EDITION 2

MAKE THINGS HAPPEN

NEDBANK

CARBON FOOTPRINTING GUIDE

A PRACTICAL FOOTPRINTING CALCULATION GUIDE FOCUSING ON MEASURING, MONITORING, REPORTING AND VERIFICATION.

SUSTAINABILITY INSTITUTE

UNIVERSITEIT STELLENBOSCH UNIVERSITY

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FOREWORD

AS THE **FIRST FINANCIAL SERVICES ORGANISATION IN AFRICA TO ACHIEVE CARBON NEUTRALITY**, NEDBANK GROUP HAS FIRSTHAND EXPERIENCE OF THE MANY CHALLENGES FACING ANY COMPANY UNDERTAKING A GENUINE CARBON MANAGEMENT OR REDUCTION JOURNEY.

For us, carbon reduction is just one component, albeit a very important one, of a far broader integrated sustainability imperative that incorporates the pillars of environmental, social, cultural and economic sustainability.

We take a three-pronged approach to achieving such integrated sustainability, which includes: effectively managing our own impacts; enabling sustainability through our products and services; and collaborating and partnering with, as well as influencing, others to maximise the positive impact of all our sustainability efforts.

This is the second version of the guide that speaks directly to the last element of our sustainability strategy. The first version of the guide was very successful, attracting more than 53 000 downloads within six months of release and winning the 2014 South African National Energy Association (SANEA) Energy Education Award. By continuing to support and distributing this guide, Nedbank hopes to play a small part in the success and longevity of those companies that are starting or enhancing their carbon reduction journeys.

Often such a carbon management journey begins with just a few staffmembers being tasked with the overwhelming duty of plotting the course towards carbon 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 the road on your carbon journey, we wish you every success. We trust that the information, step-by-step guidelines, and thought-provoking case studies will provide a valuable source of assistance and inspiration to you along the way.

Mike Brown
Chief Executive
Nedbank Group Limited

ABOUT THE AUTHORS

Marco Lotz holds a bachelor's degree in engineering (chemical), a master's degree in the modelling of process systems with genetic programming (chemical engineering) and a PhD in engineering management. His PhD focused on the project management and risk management of greenhouse gas reduction projects. Marco started his career in 2006 and consulted to 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 an associate researcher at the Tropical Research Institute in Portugal, acts as a contributor for various well-known carbon publications and as external review expert for selected academic and other publications.

Alan Brent holds bachelor's degrees in engineering (chemical) 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 to a variety of industry and public sectors in South Africa and other developing countries in the fields of environmental engineering and management. His research focus now revolves around sustainable technology management. Currently he is appointed as a professor of Engineering Management and Sustainable Systems in the Department of Industrial Engineering at Stellenbosch University, and as the associate director of the Centre for Renewable and Sustainable Energy Studies (CRSES), which is based in the Faculty of Engineering. He is also appointed as a part-time professor of Sustainable Life Cycle Management in the Graduate School of Technology Management (GSTM) at the University of Pretoria.

The authors would like to thank Nedbank group for its generous support in enabling the publication and distribution of this guide. They would also like to thank Justine Bolton from Bright Green Solutions for her help and input.

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

Although all reasonable efforts were made to ensure correctness, it remains a possibility that some elements of error may occur. Nedbank Group, the University of Stellenbosch, the Sustainability Institute and the authors cannot be held responsible for any loss or damage incurred from applying this manuscript in part or in full.

Any suggestions, comments or possible corrections are welcome and can be emailed to marcolotzcarbonfootprint@gmail.com.

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LEGEND

Highlight	Highlighting will be used 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 GUIDE

While many of the top 100 companies listed on JSE Limited already calculate their carbon footprints, this is just the tip of the iceberg. Before long, every company will need to have at least one employee tasked with calculating its carbon footprint and suggesting how to reduce it. This will probably lead to each organisation eventually having a team of carbon footprint reduction champions. Soon carbon (and water) footprinting will be implemented and actioned by all listed companies – and not just as part of an energy audit.

This guide focuses on carbon footprinting and the pressure that will come from two primary areas:

- Top down: With current South African regulatory developments it would seem that we are on the brink of a world in which historic environmental externalities will be internalised. This is really just a complicated way of warning organisations that carbon and other environmental taxes are going to be rolled out.
- Bottom up: 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 historically required; and
  - pollute proactively less than what is legally allowed.

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

Currently there is much credible information in the public domain regarding carbon footprinting, but the information is generally not user-friendly.

The main aim of this guide then is to demystify carbon footprint approaches and help readers grasp the main concepts, as well as to expose them to how to do the actual calculations. Throughout the guide the theory is constantly explained by application to a number of real-world cases.

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

Other aims include the following:

- It is ironic that scientists and engineers are mostly responsible for calculating carbon footprints, while commerce people do the audits. 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 carbon 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 this evolving world where someone is tasked with keeping tabs on the pollution of every company. This guide 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 in creating a practical vantage point. This guide will start by explaining the basics of carbon footprinting before looking at how various people and organisations actually applied their knowledge in real life. Carbon footprinting is not yet a stable science – it is too new – so the evolving thinking over the past few years can clearly be seen, and effectively understood, by analysing case studies.

This guide will give you the key skills required to audit seemingly very technical work.

- 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, carbon 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.

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 there is in excess of a 95% chance that anthropogenic emissions are affecting the earth's climate. It is also widely accepted that, if climate change is happening, we will have less fresh water available, higher average temperatures, and generally a much more difficult world to live in.

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. As an example, your South African electricity bill already includes an 'environmental levy' that you have to pay. Not that this is, in its truest sense, a 'climate change levy', but the causality should be clear.

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 (GHG)?

These are gasses that 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 at the earth's surface would also be catastrophic.

If too much GHG emissions are emitted, this blanket of insulation around the earth would 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 are the various GHGs, tonnes of carbon dioxide equivalent (tCO_2e) and Global Warming Potential (GWP)?

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 GWP and 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 define CO_2 then as the common GHG denominator and relate all GHGs back to CO_2 in the same sense that one can convert South African rand to US dollar. Obviously 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, and this is called the Global Warming Potential (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 CH_4 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 family 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
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 for1 metre, and 1 Newton is the force required to accelerate 1 kilogram by 1 metre per second squared. Figure 1 summarises these concepts.

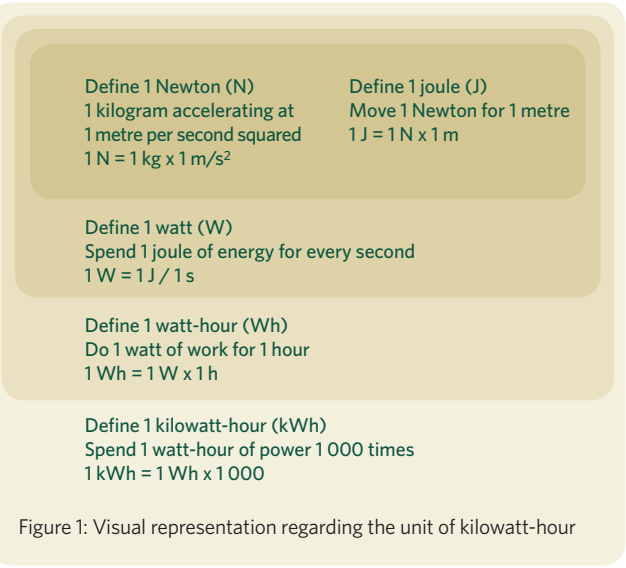


Figure 1: Visual representation regarding the unit of kilowatt-hour

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 very easily be converted 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: $\frac{30\,000}{350} \times \frac{1055}{1}$

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

First result

Values: $\frac{30\,000 \times 1055}{350} \times \frac{1}{0{,}3048 \times 0{,}3048}$

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

Figure 2: Keeping track of units

Keep control of your units of measure.

Second result

Values: $\frac{30\,000 \times 1055}{350 \times 0{,}3048 \times 0{,}3048}$

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

Third result

Values: $\frac{30\,000 \times 1055}{350 \times 0{,}3048 \times 0{,}3048} \times \frac{1}{1\,000}$

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

Fourth result 973 kJ/m^2

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 a LCA all steps in producing some 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 the impacts thereof;
  - 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 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 he 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 gates 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 is purposefully included or excluded.

- Environmental externalities
  Basically an environmental externality is a burden the environment must bear on some basis. As an example, let's assume a company produces steam by combusting coal. It has a licence to do this and is completely within the law to do what it does. 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.

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 end-user (consumer), which is why such cost internalisation is not usually associated with a warm fuzzy feeling.

- GHG scopes

  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.*' (Verbatim from GHG Protocol.) In following chapters this definition will become clearer as we apply it and give examples thereof.

- 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 have 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 was 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 were 125 passengers on the aeroplane then:

pkm = vkm ÷ 125
pkm = 14,3 $kgCO_2e$/vkm ÷ 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 his/her pollution for the trip was:

Pollution for trip = 0,114 $kgCO_2e$/pkm × 1 400 km
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 gasses. 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 gasses. 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 had to supply you with the amount of gas that would have filled 10 m^3 if the temperature was 0 °C and the pressure was 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 (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.

- **United Kingdom Department of Environment, Food and Rural Affairs (DEFRA)**
  http://www.defra.gov.uk/
  Description (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 2) uses the 2015 DEFRA emission factors that can be found at: http://www.ukconversionfactorscarbonsmart.co.uk.

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 in 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 2015 DEFRA emission factors before delving into some of the more technical calculations.

The DEFRA emission factors do periodically get updated, but should remain accurate up to approximately June 2016. 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 on an annual basis. This said, one will frequently find that (for example) car emissions will generally come down over the years as the fuel efficiency of vehicles increases.

- The GHG Protocol
  http://www.ghgprotocol.org/
  Description (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.

- Mervyn E King (as relating to the King III principles)
  http://www.mervynking.co.za/
  Description (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.

UNDERSTANDING THE FOUR TIERS OF CARBON PROJECTS

Not all carbon projects are created equally. Below is a guide to differentiating between possible carbon projects and their motives:

- Tier 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 20% accurate. (This implies the 'real footprint' is between 80% and 120% of the final calculated value). This guide predominantly focuses on this tier and a major aim is to understand where the approximately 20% accuracy comes from and how to reduce this as much as possible with an appropriate level of effort. In other words, if you are going to spend hours to increase data accuracy, the final accuracy of the carbon footprint should also increase significantly, otherwise you have wasted your time.

- Tier 2: Carbon Disclosure Project (CDP)
  The CDP is a voluntary disclosing scheme through which companies can freely disclose their impact on the environment from a GHG point of view. There is also a 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.

Subjectively carbon projects can be divided into four types of projects with increasing complexity:
1 carbon footprinting;
2 Carbon Disclosure Project (CDP);
3 carbon neutrality endeavours; and
4 profit-driven emission reduction incentive projects.

The CDP and WDP are questionnaire-based, which requires the carbon footprint as input and then a lot of narrative to justify action, or the lack thereof. The CDP and WDP are viewed as tier 2 as it builds on tier 1.

As an aside, it is fair to say that the CDP is losing its voluntary angle as investors are putting increasing pressure on companies to disclose through these and other channels. It would seem that, in the not too distant future, companies might have to report to the South African national government on their GHG emissions and water impact to a far greater extent than what is currently the case. It remains to be seen what will happen to voluntary disclosures if reporting becomes mandatory.

- Tier 3: Carbon neutrality endeavours
  Once a carbon footprint has been calculated and disclosed in an annual report and through other channels (CDP, WDP, and such), the question becomes what to do with it. 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 such 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 becomes: 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's 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's 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 developed. 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 internalise 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.

- Tier 4: Profit-driven emission reduction incentive projects
  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. As an 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 oversimplification, but serves as a quick introduction.

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 (http://www.unfccc.org) 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 or so to increase confidence in the real reduction achieved by these schemes.

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

The steps are described in terms of the different GHG scopes, namely Scope 1, Scope 2 and Scope 3 emissions.

Step A: Source the information regarding your consumption

Step	Description	Page
A	Source the information regarding your consumption	14

Step A is universal, irrespective of which emissions scope you are busy with. It also sounds trivial, but you should not assume that the carbon footprint information is readily available. Just because an invoice was received and the supplier paid does not imply you will easily be able to source from the procurement department, or from the accounts department, how much paper was bought or flights were undertaken. Also, most small companies do not have a dedicated procurement department. In these cases you need to contact the accountant or person that is responsible for paying the supplier.

A good start will be to go to the procurement department (or person) and source the amount of paper, diesel, flights, etc sourced. In many cases you will need to accept the fact that the 'amount' you receive will probably be in rand value rather than the actual 'amount' 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 information relating to other stationary supplies is not part of your final 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 people. Hopefully there are key account staff at the various suppliers so that you can get quick and competent help. Most companies are simply too small to have such a formal approach. In short, the person calculating the carbon footprint should contact the person who pays the suppliers, who in turn impact on the carbon footprint.

If the reconciliation ties up well, you know you have adequate sources of information. If the reconciliation does not tie up, 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. It is recommended that you piggyback on accounting information, as the payment process ought to be well established.

Start by sourcing 'amounts' 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

According to the GHG Protocol, Scope 1 emissions are 'all direct GHG emissions.' So what are these? Basically these are all GHGs that originate from material you combust yourself or vent into the atmosphere.

Scope 1 emissions can be divided into two broad categories:

- Emissions associated with fuels you combust yourself. This will include:
  - liquid fuels – petrol, diesel, paraffin and others associated with, for example, vehicles; and
  - gaseous fuel – liquid petroleum gas (LPG) and town gas.
- Emissions associated with GHG gases you emit into the atmosphere. These will include:
  - refrigerant gases used in air-conditioning units; and
  - diverse other gases such as methane from rotting organic matter.

However, Scope 1 emissions can be more complex as they could also, for example, include SF_6 gas releases. It should be noted that SF_6 and some other gases are mostly emitted 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 in quantity by a few fertiliser-producing companies in South Africa.

If you have any vehicles that your company owns and uses 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 example of an exception would be 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) used during power outages will also count as releasing Scope 1 emissions. Note that it is not important whether the equipment consuming the petrol/diesel is stationary (generator) or able to move (car or truck). Refer back 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/truck) and therefore that you do not have to include it in your calculations.

More problematic is 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 do 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 also 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 also common for people to distinguish mentally between liquid fuels and gaseous fuels. This is not necessary when it comes to carbon footprints. The calculation might differ, as one will have different pieces of information available for liquid and gaseous fuels, but the principle of these fuels remain the same: you buy it and you burn it.

The first section of Scope 1 examples will tackle combustible fuels.

So what are the steps to calculate your footprint associated with liquid and gas fuels?

Step B: Source the information regarding your consumption: specific to liquid and gas fuels (continued from above)

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to liquid and gas fuels (continued from above).	17
C	Get the liquid-fuel emission factors.	19

Let's look at petrol and diesel consumption (if you can handle these two, you can handle all liquid fuels.) Your typical procurement discussion may be along the lines of the one shown in figure 3.

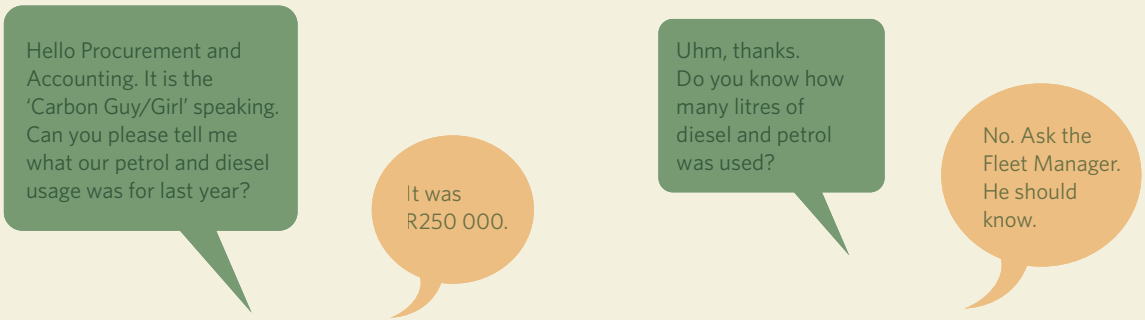


Figure 3: Sourcing consumption information

So you chatted to the accountant paying your liquid-fuel bill or you spoke to the supplier of the fuel and got the rand value of your purchased liquid fuels. Again, having the rand value spent is a good start, but you also require the consumption data. Consumption of liquid fuels is almost always logged as litres of fuel used. What makes liquid-fuel consumption one of the easier bits of a carbon footprint is that someone probably had to log the litres of fuel consumption as part of his job. It is now your job to find this person and do a reconciliation between the litres consumed and rand value spent.

This 'recon' can be conducted as a ballpark on a monthly basis. Simply take the rand value spent on fuels (petrol or diesel) and divide it by the litres bought (petrol or diesel). Currently the South African liquid-fuel price is about R13/ℓ. While petrol and diesel prices differ, as a first stab these prices are close enough to lump the rand spent and litre amount together to get an average price. If your resultant average price is far more than R13/ℓ, you might not have all the information relating to the litres of fuel used. And if your price is far less than R13/ℓ, you might not have obtained all the expenditure relating to this calculation.

A word of caution: Liquid-fuel prices are highly fluctuating, so there is the obvious risk that the R13/ℓ average for liquid fuel will date quickly. Adjust your base price as necessary. The main objective here is just to do a quick reconciliation between litres of fuel used and expenditure. It doesn't have to be an exact science.

Some notes to consider at this stage:

- In certain situations you might not know what the fuel consumption of a fleet was, but you will know the distance travelled. If this is the case, this data can be dealt with in the same manner as rental car distance travelled. See the Scope 3 rental discussion for more detail.
- Vehicles also use oil, but if properly maintained, vehicles primarily use oil for lubrication and only combust small amounts. As an example, if a person drives 1 500 km/month and uses 120 ℓ of petrol, he will hope that his car doesn't use more than 0,5 ℓ of oil. If the car uses more oil, or even 0,5 ℓ, he would need to take it for a service as something might be wrong. As a rule, oil used is then excluded from Scope 1 emissions, except in certain large-scale applications (shipping, large stationary combustion, etc) where oil is viewed also as a fuel and not only as a lubricant.

At this point you ought to have the following for liquid fuels:[1]

A	B	C	D	E
Number	User of fuel	Department	Fuel type	Fuel used(ℓ)
1	Truck A	Manufacturing	Diesel	8 300
2	Car A	Deliveries	Petrol	2 400

Gaseous fuels are normally purchased in gigajoules (GJ), especially if it is piped to your facility. For this example, assume you have the gaseous-fuel consumption data in GJ. In some cases you might obtain the information in other units, such as Nm^3 or kg. See the section earlier on how to convert the units to GJ. Please also note that there are various gaseous fuels and you should be specific regarding the one you are using.

[1] The columns in the tables will be labelled alphabetically, similar to what it will look like in a spreadsheet. As the calculation progresses some columns will be omitted and the corresponding alphabetic label will also be omitted. This is done for brevity.

The name given to a gas fuel is mostly determined by its composition and its origin. This sounds more complicated than it is, as the specific name for the gas you used should be:

- stated by the supplier of the gas; and
- very specific to the equipment for which it is to be used.

It should therefore not be an issue to establish the exact name of the gaseous fuel. The name of the gaseous fuel is important as the emission factor per unit of gas used is specific to the gas being used and depends on the gaseous components of the fuel. In the same sense, croissants and chocolate chip muffins might broadly have the same ingredients, but the final product differs significantly.

Liquid petroleum gas (LPG) has been used in this example.

By now you should have obtained the following information to proceed:

A	B	C	D	E
Number	**User of fuel**	**Department**	**Fuel type**	**Fuel used (GJ)**
3	Gas-fired electricity generator	Utilities	LPG	40 000

Step C: Get the liquid-fuel emission factors

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to liquid and gas fuels (continued from above).	17
C	Get the liquid-fuel emission factors.	19

Fortunately, liquid fuels are more or less standard across the world. This allows for a reliable approximation, as it isn't frequently that vehicles need to be adapted specifically for a country or territory. That said, you may need to adapt cars for some of the colder parts of the world and additional cooling can be required for harsh desert conditions, but in general petrol and diesel are standardised.

If liquid fuels are fairly standard, it stands to reason that combusting a litre of fuel in South Africa will generate the same amount of pollution as if combusted in the United Kingdom. This implies that we can use the United Kingdom-based DEFRA combustion figures for liquid fuels in South Africa. Take note that this is only for the Scope 1 emissions of fuel combustion and that other scopes relating to the manufacture and transport of United Kingdom fuels are not relevant to South Africa.

Please refer back to the section entitled 'Technical terms.' Throughout this guide (version 2) the 2015 DEFRA emission factors are used. If you then take a look at the 2015 DEFRA emission factors (**http://www.ukconversionfactorscarbonsmart.co.uk/**), you will be able to find the emission factors for diesel and petrol. (Note that, for South African conditions, it is fair to assume 100% mineral fuel, as there is no regulatory-defined biofuel blend in our fuels.) The emission factor can be limited to Scope 1. Also ensure that the unit of measure picked is suitable for the calculation. In the table below the chosen emission factor had units of '$kgCO_2e/\ell$' as litre is the most common unit to measure liquid fuels. You might want to use another unit of measure.

You can now update the table above with the emission factors and multiply this by the litres of fuel used. The result should be divided by 1 000 to get to tonnes of CO_2 equivalent GHGs released:

A	B	C	D	E	F	G
Number	**User of fuel**	**Department**	**Fuel type**	**Fuel used(ℓ)**	**Emission factor for fuel type ($kgCO_2e/\ell$)**	**Total direct GHG emissions (tCO_2e)**
1	Truck A	Manufacturing	Diesel	8 300	2,67614	22,21
2	Car A	Deliveries	Petrol	2 400	2,29968	5,52

We are next focusing on the LPG example above and aim to follow the same approach as that applied for the liquid fuels. We need to obtain an emission factor for LPG, but there is a catch. The emission factor for LPG states the consumption in kWh and our gas data is in GJ. This is quite easy to solve.
(See conversion of GJ to kWh earlier.)

Intuitively the numerical value of kWh used should be more than GJ used as:
1 GJ = 1 000 000 000 J, and
1 kWh = 3 600 000 J
As in the case of the liquid fuels, the gas consumption (in the right units) can be multiplied by the emission factor and divided by 1 000 to get to tCO_2e, as shown below:

A	D	E	F	G	H
Number	**Fuel type**	**Fuel used (GJ)**	**Fuel used (kWh)**	**Emission factor for fuel type ($kgCO_2/kWh$)**	**Total direct GHG emissions (tCO_2e)**
3	LPG	40 000	11 111 111	0,21468	2 385

Dealing with exceptions

The golden rule is that if you don't have data or information at your disposal, you should use a value higher than what you think the value possibly is. Examples of the golden rule include:

- If you do not know whether it was a petrol or diesel vehicle, it is better to assume it was a diesel vehicle as the emission factor is higher. You will then artificially increase your footprint to a worst-case scenario as opposed to artificially decreasing your footprint. Your footprint will then not increase when you obtain better information and will probably decrease.
- You can also use the average emission factor of diesel and petrol or a pro rata emission factor for your company, getting to a less conservative emission factor for vehicles using an unknown fuel type.
- If you do not know exactly what gas is used in your processes, also focus on using a high-emission factor.
- If you do not have all the fuel consumption data for all the vehicles, you can use distance travelled data to calculate reasonable fuel consumption rates.

What are the steps to calculate your footprint associated with refrigerant gases?

Step B: Source the information regarding your consumption: specific to refrigerant gases (continued from above)

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to refrigerant gases (continued from above).	21
C	Keep track of units and calculate total emissions.	23

As stated above, refrigerant gases are used by air-conditioning units and other machines that cool air and liquids. 'Used' might not be the correct term, as the refrigerant gases are not combusted, should not react chemically, and should not be released into the atmosphere. Refrigerant gases are used in closed-loop systems and are pumped time and time again.

Only very specific gases can be used as refrigerant gases. Basically you need a gas that cools down when it expands and heats up when it is compressed. In essence this is how most refrigerating systems work: The gas expands and gets cold. Heat is then absorbed from the inside of the fridge. After this the refrigerant gas is compressed, it gets warm and the heat dissipates into those squiggly thin black tubes at the back of the fridge, acting as a radiator.

Unfortunately closed-loop systems are not perfect. We know this because many of us have had to regas our car air conditioners or our refrigerators at home at some time or another. Regassing implies that a certain gas load is put back into the refrigeration system either to top up the amount of refrigerant gas or to replace the total refrigerant load. In essence regassing therefore involves a person with a gas cylinder filling your fridge's 'gas tank'.

Normally regassing of air conditioners is managed through one or more of the following approaches:

- If your business only has a few air-conditioning units, you will probably have to get people to regas the units for you every few years.
- If you are leasing space in a bigger building, the building's facility management will do the regassing or an external company will be hired to do this.
- One also frequently finds that regassing, servicing and maintenance of air-conditioning units are outsourced and governed by a service level agreement (SLA).

These parties should provide you with two bits of information:

- the type of refrigerant gas that was used to refill your air-conditioning system; and
- the amount of gas used.

There is no need to go into too much detail on the different types of refrigerant gases available – the reason being that you do not need to understand the technical detail of refrigerants to calculate the carbon footprint impact. What you do need to understand is that:

- not all refrigerants are GHGs;
- the same refrigerant gas can have more than one name; and
- some refrigerant gases are not pure gases, but rather gas mixtures.

Focus on gathering information regarding the refrigerant gas consumption from the sources indicated.

The best way to figure out what to do with the refrigerant you are dealing with is to do a search for it in the DEFRA document. Most common refrigerants are listed in the 2015 DEFRA emission factors with the applicable GWP.

Normally refrigerant gas usage is measured in litres and is not a particularly big number (this is the good news), but many refrigerants have huge GWPs (that is the bad news). Let us use an example to illustrate how you deal with refrigerants. At this stage you ought to have the following:

A	B	C	D
Number	**Type of refrigerant**	**Amount used (ℓ)**	**GWP**
1	R404a	104	3 921,6
2	R134a	88	1 430

Step C: Keep track of units and calculate total emissions

The GWP factors of DEFRA require that the refrigerant input should be in kilograms and you will probably have it in litres at this stage. To get to tonnes usage you will need the densities of the gases. (Please also see Nm^3.) After updating, the table above looks like this:

A	B	C	D	E
Number	**Type of refrigerant**	**Amount used (ℓ)**	**GWP**	**Density (kg/ℓ)**
1	R404a	104	3 921,6	0,485
2	R134a	88	1 430	1,21

You now have all the information you need to calculate the mass of refrigerant gases. Now multiply it by the GWP to get to tonnes of CO_2 equivalent. As always, you should be in control of your units of measure so as not to make an order of magnitude error. The result is:

A	B	C	D	E	F	G
Number	Type of refrigerant	Amount used (ℓ)	GWP	Density (kg/ℓ)	Mass of refrigerant (kg)	Total direct GHG emissions (tCO_2e)
1	R404a	104	3 921,6	0,485	50,4	197,81
2	R134a	88	1 430	1,21	106,1*	151,72*

** Values may differ due to rounding.*

So how do you deal with other Scope 1 emissions that weren't covered in the examples above?

Go back to the start of the discussion of Scope 1 emissions. There, Scope 1 emissions were divided into:

- emissions associated with fuels you combust yourself; and
- emissions associated with GHG gases you emit into atmosphere.

Normally, Scope 1 emissions are either combusted and vented into atmosphere, or vented straight into atmosphere. So, if you understand the examples above, you will know how to deal with other Scope 1 emissions like paraffin.

There are a few websites where you can source the densities of the refrigerant gases. Here are a few websites with information of typical refrigerant gases:

- http://www.engineeringtoolbox.com/r22-properties-d_365.html
- http://www.cameochemicals.noaa.gov/chemical/26023
- http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=141

Scope 2

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 by one acronym: Eskom.

This is because the South African electricity supplier market is dominated by Eskom, as 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.

In many other countries you would be able to pick your electricity supplier in the same way you can pick a cellphone network service provider in South Africa. Your specific preferences would determine who you use. You might have a pure cost-driven motive, or you can pick 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 all your attention on Eskom for Scope 2 emissions and your usage (MWh) and the Eskom grid emission factor (tCO_2e/MWh) will be the factors of interest.

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

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

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

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

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:

- Eskom – This normally applies to larger users such as mines and industry 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 arrear.
- 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 without knowing.
  - 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), he might be using more electricity than you.
  - Whether water, sewage, electricity and sundries will be broken down on your invoice. Some property managers will simply provide tenants with a lumped monthly invoice and it can take some effort to understand how much of that is for electricity.
- Prepaid electricity – The use of prepaid electricity has become much more common in South Africa than previously.

The billing source options indicated above will most probably provide 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 throughout this guide.)

You will find that there are various components on an electricity bill. These components could include:

- 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/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.' If you take a look at the units of measure, you should be able to figure out what your usage is. Usage 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 – Frequently you will also find an environmental levy specified on your bill. The units will be the same as for the energy charge (R/kWh or derivative), but the amount will frequently be quite small. There is currently a big debate in South Africa as the current environmental levy might be phased out and replaced by a carbon tax. As you can see from some electricity bills, these levies or carbon taxes already exist in some form.
  The issues to be addressed are:
  - Will these environmental levies 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 facility	2 300	1,42	1 620
2	Local municipality	Average billed	825	1,47	561
3	Facility manager A	Actual electricity	790	1,45	545
4	Facility manager B	Lumped levies	1 020	Unknown	Unknown
5	Prepaid electricity	None	1 200	1,47	816

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

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to electricity use (continued from above).	25
C	Take a view on the Eskom grid emission factor.	28

The Eskom grid emission factor has been a discussion point and a topic of debate since 2006 when South Africa became a signatory to 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. As an 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.

[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.

Remember that the Eskom grid emission factor for CDM purposes is calculated by using a prescribed mathematical model. One would think that such a mathematical model could have only one possible answer, but the model requires you to make some assumptions to calculate the grid emission factor. Think of it 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 very much the same concept – the only difference is that everyone that 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. Be on the lookout for differences in the value applied between different reporting years.

When determining a carbon footprint, you do not need to calculate the Eskom grid emission factor in accordance with the CDM methodology. One would think that this ought to make one's life easier, but that's not necessarily the case. For some background consider Eskom's 2011 annual report that provides the following information on page 11:

	Unit	2011	2010	2009
Total electricity produced	GWh	237 430	232 812	228 944
Total electricity sold	GWh	224 446	218 591	214 850
Carbon dioxide	Mt CO_2	230,3	224,7	221,7

As you can see, there is a difference between total electricity produced and total electricity sold. Total electricity produced could include:

- electricity that Eskom needs to run its electricity plants; and
- distribution losses that occur when electricity needs to be relayed across significant distances as is the case in South Africa. (Think of the distance electricity needs to travel from Mpumalanga to the Western Cape.) The result is that total electricity produced is always more than total electricity sold.

You can now divide the carbon dioxide produced by the electricity numbers and multiply that figure by 1 000 to get to tCO_2/MWh. The result is:*

	Unit	2011	2010	2009
Total electricity produced	GWh	237 430	232 812	228 944
Total electricity sold	GWh	224 446	218 591	214 850
Carbon dioxide	Mt CO_2	230,3	224,7	221,7
Grid emission factor based on total electricity produced	tCO_2/MWh	0,970	0,965	0,968
Grid emission factor based on total electricity sold	tCO_2/MWh	1,026	1,028	1,032

** Values may differ due to rounding.*

The GHG Protocol suggests that technical and distribution losses should not be taken into account when the grid emission factor is calculated for the end-user. If it is assumed that you are the end-user and not Eskom, the grid emission factor based on total electricity sold will be incorrect, as factors such as distribution losses are still in the GWh generated value. The grid emission factor based on total electricity produced would be the more accurate/representative value to use. On page 51 of the Eskom's 2011 annual report the grid emission factor is stated as 0,99 t/MWh (assuming it is 0,99 tCO_2e/MWh). However, there is no indication as to how the 0,99 tCO_2/MWh was calculated, which is problematic. The 2012 report provides more clarity regarding the calculation and the emission factor is again stated as 0,99 tCO_2e/MWh.

On page 21 of Eskom's 2014 integrated report – supplementary and divisional – CO_2 emissions (relative) is stated as 1,01 kg/kWh for the 2013/2014 period. This is an increase from 2012/2013 (0,98 kg/kWh) and 2011/2012 (0.99 kg/kWh). Page 45 of Eskom's 2014 integrated report gives the CO_2 emissions factor for total electricity sold as 1,07 tCO_2/MWh and as 1,03 tCO_2/MWh for total energy generated.

One possible approach would be to use the 1,03 tCO_2/MWh and state in your footprint that you used the 'vendor-supplied value.' It is, however, important that the vendor discloses the emission factor calculation where possible and that one understands what the audit statement (limited, reasonable, qualified) implies.

In this guide it is assumed that the Eskom emission factor is 1,03 tCO_2e/MWh. Adding this to the information you already have and multiplying the assumed grid emission factor by the actual electricity consumption 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 facility	2 300	1,42	1 620	1,03	1,67
2	Local municipality	Average billed	825	1,47	561	1,03	0,58
3	Facility manager A	Actual electricity	790	1,45	545	1,03	0,56
4	Facility manager B	Lumped levies	1 020	Unknown	Unknown	1,03	Unknown
5	Prepaid electricity	None	1 200	1,47	816	1,03	0,84

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/data, you should use a value higher than what you think the value possibly is.
- Data sets can potentially 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.

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

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 rental 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 not frequently 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 component.

As stated earlier, in some cases heat and/or steam can also be purchased 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 purchased 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 regassing refrigerant gases (Scope 1) discussed earlier. In short, the third party that supplies the heat and/or steam to you should provide you with two key pieces of information:

- the emission factor of the heat and/or steam that you bought; and
- 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 measure to ensure that the product of the multiplication produces a meaningful result.

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

Scope 3

The GHG Protocol defines Scope 3 emissions as other indirect emissions. That doesn't shed much light, but it does go 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 further includes as Scope 3 emissions electricity-related activities, eg technical and distribution losses not covered in Scope 2, outsourced activities, waste disposal, etc. 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.

Car rental

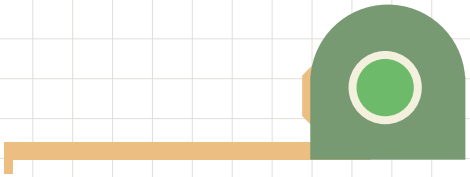
Attributing emissions associated with rental car use is one of the less contentious parts of a carbon footprint as most people make the logical link between fuel consumption and GHG pollution. What makes rental car fuel consumption even more tangible is that most people will be familiar with fuelling 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 regarding just how green some of the hybrid vehicles that have come onto the market are in reality.

Scope 3 emissions are 'everything else' and normally relate to emissions that someone else will be emitting on your behalf. This includes business travel and emissions from paper manufacturing.

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 7.) Normally, for carbon footprinting purposes, one only looks at the emissions associated with the fuel used during the use of the rental car. Over and above this, one normally only includes the emissions associated with the direct combustion of the fuel. In other words, it normally 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 rental 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)

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

Rental car use differs from air travel in that the distance for which the rental 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 rental period.

If you have ever rented a car, you will know that a certain amount of money on your credit card will be put on 'hold' by the car rental 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
- 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 rental company to tell you how far an employee has driven during a specific car rental transaction, which is crucial for carbon footprinting purposes. This also implies that rental car emissions can only be calculated after the transaction has been completed and captured in detail by the accounting system.

Remember that it is important to include some information about which department/unit used the rental 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 rental company.

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

Different car rental companies use different classes to distinguish between car groups, but there are general similarities. For example, Avis will have Chevrolet Spark 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. First Car Rental will define a Chevrolet Spark as Class A, with an associated emission value of, for example, 120 gram CO_2/km. First Car Rental also has a Chevrolet Spark Hatch option as a Group B car. This model's emission value compares well with that of Avis. It should be noted that the Avis value is for a class average and First Car Rental's value is specific for the different models in each class.

This example is summarised in the table below:

Car rental company	Car	Car class	Emission rate (gram CO_2/km)
Avis	Chevrolet Spark	Group M – Economy	161
First Car Rental	Chevrolet Spark	Group A	120
First Car Rental	Chevrolet Spark Hatch	Group B	154

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 these classes are.

It is advisable to compile a single list of car groups and emission factors for all the car rental companies you use. Such a consolidated table will make your life much easier.

Draw up an alphabetical car group list of all the rental car suppliers. If you use Company A and Company B, you should have two tables very similar to the following:

Company A			
Car group	Car code	Typical vehicle	Emissions
A	MDMN	Polo Vivo	202
B	EDMR	Polo Hatch	178
C	CDMR	Corolla	184
D	EDAR	Polo Sedan	156
E	CDAR	Corolla Sedan	203
F	PCAR	BMW 3 Sedan	221
G	PDAR	Mercedes C	187
H	EXAR	Hybrid	105
I			
J	LCAR	Mercedes E	235
K	IFMR	Hyundai IX35	285
L			
M	MCMR	Chevrolet Spark	161
N	LVMR	Kombi	255
O			
P			
Q			
R			
S	IFAR	Toyota Fortuner	303
T			
U			
V			
W			
X			
Y			
Z	LVMR	Toyota Quantum	282

Company B			
Car group	Car code	Typical vehicle	Emissions
A	MDMN	Kia Picanto	149
B	CDMR	Hyundai I20	190
C	CCMR	Corolla	203
D	IDAR	Chevrolet Aveo	198
E	PVMR	Hyundai H1	282
F	SDAR	Chevrolet Cruz	198
G	CDMD	Polo Blue Motion	89
H	FDAR	BMW 320i	205
I			
J			
K			
L			
M			
N			
O	PDAR	Mercedes C180	174
P	CFMR	Daihatsu Terios	249
Q			
R			
S	IFMR	Hyundai Ix35	236
T	EDMR	Hyundai Atos	184
U			
V			
W	FFMR	Toyota Hilux Double	300
X			
Y	EFNR	Toyota Hilux Single	284
Z			

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 as such. This said, consider updating the rental car emission factors as part of your annual emission factor updating.

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 as Group G and German saloons in Group H.

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

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 rental car use

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to rental car use (continued from above).	34
C	Start by drawing up a list of car groups.	35
D	Log the distance travelled during the rental car use.	38
E	Calculate emissions.	38

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

Step E: Calculate emissions

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to rental car use (continued from above).	34
C	Start by drawing up a list of car groups.	35
D	Log the distance travelled during the rental car use.	38
E	Calculate emissions.	38

You now have all the information you need to calculate the emissions associated with every car rental 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 rental car use and ways to deal with these exceptions:

- As always the golden rule is that if you don't have information/data, you should use a value higher than what you think the value possibly is. So, when it gets to rental car use, 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 rented a truck for normal city use. So, let sanity prevail and assign a class of rental 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 rental vehicle travelled, but sometimes you might not have this data due to poor data quality. In these cases you could possible assume the free/included kilometre limit as set by the car rental company. The daily limit is typically between 100 and 200 km. You can then multiply the daily limit by the duration of the car rental to get to a thumbsuck 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. There is hence a big push 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 cost as follows:

- Allocating more people per flight, ie cutting back on leg room and baggage allocation per passenger.

- Ensuring that flights carry more passengers than premium carriers (if a carrier feels 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 make no mistake, 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 is carried as possible.

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.

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.

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 do 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 B: Source the information regarding your consumption: specific to flights (continued from above)

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 absolutely 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 post-flight lag anyway. The lag implies that, instead of allocating the emissions too early, it will now definitely be allocated after the actual flight. The post-flight 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.

It is important to include some information regarding which department/unit undertook the flight if you would like to do a department/unit breakdown later on.

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. There are various websites that 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.airrouting.com/content/TimeDistanceForm.aspx
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 about the distance between these airports.
- As the flight path is not known, the distance between airport pairs will in most cases be the theoretical best case. This having been said, make sure that the distance between the airports take the curvature of the earth into account. For domestic flights the straight-line (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 all across the world has a specific abbreviation that references that airport. Stick to using these internationally accepted abbreviations at all cost. For example, London Heathrow International Airport is abbreviated LHR and Cape Town International Airport is abbreviated 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.

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.

1

You cannot fly through the earth, as indicated on the right, so you need to take the earth's curvature into account.

Front view of Africa

2

The earth's curvature is now taken into account, but the flight path on the left is not correct.

3

The earth's curvature and flight path is now accounted for.

Side view of Africa

Figure 4: Typical mistakes and remedies when calculating flight distances.

2

3

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

Furthermore, airport pairs work both ways, ie the distance of a flight from OR Tambo International Airport (ORTIA, JNB) to London Heathrow International Airport (LHR) is the same distance as the return flight from London Heathrow International Airport to OR Tambo International Airport. 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 (CPT), 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.

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 least 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 this section will discuss how to deal with flights of airport pairs you do not have on your list.

So at this stage you should 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)	1 850	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 2015 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.

South Africa is geographically a large country. Therefore, some European default factors for domestic travel will not always be applicable.

DEFRA have, in 2015, added a new set of aviation factors for international flights between non-United Kingdom destinations.

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 international 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 in the 2015 emission tables, but some simplification will result in much less work and not much worse (inaccurate) results.

Step E: Distinguish between flight classes

Differentiate between long-haul and short-haul flights and different flight classes, but limit the total number of combinations. Sanity should prevail.

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 first-class flight passenger will pollute more than a business class flight passenger.

If you look at the 2015 DEFRA emission factors, you will be able to associate a certain amount of GHG pollution per passenger kilometre (pkm) for 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's look at one of the most common ones. This factor is called the 'uplift factor', which in DEFRA 2012 is 1,09 (an additional 9%) and 1,08 (an additional 8%) in 2013 and later. This implies that your calculated emissions or emission factor (mathematically it makes no difference) should be multiplied by 1,08 to take into account that flights do not take a straight path from origin to destination. This factor is commonly used and in the 2013 and later DEFRA emission factors it is not even stated separately but rather already taken into account in the stated emission factors. No other correction factor will be added to the example below and the more contentious 'radiative forcing factor' will be discussed a bit later on as part of the exceptions.

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	0,08795
2	CPT – LHR	9 700	John Smith	Production	Long	Business	0,23271
3	LHR – HEM	Unknown	Sally Shield	Production	Long	Unknown	Unknown

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

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. Please remember that this will only be the pollution for a one-way trip and that the resulting unit is $kgCO_2e$.

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	0,08795	114,34
2	CPT – LHR	9 700	0,23271	2 257,29
3	LHR – HEM	Unknown	Unknown	Unknown

Dealing with the 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	0,08795	114,34
2	CPT – LHR	9 700	0,23271	2 257,29
3	LHR – HEM	9 700	0,32098	3 113,51

If we knew the distance from London Heathrow International Airport to Helsinki-Malmi Airport was 1 800 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	0,08795	114,34
2	CPT – LHR	9 700	0,23271	2 257,29
3	LHR – HEM	1 850	0,32098	593,81

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 5. 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 wide spread of possible radiative forcing applied value implies that the possible pollution of the same flight can differ 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 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.

Commuting

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 on a daily basis.

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.

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

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 staffmembers travel to the office. Please also note that once it is included in the company's footprint, it will be very difficult to take out in future years. One viewpoint to include 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 shrugging its responsibility.

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

As with any questionnaire the aim is to be able to extract the most information with the least possible questions. Figure 5 overleaf illustrates a possible tree-like staff commuting questionnaire structure:

BUSINESS TRAVEL IS DRIVING FROM HOME OR FROM THE OFFICE TO A CLIENT. **COMMUTING** REFERS TO EMPLOYEES' TRAVELS BETWEEN HOME AND THE OFFICE ON A DAILY BASIS.

EMPLOYEE THAT COMMUTES ...

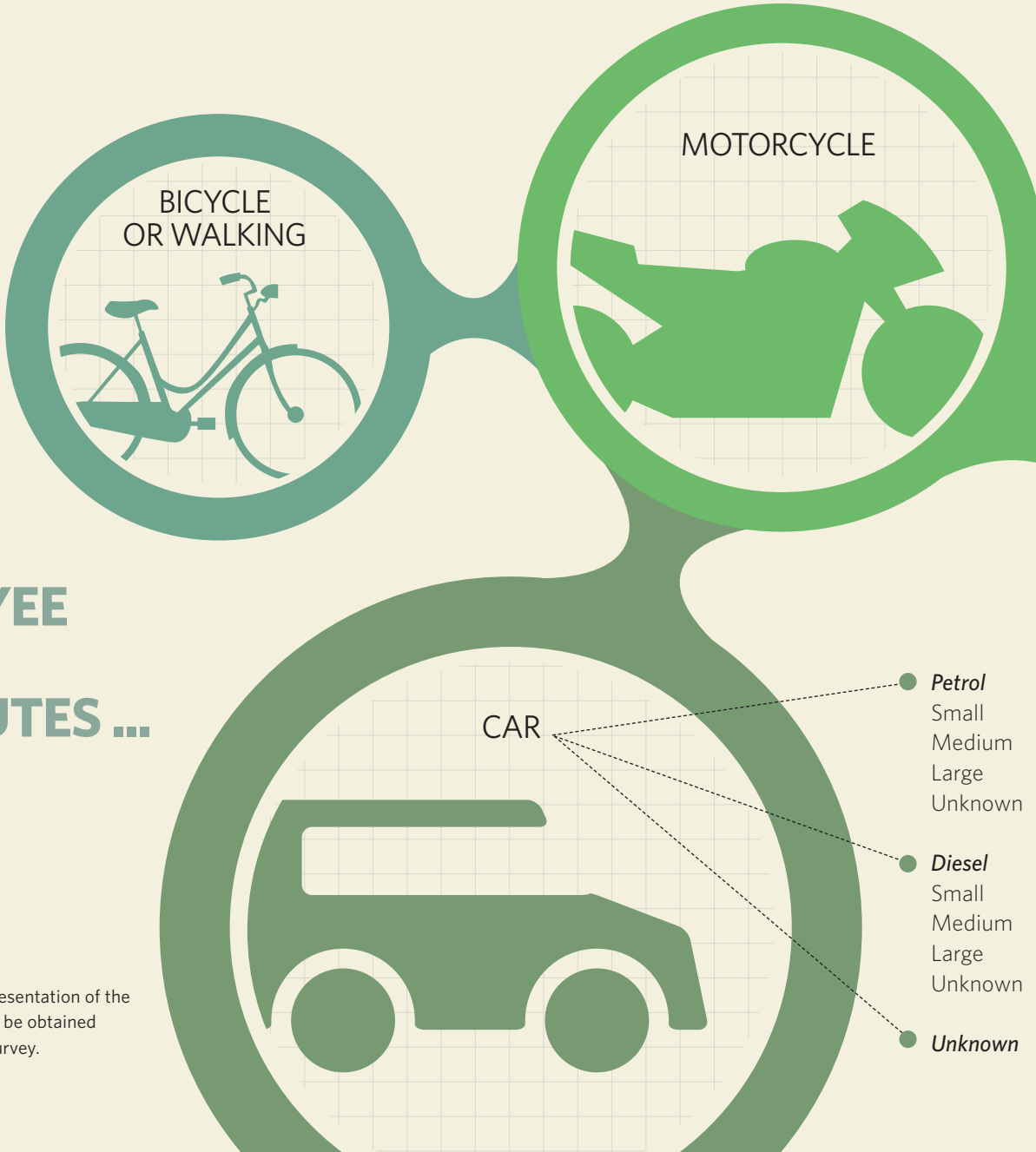
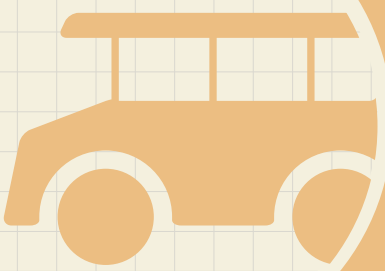
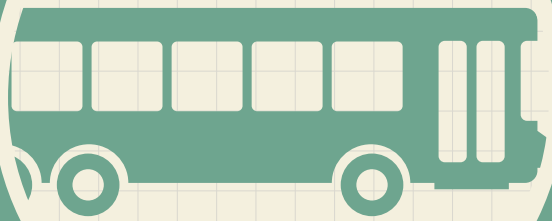


Figure 5: Graphical representation of the information that should be obtained by a staff commuting survey.

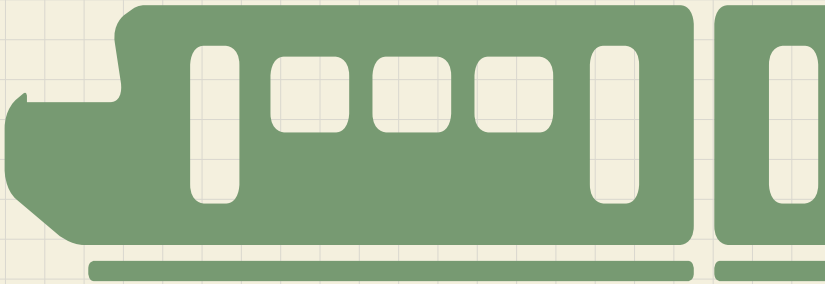
TAXI



BUS



TRAIN



The process will be 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 (0,10883 $kgCO_2e$/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 the enforcement thereof, is 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 pick an unknown-fuel multipurpose vehicle, you could reasonable assign an emission rate of 0,20116 $kgCO_2e$/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's assume that the average taxi will have an average of 10 occupants at any time. The emission factor per taxi commuter should then be:
0,20116 $kgCO_2e$/vkm ÷ 10 = 0,020116 $kgCO_2e$/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 2015 emission factors, you can argue that you need to use the light rail and tram options and basically pick the highest above-ground rail pollution rate. This will be an emission rate of 0,05461 $kgCO_2e$/pkm.

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

- Question 2.1: If a car, is it a petrol or diesel car?
  - Answer by selecting one option:
    - Petrol
    - Diesel
    - Unknown

- Question 2.2: If a car, is it a small, medium or large car (defined by engine capacity)?
  - Answer by selecting one option:
    - Small (petrol engines 1,4 ℓ and smaller and diesel engines 1,7 ℓ and smaller).
    - Medium (petrol engines 1,4 – 2,0 ℓ and diesel engines 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 downloaded 2015 emission factors for these vehicles.

- Question 2.3: If a motorcycle, is it a small, medium or large motorcycle [defined by engine capacity as cubic centimetres (cc) and assuming all motorcycles are petrol]?
  - Answer by selecting one option:
    - Small (petrol engines 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. The downloadable 2015 DEFRA emission factors are not that specific about the 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			0,20116
4	Rail			vkm NA
5.1	Car	Petrol	Small	0,15859
5.2			Medium	0,19931
5.3			Large	0,29074
5.4			Average	0,19126
5.5		Diesel	Small	0,14367
5.6			Medium	0,17561
5.7			Large	0,2252
5.8			Average	0,18232
5.9		Unknown	Average	0,18635
6.1	Motorcycle	Petrol	Small	0,08814
6.2			Medium	0,10644
6.3			Large	0,13977
6.4			Unknown	0,11966

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 commuting of staffmembers.

Therefore, we have to transform the vehicle kilometres (vkm) to some sort of passenger kilometre (pkm) 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 back 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 in respect of 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?

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 won't 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 between three and five. Flexible working practices imply that even full-time 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 percentage of 220 to 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 = 35 – 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	0,10883
3	Taxi			0,20116	10	0,020116
4	Rail			vkm NA	NA	0,05461
					Number of people in vehicle	
5.1	Car	Petrol	Small	0,15859	2	0,079295
5.2			Medium	0,19931	2	0,099655
5.3			Large	0,29074	3	0,096913
5.4			Average	0,19126	2	0,095630
5.5		Diesel	Small	0,14367	1	0,143670
5.6			Medium	0,17561	2	0,087805
5.7			Large	0,2252	3	0,075067
5.8			Average	0,18232	2	0,091160
5.9		Unknown	Average	0,18635	3	0,062117
6.1	Motorcycle	Petrol	Small	0,08814	1	0,088140
6.2			Medium	0,10644	1	0,106440
6.3			Large	0,13977	1	0,139770
6.4			Unknown	0,11966	1	0,119660

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 illustrates 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		0	5			
2	Bus			NA	NA	0,10883	5	20	8 800	957,70
3	Taxi			0,20116	10	0,020116	5	15	6 600	132,77
4	Rail			NA	NA	0,05461	5	42	18 480	1 009,19
					Number of people in vehicle					
5.1	Car	Petrol	Small	0,15859	2	0,079295	5	22	9 680	767,58
5.2			Medium	0,19931	2	0,099655	5	40	17 600	1 753,93
5.3			Large	0,29074	3	0,096913	5	34	14 960	1 449,82
5.4			Average	0,19126	2	0,095630	5	38	16 720	1 598,93
5.5		Diesel	Small	0,14367	1	0,143670	5	29	12 760	1 833,23
5.6			Medium	0,17561	2	0,087805	5	28	12 320	1 081,76
5.7			Large	0,2252	3	0,075067	5	4	1 760	132,12
5.8			Average	0,18232	2	0,091160	5	22	9 680	882,43
5.9		Unknown	Average	0,18635	3	0,062117	5	52	22 880	1 421,23
6.1	Motorcycle	Petrol	Small	0,08814	1	0,088140	5	17	7 480	659,29
6.2			Medium	0,10644	1	0,106440	5	24	10 560	1 124,01
6.3			Large	0,13977	1	0,139770	5	65	28 600	3 997,42
6.4			Unknown	0,11966	1	0,119660	5	21	9 240	1 105,66

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 usage.

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 seems far away and much less tangible compared to 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 was 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. Hopefully South Africa will not follow the United States, where communication is so over the top that even a packet of peanuts can feature the statement: 'Caution – this may contain nuts'. However, printing on only one side of a statement may be much harder to justify.

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.

In the South African context most companies' emissions associated with paper usage 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 print significant amounts per client could be universities that have thousands of students, with possibly thousands of pages being printed per student per year.

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 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 was indeed carbon negative (net result is absorbing more carbon 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 was 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?

Step B: Source the information regarding your consumption: specific to paper (continued from above)

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. Obviously this is most probably not the case, but the result is that you can link your data to the accounting system. Remember that it is important to include some information on which department/unit consumed the paper if you would like to do a department/unit breakdown later on.

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

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

- 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 whereby 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 isn't 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.

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. For this 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 usage as possible.

Limit what paper products you include in your paper footprint so as to be able to track the most relevant consumption.

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 so as to exclude any seasonal ordering that may be attributed to a specific project.

Step D: Carry over the other required information

Step	Description	Page
A	Source the information regarding your consumption.	14
B	Source the information regarding your consumption: specific to paper (continued from above).	61
C	Limit what you include in your paper footprint to what matters.	62
D	Carry over other information required.	63
E	Calculate the mass of paper per order.	64
F	Determine the emission factor for the paper you are using.	66
G	Calculate the GHG emissions associated with each transaction.	67

Other bits of information you will shortly require includes:

- 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-paper 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). Remember, 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.

Always keep track of the units of measure used!

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 you do the calculation steps as illustrated above and do not combine too many steps – especially when starting out. Later on you will develop a tangible feel for some of these measures so that you will instinctively know whether, as a ballpark, 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 × 2 500
= 155,93 m^2

And at 80 gsm the mass per box equates to:

Total area per box × mass per square unit = 155,93 × 80 ÷ 1 000
= 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's 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 1,03 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 basically 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.

In the example in step G below, assume typical South African paper production emission factors will be used. (In this example it will be 1,8 tCO_2e/tonne of paper.) For your use it is advisable to source the specific factors relating to the paper suppliers and manufacturers that you are dealing with.

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 rather 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
No	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/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 what the unit was 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, you then have to assume that it would have been boxes. The usage will then be inflated, which reiterates the importance of good-quality data.

CASE STUDY OF FOOTPRINTS

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. It is therefore time to investigate a few practical carbon footprint case studies. 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.

Some of the case study sources are very comprehensive documents. To traverse these documents it is advisable to do a word search (for example 'carbon') so as to be directed to the most relevant sections. It should be noted that, during the case study discussions, all page references are based on the page count in the portable document format (PDF) file and not the page numbers as shown in the printed document.

Discussion regarding the selection of case studies and sources of information

The Carbon Disclosure Project (CDP) is currently the predominant global GHG reporting system for companies. Under this system the South African economy is broken down into various subsectors, in which a variety of case studies may be found. The CDP is not a perfect system, but it at least adds some external validity to the GHG impact of individual companies. It should be noted that, in the case studies included in this guide, CDP submissions were not used, but rather company-specific reports, such as sustainability reports and integrated annual reports, which are all open-source documents.

Each case study was deliberately selected to illustrate specific aspects or show interaction between case studies. The following is a summary of the CDP sectoral breakdown of the South African economy, with specific companies in those sectors being used as case studies:

- Consumer Discretionary: Truworths International and Sun International.
- Consumer Staples: British American Tobacco (BAT) and SABMiller
- Financials: FirstRand, Nedbank and Redefine Properties
- Health Care: Netcare
- Industrials: Barloworld and Konica Minolta South Africa (owned by the Bidvest Group)
- Information Technology (IT) and Telecoms: Vodacom
- Materials: PPC

The tables overleaf summarise why each case study was chosen and what the source of information was. It should be noted that all the sources were available in the public domain, for example integrated annual reports of companies listed on the stock exchange.

Sector	Consumer Discretionary
Company	Truworths International
Reasons for selecting this case study	Truworths performed well in the CDP for this sector, despite not reporting on targets.
Source of information used	Truworths International Integrated Report 2014. https://www.truworths.co.za/assets/investor/2014/september2014/Truworths_IAR%20 2014%2025%20Sept.pdf Downloaded. Last accessed in June 2015.

Sector	Consumer Discretionary
Company	Sun International
Reasons for selecting this case study	Sun International has an uncommon classification of Scope 2 and Scope 3 emissions relating to electricity of leased and owned buildings, which makes for an interesting comparison.
Source of information used	Sun International Integrated Annual Report 2014. http://ir.suninternational.com/downloads/full-report.pdf Downloaded. Last accessed in June 2015.

Sector	Consumer Staples
Company	British American Tobacco (BAT)
Reasons for selecting this case study	BAT has strong agricultural links, which makes it novel. It is an international company with a strong local and African presence.
Source of information used	British American Tobacco Annual Report 2014. http://www.bat.com/group/sites/uk__9d9kcy.nsf/vwPagesWebLive/DO9DCL3B/$FILE/ medMD9UWNKU.pdf Downloaded. Last accessed in June 2015.

Sector	Consumer Staples
Company	SABMiller
Reasons for selecting this case study	SABMiller has consistently improved its CDP scores over the past three years. The company makes for an interesting case study when looking at normalisation measures chosen to describe the company's carbon footprint.
Source of information used	SABMiller plc Annual Report 2014 http://www.sabmiller.com/docs/default-source/investor-documents/reports/2014/financial-reports/annual-report-2014.pdf?sfvrsn=8f Downloaded. Last accessed in June 2015. OR SABMiller plc Sustainable Development Summary Report 2014 http://www.sabmiller.com/docs/default-source/investor-documents/reports/2014/sustainability-reports/sustainable-development-report-2014.pdf?sfvrsn=14 Downloaded. Last accessed in June 2015.

Sector	Consumer Staples
Company	PPC Ltd
Reasons for selecting this case study	PPC is an energy and carbon-intensive business. The proposed South African carbon tax discussed in the case study could have a big impact on manufacturing companies such as this one.
Source of information used	PPC Integrated Report 2014 – Sustainability http://ppc.investoreports.com/iar2014/download/sustainability.pdf Downloaded. Last accessed in June 2015.

Sector	Financials
Company	FirstRand
Reasons for selecting this case study	FirstRand is a top performer in the 2014 CDP for the financial sector. The manner in which it discloses the components of its carbon footprint in the integrated report has changed in recent years. Emission sources are no longer classified into scopes.
Source of information used	FirstRand Annual Integrated Report 2014 http://www.firstrand.co.za/InvestorCentre/Current%20FSR%20annual%20report/2014%20FSR%20annual%20integrated%20report.pdf Downloaded. Last accessed in June 2015.

Sector	Financials
Company	Nedbank
Reasons for selecting this case study	Nedbank is the first carbon-neutral bank in Africa. Its Scope 3 emissions include components that differ from those of most companies.
Source of information used	Nedbank Group Limited Integrated Report for the year ended 31 December 2014 http://www.nedbankgroup.co.za/financial/Nedbank_ar2014/downloads/NedbankIR2014.pdf Downloaded. Last accessed in June 2015.

Sector	Consumer Discretionary
Company	Redefine Properties
Reasons for selecting this case study	Redefine's Scope 3 emissions make up the biggest part of its carbon footprint, which is unusual.
Source of information used	Redefine Properties Limited Integrated Annual Report 2014 http://www.redefine.co.za/AnnualReport2014/files/assets/common/downloads/AR2014.pdf Downloaded. Last accessed in June 2015.

Sector	Health Care
Company	Netcare
Reasons for selecting this case study	This case study illustrates that, even in healthcare, carbon footprinting may be of significance. A different view of Scope 3 emissions is presented, with an illustration of how overall reductions and a list of GHG reduction initiatives can potentially be reconciled.
Source of information used	Netcare 2014 Annual Integrated Report http://www.netcareinvestor.co.za/reports/ar_2014/pdf/netcare_limited_air_2014.pdf Downloaded. Last accessed in June 2015.

Sector	Industrials
Company	Barloworld – focusing on Avis Rent a Car
Reasons for selecting this case study	Barloworld (holding company) is a good performer in the CDP for this sector. Avis Rent a Car (subsidiary) is a carbon-neutral company.
Source of information used	Barloworld Integrated Report 2014 http://www.barloworld.com/docs/default-source/2014/integrated-report.pdf?sfvrsn=2 Downloaded. Last accessed in June 2015.

Sector	Industrials
Company	Bidvest Group – focusing on Konica Minolta South Africa
Reasons for selecting this case study	Konica Minolta South Africa is one of a handful of South African companies reporting to be carbon neutral.
Source of information used	Konica Minolta GHG Inventory Report 2014 http://www.bidvest.co.za/ar/bidvest_ar2014/pdf/kmsa-carbon-footprint-fy-2014.pdf Downloaded. Last accessed in June 2015. And http://www.bidvest.com/ar/bidvest_ar2014/ops-reviews-office.php Viewed online. Last accessed in June 2015.

Sector	IT and Telecomms
Company	Vodacom
Reasons for selecting this case study	Vodacom significantly outperforms other telecommunication companies in the CDP. The relationship between Scope 1 and Scope 2 emissions is the inverse of many other companies.
Source of information used	Vodacom Integrated Report for the year ended 31 March 2014 http://vodacom.onlinereport.co.za/vodacom_ir_2014/wp-content/themes/vodacom/downloads/Vodacom_2014_integrated_report.pdf Downloaded. Last accessed in June 2015. And http://vodacom.onlinereport.co.za/vodacom_ir_2014/wp-content/themes/vodacom/downloads/Environment_report_Vodacom_IR_2014.pdf Downloaded. Last accessed in June 2015.

Cross case study topics and investigation

The case studies were evaluated and various topics spanning the carbon footprinting space were identified. The case study discussions focus on these identified topics and not only on the evaluations of the single case studies:

Topic 1: General (matters such as different views on the concepts of 'sustainability' and 'climate change' are discussed).
Topic 2: A company's view on sustainability and placement within a company.
Topic 3: Carbon neutrality.
Topic 4: Auditing.
Topic 5: Carbon standard and methodology.
Topic 6: Scope 1.
Topic 7: Scope 2.
Topic 8: Scope 3.
Topic 9: Emission factors.
Topics 10: Targets.
Topic 11: Normalisation.
Topic 12: Comparisons.
Topic 13: Company-specific.
Topic 14: Disclosure.
Topic 15: Carbon tax.
Topic 16: What can you do in your company?

These topics cut across multiple case studies and an integrated approach should be followed to address the various views on each of the identified topics.

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

Number and topic	Barloworld	BAT	FirstRand	Konica Minolta SA	Nedbank	Netcare	PPC	Redefine Prop	SABMiller	Sun International	Truworths	Vodacom
1 General	X	X			X	X				X		
2 Where is sustainability positioned?	X				X				X	X		
3 Carbon neutrality	X			X	X							
4 Auditing	X							X				X
5 Carbon standard and methodology				X						X		X
6 Scope 1						X						X
7 Scope 2			X							X		
8 Scope 3	X				X	X		X			X	
9 Emission factors												
10 Targets		X			X						X	
11 Normalisation		X			X	X			X			
12 Comparisons	X				X				X	X		
13 Company-specific		X		X		X						
14 Disclosure												
15 Carbon tax							X					
16 What can you do in your company?						X	X				X	

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

Topic 1: General

Sustainability

- The use of the term
  'Sustainability' is reaching a point of overuse. There are many different definitions and a variety of applications such as 'sustainable development' or 'sustainable business' to name but a few.

  A commonly used definition of sustainability is one made up of three aspects – people, planet and profit. Nedbank states that environmental, societal and economic sustainability are all inextricably linked (page 27 of its 2014 integrated report). Nedbank considers that, as a bank for all, its business success is linked to the sustainability of the environment that it operates in.

  Sun International also describes sustainability in its business as being about creating shared value between business, environment and people (page 50 of its 2014 integrated annual report, left-hand column). The company states that it considers the sustainability of its business practices and its potential impact on all stakeholders and on the environment.

  In Netcare's 2014 annual integrated report, sustainability is discussed in terms of the company's business model (page 4) as well as its environmental sustainability strategy (page 13). Environmental sustainability is given as a strategic priority, which aims to eliminate harm and waste in every area of operation and optimise energy and water use. This said, there is no explicit link made between environmental, economic and social sustainability.

- Conclusion
  Nedbank is a commercial bank, Sun International is in the hotels and leisure industry, and Netcare is in the health provider industry. This is a wide spread of companies and industries, 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?

Sustainable product and sustainable company

Barloworld (page 38 of its integrated report) describes sustainable development as a strategic focus area of the company. The objective of this focus area is to 'develop products and services to capitalise on emerging sustainable business opportunities, realize cost savings though energy efficiency and other sustainable business practices, and enhance Barloworld's reputation by leading in sustainable development'.

Please consider the following:
It is commonly accepted that tobacco is detrimental to one's health. Can tobacco then be considered as a sustainable industry? How does the impact of tobacco tie up with the British American Tobacco (BAT) group strategy? For guidance see the BAT plc Chairman's introduction to the company's annual report on page 5. Health risks will not be discussed in detail. Please see the rest of BAT plc correspondence for its more detailed view.

- Conclusion
  A company can be considered a 'sustainable company' even if its current product offering does not consist only of 'sustainable products.' 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? Does the sustainability of various product ranges differ?

Sustainability of agricultural sources

- Input from agricultural sources
  BAT also has a large agricultural footprint and agricultural activities can also have adverse environmental impacts. It is generally accepted that agriculture is a major user of water and that a landuse change from forestry to agriculture will reduce sequestrated carbon. For this reason there are ever-increasing pressures on agriculture to focus on sustainability. What is the view of BAT plc in this regard and what is being done?

- Conclusion
  One possible set of conclusions is outlined by BAT in its 2014 annual report as answers to a set of questions:
  - 'What other sustainability issues are important to British American Tobacco?' (Page 5)
  - 'What else is British American Tobacco doing to prepare for the future?' (Page 6)
  - Refer to 'Promoting sustainable agriculture'. (Page 28)

- Self-assessment
  Does your company have any exposure to agricultural sources? How are you managing these risks? Do you have any other sustainability risk exposures in similar niche areas?

Climate change

- Different views
  Barloworld (page 46 of its 2014 integrated report) considers the following as environment-related risks to its operations and value chains:
  - climate change and related physical risks due to changing weather patterns;
  - regulatory risks associated with greenhouse gas emissions;
  - financial risks resulting from carbon taxes;
  - operational risks due to constraints in energy supply and the availability of natural resources such as water; and
  - operational risks due to the use of fossil-fuel-based energy in its supply chain, operations, products and solutions.

The Barloworld report (page 99) states the company's concern about climate change and the impact of GHG emissions on global warming. The company acknowledges that restrictions on emissions and proposed carbon taxes pose risks to it, its value chain and its customer base. However, the opportunities presented by climate change are also recognised, including the increased demand for products and solutions with reduced carbon emissions. Recognition is also given to opportunities for internal initiatives to further improve energy and emissions efficiency, indicating related cost savings.

- Conclusion
  Companies view climate change and the potential impacts on their business in different ways. Some companies may respond to climate change challenges through reducing their carbon footprint and mitigating the potential impacts of resource limits on their business. Others may look at the associated financial, regulatory, operational and reputational risks to their business and stakeholders in addition to the preservation of natural resources.

- Self-assessment
  Consider the risks Barloworld identifies to its operations and value chains. Which of these will be applicable to your company? Which positioning will lead to the most, and quickest, action in your company?

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

This section looks at how a company views sustainability and the impact its position in a company can have.

A company's view on sustainability

Most companies agree that sustainability has different aspects. For example, Barloworld (page 36 of its 2014 integrated report) says that sustainability comprises economic, environmental and social aspects. Nedbank (page 27 of its 2014 integrated report) recognises that environmental, societal and economic sustainability are closely linked – the bank's success is linked to the sustainability of the environment that it operates in, and future business prospects are greatly improved if society is flourishing. Sun International (page 50 of its 2014 integrated annual report, left-hand column) believes that sustainability in its business is about creating shared value between business, environment and people, and that in its business the distinction between purpose and profit is no longer in opposition.

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

The focus on these aspects are ever changing and could be impacted by the type of company. A classic example could be 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 responsibility (CSR) 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 on-the-ground application. This is especially true if the strategy is not reflected in people's scorecards.
Compliance	There will be a lot of 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 in letter, but not in principle. External disclosures could be very time-consuming.

Barloworld's sustainability falls under the human resources, strategy and sustainability portfolio (page 32), with sustainability forming part of the group's strategic planning process. Central to this process is a robust and systematic identification of risks and opportunities. SABMiller's sustainable development performance is overseen by the group corporate accountability and risk assurance committee (page 22 of its 2014 sustainable development report). Up to now we discussed how a company views sustainability and in which business unit it is positioned. 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 the buy-in from top management. This could result in the sustainability unit being ineffective and frustrated.

The CDP South Africa Climate Change Report 2014 (page 14) shows that more companies need to integrate the management of climate change, and filter it down throughout their businesses to achieve significant emission reductions against set targets.

Barloworld's human resources, strategy and sustainability reporting is housed under one group executive portfolio (page 32), showing the group's top-down strategic framework, complemented by strategic and operational planning and execution spread throughout the company's divisions. This allows for an integrated approach to sustainable value creation and effective implementation of initiatives.

In another example of a top-down approach to sustainability, SABMiller's sustainable development is overseen by the group corporate accountability and risk assurance committee (CARAC), a subcommittee of the SABMiller plc board.

Each region then has its own committee (CARAC), which oversees local performance and emerging issues. Sustainable development is integrated into SABMiller's business strategies at a global, regional and in-country level through sustainable development priorities (page 5 of its integrated report), measured against key performance indicators (KPIs). This gives the company 'global focus and alignment, while allowing local markets to respond to local needs'.

- 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 decisionmakers and decentralised business unit experts with knowhow 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 organisation?
  - 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 organisations sustainability unit on performance of GHG-reducing actions?
  - Is sustainability seen as a risk or an opportunity?

Topic 3: Carbon neutrality

Nedbank states (page 89 of its 2014 integrated report) that it is 'Africa's only carbon-neutral bank.' (To refresh your memory see the technical terms section for a definition of carbon neutrality.) This implies that its remaining Scope 1, Scope 2 and Scope 3 emissions are offset after GHG reduction initiatives.

Konica Minolta South Africa (KMSA) has an ongoing carbon-neutral strategy (page 2 of its 2014 carbon footprint report). KMSA offers products and services within the document imaging and management business, and is wholly owned by the Bidvest Group. KMSA's carbon neutrality strategy (page 23) is a three-step process:

- Firstly, calculating the company's carbon footprint.
- Secondly carrying out emission reduction initiatives where possible.
- Thirdly, offsetting the remaining emissions by offset projects.

KMSA has offset its carbon footprint, both direct and indirect emissions (Scope 1, Scope 2 and Scope 3 emissions amounting to 5,681 tCO_2e) by planting 15 396 fruit and indigenous trees in collaboration with a non-governmental organisation (page 2).

In Barloworld's 2011 integrated report it was stated that Avis Rent a Car (a subsidiary of Barloworld) was carbon-neutral. This carbon-neutral status was achieved by offsetting all emissions associated with the company's facilities. However, in Barloworld's 2014 integrated report there was no mention of the previous CarbonNeutral® accreditation of carbon offsets.

The control principle

- Application

  KMSA has decided to account for all the emissions from its operations that it has control over, which implies all Scope 1, Scope 2 and Scope 3 emissions. This reporting boundary is frequently referred to as the operational control approach (see page 7 of KMSA's 2014 carbon footprint report). KMSA's operations include the headoffice, 17 branches and 49 dealerships.

  See Nedbank's 2014 integrated report on page 82 for its carbon neutrality approach. Nedbank offsets its remaining Scope 1, Scope 2 and Scope 3 emissions, but 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.

  In its 2011 financial year Avis did not offset the emissions associated with the use of its rental fleet. This said, the predominant source of pollution is associated with the use of the Avis fleet (combustion of liquid fuel) as opposed to that of Avis offices.

  It is therefore clear that there are similarities and differences between the approaches followed by Nedbank, Avis and Konica Minolta South Africa.

- Conclusion

  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 rental fleet, but Nedbank will offset its use of rental 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 KMSA, Nedbank and the previous Avis approach 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.

The concept of '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.

  For example, KMSA submitted their carbon footprint and offsetting reports to the Carbon Protocol's Carbon Neutral Programme (page 2 of KMSA's carbon footprint report). This Carbon Neutral Programme acts as an independent third-party verifier and grants the use of its standardised carbon-neutral logo for members to portray their carbon-neutral status. On page 17 of its 2011 integrated report Barloworld indicated that it had 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/she sees fit?
  - Was Avis carbon-neutral due to its CarbonNeutral® accreditation? (See page 49 of Barloworld's 2011 integrated report that 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?

Picking projects for carbon-neutral status

- Which projects to support
  Companies differ with regard to the type of carbon offsets they purchase.

  KMSA (page 23 of KMSA's carbon footprint report) chose to plant fruit and indigenous trees, as well as bamboo plants, to offset their carbon footprint 5,681 tCO_2e. These trees and plants were planted to support South African conservation projects. The calculation is on the basis that 2,71 trees should be planted for every 1 tonne of CO_2e to be sequestered. If bamboo plants are used, the calculation is carried out on the basis that 1,7 bamboo plants should be planted to sequester 1 tonne of CO_2e. 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 5 or 10 years' time. How will this affect the carbon-offsetting status?

  The carbon credits Nedbank needs to offset its carbon footprint are obtained from projects that benefit the natural heritage and social structures of Africa (page 82 of its 2014 integrated report). This is in line with Nedbank's understanding of the need for strong social and environmental sustainability interconnectedness. The majority of the projects supported are forest-based projects.

  The previous two projects chosen by Avis related to coal mining and the combustion of coal. These were the Tieling Coal Mine Methane Capture project in China, and the Basa Magogo 'Light it up' Improved Cooking Technique project in South Africa, which taught local communities in South Africa to burn coal differently in order to be more fuel-efficient, thereby saving money and reducing carbon emissions.

- 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.

- 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 emission 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 NGOs.

The benefits of being carbon-neutral

The research report 'When does it pay to be carbon-neutral?' (http://hdl.handle.net/10019.1/80783) looks at reasons and benefits of being carbon-neutral.
These include:

- Competitive strategy – carbon neutrality can be seen as a tool to encourage effectiveness (and reduce product or operational costs) or as a differentiating strategy.
- Moral incentive or responsibility.

Overestimation and buffering carbon neutrality claims

Nedbank (page 55 of its 2014 integrated report) stated that it retired 225 000 tCO_2e although its carbon footprint was approximately 213 133 tCO_2e. This implies that it has added a buffer of some 10%. What would you consider to be a good buffer size and how should it tie up with the audit findings in respect of a carbon footprint?

- Reputation and legitimacy – carbon neutrality should please stakeholders, environmentalists and the media.
- New sources of revenue and capital – through green products and services as well as carbon trading mechanisms.
- Risk management strategy – to improve the management of regulatory risks, for example the proposed South African carbon tax (using carbon offsets to lower tax liabilities), and physical risks (the direct risk of climate changes on the stability of the environment and the impact on the company's operations).

  The above report says on page 69 that 'when companies are aiming to become carbon neutral, they need to be clear on what benefit they are trying to achieve'. The carbon-neutral companies looked at in the report (Nedbank, Avis Rent a Car and Backsberg Wines) all had different motivations to reduce carbon emissions and become carbon-neutral.

  Backsberg's decision was based on moral responsibility, believing that 'businesses are in part responsible for the (climate change) problem and should take responsibility to participate in repairing damages' (page 53 of the report). Further benefits were realised from being carbon-neutral once this status had been achieved, such as a stronger positive reputation and an increase in sales.

  Nedbank has built a culture of differentiation by being the only financial institution that is carbon-neutral. This gives the company a competitive advantage by attracting clients who ethically approve of and identify with green products and services and the bank's brand. A further benefit to being carbon-neutral (page 49 of the 'When does it pay to be carbon neutral?' report) is that the company will be prepared for the introduction of proposed carbon taxes. Being carbon-neutral also has strong market angles such as offering strategically placed products.

  Avis (page 59 of the report) recognises that reducing CO_2 emissions is a moral and commercial imperative. It also acknowledges that carbon neutrality is linked to a good corporate social responsibility reputation by positively influencing consumers' attitudes toward Avis 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 as it relates to your own company:
  - The value of a company's carbon-neutral status, including:
    - strategic value;
    - marketing value; and
    - inhouse learning that could become 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 big 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 only 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 check whether the environmental and carbon footprint claims made by a company can be substantiated.

The National Business Initiative (NBI) is a voluntary coalition of South African and multinational companies, committed to working towards sustainable growth and development in South Africa. The NBI has produced a document titled 'A Primer on Selecting an Assurance Provider' (http://www.nbi.org.za/Lists/Publications/Attachments/389/A_Primer_for_Assurance_in_South_Africa.pdf). Verbatim from source: *'the reporting of sustainability information and greenhouse gas 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 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 (page 8). An additional level of comfort is provided to internal decisionmakers. It allows them to gain a better understanding of how to mitigate identified risks effectively (page 3).
- Stakeholders are more frequently 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. The CDP, for example, recommends verification of climate change data and allocates disclosure and performance points to verification (page 3). By scoring more points with the CDP programme your company can gain increased rankings and increased value with investors. (For more information on this point see the case study Topic 13: Disclosure).

First-party assurance is that which 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 (page 4) agrees with the value of having both.

CURRENTLY ONE OF THE BIG CONCERNS WITH CARBON FOOTPRINT AUDITING IS THAT **ANOTHER AUDITING LAYER AND ADDITIONAL REPORTING ARE ADDED** TO THE DUTIES OF COMPANIES.

- Discussion
  - Redefine's carbon footprints were prepared with the assistance of an external consulting company (page 6 of Redefine's 2014 annual report). They have not obtained independent assurance on their carbon footprint. What are the reasons given for this?
  - Barloworld: The assurance report by auditing firm Deloitte & Touche (page 143 of Barloworld's integrated report) includes verifying Barloworld's environmental data. Refer to the conclusion paragraph on this page – were there any adverse findings?
  - Vodacom: Independent limited assurance was given by Ernst & Young Inc (pages 96 and 97 of Vodacom's 2014 integrated report). The assurance report states that 'where a limited assurance conclusion is expressed, evidence gathering procedures are more limited than for a reasonable assurance engagement. Therefore less assurance is obtained than in a reasonable assurance engagement'.

  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 utilised 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.)

Topic 5: Carbon standard and methodology

The carbon standard and methodology applied

- Discussion

  'Standard' and 'methodology' can refer to documents that state the perceived best practice on how to gather information, and/or how to use this information to calculate a carbon footprint.

  Using internationally recognised GHG standards promotes 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 World Resources Institute (WRI) and World Business Council on Sustainable Development (WBCSD), is an often-used global standard to measure, manage and report GHG emissions. Sun International's carbon emissions are measured in accordance with the GHG Protocol (page 160 of its 2014 integrated annual report). Its Scope 3 emissions include electricity from leased facilities. Vodacom also uses the GHG Protocol to define its emission scopes. All their electricity consumption emissions are included in Scope 2. This example shows that, even when the same standard is used, different methods can be applied to define the scopes of a company's emissions. Sun International and Vodacom apply the same GHG Protocol, but in different ways.

KMSA uses the GHG Protocol and the ISO 14064-1 standards for calculating its carbon footprint. The ISO 14064-1 standard is used to specify principles and requirements at organisation level to measure and report on GHG emissions. The GHG Protocol is used to provide further guidance on boundary setting and the quantification of other indirect (Scope 3) emissions (page 5 of KMSA's carbon footprint report). Again, different approaches can be followed when using carbon standards. In KMSA's example, two different standards were used to define and quantify its carbon footprint.

The South African Governments Department of Environmental Affairs (DEA) is proposing to introduce the National Greenhouse Gas Emission Reporting system (Government Gazette no 38779, published on 11 May 2015). This national system for the reporting of GHG emissions will be used:

- to inform policy formulation;
- for the Republic of South Africa to meet its obligations under the United Framework Convention on Climate Change and any other international treaties to which it is bound; and
- to establish and maintain a national GHG inventory.

This mandatory reporting system is to be aligned with the Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC). The reporting system will require data providers (including companies) to submit GHG emission data for specified listed activities to an internet-based reporting system by 31 March of each year.

'STANDARD' AND 'METHODOLOGY' CAN HAVE DIFFERENT MEANINGS, AND **THE 'RECIPE' USED FOR CALCULATING THE CARBON FOOTPRINT** SHOULD THEREFORE BE DESCRIBED CLEARLY.

The DEA can instruct companies to verify the information submitted. It can also request supporting documentation prepared by an independent person if it believes that the information submitted is incomplete or incorrect.

- Conclusion
  'Standard' and 'methodology' can have different meanings, and the 'recipe' used for calculating the carbon footprint should therefore be described clearly. There is not really a single perfect recipe – and the examples above indicate that the granular application can differ vastly, even when companies use similar recipes. The standards provide guidelines on the emission accounting practice – just like in financial accounting. It is up to the company to decide what is relevant and applicable to its operations.

- Self-assessment
  - Compare the Scope 3 emissions of Sun International and Vodacom. How have they defined their scopes differently? How does this compare with those of your company?
  - KMSA uses two standards to measure and report its GHG emissions. Can these two standards be used together? How do they differ?
  - How will the introduction of a national reporting system aligned to a different standard affect your company?

Topic 6: Scope 1

Scope 1 emissions

- Discussion
  Scope 1 emissions are the highest emission bracket for Vodacom's international operations (page 4 of its 2014 integrated report – environmental). This could be due to diesel base stations in remote parts of the world – taking into account that base station power will predominantly be provided by diesel generators without heat recovery. It is uncommon to have Scope 1 emissions as a company's predominant source. (Other exceptions could include Eskom and the transport/aviation industry.)

  In the 2013 South African Operations Environmental Report for Netcare (**http://www.netcareinvestor.co.za/reports/ar_2013/sao-environment-report.php**) a large 33,7% year-on-year increase in Scope 1 emissions was reported. In the more recent 2014 Netcare South African Operations Environment Report (http://www.netcareinvestor.co.za/reports/ar_2014/sao-environment-report.php) the year-on-year change in Scope 1 emissions was given as a 12% increase. This example illustrates that one can focus on year-on-year increases or decreases or take a longer view to assess trends in the Scope 1 emission percentage.

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

- 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 base stations. What could other Scope 1 emissions include?
    - Can you calculate what the emissions would have been if electricity was used instead of diesel, and what the impact on the footprint would be?

  - The following question can be posed with regard to Netcare:
    - What could be the possible reasons for the large rise in Scope 1 emissions from 2013 to 2014?

      Possible answers:
      > broadening of reporting scope;
      > vast increase in transport emissions; and/or
      > expansion of facilities with stationary combustion for electricity generation. This could be at facilities that do not have the option of grid connectivity.

  - 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?

Topic 7: Scope 2

Scope 2 emissions

- Discussion
  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 should be included in the Scope 3 emissions of the end-user. (See Topic 4: Auditing).

  Sun International's Scope 2 emissions – mainly electricity consumption – make up a majority 77% of the company's carbon footprint (pages 160 and 161 of Sun International's 2014 integrated annual report). This is typical of many carbon footprints in South Africa. What is not common is Sun International's 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). (See Topic 4: Auditing). Until 2008 FirstRand followed the same approach (**http://www.rmb.co.za/PDFs/carbonFootprintReportMay2009.pdf**). It has subsequently altered its carbon footprinting methodology and disclosure. The emission sources are listed under its carbon footprint table (page 128 of its 2014 annual integrated report), but are no longer categorised into scopes.

  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? More will be said about this in Topic 16: What can you do in your company?

- 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 of 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 (page 158 of its annual integrated report).

  Now answer the following questions 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?

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 TO BE ABLE TO DRAW A COMPARISON.

Topic 8: Scope 3

Scope 3 emissions

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

  Some companies report on Scope 3 emissions and provide an indication of whether Scope 3 emissions are increasing or decreasing. Nedbank's Scope 3 emissions include commuting, namely staff travel to the office and back (page 82 of its 2014 integrated report). Redefine (page 86 of its 2014 integrated annual report) identified electricity as the company's major emission source. These were reported under Scope 3 emissions. 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 back to the discussion of 'control principle' in the Scope 1 section of the guide.

  Certain companies report very little about Scope 3 emissions. These companies include Barloworld (see the footprint on page 99 and reference to Scope 3 on page 100 of its 2014 integrated report). Truworths includes no Scope 3 emissions in its report.

- 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 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 a previous year.

- Self-assessment
  Consider the following questions:
  - Netcare reports on its Scope 3 emissions in its online SA Environmental Report (**http://www.netcareinvestor.co.za/reports/ar_2014/sao-environment-report.php**). The tonnes CO_2e emission value is given for 2014 and compared with a restated value for 2013. This restated 2013 value is much larger (9 times) than the Scope 3 emissions value given in the 2013 report. What could be the reasons for this?
  - Nedbank includes staff commuting in its Scope 3 emissions. Is this an emission source that should be included? Keep the control principle in mind.
  - What Scope 3 emissions could Truworths possibly have and should these have been included in its report?
  - What will your company include in Scope 3 emissions and what is most relevant?
  - Would any electricity be included in your company's Scope 3 emissions?

Topic 9: Emission factors

- Discussion
  South Africa does not have a single authoritative publically available source of country-specific emission factors to use in GHG reporting. The United Kingdom emission factors are often used instead. This guide (version 2) uses the 2015 DEFRA emission factors that can be found at: http://www.ukconversionfactorscarbonsmart.co.uk. As mentioned on page 9 of this guide, emission factors do not frequently change much year on year. If they do, it may be due to updated methodologies to calculate the emission factors, or relating to improved technologies resulting in changes in the amount of emissions released. Each year DEFRA releases its updated emission factors for use in carbon footprint calculations.

  For many energy sources the United Kingdom emission factor will be very similar to that for South Africa. For example, DEFRA-defined emission factors for refrigerants and liquid fuels will apply as is to South Africa. However, care should be taken when selecting the appropriate emission factors for many other emission factors, as South African circumstances do not mimic United Kingdom conditions perfectly. An example of this could be that the United Kingdom defined taxi is a 'black cab', whereas the South African idea of a taxi could be a minibus.

  When it comes to emission factors for the consumption of electricity, the source of the electricity should be considered for that specific country. Refer back to the section in this guide on Scope 2 emissions and the discussion on the Eskom grid emission factor. The 'vendor-supplied value' of 1,03 tCO_2e/MWh has been used as the emission factor in this guide. This said, Eskom can be seen as the primary 'vendor' to the South African grid, but Eskom cannot be seen as the total South African grid. The factor used for the South African grid should therefore be clearly stated and justified within a carbon footprint. For example, compare the emission factors given by DEFRA in the section on electricity conversion factors for overseas countries. The emission factor for South Africa is given as 0,85728 kg CO_2/kWh. This differs greatly from the Eskom emission factor.

  The DEFRA grid emission factor for South Africa is similar to that for India (0,82909 CO_2/kWh) and Australia (0,8136 CO_2/kWh), but vastly different from that of Switzerland, with an emissions factor of 0,03151 CO_2/kWh. South Africa's electricity (primarily from Eskom) is generated mainly from coal-fired power stations. Consider the technologies used in these other countries in relation to the emission factors given.

- Conclusion
  DEFRA is a good place to start for emission factors, but keep South African specifics in mind. The South African grid emission factor has been contentious and different sources provide different values. Make sure you disclose the figure you use, the reasoning and the source.

- Self-assessment
  What emission factor for electricity consumption does your company use? Why was this value selected?

Topic 10: Targets

Reduction targets

- Discussion
  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 2014 CDP South Africa Climate Change Report (page 15) says that GHG reduction targets are important as they require conscious senior management decisions and show a solid commitment to tackling climate change.

  In the past many companies did their target setting haphazardly. The reality is that target setting can only be done 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 pick this measure very carefully. If the base year was picked after certain reduction initiatives had been introduced, the actions would not show up as reduction initiatives in future. Deciding on a base year too far back in time 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.

  A key message in the 2014 CDP South Africa Climate Change Report (page 7) is that, while more companies are setting reduction targets, the scale and ambition of many of these targets do not match the scale of the challenge or the contribution promised by South Africa. (In 2009, at the United Nations climate change talks, the South African government committed to reducing the country's emissions by 34% from business-as-usual levels by 2020 and by 42% by 2025.) The report encourages more ambitious and long-term goals (in line with companies' long-term strategic planning) to reduce emissions so that South Africa has a better chance of meeting our climate change targets.

  See 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 with which future carbon footprints will be compared.

Absolute versus intensity reduction targets

- Discussion
  Absolute reduction targets involve reducing actual 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 they may be difficult to achieve if the company grows or expands and this growth results in an increase in GHG emissions. Also, target base 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. 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. (See Topic 11: Normalisation, which looks at choosing suitable metrics).

Intensity reduction targets reflect GHG performance improvement independently of organic growth of the company. They also allow for comparing your performance against that of other companies operating in a similar field. One disadvantage is that they can allow for increases in emissions, while still achieving targets. 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.

- 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.

- Self-assessment
  Truworths (page 24 of its 2014 integrated annual report) gives a 2014 emission figure of 64 420 tons of store carbon emissions. (It is assumed that 1 ton in this case is equal to 1 tonne or 1000 kg.) This is related to both its 2014 target (55 000 tons over the medium term) and 2015 target (store electricity carbon emissions of 64 000 tons).

  The report mentions that Truworths is currently refining its baseline for the measurement of carbon emissions and plans to set emission reduction targets in the near future.

  The following questions can be asked:
  - Can this be viewed as an absolute or intensity target?
  - What emission reduction targets do you think Truworths should set going forward? Should it plan for organic growth when considering these targets?

  - How does this compare with BAT plc's environmental targets? What base year it decides on and how does it normalise its pollution measures? (See pages 28 and 29 of the company's 2014 annual report.)

  - Nedbank's targets are stated on page 33 of its 2014 Sustainability Review. Are these targets:
    - conveyed clearly and unambiguously?
    - applicable to Nedbank?
    - being met as time progresses?
    - relevant to your company?

  - 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 with which reduction initiatives will be compared?
    - normalisation (see Topic 11 before attempting this) and what is most applicable in your industry?

Topic 11: Normalisation

Putting things into perspective

- Discussion
  It is possible to have an increased carbon footprint in gross terms, but a reduced carbon footprint in normalised terms (see the paragraph on intensity targets in the previous case study). Normalisation is the process by which a carbon footprint (measured in tCO_2e) is divided by an appropriate measure. In Nedbank's case the appropriate measures were deemed to be 'fulltime employee' (FTE) and 'square metre of occupied space' (page 82 of Nedbank's 2014 integrated report).

  British America Tobacco (BAT) is a major producer of cigarettes and tobacco products. Its normalisation criterion was tonnes of CO_2e per million cigarettes produced (pages 20, 28 and 29 of the company's 2014 annual report). It should be noted that this normalisation is novel as it takes production into account as opposed to FTE or m^2 (floor space). SABMiller also uses a production approach to normalisation – fossil fuel emissions are measured by the total amount of CO_2e in kilograms released to the atmosphere by brewery operations, divided by the volume of lager produced (page 177 of SABMiller's 2014 annual report).

  Please note that this type of normalisation can skew the results if production drops for reasons unrelated to energy use or GHG production, such as strikes and suppressed market demand. Normalisation implies that the carbon footprint is linked to other measures such as FTE, m^2 (floor space), etc. The causality between the carbon footprint and the normalised unit should be clear and one should guard against:
  - absurd normalisations – such as tonnes CO_2e per phonecall to a bank; and
  - risky but relevant normalisations – such as tonnes CO_2e per FTE. The result could be an overall carbon footprint reduction, but the normalised value can show an increase if, for example, jobs (counted as FTE) were reduced due to economic conditions.

- Conclusion
  Normalisation is an important tool, for example to put GHG pollution rates into perspective or to compare it with some industry norm. Inappropriate normalisation could skew a carbon footprint and create uncertainty rather than add value.

- Self-assessment
  Please refer to Netcare's 2014 annual integrated report. Netcare reports its CO_2e emissions in tonnes and also as total CO_2e per R1 million revenue (at the bottom of page 131). If you look at its SA: Environment Report 2014 published online (**http://www.netcareinvestor.co.za/reports/ar_2014/sao-environment-report.php**) Netcare also reports on normalised emissions per registered bed. This normalised unit has changed since its 2011 annual integrated report, which reported emissions in $kgCO_2$ per patient day as well as tonnes of CO_2 per R1 million revenue generated (**http://www.netcareinvestor.co.za/reports/ar_2011/sa_environmental.php**).

  The following questions can be posed:
  - Are the different measures relevant for this industry?
  - The change in normalisation unit from 2011 to 2012 makes it difficult to compare data and measure progress. How has Netcare clarified its progress against its targets?
  - What possible unintended consequences of normalisation could there be for your company that are detrimental to your carbon footprint? (Think of a decrease in revenue if revenue is the intensity measure.)
  - Are the various normalisation methods and units that these companies use sensible? What normalisation would be most applicable to your company?

WITH TIME AND PRACTICE YOU WILL DEVELOP THE SKILL TO
COMPARE DIFFERENT CARBON FOOTPRINTS AT A GLANCE.

Topic 12: Comparisons

Carbon footprint comparisons

- Discussion
  It is generally possible to do two types of carbon footprint comparisons:
  - external view – comparisons between different companies; and
  - 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 (page 82 of its 2014 integrated report); and
  - Sun International (page 161 of its 2014 integrated annual report).

  For an internal comparison look at how Barloworld (page 99 of its integrated report) discloses its carbon footprint breakdown by division. SABMiller's approach differs in that it compares the average GHG emissions by product packaging type (kegs, returnable bottles, PET bottles, cans and non-returnable bottles are compared by $kgCO_2e/hl$ per stock-keeping unit (page 15 of SABMiller's 2014 sustainable development report).

- 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/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 Nedbank and Sun International by focusing on the following questions:
  - 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.
  - How does the carbon footprint of your company compare with these?

You will find that these pie charts are very representative and actually compare well with the typical South African company, although Nedbank and Sun International are in different economic sectors. Gross emissions will, however, differ between companies in different sectors.

Refer to the Barloworld divisional comparisons.
Which division has the highest emission? What are possible reasons for this?

A HIGHER-ENERGY REQUIREMENT WILL POTENTIALLY RESULT IN A BIGGER CARBON FOOTPRINT.

Topic 13: Company-specific

Selected company-specific carbon footprint commentary

- Discussion
  Delving into specific company carbon footprints you will find certain peculiarities. A few of these are highlighted below:
  - British American Tabacco (BAT) reports in its 2014 annual report on various business measures (page 29). Carbon dioxide equivalent is reported in tonnes CO_2e per million cigarettes equivalent produced. The 2014 value is reported as 45% lower than the 2000 baseline. The target is to reduce group CO_2e by 50% by 2030 from the 2000 baseline (of 1,52 tonnes CO_2e per million cigarettes equivalent produced) and by 80% by 2050. Also reported is the group energy use (gigajoules per million cigarettes equivalent produced). This value is reported as 13% lower than the 2007 baseline. The target for this business measure is to reduce energy use by 17% by 2017 from the 2007 baseline.
    - Refer to the BAT report and investigate how these ambitious reduction targets were set. How have the reductions to date been achieved?
    - What could be the reason that different baseline years are used for the different reduction measures?
  - Netcare reports under environmental performance indicators on both South African operations and those in the United Kingdom (see the table on page 131 of its 2014 integrated annual report). South African energy usage is reported in gigajoules, but the energy usage for the United Kingdom is reported in megawatt hours. Both South Africa and the United Kingdom report on CO_2e emissions in tonnes. Total CO_2e per R1 million revenue is reported only for the South African operations.
    - Why do you think there are different reporting measures for the different operations?
    - Does the split in reporting measures provide a clearer understanding of the pollution rate and responsible entity?
  - Refer to page 8 of the Konica Minolta South Africa (KMSA) carbon footprint 2014 report. Scope 3 emissions are identified as business-travel-related emissions and fuel- and energy-related emissions. These fuel- and energy-related emissions are defined as: extraction, production and transportation of diesel, petrol and liquid petroleum gas; and electricity transmissions and distribution losses. Also look at the diagram on page 7, which illustrates the different sources of emissions as well as the operational boundaries of an organisation.
    - Why does KMSA include these additional fuel- and energy-related emissions in Scope 3, and not in Scope 1 or Scope 2?

Topic 14: Disclosure

- Discussion
  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:
  - Carbon Disclosure Project
  - Dow Jones Sustainability Index
  - FTSE4Good Index Series
  - JSE SRI Index
  - The United Nations Global Compact

  There is also the proposed South African government's mandatory National Greenhouse Gas Emission Reporting system (see Topic 5) that is being developed during the release of version 2 of this guide. As the name suggests, this system could be mandatory and not a voluntary system.

  Many of the voluntary disclosure schemes argue that participation in these 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 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/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 and submitting the relevant data 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?

Topic 15: Carbon tax

- Discussion

  For the past few years the South African government has been considering implementing a carbon tax as a way of managing countrywide GHG production. On 25 February 2015 the Minister of Finance announced that the draft carbon tax legislation would be published in 2015 for public consultation, with a view to it becoming law in 2016. The Draft National Greenhouse Gas Emission Reporting Regulations have been published in Government Gazette GG 38779 Notice no 411 on 11 May 2015 for public comment.

  The proposed carbon tax will apply to businesses operating in specific sectors. These businesses will be directly subject to the carbon tax, which will be calculated on the fossil fuel inputs that result in Scope 1 GHG emissions. Total Scope 1 emissions will not be taxed, but certain deductions will rather be made, as governed by legislation. Even if a business is not directly subject to the new carbon tax, it will need to consider the effect the carbon tax will have on its supply chain and the increase in input costs. An example is an increase in electricity prices because Eskom is subject to the carbon tax and is passing the increased costs through to the consumer. Another example could be that the tax on Scope 1 emissions produced during paper production in South Africa must be included in the price of a box of paper. In such a case the purchaser will effectively pay the tax although the product is part of the Scope 3 emissions of the producer.

  Sectors that are likely to be most negatively affected by the tax are the utilities and resources sectors as companies in these sectors tend to be heavy GHG emitters. Eskom (electricity generation) accounts for a large percentage of South Africa's GHG emissions. The mining sector and linked manufacturing industries are high electricity users and emitters of GHG emissions. Consider the Scope 1 emissions of companies such as Sasol (chemical sector) and ArcelorMittal South Africa (steel manufacturing) and the impact that the carbon tax will have on them and on the end-user of its products. Look at PPC's response to the proposed carbon tax on pages 20 and 21 of its 2014 sustainability report. PPC is an energy- and carbon-intensive business. If electricity prices increase and the company is taxed on its carbon emissions, how will this affect the price of its product? What implications will this have on the construction industry? And on house prices?

However, the implementation of the tax does hold benefits and opportunities for businesses:

- This could be an incentive for a company to reduce its CO_2 emissions and realise the associated cost saving and operational efficiencies.
- Services relating to tax advice, measuring carbon footprints and building sustainability strategies will be in greater demand.
- Products offering solutions to lowering a carbon footprint will be more popular.
- This could drive research and technology development in renewable energies and low-carbon offerings.

- Carbon offsetting can reduce a company's carbon tax liability to a certain level. The increase in the purchase of carbon offsets could result in increasing investment in rural development projects, regenerating landscapes, reducing land degradation, providing jobs and protecting biodiversity.

- Conclusion
  Environmental externalities need to be priced. We cannot continue on the same GHG pollution trajectory as before. Some form of environmental levy, be it through a carbon tax, a levy or an incentive for companies, is inevitable. However it is done, it will be priced into the goods we buy.

  Businesses should have a strategy to factor in the costs (direct or indirect) of the carbon tax or similar levy. It's a great opportunity for companies to build a case for sustainability.

- Self-assessment
  - How prepared is your company for the implementation of a carbon tax? Have the risks and opportunities been considered? Are the carbon emission measurements in place?

  - Companies will be required to calculate and report on their own emissions. Where will this reporting function be positioned in your company? Will it fall under governance? Strategy? Or perhaps even the tax department?

EVEN IF A BUSINESS IS NOT DIRECTLY SUBJECT TO THE NEW CARBON TAX, **IT WILL NEED TO CONSIDER THE EFFECT THE CARBON TAX WILL HAVE ON ITS SUPPLY CHAIN AND THE INCREASE IN INPUT COSTS**. AN EXAMPLE IS AN INCREASE IN ELECTRICITY PRICES BECAUSE ESKOM IS SUBJECT TO THE CARBON TAX AND IS PASSING THE INCREASED COSTS THROUGH TO THE CONSUMER.

Topic 16: What can you do in your company?

Various GHG reduction initiatives and what you can do in your company

- Discussion
  The possibilities to reduce a company's carbon footprint can be vast, but should be specific as to:
  - the circumstances of that company, as the options of a manufacturing facility will be different to 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 is currently refining its baseline for the measurement of carbon emissions and plans to set emission reduction targets in the near future (page 123 of its 2014 international integrated annual report). 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. It is planning a number of projects to drive energy efficiency and the self-provision of renewable energy, specifically solar energy (page 48 of its 2014 annual integrated report). The reduced grid dependency links back to the strategic importance of this healthcare group.

  PPC (page 23 of its 2014 integrated report – sustainability) is looking at ways to reduce coal use, and has identified carbonaceous spent pot liner (cSPL), a waste stream from the aluminium smelting industry, as a potential coal replacement at its Dwaalboom kiln. This will result in a net reduction in the use of non-renewable fuel sources and PPC's net specific carbon footprint.

  Heating, ventilation and air-conditioning (HVAC) facilities have also received a lot of attention over the past decade. Great strides have been made in reducing the energy consumption of these units. It is interesting to note that HVAC system optimisation is just as relevant in heavy industries and mining as it is in office environments.

- 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.

A BRIEF DISCUSSION REGARDING CONSULTANTS

Picking your carbon consultant

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 four tiers 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 to become 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 tier will most 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 with regard to carbon- and water-related projects. 'We are working on' or 'we have a current project' 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 here be lumped together. It is also important that the auditing experience should be 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.
- 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.
- 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 doesn't 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 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'd 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 skills set.

As auditing firms became involved in the GHG space they also brought with them their auditing 'lingo', examples of which include:

'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 auditing house before deciding to use a specific auditor:

- How many carbon footprints have your staffmembers 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 team members 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.

IN CONCLUSION

While the content of this guide is not intended to be an exhaustive or detailed study of carbon footprinting, the authors trust that you have found it useful by adding real value to your carbon measurement and reduction efforts. It is our hope that the information offered on these pages not only helps to guide 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 effectiveness has the potential to offer untold value to any organisation – not just because reducing your impact on the environment is morally the correct thing to do, but also because carbon management makes excellent business sense. Carbon footprinting can add significantly to your company's bottomline over time. We hope that this is the case for your organisation and that this humble information offering plays a part in realising the carbon vision for your business.

CARBON FOOTPRINTING CAN ADD SIGNIFICANTLY TO **YOUR COMPANY'S BOTTOMLINE** OVER TIME. WE HOPE THAT THIS IS THE CASE FOR YOUR ORGANISATION AND THAT THIS HUMBLE INFORMATION OFFERING PLAYS A PART IN REALISING **THE CARBON VISION FOR YOUR BUSINESS**.

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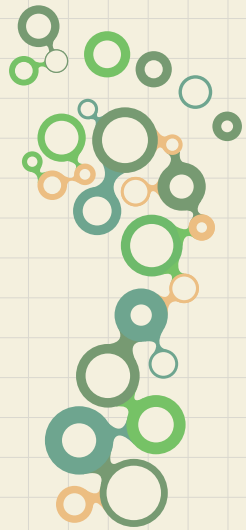

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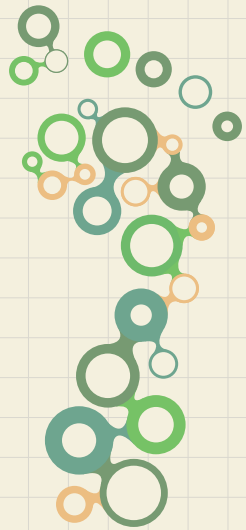

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