be difficult to achieve if the company grows or expands and this growth results in an increase in GHG emissions. Also, target-based year recalculations for significant structural changes to the organisation make it more difficult to track progress over time.

Intensity reduction targets involve defining a unit of output or work and assigning an amount of CO_2e to each unit.

This process is also often referred to as normalisation as pollution is normalised against another measure, such as profit or production units. Reduction targets are then set according to these units. For example, a company currently emits 5 tonnes of CO_2 per employee, and aims to reduce its emissions to 4 tonnes per employee. It is crucial to choose relevant normalisation measures if this approach is to be followed.

Intensity reduction targets reflect GHG performance improvement independently of the organic growth of the company. They also allow for comparing your performance against that of other companies in a similar field. One disadvantage is that intensity reduction targets can still be achieved even though the overall emissions of a company increased. Absolute emissions may rise even if intensity goes down and output increases. For example, the company could employ more people and, without reducing its emissions, it could still meet its intensity reduction target of 4 tonnes per employee.

Topic 10:
Targets and normalisation

ABSOLUTE VERSUS INTENSITY REDUCTION TARGETS

CONCLUSION

Used individually, absolute and intensity-based reduction targets do not always provide an understanding of how efficiently a company is managing its carbon emissions. Used together, they can provide a more detailed insight into the company's commitment to reducing emissions and the efficiency of its reduction methods.

Now for some questions:

- Which target-setting approach will work best for you in your company? Would it be better to use normalised, intensity or absolute targets?
- Are the targets above clear? How can it be made clearer or what can you learn from the approaches followed?

How will you go about developing emission reduction targets for your company in terms of:

- prioritising the scopes and elements of your carbon footprint;
- the base year against which reduction initiatives will be compared?

SELF-ASSESSMENT

Netcare provides details regarding its intensity reduction targets in its CDP response[34].

The information can be summarised as follows:

- Short term – 25% energy intensity reduction between 2013 and 2018.
- Medium term – 35% energy intensity reduction between 2013 and 2023.
- Long term – 99% energy intensity reduction between 2023 and 2050.

These targets are intensity targets as they deal with percentages, but they are not normalised targets. An example of a normalised target for Netcare is pollution per patient or pollution per hospital bed.

BAT set absolute targets[35] that can be summarised as follows, based on a 2017 baseline:

- 30% absolute reduction in Scope 1 and 2 CO_2e emissions by 2030.
- 16% absolute reduction in Scope 3 CO_2e emissions by 2030.
- 30% of energy to be sourced from renewable sources by 2030.
- 35% absolute reduction of water withdrawn by 2030.
- 15% of water to be recycled by 2030.
- 15% reduction in the total volume of waste generated by 2030.
- 40% absolute reduction in waste sent to landfill by 2030.

These targets can be seen as ambitious as absolute targets such as these do not leave room for organic growth. Take note also of the water and waste targets. The water targets will feed into a discussion regarding water footprinting that will follow.

[34] https://netcare.co.za/Portals/0/Investor%20Relations/Governance/JSE%20SRI/FTSE%20ESG%20-%20Climate%20Change/Netcare%20-%20CDP_Climate%20Change_2018.pdf?ver=2019-04-01-115140-760

[35] https://www.bat.com/environment

Topic 11:
Comparisons

CARBON FOOTPRINT COMPARISONS

It is generally possible to do two types of carbon footprint comparisons:
- External view – comparisons between different companies.
- Internal view – comparisons between different entities, business units or subsidiaries.

For an external comparison refer to the pie chart breakdowns of the following carbon footprints:
- Nedbank[36]
- Redefine[37]
- Other footprints noted or referenced earlier

For an internal comparison look at how AB InBev[38] compares breweries on different continents and geographical regions. Keep in mind that South African Breweries (SAB) is part of AB InBev. This will be a good primer for the discussion on water a bit later on.

CONCLUSION

With time and practice you will develop the skill to compare different carbon footprints at a glance. This is similar to the skill of an accountant that enables him or her to glance at a company's balance sheet and gain a lot of detail about that company. Generally, you will either do an internal comparison between different business entities or you will compare a carbon footprint of one company with that of another company.

SELF-ASSESSMENT

Compare the carbon footprint of your company with that of a peer and with a company from another sector.
- How do the pie charts of these companies compare with each other and with those of other companies? Compare percentages per GHG constituent and gross carbon footprints.

[36] https://www.nedbank.co.za/content/nedbank/desktop/gt/en/aboutus/green-and-caring/sustainability/climate-change-position-statement.html

[37] https://www.redefine.co.za/view-file/esg_view_10_jan.pdf

[38] http://sab.co.za/static/documents/AB%20InBev%20Sustainability%20Report%202018%202.pdf https://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=2ahUKEwjRpoz9pIrnAhVIQhUIHQr9CV0QFjADegQIAxAB&url=https%3A%2F%2F www.ab-inbev.com%2Fcontent%2Fdam%2Funiversaltemplate%2Fab-inbev%2Finvestors%2Freports-and-filings%2Fannual-and-hy-reports%2F2019%2F190321_AB%2520InBev%2520RA2018%2520EN.pdf&usg=AOvVaw1vnkXqSYbRuL7U3YzMRyMj.

Topic 12:
Disclosure

CARBON FOOTPRINT COMPARISONS

Once a carbon footprint has been calculated, it can be disclosed in an annual report and through external reporting systems.

There are many disclosure programmes, including:
- the Carbon Disclosure Project;
- the Dow Jones Sustainability Index;
- the FTSE4Good Index Series;
- previously the JSE SRI Index; and
- the United Nations Global Compact.

On 3 April 2017 the National Greenhouse Gas Emission Reporting Regulations came into operation. These include a mandatory reporting system and, as such, could signal the end of voluntary reporting. As discussed, the domestic carbon tax came into effect in 2019. Many of the voluntary disclosure schemes argue that participation in the voluntary programmes will lead to increased shareholder value and drive investment in the company. It promotes increased transparency of a company's risk and opportunity management and its sustainability strategy. Participating companies are often ranked against competitors – a high score could lead to a better reputation and increased investment. The Task Force on Climate-related Financial Disclosures[39] has also gained momentum recently and straddles an interesting position in the market, where it is currently seen as voluntary, but has serious intentions to become a mandatory disclosure initiative.

The question then arises: which one (or more) of these reporting programmes should a company disclose to? Factors to consider should include where the company is listed and if the company's competitors or peers are also respondents. If one should respond to more than one programme, think about the information required by each programme. The level of effort involved in gathering the relevant data and submitting it for just one of these reporting programmes can be high. Having to do this for two different reporting mechanisms that may have different data requirements could result in a heavy reporting burden.

When deciding whether your company should participate in a disclosure programme, keep in mind the level of effort and time involved, any associated costs, as well as the potential reputational risks. What message would be sent to stakeholders or potential investors if the company participated in a reporting system one year but then stopped disclosing their information the next?

CONCLUSION

No green or sustainable external reporting is a perfect reporting tool. It takes a skilful eye to study the nuances in the various reporting systems, as the same carbon footprint can be punted in various ways in these reporting systems.

SELF-ASSESSMENT

- To which reporting systems does your company disclose its GHG emission data?
- What is the value of this disclosure to your company?
- Should your company start, or continue, to disclose this information using these reporting systems?

[39] https://www.fsb-tcfd.org/

Topic 13:

Water as a product input and measuring efficiency

CARBON FOOTPRINT COMPARISONS

SAB is part of AB InBev and more specifically part of AB InBev Africa. From a product input point of view, very few industries are more reliant on water than the beer-brewing business.

In its 2018 report AB InBev Africa[40] states that 95% of beer comprises water. It is also important to look at the 2018 AB InBev[41] holding company annual report so as to understand more about the company and its water use overall.

The AB InBev Africa report has a major focus on water stewardship and the protection of the water supply is highlighted. Its approach is anchored by the SDG discussion on page 6 of the report. This section is verbatim from page 14 of the report:

Globally, AB InBev's goal is to ensure that 100% of our high-risk communities will have measurably improved water security and access by 2025. This ambition is in line with the UN Sustainable Development Goals (SDGs) to provide access to water and sanitation for all by 2030.

The three water focus areas are the following:

1 **Transformational water partnerships**
This focuses on water scarcity and quality while collaborating with other parties. The partnerships have a strong corporate social investment approach with projects such as the clearing of invasive alien plants to free up water in the ecosystem.

2 **Water use efficiency**
The efficient use of water in operations and production, coupled with the reduced energy use, is the primary goal. This will be the primary focus of this discussion and more will be said below.

3 **Effluent management and reuse**
The reuse of treated water within the production boundary and outside is the focus. This does not relate to the use of water in the product.

AB InBev Africa states that in 2017 the overall African water efficiency ratio achieved was 3,46 hectolitres (hℓ) of water per hℓ of lager. The target for 2025 was set as 2,8 hℓ/hℓ.

So, what does this mean? Well, we do not have a complete water balance, as was the approach discussed in the water section of the guide, but we do know that for every 3,46 litres of water being used by AB InBev Africa 1 litre of beer is produced. Obviously one litre of the 3,46 litres will be in the beer itself and another 2,46 litres of water were used.

[40] http://sab.co.za/static/documents/AB%20InBev%20Sustainability%20Report%202018%202.pdf

[41] https://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=2ahUKEwjRpoz9pIrnAhVIQhUIHQr9CV0QFjADegQIAxAB&url=https%3A%2F%2Fwww.ab-inbev.com%2Fcontent%2Fdam%2Funiversaltemplate%2Fab-inbev%2Finvestors%2Freports-and-filings%2Fannual-and-hy-reports%2F2019%2F190321_AB%2520InBev%2520RA2018%2520EN.pdf&usg=AOvVaw1vnkXqSYbRuL7U3YzMRyMj

Topic 13:

Water as a product input and measuring efficiency

CARBON FOOTPRINT COMPARISONS

A very important aspect of how to interpret this is to understand how the boundary was drawn, ie what is included in the calculation. For this one needs to look at the AB InBev reporting, which states that:

Our goals on water, GHG emissions per hectoliter of production and energy pertain to our beverage facilities only and do not encompass our vertical operations such as malt plants and packaging facilities.

This is very important and clearly states that goods received, like packaging, or the water used in the agricultural part of the business (growing the hobs) are not taken into account.

Let us bring it a bit closer to South Africa. AB InBev Africa states that South African Breweries' Newlands Brewery in Cape Town is the most water-efficient brewery in Africa. The 2017 water efficiency ratio was 2,74 hℓ of water per hℓ of beer. This brewery is already exceeding the target set for 2025.

Again, this implies that for every 2,74 litres of water used, one litre of beer was produced. So, where did the other 1,74 litres of water go to? Obviously the water is not still in the brewery, otherwise the brewery will overflow! Some water could have exited the plant as sewage, but this would be a small component. Evaporative cooling towers on the other hand can emit massive amounts of water into the atmosphere as steam or water vapour. Furthermore, steam used in the different brewing processes could also lead to some of the water losses.

CONCLUSION

The total water balance of an industry could be confidential, but a lot of information can be disclosed to the public through the disclosure of ratios. Targets can also be set according to these ratios.

SELF-ASSESSMENT

Is the application of water usage ratios relevant to your industry?

See if you can apply the different definitions of water (see 'embedded water,' etc) to the information disclosed in the AB InBev Africa report.

Topic 14:

Thinking about Eskom and water use

> Let us look at the Eskom 2019 (31 March) integrated report[42] again and this time from a water use point of view.

The Eskom reports are a wealth of knowledge and we strongly recommend that some time be spent on these reports.

The report states that 292 344 Mℓ of raw water were used and the distributed electricity was 218 939 GWh. This implies that 1,35 Mℓ/GWh was used. In more commonly understood units this implies that 1,34 litres of water were used for 1 kWh distributed. Let us put this into perspective. If I use 720 kWh of electricity from Eskom per month then ±961 litres of water were used on my behalf.

Sources[43] differ and use differ, but estimates put Cape Town's water consumption at about 570 million litres of water per day. This implies that Eskom's national water use per annum is comparable to the annual water use of a city like Cape Town.

> So where is all this water used by Eskom? The simplest answer is in the cooling towers as cooling water.

One will frequently drive by Eskom power plants and see bellows of white 'smoke' emanating from round buildings that look like salt and pepper pots. These salt and pepper pots are the cooling towers and the 'smoke' is actually water vapour that is escaping into the atmosphere as the cooling towers cool the water inside.

CONCLUSION

> Eskom is a massive user of water and the main reason is the cooling it requires. Very few people take the water use associated with electricity into consideration when looking at an electricity invoice or when calculating a carbon footprint.

SELF-ASSESSMENT

What do you think, should you include the embedded water use of Eskom electricity production into your water footprint?

Do your suppliers or clients do this or want to see this being done?

What can Eskom do to reduce its use of water?

[42] http://www.eskom.co.za/IR2019/Documents/Eskom_2019_integrated_report.pdf

[43] https://www.news24.com/SouthAfrica/News/cape-town-water-consumption-increases-by-28-million-litres-per-day-20190715

Topic 15:

What can you do in your company?

VARIOUS GHG REDUCTION INITIATIVES AND WHAT YOU CAN DO IN YOUR COMPANY

The possibilities to reduce a company's carbon footprint can be vast, but should be specific to:

- the circumstances of the company, as the options of a manufacturing facility will be different from those of an office space facility;
- the budget available for possible changes; and
- the perceived strategic value that such a lowering of a carbon footprint could hold for a company.

Reducing a carbon footprint is a journey that should be undertaken one step at a time. The first steps can be quite simple and could include building a more rigorous carbon footprint database and history. For example, Truworths has been refining its baseline for the measurement of carbon emissions in 2014 and has started with setting emissions reduction targets. The reporting boundary has also increased year-on-year and it is interesting to compare the 2017[44] to the 2018[45] report. The increase in boundary does result in some year-on-year comparisons to be done with care as the baselines could have changed. Once you have a clear understanding of your company's carbon footprint and a baseline of emissions, the journey can continue and steps can be taken to reduce emissions.

In Netcare's case, the company has arguably progressed along on its carbon footprinting journey and is looking at initiatives to reduce its dependency on the national grid, specifically through solar energy. Its solar energy projects in South Africa are extensive and well documented.

Refer to its CDP response[46] that discusses the extent as its investments as follows:

In 2017 we expanded our monitored facilities to include Medicross, which recorded electricity use of 10 GWh in 2017 (2016: 14.3 GWh). Our electricity expense for 2017 was R288 million (2016: 279 million, 2015: R259 million, 2014: R239 million, R2013: R235 million).

The 2019 report has not been released yet and it will be worth noting how Netcare progressed on its journey.

[44] https://www.truworthsinternational.com/assets/TRU%20IAR17_Online_Social%20and%20environmental.pdf

[45] https://www.truworthsinternational.com/assets/investor/2018/Truworths-Social-and-environmental-2018.pdf

[46] https://netcare.co.za/Portals/0/Investor%20Relations/Governance/JSE%20SRI/FTSE%20ESG%20-%20Climate%20Change/Netcare%20-%20CDP_Climate%20Change_2018.pdf?ver=2019-04-01-115140-760

Topic 15:

What can you do in your company?

VARIOUS GHG REDUCTION INITIATIVES AND WHAT YOU CAN DO IN YOUR COMPANY

CONCLUSION

Reduction initiatives, such as GHG emission target setting (see previous discussion), should be a well-thought-through process. Many of the case studies used in this guide are excellent initiatives for you to consider.

As a concluding thought, it is important to remember that technology is ever-evolving. So, even if a certain technology does not make financial sense today, it may well do so in the future. A periodic review of previous technological investigations is therefore strongly advised.

SELF-ASSESSMENT

Consider how far your company is along its carbon footprinting journey.

What steps and initiatives are in place in your company and which should you focus on next?

Are the targets and initiatives formalised in your company and is the output measurable? Generally, the impact of the best project or initiative can be nullified if the outcome cannot be measured clearly.

9 A brief discussion **about consultants**

Most good carbon consultancies are small, niche companies. Do not be too apprehensive **about a company's possible output if it seems to be a small niche company without a big office.**

A brief discussion regarding consultants

Since the mid-2000s the South African market has been flooded with carbon consultancies. Frequently, these environmental consultancies have overpromised and underdelivered as they promoted the idea that being 'green' will be so profitable that any idea remotely linked to 'greening the environment' had a definite business case. Frankly, this is not the reality.

Sustainability initiatives should not be confused with corporate social investment (CSI). While many sustainability initiatives do have a CSI dimension, it is advisable for sustainability initiatives to be founded on sound business sense so that they can be economically feasible too.

When it comes to picking your carbon consultant the following is recommended:

- Apply the five levels discussed above in reverse, ie ask a company whether it has a registered clean development mechanism (CDM) or verified emission reduction (VER) project. If not, ask if it has assisted companies in becoming carbon-neutral. If not, continue down the tiers. The logic behind this approach is that a carbon consultancy that has achieved success on a higher level will probably be able to handle a lower tier quite easily as the tiers build on one another.
- Be wary of consultants using the present and present-continuous tense for carbon- and water-related projects. 'We have a current project' or 'we are working on' does not relate to historic successes.
- Does the carbon consultancy have teammembers with a science, financial or other relevant background? Auditing and financial experience will be lumped together. It is also important that the auditing experience is a carbon footprint auditing experience. Carbon footprinting is, in essence, a technical endeavour. If the carbon consultancy does not have a solid scientific background, it could potentially be represented by mediocre carbon consultants.
- When it comes to revenue-generating emission reduction projects, it is a good idea to negotiate lower hourly tariffs with your carbon consultants in exchange for some success kicker. So, if they get the project registered, they will share in the upside. If the project does not get registered, the fees will be limited. The fact that most good carbon consultancies are small companies implies that they will have a limited appetite for too much risk and also have to invoice the consulting hours spent. A delicate balance should be negotiated.
- Some of the best carbon consultants are academics. Their fees are also frequently better priced when compared with those of purely commercial companies. The reason for this is quite simple: they have lower operating costs and they have bright and affordable labour on their doorstep in the form of postgraduate students. Of course, the cliché remains that these academics may not be as focused on deadlines as you would like. Consider structuring the payment schedule so that it has a strong focus on deliverables if this is a concern for you.

PICKING YOUR CARBON AUDITOR

The classic financial auditing firms are also players in the GHG space. Historically, annual reports consisted predominantly of financial numbers and this is what auditors checked.

One view is that, with the onset of sustainability reporting and more recently integrated reporting, it makes sense that the GHG part of the report also be checked by the same people that check the financials. It is after all in the same report.

There is also the opinion that a dedicated carbon auditor is required and that financial auditors frequently do not have the correct skill set.

As auditing firms became involved in the GHG space they also brought with them their auditing 'lingo.' Examples include the following:

'Prudent'	They were really thorough.
'Significant'	Something that made a real difference, such as having found a significant error or having found no significant error.
'Limited assurance'	Everything they checked seemed fine, but they didn't check everything.
'Reasonable assurance'	The check was more complete than in the previous case (limited assurance) and they looked for completeness of information.
'Qualified audit'	It might be good to be a qualified engineer, plumber or doctor, but a qualified audit is a bad thing. In essence a qualification implies that the auditors cannot sign off on the validity of the information highlighted in the qualification.

There are certain questions that can, and should, be asked of one's carbon footprint auditor before deciding to use a specific auditor:

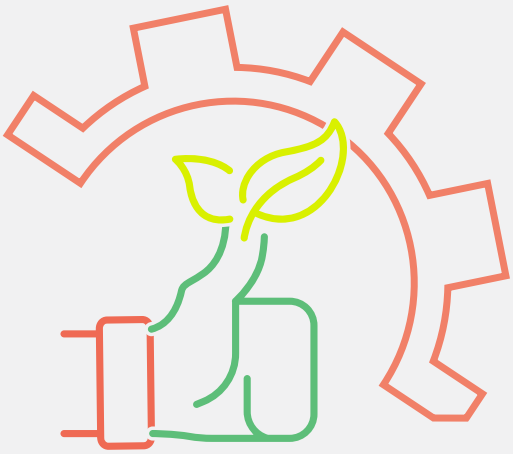
How many carbon footprints have your staff actually calculated?
The aim of this question is to ascertain how many footprints the auditing team have conducted themselves. It is not asking how many carbon footprints the company as a whole has audited, but refers specifically to the staff that will be doing your audit.

Does the auditing team have a science background, or did they do any courses related to carbon footprinting?
Carbon footprinting is, in essence, a technical endeavour but cross-skilled individuals can execute it with great success. If the auditing teammembers do not have a solid carbon footprinting background, they might still be great financial auditors, but possibly poor carbon footprint auditors.

Did the auditors audit and sign off on any of the emission factors or input values from any inputs into your carbon footprint If so, which values and to what level of certainty?
(See 'Limited assurance', 'Reasonable assurance' and 'Qualified audit' above.) Be aware of any potential conflicts of interest.

10 In conclusion

The information in this guide is intended to play a part in your **realising the carbon vision** for your business.



In conclusion

While the content of this guide is not intended to be an exhaustive or detailed study of carbon or water footprinting, the authors trust that you have found it useful by its adding real value to your carbon and water measurement and reduction efforts.

It is our hope that the information in this guide not only helps you on your path to carbon efficiency in your business, but also inspires you to take your carbon footprinting efforts to ever higher levels of accuracy and effectiveness.

In our experience such carbon and water efficiency has the potential to offer untold value to any organisation – not just because reducing your impact on the environment is the morally correct thing to do, but also because carbon and water management makes excellent business sense.

CARBON AND WATER FOOTPRINTING CAN ADD SIGNIFICANTLY TO YOUR COMPANY'S BOTTOMLINE OVER TIME. WE HOPE THAT THIS IS THE CASE FOR YOUR ORGANISATION AND THAT THIS INFORMATION OFFERING PLAYS A PART IN YOUR REALISING THE CARBON VISION FOR YOUR BUSINESS.

For more information about Nedbank's approach to sustainability visit nedbank.co.za.

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