Carbon Footprint Report

2009

Department of Environmental Affairs and Tourism

The challenge: To respond to climate change, reduce our own environmental impacts, and lead the way in reducing the environmental impact of government.

environment & tourism
Department:
Environmental Affairs and Tourism
REPUBLIC OF SOUTH AFRICA

Carbon footprint report 2009

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Disclaimer

This report is based on information gathered by the project team. The views it contains are not necessarily those of Government. The Department of Environmental Affairs and Tourism does not accept responsibility in respect of any information or advice given in relation to this or as a consequence of anything contained herein.

Team for the calculation of the carbon footprint

Director: Dr Rudi Pretorius

Rest of project team: Ms Leanne Hart, Ms Anna Mampye, Ms Mpho Monyai, Mr Ngodiseni Madadzhe.

Acknowledgements

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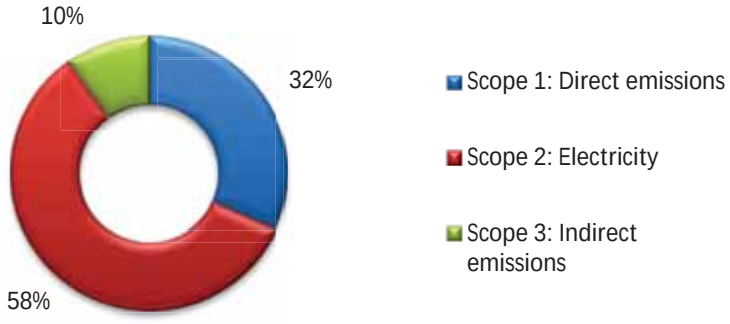
Emissions inventory summary

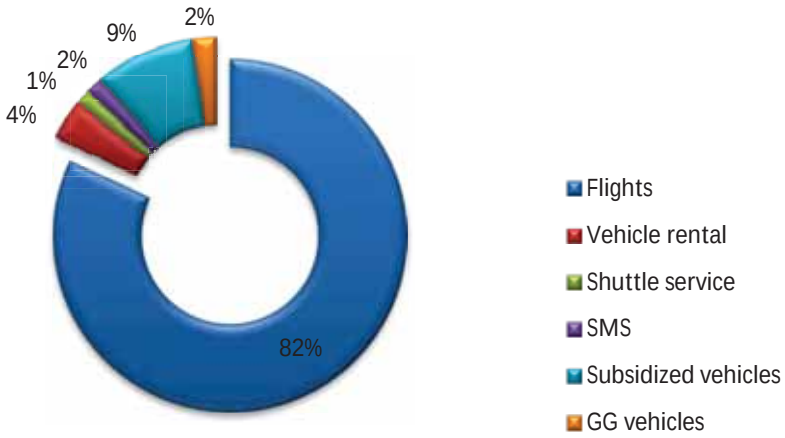
Emission sources	Consumption	Consumption units	CO_2e (tons)	Sub total (tons)	% of total emissions
Direct emissions (Scope 1)				7,529.4	30.63
GG vehicles	257,160	Km's	48.07		*0.19*
Air conditioning units (split units)	14.04	Kg's	23.87		*0.09*
Fridges/freezers	0.45	Kg's	0.77		*0.003*
Antarctic programme				*7,456.69*	*30.33*
Helicopters – aviation gasoline	140,000	litres	332.84		*1.35*
SA Agulhas – arctic diesel	1,852,000	litres	5,085.22		*20.69*
CFC	300	kg	510.0		*2.07*
Antarctic base				*1,116.24*	*4.54*
Polar diesel - generators	320,000	litres	878.66		*3.57*
Polar diesel - vehicles	85,000	litres	233.39		*0.95*
Two stroke Fuel	1,600	litres	3.81		*0.015*
Household gas	132	kg	0.38		*0.002*
Marion				*219.92*	*0.89*
Polar diesel - generators	80,000	litres	219.66		*0.88*
Petrol	20	litres	0.05		*0.0002*
Household gas	72	kg	0.21		*0.0008*
Gough				*192.47*	*0.78*
Polar diesel - generators	70,000	litres	192.21		*0.78*
Petrol	20	litres	0.05		*0.0002*
Household gas	72	kg	0.21		*0.0008*
Indirect emissions (Scope 2)				13,673.16	55.62
Electricity consumption	14,272,609	kWh	13,637.16		
Other indirect emissions (Scope 3)				3,381.13	13.75
Business travel				*2,198.62*	*8.94*
Domestic and international flights	15,946,984	Km's	1,846.6		*7.51*
Vehicle rental	507,787	Km's	84.44		*0.34*
Shuttle service	133,865	Km's	26.24		*0.11*
Management (official trips)	172,028	Km's	34.44		*0.14*
Subsidized vehicles	1,084,198	Km's	206.90		*0.84*
Staff commuting*	7,757,985	Km's	1,008.51		*4.10*
Paper	16,115	Reams	41.38		*0.168*
Computers	800	Computers	56.12		*0.228*
Air conditioning units (built in)	45	Kg's	76.50		*0.31*
Total: Scope 1, 2 and 3			24,582.69		100
Reduction offsets			0		
Nett emissions			24,582.69		100

*Extrapolated from a staff commuting survey with a survey sample size of 391 out of 833 staff members. Confidence level of 95%.

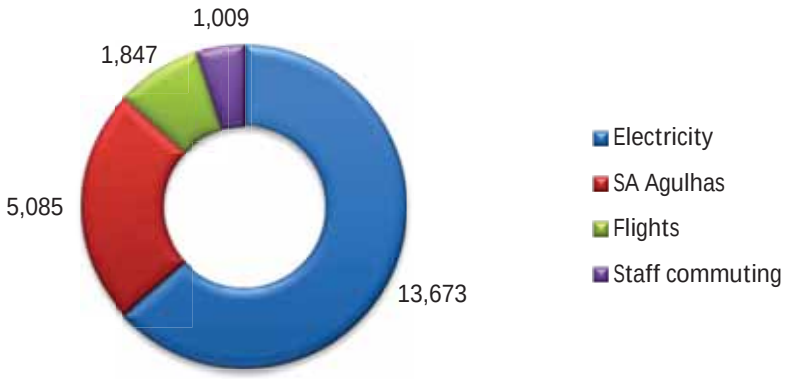
Carbon emissions 2008/09
Total 24,583.69 tons



Emissions from business travel
Total: 2,250.45 tons



Top four emission sources (tons)



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List of acronyms

ARS – Asset Recovery Service
CDM – Clean Development Mechanism
CER - Certified Emission Reductions
CFA – Carbon footprint analysis
CNG – Compressed Natural Gas
CRT – Cathode Ray Tube
CY – Calendar year
DEAT – Department of Environmental Affairs and Tourism
DME – Department of Minerals and Energy
EU – European Union
FY – Fiscal year
GHG – Greenhouse gas(es)
GWP – Global Warming Potential
HCFC - Hydrochlorofluorocarbon
HFC - Hydrofluorocarbon
IPCC – Intergovernmental Panel on Climate Change (UNEP)
IT – Information Technology
Kg - Kilogram
Km - kilometre
kW - Kilowatt
kWh – Kilowatt hour
LCD – Liquid Cristal display
ODS – Ozone Depleting Substance
UNEP – United Nations Environment Programme
UNFCC - United Nations Framework Convention on Climate Change
US EPA – United States Environmental Protection Agency
VMT – Vehicle miles travelled
WRI – World Resources Institute
WWF – World Wildlife Fund for Nature

Executive summary

The Directorate Information Management was tasked to do a carbon audit for the Department of Environmental Affairs and Tourism (DEAT). This report presents the carbon footprint of DEAT, in tons of carbon dioxide equivalent (CO_2e) emissions for the financial year 2008/09.

The audit covered seven broad emission categories; Electricity Usage, the Antarctic Programme, Business Travel, Office Paper, Air conditioning, Computers, and Staff commuting. These seven categories were chosen as they were the most likely to be the most carbon heavy aspects of the department's activities. The methodology used to carry out the audit was the methodology developed under the Greenhouse Gas Protocol Initiative.

The footprint is as follows:

Source	Tons CO_2e:	% of total
Electricity	13,673.16	55.62
Antarctic programme	7,456.69	30.33
Business travel	2,246.69	9.14
Air conditioning/fridges/freezers	100.37	0.41
Computers	56.12	0.23
Office paper	41.38	0.17
Staff commuting	1,008.51	4.10
TOTAL	24,582.69	100.00

Now that the emissions levels are known, the next step will be to reduce our impact. Several options to reduce emissions for each main emissions source are highlighted throughout the report. Several high level strategic reduction options are also identified including:

- Establishing an emissions target
- Develop a sustainable transport policy
- Switching to renewable power
- Develop a green office policy
- Record keeping for audit information

It is recommended that the Department, as a first concrete step, set an emissions target for the department. Some examples within the context of the emission scopes of the Department are provided.

Carbon offsetting, and the different offset schemes that are available are briefly discussed. The current portfolio of South Africa's registered Cleaner Development Mechanism (CDM) projects is also presented. It is recommended that the department:

- As a first priority establish an emissions target and then evaluate the feasibility of implementing the reduction opportunities identified in this report.
- Use offsetting as a last resort, after all steps have been taken to reduce emissions.
- Should offsetting be considered, invest only in South Africa's CDM project portfolio, preferably those projects that relate to renewable energy or energy efficiency.

Chapter 1: Setting the scene

This report summarises the carbon footprint for the Department of Environmental Affairs and Tourism (DEAT) for the financial year 2008/09. This is an office carbon footprint calculated in accordance with the Corporate Accounting and Reporting Standard, developed under the Greenhouse Gas Protocol Initiative. This emissions inventory report is designed to be used to identify carbon reduction opportunities.

BOX 1. EMISSIONS CONTAINED IN THE AUDIT

Our objective was to identify the major direct and indirect emissions created by the department and include all manageable emission losses caused by our operations plus some that we are aware of but can't manage.

As defined by the GHG Protocol and the World Resources Institute we have categorised the emission losses into the following scopes.

Scope 1 covers direct emissions from sources owned or controlled by the department.

Scope 2 covers indirect emissions from the consumption of purchased electricity, produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate the electricity, and do not include emissions associated with the production of fuel.

Scope 3 includes all other indirect emissions that are a consequence of the department's activities but are not from sources owned or controlled by the department.

The report has three goals:

- to provide a detailed analysis of the carbon footprint of the department;
- to serve as a planning tool for the department as it develops long-term strategies for reducing the institutions environmental impacts; and
- to serve as a model for other government departments as they grapple with their responsibilities in the face of global climate change.

A decision to calculate the carbon footprint of the Department of Environmental Affairs and Tourism was taken at the DEAT Lekgotla held from the 29-31 October 2008. The methodology for calculating the carbon footprint was presented and approved at a 4D management meeting on 23 February 2009, and at that meeting a decision was taken that a staff commuting survey should form part of the footprint calculations.

Chapter 2: Methodology

A carbon audit is a means of quantifying carbon emissions and allows us to determine our "carbon footprint". The methodology used was that developed under the Greenhouse Gas Protocol Initiative. To initiate, plan and implement the carbon audit, the steps outlined in the guideline document "Working 9 to 5 on Climate Change: An Office Guide" developed by the World Resources Institute was used (see figure below). In general, the Office Carbon Footprint Tool follows the methodology recommended in the 2006 Intergovernmental Panel on Climate Change (IPCC) Greenhouse Gas Inventory Guidance.

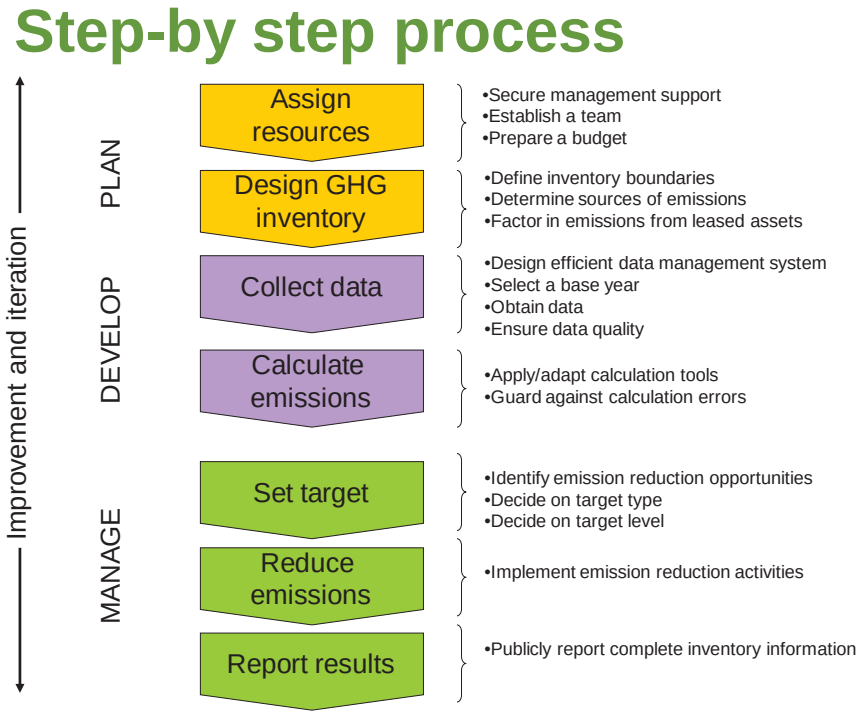


Figure 1. Carbon audit process
Source: WRI

Organisational boundaries

Organisational boundaries define the facilities/entities that are included in the CO_2 inventory. The department uses the financial control based approach[1] to defining organisational boundaries. Due to the legally prescribed nature of the core public service, the application of either the control or equity approach[2] is likely to have the same effect, as government

[1] Under the control approach, a company accounts for 100 percent of the GHG emissions from operations over which it has control. It does not account for GHG emissions from operations in which it owns an interest but has no control. Control can be defined in either financial or operational terms.
[2] Under the equity share approach, a company accounts for GHG emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation.

agencies do not have subsidiaries, associate companies in the same manner that private sector companies have group structures, or complex lease arrangements.

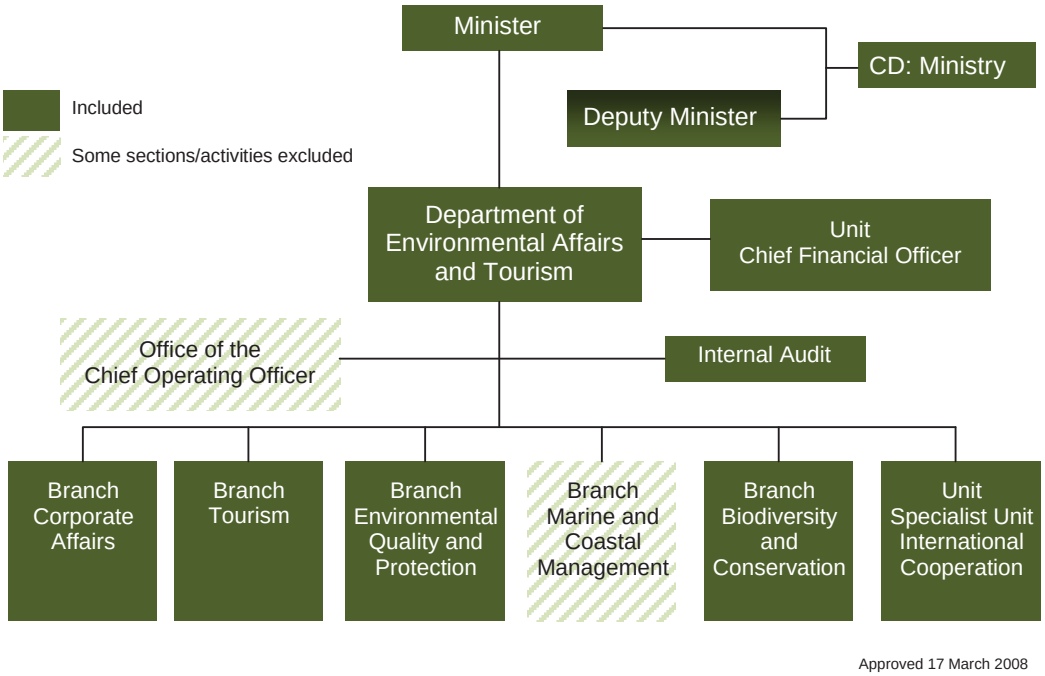


Figure 2. DEAT organizational structure as approved and those components included/excluded from calculations

The organisational boundaries of the department are defined by statute and for the purposes of the GHG inventory include core agency activities only, as outlined in the organizational structure[3] above. For practical reasons (limited resources, tight timeframes) the inventory excluded some activities in the Branch Marine and Coastal Management, and some aspects of the Social Responsibility Programme under the Office of the Chief Operating Officer.

Operational boundaries

Emissions result from a variety of activities undertaken by the department and can range from using a photocopier, boiling a kettle for tea, to travelling to meetings. It is not possible to include all activities that have emissions associated with them in the inventory and it is therefore necessary to define those activities or sources of emissions that will be included in the inventory – this is commonly referred to as the operational boundary[4].

Emission sources were identified with reference to the methodology described in the GHG protocol. Identification of emissions sources was achieved by using the specific guidance on

[3] Approved 17 March 2008.
[4] In general, it is simpler to draw narrow boundaries. However, a more comprehensive inventory provides greater opportunities for emissions reductions.

Scope 3 factors included in the guideline document "*Working 9 to 5 on Climate Change: An Office Guide*".

Emissions have then been classified into three categories. The definition of each has been adapted from the GHG Protocol; the three types of emissions are:

- Direct emissions[5] (Scope 1): emissions from sources that are owned or controlled by the department. Typical direct emissions include business travel in a GG vehicle. Accounting for and reporting on direct emissions is required under the framework of the GHG Protocol. For reporting purposes, direct emissions are called "Scope 1" emissions.
- Indirect emissions[6] (Scope 2): emissions from the generation of purchased electricity consumed by the department. Accounting for and reporting on Scope 2 emissions is required under the GHG Protocol because these are likely to make up a significant percentage of any organization's inventory and are relatively easy to quantify.
- Indirect emissions (Scope 3): emissions that occur as a consequence of the activities of the agency, but occur from sources not owned or controlled by the agency. Accounting for and reporting on relevant Scope 3 emissions is not mandatory in the GHG Protocol but is encouraged because it increases emissions reduction opportunities.

Table 1. Emission sources included in the carbon footprint

Scope type	Source
Scope 1: Direct emissions	
	Employee commuting in GG vehicles Air conditioning units Fridges and freezers Antarctic programme
Scope 2: Indirect emissions	
	Electricity consumption
Scope 3: Indirect emissions	
	Business travel in non-company-owned vehicles: rental cars, employee cars, airport shuttle and commercial planes Employee commuting in vehicles not owned by department: Train, bus, taxis and private vehicles Resources used by in the office environment: Computers and photocopy paper

[5] To ensure that organisations do not double count the same emissions, emissions are specifically defined to help clarify which emissions an organisation owns (direct), and which it does not (indirect). The GHG Protocol developed the concept of "scope" to add further clarity to direct and indirect emissions and how an organisation should report them.
[6] The terms "direct" and "indirect" as used in this document should not be confused with their use in national GHG inventories where 'direct' refers to the six Kyoto gases and 'indirect' refers to the precursors NOx, NMVOC, and CO.

Emission sources exclusions

In setting the operational boundaries, some emission sources had to be excluded from the carbon footprint calculations. These are listed in the table below.

Table 2. Typical office emissions sources excluded and reasons for exclusion

Emission source	Reason for exclusion	Emission scope
Paper consumption other than photocopy paper – for example related to official publications	No efficient method of capturing this information	Scope 3
Travelling outside the boundaries of South Africa by means other than by plane	Small percentage of total kilometres travelled	Scope 3
Business travel inside South Africa by bus or train	Small percentage of total kilometres travelled	Scope 3
Business travel where DEAT did not make the travel arrangements	No efficient method of capturing this information	Scope 3
Incineration of office waste or decomposition in a landfill – waste to landfill	No efficient method of capturing this information	Scope 3
Emissions associated with consultants, NEMA section 40 employees working for DEAT that do not occupy office space at the department.	No efficient method of capturing this information	Scope 3
Outsourced activities such as shipping, courier services, and printing services	No efficient method of capturing this information	Scope 3

Base year selected

This is the first report for the Department of Environment Affairs and Tourism. The chosen base year calculated for this report is the year from 1 April 2008 to 31 March 2009.

Activity data

To calculate emissions, two kinds of data are required. For each emission source identified in Table 1 above, the appropriate “activity data” and “emission factor” is needed in the following calculation:

$$CO_2 \text{ emissions} = \text{Activity data} * \text{emission factor}$$

Where activity data, is the extent to which a human activity takes place (i.e. fuel consumption), and the emission factor is the coefficient that quantifies the emissions per unit of activity.

Activity data quantifies an activity such as employee business trips in units that will enable the calculation of emissions generated associated with this activity. Activities are presented in a specific unit such as:

- Kilowatt hours of electricity
- Business air miles or kilometres travelled
- Fuel consumption

Activity data were sourced from the following sections within the department:

- Chief Directorate Building and Admin Services
- Directorate Supply Chain Management
- Directorate Financial Management
- Director Antarctica and Islands

In some instances activity data was sourced from external service providers. For example, information on business air miles was sourced through the travel agencies contracted by the department to provide a travel agency service to the department. Activity data on staff commuting was collected by means of a staff commuting survey. The table below details the sources of the relevant data and the emission factors which have been used. The amount of CO_2 has been calculated by multiplying the activity data sourced by the department by the relevant emissions factor.

Table 3. Data sources and emission factors

Emission or removal source	Data unit	Emission or removal factor	Factor source
Air travel	Km travelled	Short haul: 0.15 kg CO_2 per passenger km Medium haul: 0.12 kg CO_2 per passenger km Long haul: 0.11 kg CO_2 per passenger km	Accounts payable/Travel provider
Vehicle fuel petrol	Km travelled	Small petrol (max 1.4 litre engine): 0.16 kg CO_2 per unit Medium petrol (1.4 – 2.1 litre engine): 0.19 kg CO_2 per unit Large petrol (above 2.1 litres): 0.22 kg CO_2 per unit	Log sheets Commuting survey Service providers Claim submitted
Vehicle fuel diesel	Km travelled	Small diesel (2 litre engine or under): 0.16 kg CO_2 per unit Large diesel (above 2 litres): 0.19 kg CO_2 per unit	Log sheets Accounts payable/Travel provider
Bus travel	Km travelled	0.19 kg CO_2 per passenger km	Commuting survey
Train travel	Km travelled	0.20 kg CO_2 per passenger km	Commuting survey
Taxi travel	Km travelled	0.025 kg CO_2 per km	Commuting survey
Electricity consumption	kWh of electricity	958 grams CO_2 per kWh	Electricity accounts
Computers	# of computers	276 kg CO_2 per computer	Computer inventory
Air conditioning	Kg leakages	1700 kg CO_2	Air conditioning inventory
Paper consumption	Reams used	Virgin paper: 1027 kg CO_2/ton 30% recycled: 1139 kg CO_2/ton 100% recycled: 1400 kg CO_2/ton	Register of photo copy paper

Emission factors

Emission Factors convert activity data into emission values. All of the emission factors are source specific and specific to different units of activity data; so for example with car travel, different emission factors are needed depending on if the car is powered by petrol, diesel or electricity and also on how efficient the car uses fuel.

Many different organisations, agencies, governments etc have published emission factors. Emission Factors are published by various organisations, agencies and government. The emission factors for this audit were obtained from the World Resources Institute (WRI), the

US EPA Office Carbon Footprint Calculator, the Office Carbon Footprint Tool developed by ICF International, Solid Waste Management and Greenhouse Gases - A Life-Cycle Assessment by the US EPA, Carbon Innovations Network, Duke University, Seattle Climate Partnership and others. A full list appears in the references section.

Finding emission factors for South Africa proved to be difficult as the relevant emission factor may not exist. Some compromises were necessary in relation to the emission factors used and some of the emission factors used in this audit are from other countries.

This not ideal but unfortunately there is very little that can be done about it. To ensure continuity between audits, a set of emission factors were chosen to be used in all of the audits.

Data quality management and uncertainties

Data quality

High quality information has greater value and more uses, while low quality information will have little or no value or use. A quality management system is essential to ensuring that an inventory meets the principle of the GHG Protocol Corporate Standard. Internal and external stakeholders will demand high quality inventory information and therefore the implementation of some type of quality management system is important.

As this is the first inventory to be done for the department, a formal department wide inventory quality management system as promoted by the Protocol, shown in Figure 3 below, was not operational at the start of the inventory process.

Figure 3. Inventory quality management system as proposed by the Greenhouse Gas Protocol
Source: WRI. The Greenhouse GAS Protocol.

In the absence of a formal quality management system, generic rigorous quality checks across the entire inventory were carried out. These checks focussed on data handling, documentation, and emission calculation activities (Table 4).

Table 4. Generic quality management measures undertaken

Data gathering, input and handling activities	**Status**
Check a sample of input data for transcription errors	Done
Identify spreadsheet modifications that could provide additional controls or checks on quality	Done where appropriate
Ensure that adequate version control procedures for electronic files have been implemented	N/A
Others	N/A
Data documentation	**Status**
Confirm that bibliographical data references are included in spreadsheets for all primary data	Done
Check that copies of cited references have been archived	Not done
Check that assumptions and criteria for selection of boundaries, base years, methods, activity data, emission factors, and other parameters are documented	Done in report
Check that changes in data or methodology are documented	Done in report
Others	N/A
Calculating emissions and checking calculations	**Status**
Check whether emission units, parameters, and conversion factors are appropriately labelled	Done
Check if units are properly labelled and correctly carried through from beginning to end of calculations	Done
Check that conversion factors are correct	Done
Check the data processing steps (e.g., equations) in the spreadsheets	Done
Check that spreadsheet input data and calculated data are clearly differentiated	Done
Check a representative sample of calculations, by hand or electronically	Done
Check some calculations with abbreviated calculations (i.e., back of the envelope calculations)	Done
Check the aggregation of data across source categories, business units, etc.	N/A
Check consistency of time series inputs and calculations	N/A
Others	N/A

Uncertainty

The protocol requires that some assessment of the accuracy of the data used to calculate the emissions. Usually this is achieved by describing the impact of uncertainties on the accuracy of the GHG emissions and removals data.

Uncertainties associated with greenhouse gas inventories can be broadly categorized into scientific uncertainty and estimation uncertainty. Scientific uncertainty arises when the science of the actual emission and/or removal process is not sufficiently understood. For example, many of the direct and indirect emissions factors associated with global warming potential (GWP) values that are used to combine emission estimates of different greenhouse gases involve significant scientific uncertainty. Analyzing and quantifying such scientific uncertainty is extremely problematic and is beyond the scope of our inventory efforts.

Estimation uncertainty arises any time greenhouse gas emissions are quantified. Therefore all emission or removal estimates are associated with estimation uncertainty. Estimation uncertainty can be further classified into two types: model uncertainty and parameter uncertainty.

Model uncertainty refers to the uncertainty associated with the mathematical equations (i.e. models) used to characterize the relationships between various parameters and emission processes. For example, model uncertainty may arise either due to the use of an incorrect mathematical model or inappropriate parameters (i.e. inputs) in the model. Like scientific uncertainty, estimating model uncertainty is beyond the scope of our inventory efforts.

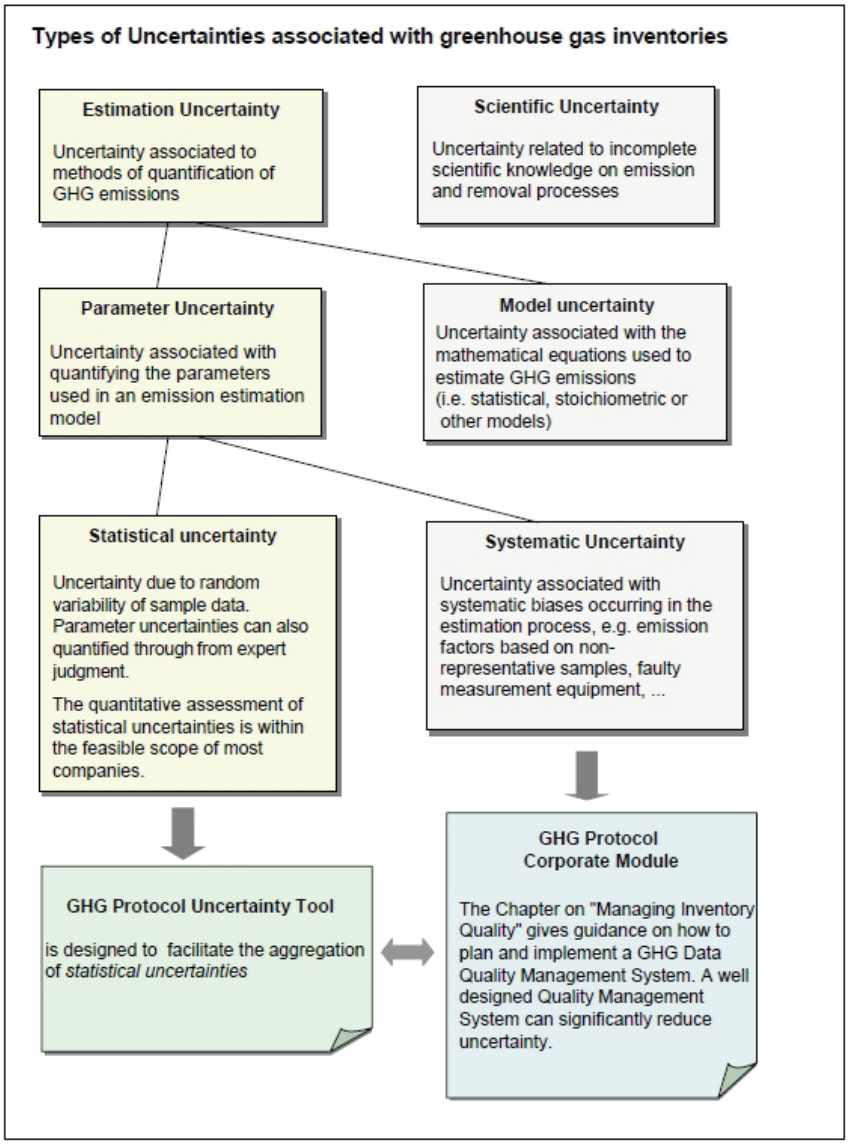


Figure 4. Types of uncertainties
Source: WRI (ND): GHG Protocol guidance on uncertainty assessment in GHG inventories and calculating statistical parameter uncertainty.

Parameter uncertainty refers to the uncertainty associated with quantifying the parameters used as inputs (e.g. activity data, emission factors, or other parameters) to estimation models. Parameter uncertainties can be evaluated through statistical analysis, measurement equipment precision determinations, and expert judgement. Quantifying parameter uncertainties and then estimating source category uncertainties based on these parameter uncertainties formed the primary focus for the determination of uncertainty in this emission inventory.

Certainty rankings

Uncertainty rankings, calculated by means of the ghg-uncertainty tool developed by the WRI, are presented below. The lowest certainty rankings are for air conditioning, fridges and freezers and staff commuting which are all rated as “Fair”. The aggregated uncertainty for all directly and indirectly measured emissions is calculated as ± 4.7% which has a ranking of “Good”.

Table 5. Uncertainty rankings

Emission source	Uncertainty (%)	Rating
Direct emissions (Scope 1)		
GG vehicles	±10.2	Good
Air conditioning units (split units)	±15.8	Fair
Fridges/freezers	±21.2	Fair
Antarctica	±11.2	Good
Indirect emissions (Scope 2)		
Electricity consumption	±7.1	Good
Other indirect emissions (Scope 3)		
Domestic and international flights	±13.0	Good
Vehicle rental	±10.2	Good
Shuttle service	±11.2	Good
Management (official trips)	±11.2	Good
Subsidized vehicles	±10.2	Good
Staff commuting	±15.6	Fair
Paper	±11.2	Good
Computers	±30.4	Poor
Air conditioning units (built in)	±15.8	Fair

Persons responsible

The Director General authorised the study. The work has been collated under the supervision of the Director Information Management.

Chapter 3: Scope 1 emissions

GG vehicles

The department has thirteen cars in its fleet. It is a mix of petrol driven 1.4, 1.6 and 1.8 sedan vehicles. There are also two light delivery trucks or pickups, one 2,4 litre petrol and one 2.7 litre diesel.

Using logbooks kept for these vehicles, it was determined that these vehicles travelled a total of 257,160 kilometres and emitted 48.07 tons of carbon dioxide. GG vehicles accounted for 0.19% of the overall emissions.

BOX 2. Options for reductions – GG vehicles

Reductions can be achieved through:

- Replacing current fleet with smaller, more fuel efficient vehicles
- Driver skills training
- Introduce an anti-idling policy and practice fuel-efficient driving techniques
- Proper tyre management
- Regular maintenance of vehicles
- Deploy a fleet greenhouse gas management programme such as PHH GreenFleet
- Use alternative methods of transport such as public transport

Air conditioning units[7]

Direct HFC emissions occur from sources that are owned or controlled by the department. Refrigeration and air-conditioning systems in the department is mainly in the form of commercial unitary air conditioning, domestic air conditioning and heat pumps, and mobile air conditioning. Only the latter two are owned by the department whereas the former is owned by the landlord and serviced by contractors.

[7] Calculations are based on the GHG Protocol HFC Tool (version 1.0).

A typical split air conditioning unit

Commercial unitary air conditioning unit

Historically, the refrigeration and air-conditioning sector has used various ozone-depleting substances (ODS) such as CFCs and HCFCs as refrigerants. These ODS are being phased out under the Montreal Protocol and are being replaced with HFCs.

HFC emissions from the refrigeration and air conditioning sector result from the manufacturing process, from leakage over the operational life of the equipment, and from disposal at the end of the useful life of the equipment. These gases have 100-year global warming potentials (GWP), which are 140 to 11,700 times that of carbon dioxide, so their potential impact on climate change can be significant. By the same token, any reductions of these gases can have a large potential benefit.

The recommended approach for equipment users who have their equipment serviced by contractors is to track emissions at each stage of the lifecycle of the equipment. The "Lifecycle Stage Approach" requires information on the quantity of refrigerant used to fill new equipment during installation, the quantity of refrigerant used to service equipment, the quantity of refrigerant recovered from retiring equipment, and the full and proper charges of new and retiring equipment. This approach requires information not currently available and the screening approach was considered to calculate emissions from air conditioning systems.

The screening methodology is based on IPCC Good Practice Tier 2 Bottom-Up approach. It requires data on the number of units, the type of refrigerant used, the total refrigerant charge for each type of equipment, and the annual leakage rate. This approach is used only as a screening method since default emission factors are highly uncertain.

In the end an emission factor based approach was followed in the calculation of emissions from refrigeration and air conditioning equipment. This approach requires calculations for installation, operation and disposal of air conditioning units. Currently only emissions

associated with operations are calculated, using default values from the IPCC Good Practice Guidelines as indicated in the table below.

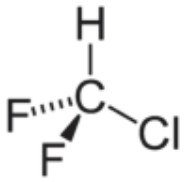
Central units are built into the building and therefore no new units have been added in reporting year (negating the calculation of emissions for installation of central units). For split units, these calculations (installation and disposal) are covered under Scope 3 emissions. No calculations were made for the air conditioning systems in vehicles owned by the department.

Table 6. Default Assumptions from IPCC Good Practice Guidelines

Application	Charge (kg)	Lifetime (years)	Emission Factors (% of initial charge/yr) Assembly	Annual Leakage Rate	Recycling Efficiency
Domestic Refrigeration	0.05 - 0.5	12 - 15	0.2 - 1 %	0.1 - 0.5 %	70% of remainder
Stand-Alone Commercial Applications	0.2 - 6	8 - 12	0.5 - 3 %	1 - 10 %	70 - 80% of the remainder
Transport Refrigeration	3.0 - 8.0	6 - 9	0.2 - 1 %	15 - 50 %	70 - 80% of remainder
Chillers	10.0 - 2000	10 - 30	0.2 - 1 %	2 - 15 %	80 - 95% of remainder
Residential and Commercial A/C, including Heat Pumps	0.5 - 100	10 - 15	0.2 - 1 %	1 - 5 %	70 - 80% of remainder
Mobile Air Conditioners	Not provided	12	0.50%	10 - 20 %	0%

* These values are from IPCC Good Practice Guidelines and Uncertainty Management in National Greenhouse Gas Inventories (2000).These default values are provided for reference purposes only as their wide range can result in highly variable calculation outcomes. If a value is chosen from within the range, that value should be used consistently from reporting period to reporting period or year to year. They should only be used if entity-specific data are not available, but an inventory that uses these values should be considered preliminary.

There are 100 central units in the North and South towers. The units are filled with Chlorodifluoromethane or difluoromonochloromethane which is a hydrochlorofluorocarbon (HCFC). It is better known under its code names of HCFC-22, R-22, Genetron 22 or Freon 22. It will soon be phased out due to ozone depletion potential and status as a potent greenhouse gas.



Chlorodifluoromethane was used as an alternative to the highly ozone-depleting CFC-11 and CFC-12, because of its relatively low ozone depletion potential of 0.055, among the lowest for chlorine-containing haloalkanes. However, even this lower ozone depletion potential is no longer considered acceptable. It will be phased out soon under the Montreal Protocol, to be replaced by refrigerants with zero ozone depletion potential such as propane (R-290), and other refrigerants (even though they don't have very similar properties): R-410A (an azeotropic mixture of difluoromethane and pentafluoroethane), R-507A, R-134a (1,1,1,2-tetrafluroethane) and R-409A. An additional environmental concern regarding chlorodifluoromethane, as well as some of the proposed replacements, is their global warming potential. The global warming potential of chlorodifluoromethane is 1700 (1700 times that of carbon dioxide). This gas is not part of the group of Kyoto protocol recognised gases

and as such is not included in greenhouse gas inventories but due to its global warming potential, it was decided to include it in this report.

Table 7. Emissions from air conditioning units

Type	Number of units	Emissions Tons CO_2
Central air conditioning units	100	76.50
Split units	52	23.87[8]
TOTAL	152	100.37

The total emissions associated from the operation of central air-conditioning units are 76.50 tones of CO_2e[9]. The total emissions associated from the operation of split air-conditioning units are 23.87 tones of CO_2e. Total emissions are calculated as 100.37 tones of CO_2e which represents 0.41% of total emissions.

BOX 3. Options for reductions – Air conditioning units

Reductions can be achieved mainly through better maintenance of air conditioning equipment, preventing leakages and following proper installation and refrigerant reclamation, recovery and re-charging procedures.

Service technicians should not be allowed to add refrigerant when the system is low due to a leak. Rather, the leak has to be found and fixed within a specified period of time.

Fridges/Freezers

According to record, there are 45 fridges/freezers in the department. In the absence of emissions data, the default assumptions from IPCC Good Practice Guidelines were used. An estimated annual leakage rate of 2% yields a total 0.77 tons of CO_2e.

Antarctic programme

Emissions from the Antarctic Programme are significant, contributing to 30.33% of total emissions. Annually, in excess of 2.54 million litres of fuel are consumed of which 1.85 million litres (72.6%) is used for the voyages of the SA Agulhas to Antarctica, Marion and Gough. A summary of emissions is provided in the table below.

[8] This is with the assumption of an annual leakage rate of 2%.
[9] This is with the assumption of an annual leakage rate of 5%. This value is at the upper end of the range as stated in the IPCC Good Practice Guidelines and Uncertainty Management in National Greenhouse Gas Inventories (2000), which varies between 1-5%. These values are used because entity-specific data are not available. Therefore this inventory should be considered preliminary.

Table 8. Emissions associated with the Antarctic Programme

Antarctic programme	Consumption	Units	CO2e (tons)	Sub total
SA Agulhas				5,928.06
Helicopters – aviation gasoline	140,000	litres	332.84	
SA Agulhas – arctic diesel	1,852,000	litres	5,085.22	
CFC's	300	kg	510.0	
Antarctic base				*1,116.24*
Polar diesel - generators	320,000	litres	878.66	
Polar diesel - vehicles	85,000	litres	233.39	
Two stroke Fuel	1,600	litres	3.81	
Household gas	132	kg	0.38	
Marion base				*219.92*
Polar diesel - generators	80,000	litres	219.66	
Petrol	20	litres	0.05	
Household gas	72	kg	0.21	
Gough base				*192.47*
Polar diesel - generators	70,000	litres	192.21	
Petrol	20	litres	0.05	
Household gas	72	kg	0.21	
TOTAL				7,456.69

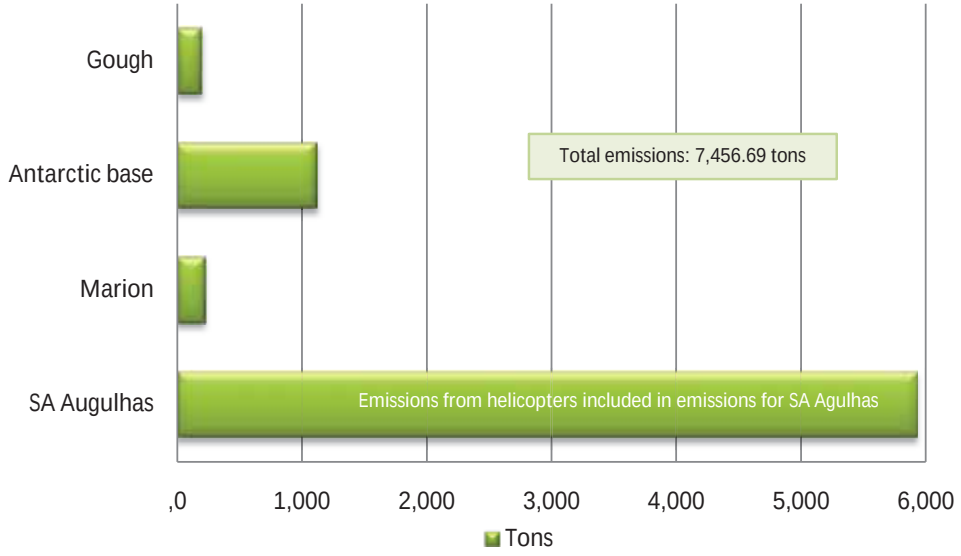


Figure 5. Emissions associated with the Antarctic Programme

Chapter 4: Scope 2 - Electricity

Electricity consumption

To quantify Scope 2 emissions, the GHG Protocol Corporate Standard recommends that companies obtain source/supplier specific emission factors for the electricity purchased. If these are not available, regional or grid emission factors should be used. For the calculation of emissions associated with electricity consumption, electricity emission factors from the ESKOM 2007 annual report was used (958 grams[10] of CO_2/ kilowatt hour (kWh)).

The department occupies floor space in 33 buildings, of which 23 are occupied by the branch Marine and Coastal Management. Total electricity consumption for the 2008/09 financial year came to 14,272,609 kWh, with a total cost of R 6,279,948. Total emissions from electricity consumption were 13,673.16 tons. This represents 55.62% of total emissions. The six offices with the highest electricity consumption, and therefore the highest carbon emissions, are indicated in the graph below.

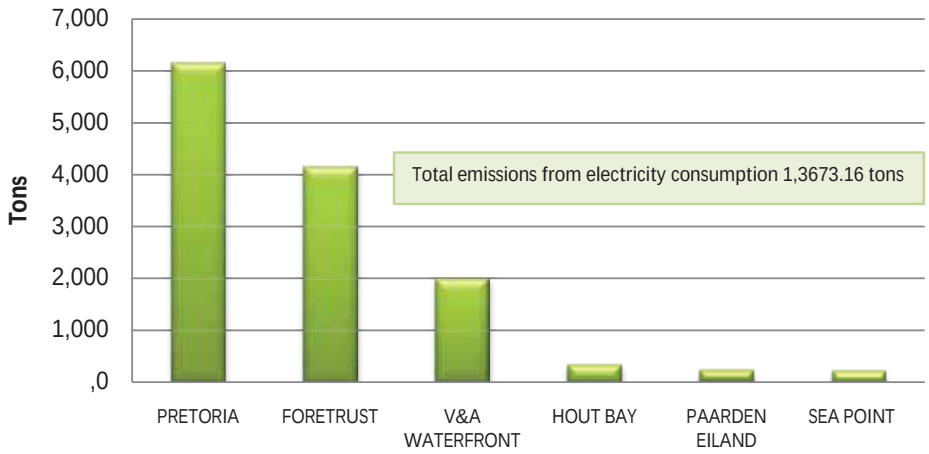


Figure 6. Electricity emissions for the six buildings with the highest electricity consumption

[10] Represents the Eskom average CO_2 figure. (http://www.eskom.co.za/annreport07/annreport07/table_environmental.htm).

BOX 5. Options for reductions - Electricity

Below we have collected a list of behavioural and technological changes that can be made to reduce energy usage in an office.

Retrolux High-frequency Lighting

Many current lighting systems incorporate T8 and T12 lamp technology. The Llumarlite Retrolux T5 System allows the user to convert existing T8 and T12 lamps into cost and energy efficient T5 lamps by simply replacing the fluorescent tube. This worthwhile exercise results in typical energy savings of 35-40%.

Source: www.energyland.emsd.gov.hk/.../equip_tubes.htm

Time-clocks

Time-clocks ensure that appliances with a high electrical demand such as photocopiers, printers, and computer monitors switch off over night and at weekends. This can result in up to 60% energy savings.

Communications Campaign

A communications campaign or 'switch-off' campaign is often an effective way to ensure behavioural change in energy use habits, and costs very little time or effort. An awareness campaign, backed by a network of champions, should save 10% on electricity bills. Techniques include stickers on monitors that are left on overnight, articles in staff newsletters, and simple posters reminding employees to switch off appliances.

Sub-metering

Sub-metering is essential to understanding energy use and making strategic reductions in a building. dcarbon8 recommends installing half-hourly metering and monitoring energy use more closely, to understand the split between mains power and small power and locate where the simplest reductions can be made.

Sub-metering as used at GRID-Arendal, Norway.

Chapter 5: Scope 3 - Other indirect GHG emissions

Reporting on Scope 3 emissions is optional, but provides an opportunity for innovative GHG management. Activities that are relevant for reporting under Scope 3 include transport related activities, electricity related activities not included under Scope 2, outsourced activities, use of sold products and services, and waste disposal. It is accepted to focus on one or two major GHG- generating activities. For DEAT, the Scope 3 emissions inventory includes business travel, employee commuting, computer use and paper use.

Business travel

The department's business travel footprint is mostly made up of plane and car travel. Business travel by bus, train and taxi was excluded from the calculations as there is currently no efficient method to capture this type of information and it makes up a small percentage off all business travel.

To measure the footprint we have used the Planet Positive carbon calculator. Transport mode emissions factors for all forms of transport are shown in Table 8 below. As can be seen from the table, trains produce the least carbon per kilometre, and cars the most.

Table 9. Transport emission factors

MODE	Factor
Car (average petrol)	0.19 kg CO_2/km
Car (average diesel)	0.175 kg CO_2/km
Bus (long distance)	0.05 kg CO_2/km per person
Bus (short distance)	0.19 kg CO_2/km per person
Train	0.101 kg CO_2/km per person
Plane (short haul)	0.1580 kg CO_2/km per person
Plane (medium haul)	0.1194 kg CO_2/km per person
Plane (long haul)	0.1100 kg CO_2/km per person

Source. DEFRA, 2007.

Travel by plane

Due to the long distances involved to attend business meetings in another province, as well as DEAT's regional and international commitments, travelling by plane is often undertaken by DEAT staff and emissions associated with this mode of transport makes up a significant part of DEAT's overall emissions.

For calculation purposes, all flights are divided into three distance categories[11] with associated emission factors; Short Flights (less than 500km), Medium Flights (less than 1600 km) and Long Flights (more than 1600km).

[11] Air travel is divided into three distinct distance categories to take account of the large percentage of carbon emissions emitted during landing and take-off, and so each different distance category has its own emissions factor.

Table 10. Air Travel emissions

Air travel	Total Distance (km)	Emissions (tons CO_2)
Short – mainly intercity	737,995	110.70
Medium – mainly national and regional flights	6,693,373	799.19
Long – international flights	8,515,616	936.72
TOTAL	15,946,984	1,846.61

From the table above we can see that staff flew a total of almost 16 million kilometres during 2008/09 and this produced 1,846.6 tons of carbon dioxide. Flight details were obtained from the travel agencies contracted by the department. A breakdown of flight distance travelled per major component is provided in the graph below.

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Destinations and number of long distance flights to each destination are shown on the map below.

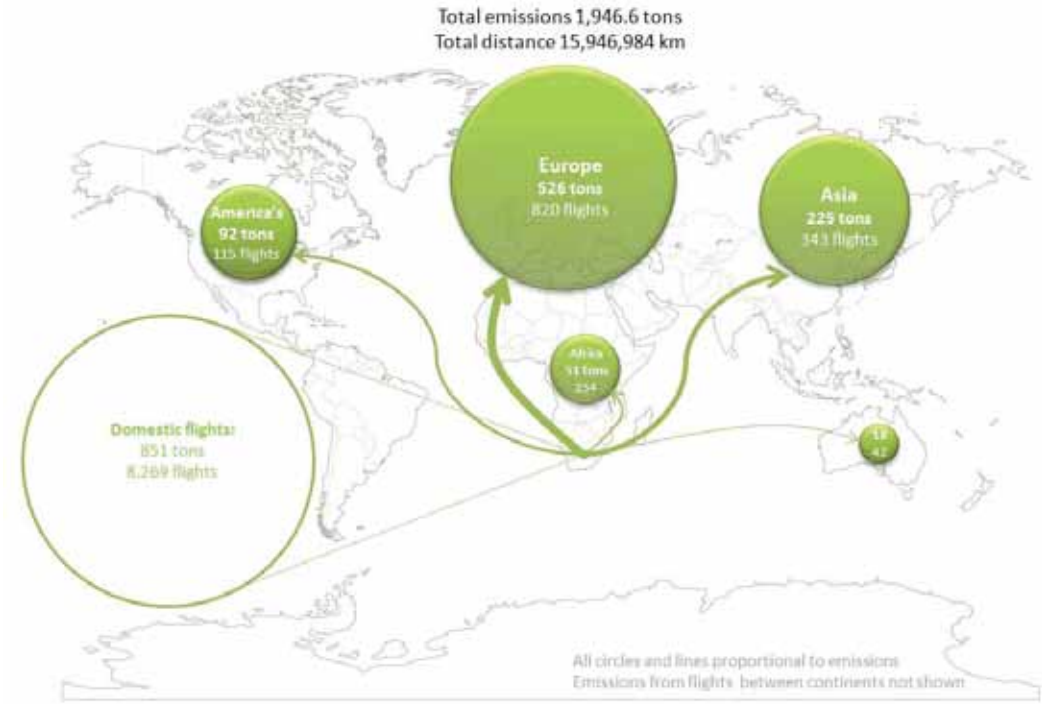


Figure 7. Emissions from travelling abroad

Car rental

For this reporting period, the department used mainly two service providers to book rental cars for officials. For each transaction, records were kept of the type of vehicle rented (model and engine size) as well as the kilometres travelled.

A histogram for all car rental trips is indicated below. As is to be expected, most rentals distances (58%) were less than 200 kilometres in length.

For the 2008/09 financial year, DEAT staff travelled 507,787 kilometres using rented vehicles, and this produced 84.44 tons of CO_2e.

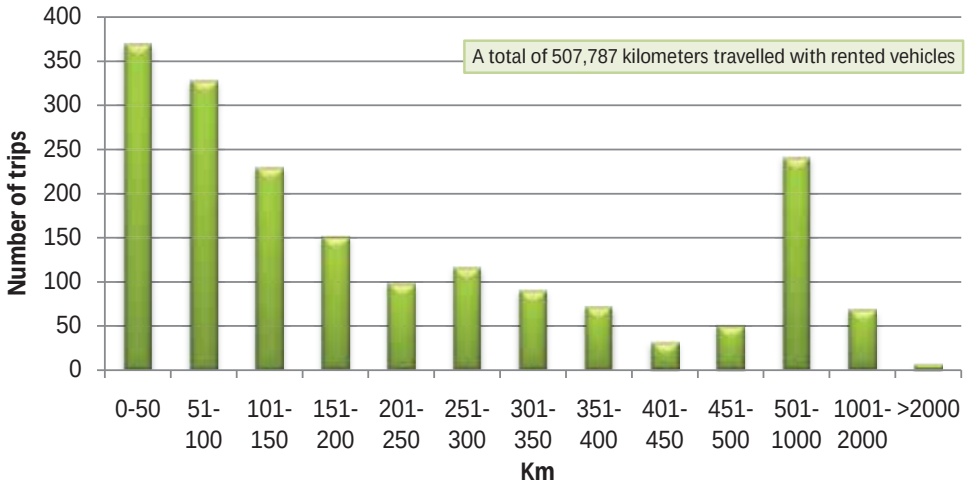


Figure 8. Trip details for rented vehicles

Shuttle service

For this reporting period, the department used mainly one service provider to provide a shuttle service between the office and the airport. Depending on the number of passengers, a sedan, microbus or 4x4 vehicle was used. To transport DEAT staff between the office and the airport, a total of 133,865 kilometres was travelled and this produced the equivalent of 26.24 tons of CO_2.

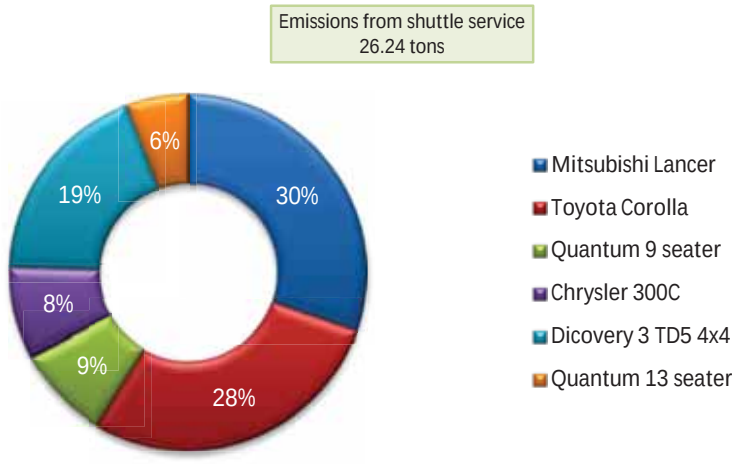


Figure 9. Emissions from shuttle service

Motor vehicle - SMS

During the year of assessment, the policy regarding claims for the use of private vehicles for official business by senior managers, as outlined in the Senior Management Service Handbook, was changed. Whereas the old policy only recognized official kilometres travelled in excess of 500 kilometres per month, the revised policy allows officials to claim for all official kilometres. Calculations for the period April to September 2008, when the old policy was still in effect, had to be adjusted to make provision for this policy change[12].

Almost 60% of monthly claims submitted was for distances less than 600 km. Total emissions from official business travel by management using own vehicles, was 34.44 tons of CO_2. The total distance travelled was 172,028 km. A breakdown of claims submitted, emissions and kilometres claimed by vehicle class is provided below.

[12] For claims before October 2008, 500 kilometers were added to the monthly claimed kilometers. Emissions for this activity is still under estimated because claims during the first six months of the reporting period were only submitted where official travel exceeded 500 kilometers per month. Therefore, no official records exist for official travel that was less than 500 kilometers per month.

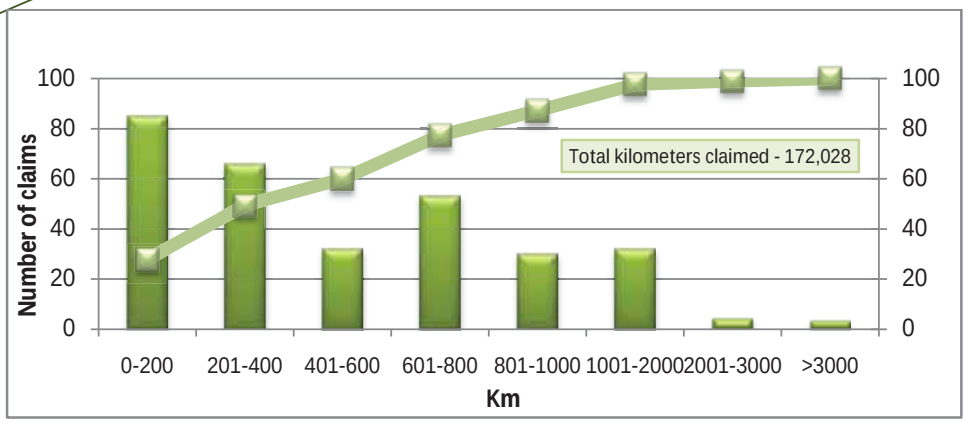


Figure 10. Claims submitted for business travel by SMS

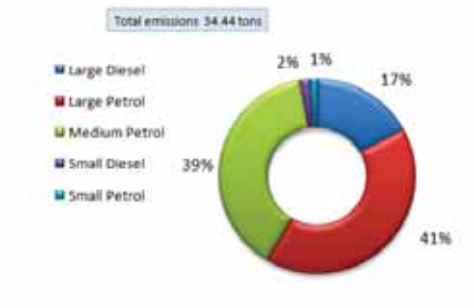


Figure 11. Percentage of emissions per vehicle class

Figure 12. SMS business kilometres travelled per vehicle class

Generally speaking, the majority (79%) of business trips are undertaken with large and medium sized petrol driven vehicles which contributed 80% to total emissions. Only 21 % of business trips were undertaken by small petrol and diesel driven vehicles, contributing to 20% of total emissions. A comparison of emissions per component reveals that regulatory services had by far the highest emissions (4.75 tons of CO_2).

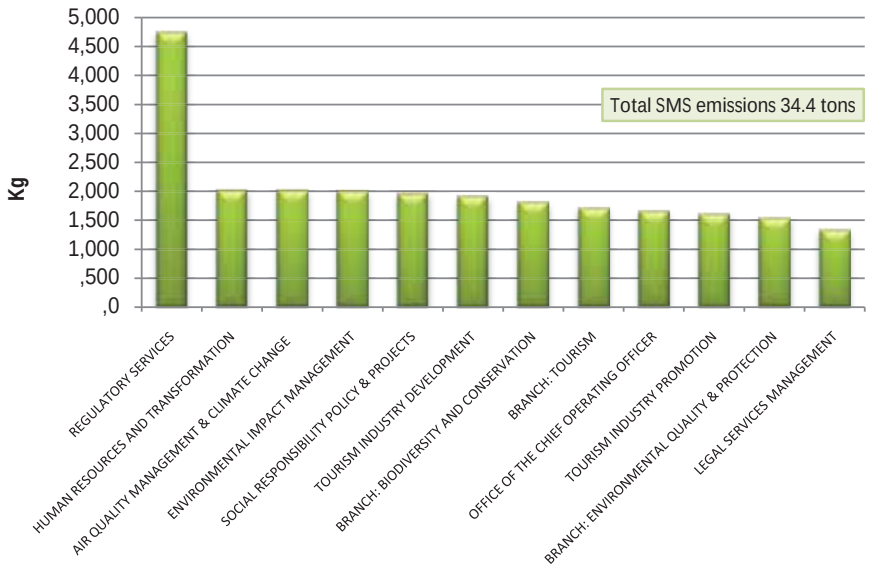


Figure 13. SMS carbon emissions per component

Subsidized vehicles

Subsidized vehicles are used mainly by staff working in the Social Responsibility Programme, Marine and Coastal Management and Environmental Quality and Protection. These subsidized vehicles are a mix of petrol and diesel vehicles. Using logbooks kept for these vehicles, it was determined that for the Social Responsibility Programme, subsidized vehicles travelled a total of 801,506 km and emitted 153.72 tons of carbon dioxide. Subsidized vehicles used by staff at Marine and Coastal Management travelled a total of 162,320 km and emitted 30,68 tons of CO_2. Subsidized vehicles used by staff of Environmental Quality and Protection travelled a total of 120,172 km and emitted 22.50 tons of CO_2. Total CO_2 emissions from subsidised vehicles were 206.9 tons. Subsided vehicles accounted for 0.84% of the overall emissions.

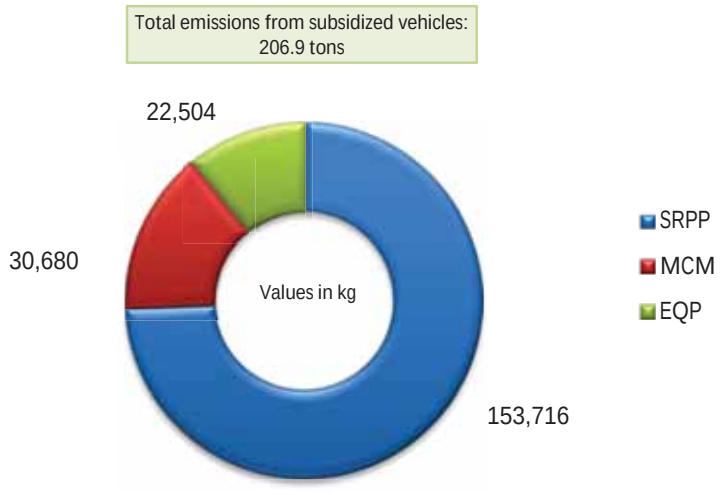


Figure 14. Emissions from subsidized vehicles per component

BOX 6. Options for reductions - Business travel

Reductions can be achieved through:

- Provide incentives for management to buy more fuel efficient vehicles.
- Consider replacing some GG vehicles with hybrid or electric vehicles.
- Recognizing that air travel is the most carbon intensive travel method, explore alternatives to plane trips.
- When possible, organize trips so they are multipurpose, enabling you to maximize your trip productivity. Also consider consolidating trips. For example, if you are travelling to the same area at two different times, consider combining the trips into one. Besides reducing emissions, reducing travel will save money.

- Promote the use of Gautrain for officials travelling between Johannesburg, Midrand and Pretoria, and between the office and OR Tambo International Airport.
- Reduce the department's need for travel, or reduce the number of employees who go on each trip.
- Alternatives to travel include telephone, video, and web conferencing. The cost and reliability of video conferencing technologies have greatly improved over the past few years. In some areas, video conferencing equipment, or public facilities with video conferencing, can be rented. Skype may also be an option.

Office paper

A source of greenhouse gas emissions in office environments is the emissions from the manufacturing and disposal of paper. The manufacturing and disposal of paper generates CO_2 and CH_4. The methodology to calculate emissions from paper production and disposal is continually evolving which makes it difficult to accurately account for these emissions.

A general methodology proposed by the WRI was used to calculate emissions from office paper. There are two kinds of paper used – office paper and publications paper. Originally the intention was that this category would cover office copy paper and also all publishing matter (printed matter, flyers, brief papers etc), as this had been done by some other organisations and had proved to be a significant source of carbon emissions in an office environment. It proved to be very difficult to find activity data for publishing matter and therefore emissions calculations were only done for office paper. For illustrative purposes, emissions associated with a few publications are given in the box below.

BOX 7. Emissions from publications

Environment Outlook
3300 copies
12.96 tons of CO_2e

Youth State of Environment Report
1000 copies
0.69 tons of CO_2e

Fifteen years
3000 copies
2.09 tons of CO_2e

Using activity data[13] on the number of reams of photo copy paper used by the department, it was possible to determine that a total of 16,115 reams were used. This equates to just over 8 million sheets of paper and 41.38 tons of CO_2. This represents 0.17% of total emissions. Most of the paper (63.88%) was used by only two branches – COO and Corporate Affairs.

[13] Activity data did not distinguish between virgin paper and recycled paper. Calculations are based on the lower emission factor of virgin paper.

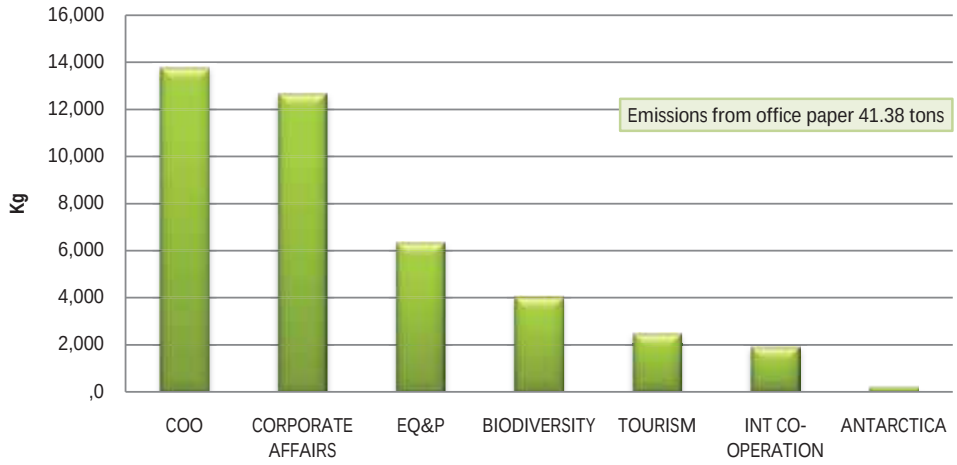


Figure 15. Emissions associated with photo copy paper per component

BOX 8. Options for reductions - Paper

Reductions can be achieved through:

Source reduction means a reduction in the amount (or toxicity) of material discarded (whether for disposal, treatment or re cycling). In developing source reduction strategies, the priorities should be elimination, reuse and increased efficiency of use. Using office paper as an example, organizations can eliminate some of their paper use through electronic filing and data storage systems. They can reuse paper already used on one side for drafts, memos or internal documents. They can increase their efficiency of use through two-sided printing and copying, printing documents single-spaced and using narrower margins or smaller typefaces. After assessing functional constraints, organizations can eliminate layers of packaging used for shipping or delivering a product, or reduce the amount of paper used in a product's packaging by lowering its basis weight.

All paper users can implement source reduction. Whether an organization is large or small, has direct purchasing relationships with paper mills, purchases paper through vendors, or buys paper "off the shelf," it generally can identify opportunities to reduce paper use and reap immediate and tangible benefits through the greater efficiency achieved. Paper is ubiquitous, and we can't conduct our businesses without it. Source reduction offers organizations and individuals true opportunities to lessen the adverse effects of our paper use.

Source Reduction Options in Office Settings

- Move in the direction of a paperless office.
- Use double-sided copying whenever possible.
- Set photocopy machines, computer laser-jet printers and word processing software so that double sided copying and printing is the default option; purchase office equipment and software that support double-sided imaging.
- Single-space documents.
- Change margins to avoid pages with little text.
- Review documents on the computer screen before printing.
- Collect and reuse paper already used on one side (for example, for drafts and internal memos).

- Use scrap paper for memo and telephone pads.
- Circulate and share copies of internal publications and documents.
- Post office announcements on bulletin boards.
- Faxing: Eliminate fax cover sheets or use alternatives such as re-positionable fax notes; program your fax to deliver " confirmation " sheets only for failed communications; update your " broadcast " fax lists; use plain paper, where appropriate, to reduce the number of copies made to replace thermal fax pages.
- Use reusable or two-way envelopes and mailing pouches (for example, for inter-office and interdepartmental communications).
- Improve office equipment to reduce paper usage (for example, buying copiers and laser printers that produce double-sided copying).
- Promote employees' awareness of waste reduction through education and incentives, and through waste audits and materials assessments to identify opportunities for source reduction.

Source: Paper Task Force. Recommendations for purchasing and using Environmentally Preferable Paper. The Environmental Defence Fund (1995)

Going Green Ideas for Printers

1. Buy and use recycled paper.
2. Save paper by not printing whenever possible. Put a prominent sign up in the office to remind users to print only when necessary.
3. Save paper by printing on both sides of a sheet of paper whenever possible.
4. Use your printer's eco-mode if it has one.
5. Use software such as GreenPrint [http://www.printgreener.com/] or EcoPrint2 [http://www.ecoprintsaver.com/products.html] to save ink, toner and paper.
6. Do not have your printer set to come on whenever your computer or computer network comes on; instead, turn on your printer only when necessary.
7. When choosing a printer to buy, choose an Energy Star compliant printer - and be sure your new printer has an energy saving feature.
8. Recycle your used ink and toner cartridges.

Staff commuting

With 833 permanent employees commuting to work each morning and back to home in the afternoon, associated GHG emissions can be significant. Experience elsewhere has shown that collecting employee commuting activity data can be challenging and that the participation rate can be disappointing[14].

Box 9. Quick staff commuting facts

Based on the commuting survey:

- Full time staff as of May 2009 – 833.
- Information sessions were attended by 170 staff members.
- Survey questionnaires completed: 391
- Most staff members travel to work by car, but a significant proportion (about 15%) walk or cycle to work.
- Total distance travelled by staff to and from work is estimated at 7.7 million km per year or 40 km per day.
- Total emissions related to staff commuting to head office in Pretoria is estimated at 1008.51 tons of CO_2e.

Due to the fact that the majority of officials at DEAT have access to the Internet, it was decided to use an Internet based survey to collect information on commuting patterns. Provision was made for officials without access to the Internet to fill in paper based questionnaires, and assistance was given to visually impaired officials and staff members that can not read or write.

[14] At the WRI, only a 48% participation rate was achieved in the first year of the survey.

Before the commuting survey was conducted, a series of staff information sessions were held to inform them of the Carbon footprint initiative, the upcoming commuting survey and to discuss the questions in the survey questionnaire. Based on feedback from these sessions, some modifications to the questionnaire were made. A total of 170 staff members attended these information sessions which formed part of the departmental 2009 World Environment Month activities during June 2009.

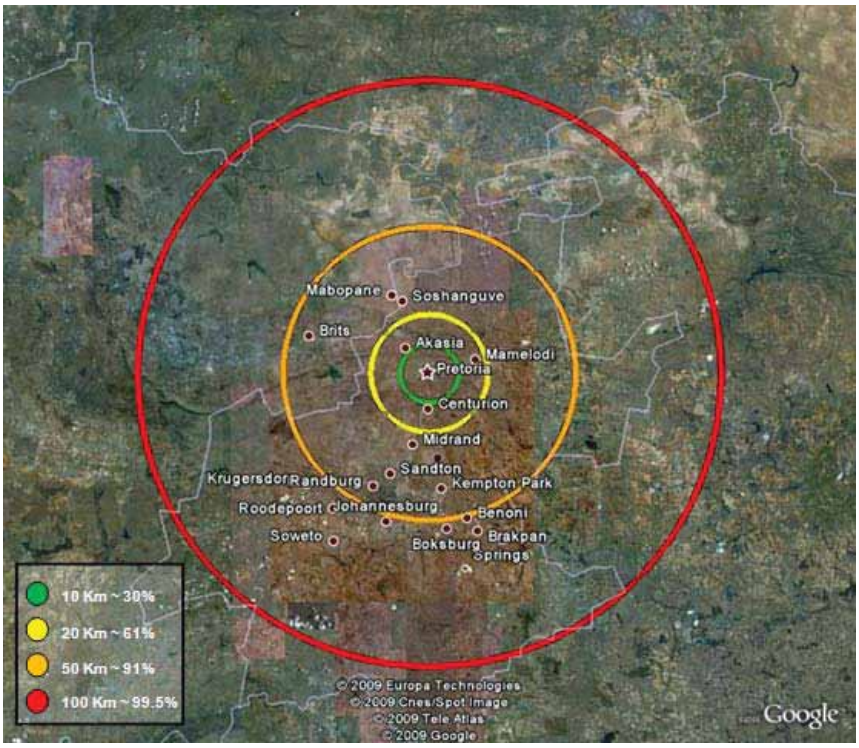


Figure 16. Commuting map for staff working at head office Pretoria

Information collected through the survey included the following:

- Distance travelled by the employee to work and back home
- Mode of transport
- Number of days per week an employee commutes
- Number of days in a year that the employee does not commute to work
- Fuel economy of employee's vehicle

The full survey is available in Annexure A.

The emissions associated with each mode of transport are summarised in the table and graphs below.

Table 11. Emissions per travel mode from commuting survey (n=391)

Mode	Frequency of use	Kilometres travelled	CO_2 (tons)
Car, motorbike or scooter	218	1,893,525	299.02
Bus	50	610,689	113.73
Train	17	212,600	41.55
Taxi	88	848,202	19.08[15]
Bike or walk	69	76,484	0.0
TOTAL	442[16]	3,641,502	473.38

Values may not add up due to rounding

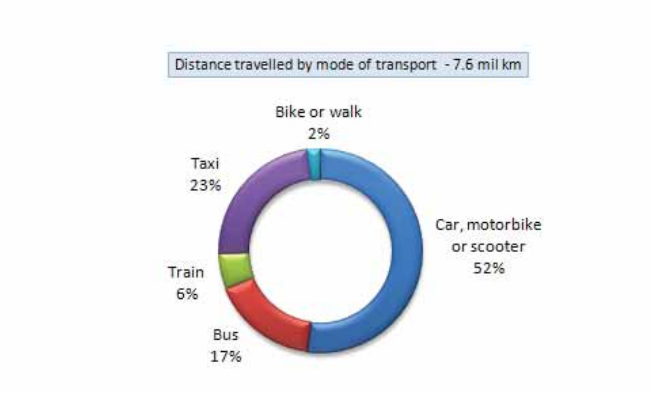


Figure 17. Commuting to work - distance travelled

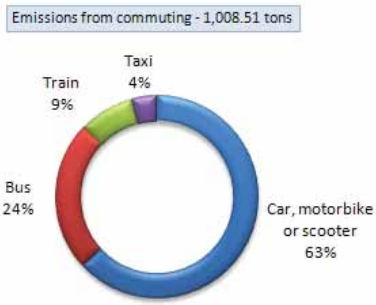


Figure 18. Commuting to work - total emissions

Based on the commuting survey, it is estimated that staff at head office commute a total of more than 7.7 million km per year (40 km on average per day) and the associated emissions are 1008.51 tons[17] of CO_2e.

[15] Assuming an occupancy level of 10 persons per taxi during peak hour when staff travel to work or back home.
[16] Total is larger than the sample size. This is to account for those officials that may use more than one mode of transport to get to work or back home. These officials are then counted more than once.
[17] Mean emission is 1.21 tons per person. Standard error is 88.98 kg. The 95% confidence level for total emissions from all 833 DEAT staff members is between 863.08 and 1,153.95 tons of CO_2e.

BOX 10. Options for reductions – Staff commuting

Reductions can be achieved through:

- Consider teleworking—that is, using communications technology such as video conferencing facilities to work at a distance rather than commuting—as an alternative to traditional commuting for some employees.
- Create incentives for employees to use car pool or other alternative methods for their work commute, such as walking, cycling, and mass transit. For example, promote the use of Gautrain for officials travelling between Johannesburg, Midrand and Pretoria, and between the office and OR Tambo International Airport.
- Provide a place where employees can secure their bicycles.
- Provide a place where employees can freshen up after commuting to work on their bicycles
- When relocating offices, consider proximity to public transportation as a factor in selecting a site.

Computers

Greenhouse gas emissions from computers are associated with the following life cycle phases:

- Production: Includes the extraction, production, and transport of raw materials; and the manufacture of the product as well as product packaging.
- Transport: Includes air and sea transportation of the finished product and its associated packaging from the manufacturing site to continental distribution hubs. Transport of products from distribution hubs to the end customer.
- Use: End user power consumption, usually assuming a 4 year period.
- Recycling: Includes transportation from collection hubs to recycling centres, and the energy used in mechanical separation and shredding of parts.

Manufacturing of computers is energy intensive and it is estimated that the total fossil fuels used to make one desktop computer weigh over 240 kilograms, some ten times the weight of the computer itself. Emission estimates during the life cycle of a computer vary. For example, greenhouse gas emissions for an Apple MacBook is 460 kg CO_2e, of which 50% is associated with production, 39% with consumer use, 10% with transport and 1% with recycling. Other sources indicate manufacturing emissions of 345 kg of CO_2e and computer use emissions as high as 940 kg of CO_2e per year.

Carbon emissions from computers used by DEAT staff is mostly associated with electricity use, which is already accounted for in Scope 2 emissions. No data is available for disposal of

computers (recycling, waste) and therefore emissions associated with recycling and waste were not calculated. It is however estimated[18] that carbon emissions due to production, transport and recycling is about 56.12 tons per annum.

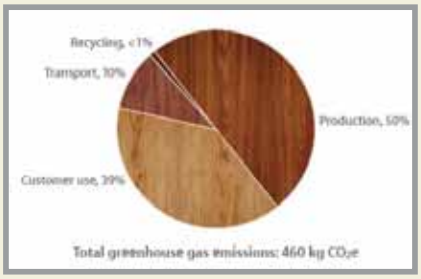
BOX 11. Quick computer facts

DEAT has about 800 computers in operation. An average desktop uses about 120 Watts. Laptops use less, about 30 Watts total.

Electricity costs for running these computers:
800 X 0.12 kW x 250 workdays X 8 hours = 192,000 kWh per year.

This amounts to 192,000 kWh X R 0.5537– R 106,310 per year in electricity costs.

Greenhouse gas emissions from this electricity amount to:
192,000 kWh X 958 grams of CO_2 per kWh / 183,936 kg = 183.94 tons of CO_2 per year.



Emissions associated with the life cycle of an Apple MacBook

BOX 12. Options for reductions - Computers

Reductions can be achieved through technical and behavioural changes to lower energy consumption of computers.

Behavioural:

- Shut down computers at night or when not in use (with the exception of servers).
- Shut off the computer and screen[19] if not used during the day (with the exception of servers).
- Procure computers and other electrical equipment conforming to the ENERGY STAR® standard and enable the power-saving feature.

Technical:

- Switching from Cathode Ray Tube (CRT) monitors to flat screen monitors. These use only about a third the energy of a CRT.
- Activate energy saving features (power management) on all computers and monitors. All new computers deployed must have this function enabled by IT.
- Consider replacing one or more desktop computers with a laptop; laptops are the most energy-efficient computer/monitor combination.
- Keep computer equipment updated; current new computers and monitors are more energy efficient than those even just two years old.
- Recycle used computers. See the section below.

[18] Calculation based on 840 computers, 276 kg CO_2e per computer over 4 years.
[19] It is a popular misconception that screen savers save energy. But this is untrue. When a screen saver is running, a PC can still be consuming the same amount of energy as when it is being used. Generally screen savers are de-activated when ENERGY STAR® is enabled.

Computer waste:

The Department of Environmental Affairs and Tourism has standardized on DELL computer equipment. There is therefore an opportunity to participate in DELL's recycling programme. Dell leads the industry by being the first to offer a free worldwide recycling program for consumers. They also provide no-charge recycling of any brand of used computer or printer with the purchase of a new Dell computer or printer. This equipment is recycled in an environmentally-responsible manner using Dell's stringent and global recycling guidelines.

Dell also offers customers in several markets around the globe the opportunity to donate working used computers to benefit non-profit organizations in their communities. They accept any brand of computer, keyboard, mouse, monitor or printer worldwide. Fast, affordable, and easy to use, Asset Recovery Services (ARS) is a suite of services offered by Dell that offers safe and environmentally-acceptable IT disposal solutions for desktops, laptops, servers, storage, networking, monitors, printers, projectors, and all computer related peripherals. The service includes transportation, flexible logistics, equipment processing and detailed security and environmental reports all for an affordable price. The service is available for any manufacturer's brand and typically for a minimum quantity of 20 assets.

BOX 13. Options for disposition of computer equipment through DELL's recycling programme

Disposition options include:

Resale: Equipment which meets functional and cosmetic requirements for resale markets will be sold based on the Used Equipment Purchase Pricelist (UEPP) schedule for the month in which the equipment was received and processed. Residual value is returned to the Customer. (Note: In general, used computer equipment over four years old has little or no resale value. This guidance may vary by product type.)

Recycle: Equipment that has no resale value is stripped down. Components/alloys/smelted material is sold to help reduce costs; remaining components are disposed of in an environmentally appropriate way, in accordance with local and EU regulations and in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive[20].

Return to Lease: Programme managed recovery of leased estate ensuring data cleansing, asset tag removal, and detailed inventory reporting in advance of delivery back to the leasing company.

Donation: Prepares retired equipment for delivery to a preferred donation partner by qualifying functionality and specification eligibility, and by addressing data security requirements in advance of donation.

[20] The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community directive 2002/96/EC on waste electrical and electronic equipment (WEEE) which, together with the RoHS Directive 2002/95/EC, became European Law in February 2003, setting collection, recycling and recovery targets for all types of electrical goods.

Chapter 6: Total emissions

An overview of emissions for the department is provided in the table below. Total emissions for the department are almost 25,000 tonnes of CO_2e. Electricity use contributes to more than half of all emissions followed by emissions from the operation of the SA Agulhas with just over 24% of all emissions. Business travel accounts for almost 9% of emissions. Emissions from staff commuting to and from work make up just over 4% of all emissions. Emissions from paper, computers, air conditioning, and fridges/freezers are less than 1 % of total emissions.

Table 12. Total emissions

Emission sources	Consumption	Consumption units	CO_2e (tons)	Sub total (tons)	% of total emissions
Direct emissions (Scope 1)				7,529.4	30.63
GG vehicles	257,160	Km's	48.07		*0.19*
Air conditioning units (split units)	14.04	Kg's	23.87		*0.09*
Fridges/freezers	0.45	Kg's	0.77		*0.003*
Antarctic programme				*7,456.69*	*30.33*
Helicopters – aviation gasoline	140,000	litres	332.84		*1.35*
SA Agulhas – arctic diesel	1,852,000	litres	5,085.22		*20.69*
CFC	300	kg	510.0		*2.07*
Antarctic base				*1,116.24*	*4.54*
Polar diesel - generators	320,000	litres	878.66		*3.57*
Polar diesel - vehicles	85,000	litres	233.39		*0.95*
Two stroke Fuel	1,600	litres	3.81		*0.015*
Household gas	132	kg	0.38		*0.002*
Marion				*219.92*	*0.89*
Polar diesel - generators	80,000	litres	219.66		*0.88*
Petrol	20	litres	0.05		*0.0002*
Household gas	72	kg	0.21		*0.0008*
Gough				*192.47*	*0.78*
Polar diesel - generators	70,000	litres	192.21		*0.78*
Petrol	20	litres	0.05		*0.0002*
Household gas	72	kg	0.21		*0.0008*
Indirect emissions (Scope 2)				13,673.16	55.62
Electricity consumption	14,272,609	kWh	13,637.16		
Other indirect emissions (Scope 3)				3,381.13	13.75
Business travel				*2,198.62*	*8.94*
Domestic and international flights	15,946,984	Km's	1,846.6		*7.51*
Vehicle rental	507,787	Km's	84.44		*0.34*
Shuttle service	133,865	Km's	26.24		*0.11*
Management (official trips)	172,028	Km's	34.44		*0.14*
Subsidized vehicles	1,084,198	Km's	206.90		*0.84*
Staff commuting*	7,757,985	Km's	1,008.51		*4.10*
Paper	16,115	Reams	41.38		*0.168*
Computers	800	Computers	56.12		*0.228*
Air conditioning units (built in)	45	Kg's	76.50		*0.31*
Total: Scope 1, 2 and 3			24,582.69		100
Reduction offsets			0		
Nett emissions			24,582.69		100

*Extrapolated from a staff commuting survey with a survey sample size of 391 out of 833 staff members. Confidence level of 95%.

A comparison of emissions from DEAT with those South African companies that report their emissions as part of the Carbon Disclosure Project is provided below. It should be noted that the companies included in the graph only reports on Scope 1 and Scope 2 emissions whereas DEAT's emissions also include Scope 3 emissions.

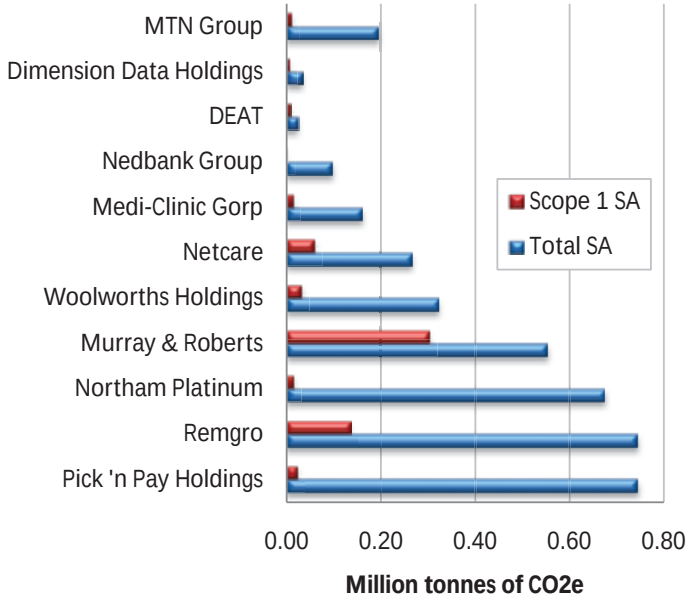


Figure 19. Comparison of emissions from DEAT with some JSE Top 100 companies

Chapter 7: Emission reduction options

In previous chapters, many ways and means to reduce emissions were highlighted. In the section below, some of these strategies are revisited and some additional ones are proposed. To effectively manage GHG, the department will have to set a GHG target. This aspect is discussed in the second part of this chapter. Some targets are proposed in the last section of this chapter.

Emission reduction options

Business related travel

Business related travel constitutes almost 10% of all emissions. There are a number of ways to reducing emissions from business related transport.

Savings can be made from the purchase of lower carbon vehicles; changing driver behaviour to improve fuel consumption (smarter driving); and encouraging reduced vehicle usage. One option would be to switch to smaller, more fuel efficient vehicles. Greening the fleet does not necessarily mean changing the class of vehicle, one could reduce CO_2 emissions and fuel bills by up to 25 per cent simply from choosing the most efficient vehicle in each class.

Toyota Prius
The Prius is a Hybrid vehicle. It uses an ultra efficient petrol engine and an electric motor working in tandem to produce a car with a fuel consumption figure of about 5 litres/100km. This is lower than most diesel cars and the lowest of any petrol driven vehicle on the road in South Africa today.

The Joule
Africa's first battery electric MPV complies with UN-ECE safety standards offering a zero emission urban driving experience. Maximum 400km range.

Another option would be to switch to fuel alternatives such as Compressed Natural Gas. Compressed Natural Gas (CNG) is a substitute for gasoline (petrol) or diesel fuel. It is considered to be an environmentally "clean" alternative to those fuels. Vehicles need to undergo some modification to use CNG. Although the conversion technology is available in South Africa, it has only been applied to a very limited scale. Consideration can also be given to switch to hybrid cars such as the Toyota Prius, the Honda hybrids that will be available in South Africa in 2010, or electric cars such as the Joule once it becomes available in South Africa. The other option is just to limit business travel to essential travel.

Ultimately, it would be best to develop a sustainable transport policy for the department that could have the following objectives:

- Reduce vehicle kilometres travelled
- Improve air, water and ecosystem quality
- Reduce greenhouse gas emissions
- Improve economic efficiency
- Reduce unnecessary travel

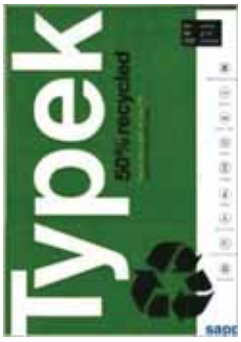
Reducing emissions associated with air travel

Staff considering travelling should be encouraged to think about whether it is really necessary and to reduce routine, non-essential trips or make trips longer and more efficient. Consideration should be given to create a tool for officials who will calculate the emissions for every official trip undertaken. This will allow staff to see the impact they have and hopefully help to encourage staff to reduce their air travel.

Switching to renewable energy

Renewable power sources such as wind and solar do not produce any carbon emission. Electricity was the largest source of carbon and as such switching to renewable power could see a major reduction in carbon emissions. Opportunities for using renewable energy were not investigated as part of this audit.

Use less paper



Printing of electronic document, particularly drafts and emails should be limited to reduce paper usage. Whenever practical the format of standard documents, correspondence etc should be modified to use less paper. This can be done by reducing margin widths or use of a smaller font.

The Department previously used virgin paper but since September 2008 started to use recycled paper as well. Duplex printing is however not practiced throughout the department. Not all printers and photocopiers are set to print on both side and any paper. Ideally, the default setting on printers and photocopiers should be set to duplex printing.

Papers that have been printed on one side should be reused for internal office use. Which is all good but for every ton of recycled paper used versus virgin paper you are savings at least 3,000 litres of water and recycled paper involves between 28-70% less energy consumption than virgin paper. This is because most of the energy used in papermaking is the pulping needed to turn wood into paper.

Develop and implement a green procurement plan

Green public procurement is procedure where environmental considerations are taken into account within the procurement process.

Green public procurement is smart procurement – it means improving the efficiency of public procurement and at the same time using public market power to bring about major environmental benefits locally and globally.

The department spend each year over R 3,807,000,000 on goods & services[21] (87 % of the total budget). Directing this spending power towards the purchase of greener products and services can:

- Achieve huge direct environmental benefits, including a reduction in carbon emissions
- Help drive the market for greener products and services
- Set an example for corporate and private consumers

Developing and implementing a green procurement plan can take two to five years. Such a plan will be a display of commitment to sustainable development, outlining to staff, clients and the public the department's fundamental principles and goals in reducing the impact of its operations on the environment.

Figure 20. Overview of the Green Procurement Policy Management Model
Source: European Commission.

[21] This figure includes transfer and subsidies.

As it will represent their views and ambitions, the plan will need to receive the whole hearted approval of senior management – receiving full official support, backing and application of resources - otherwise it will simply be a token gesture, and be quickly forgotten and ignored by employees.

Resources to assist in the development of a green procurement plan are readily available. One such resource is the Green Public Procurement Training Toolkit developed by the European Commission. The toolkit comprises three modules as indicated below.

BOX 15. European Commission Green Public Procurement (GPP) Training Toolkit

The toolkit comprises three modules:

Module 1. An action Plan for GPP
The guidance sets out a case as to why decision makers should set up a GPP strategy. It provides them with a simple yet effective methodology to develop an Action plan for gradually introducing Green Public Procurement within the organisation. It includes concrete examples of environmental criteria which can be readily introduced in tender documents.

Module 2: Legal module
The second module includes legal guidance, providing clear examples of how and where to integrate environmental criteria into the public procurement process whilst fully respecting European public procurement legislation (Directives 2004/17/EC and 2004/18/EC – more information at: http://simap.eu.int/).

Module 3: Practical module
The third module is specifically designed for purchasing officers. It includes concrete examples of environmental criteria which can be readily introduced in tender documents. Examples of criteria have been established for 11 product and service groups. These product and service groups include:

- Sustainable procurement in construction
- Purchasing green electricity
- Food procurement and catering services
- Greener cleaning products and services
- Copying and graphic paper
- Public transport
- IT equipment
- Furniture
- Electricity

Record keeping for audit information

Keeping accurate record on all activity data for both direct and indirect emissions is essential for ensuring a reliable carbon emission audit for the department. It will also allow for easier calculating of future audits. Some record keeping recommendations are outlined in the table below.

Table 13. Recommendations to improve record keeping

Emission sources	Quality of records
Direct emissions (Scope 1)	
GG vehicles	Current records are sufficient
Air conditioning units (split units)	Current records are not sufficient. No information available on charging and re-charging of units
Fridges/freezers	Current records are not sufficient
Generators	Records are not available
Antarctic programme	Records are available and sufficient
Indirect emissions (Scope 2)	
Electricity consumption	Current records are sufficient but can be improved upon by incorporating the variable rates charged by ESKOM rather than the current flat rate.
Other indirect emissions (Scope 3)	
Domestic and international flights	Current records received from service providers are sufficient
Vehicle rental	Current records received from service providers are sufficient
Shuttle service	Current records received from service providers are sufficient
SMS (official trips)	The log form should be changed to request additional information required for the carbon emission calculations. Log form should be electronic.
Subsidized vehicles	The log form should be changed to request additional information required for the carbon emission calculations. Log form should be electronic
Staff commuting	Survey information satisfactory. Sample size can be improved upon
Paper	Current records can be improved upon by distinguishing between virgin and recycled paper
Computers	Current records can be improved upon by distinguishing between computers in use and computers in storage. Need to be able to distinguish between computers and peripheral equipment
Air conditioning units (built in)	Current records are not sufficient. No information available on charging and re-charging of units
Waste	Records are not sufficient

Other suggestions

- Organize an education program on climate change for your employees using SafeClimate (http://www.safeclimate.net). E-mail sepinfo@wri.org for more information.
- Encourage and support employees' efforts to reduce CO_2 emissions at home. Resources to help individuals take action at home are available at http://www.safeclimate.net .

Establishing an emissions reduction target

Companies worldwide have started to acknowledge the need to reduce their GHG emissions and have set themselves targets to improve their performance. This is the desirable response to climate change issues, translating measurement efforts into measurable corrective action. Several South African companies have also begun to formalise their emissions reduction efforts in this way, however, only 12 companies disclosed specific company-wide GHG emission reduction targets – most of them from the carbon-intensive sector[22].

BOX 13. Setting a GHG target

Setting targets is a routine business practice that helps ensure that an issue is kept on senior management's "radar screen" and factored into relevant decisions about what products and services to provide and what materials and technologies to use. Often, a corporate GHG emission reduction target is the logical follow-up to developing a GHG inventory.

Source: GHG Protocol. WRI

[22] From Carbon Disclosure Project report 2008.

Common drivers for setting a GHG target include:

- Minimizing and managing the GHG risks
- Achieve cost savings and drive innovation
- Preparing for future regulations
- Demonstrating leadership and corporate responsibility
- Participating in voluntary programmes

With the inventory for the 2008/2009 base year completed, it is now possible to establish an emissions reduction target for the department. Two kinds of emission reduction targets can be set: absolute targets and rate-based targets.

- Absolute targets are a concrete reduction goal that does not take factors such as organizational growth into account. A 10 percent reduction in emissions below those estimated for the base year is an example of an absolute target.
- Rate-based or intensity targets are linked to the organizational fluctuations of the business. Reducing per capita emissions by 10 percent is an example of a rate-based target.

BOX 14. Comparing absolute and intensity targets

ABSOLUTE TARGETS reduce absolute emissions over time. (Example: reduce CO_2 by 25 percent below 1994 levels by 2010).

Advantages
- Designed to achieve a reduction in a specified quantity of GHGs emitted to the atmosphere
- Environmentally robust as it entails a commitment to reduce GHGs by a specified amount
- Transparently addresses potential stakeholder concerns about the need to manage absolute emissions

Disadvantages
- Target base year recalculations for significant structural changes to the organization add complexity to tracking progress over time
- Does not allow comparisons of GHG intensity/efficiency
- Recognizes a company for reducing GHGs by decreasing production or output
- May be difficult to achieve if the company grows unexpectedly and growth is linked to GHG emissions

INTENSITY TARGETS reduce the ratio of emissions relative to a business metric over time (Example: reduce CO_2 by 12 percent per km travelled between 2000 and 2008).

Advantages
- Reflects GHG performance improvements independent of organic growth or decline
- Target base year recalculations for structural changes are usually not required
- May increase the comparability of GHG performance among companies

Disadvantages
- No guarantee that GHG emissions to the atmosphere will be reduced—absolute emissions may rise even if intensity goes down and output increases
- Companies with diverse operations may find it difficult to define a single common business metric
- If a monetary variable is used for the business metric, such as dollar of revenue or sales, it must be recalculated for changes in
- product prices and product mix, as well as inflation, adding complexity to the tracking process

Source: GHG protocol. WRI

Reduction target proposals:

In setting a reduction target for the department, consideration should be given to what is practically achievable, considering also the emissions profile of the department. Even though

emissions from electricity consumption are by far the biggest contributor to the department's carbon footprint, emissions from business travel by plane is clearly significant and presents opportunities for emission reduction. Likewise, reduction targets set for emissions from subsidized vehicles, which is the second highest[23] of all Scope 3 emissions, and emissions from GG vehicles, which is the highest of all Scope 1 emissions[24], are more likely to succeed and will have a bigger impact in the short to medium term than reduction targets for emissions from computers or paper. Setting and achieving reduction targets for emissions associated with staff commuting may be difficult.

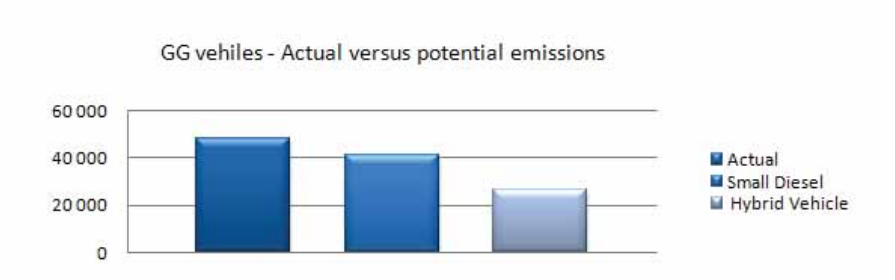
Some emissions sources are interrelated. For example, domestic business travel by plane in most cases will require the use of rental vehicles. Setting reductions targets for plane travel will have the knock-on effect of reducing business travel using rented vehicles. The boxes on the following pages provide some initial thoughts on defining realistic reduction targets for selected activities.

Towards defining realistic reduction target for GG vehicles

Replacing the existing fleet of GG vehicles with smaller, more fuel efficient vehicles can result in a reduction of carbon emissions. The question is however: what is realistically achievable?

Current total emissions from GG vehicles are 48.07 tons. Replacing the current fleet of medium size petrol driven vehicles with smaller, diesel powered vehicles will reduce emissions by 14% to 41.14 tons of CO_2.

Replacing the existing vehicles with a hybrid-type vehicle such as the Toyota Prius or the soon to be released Honda Civic hybrid, effectively changing from a category F to a category B Green Label vehicle, can reduce emissions by 44% to 26.74 tons of CO_2.



A realistic target for GG vehicle emission reductions is a reduction of 10-15% by 2015
4.8-7.2 tons

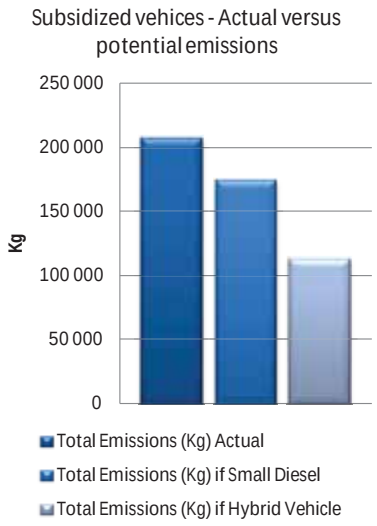
[23] Excluding staff commuting.
[24] Excluding the Antarctic Programme.

Towards defining realistic reduction target for subsidized vehicles

Replacing the existing fleet of subsidized vehicles with smaller, more fuel efficient vehicles will be more challenging than for GG vehicles. This is because currently, drivers of subsidized vehicles drive medium to large, mostly petrol driven vehicles. Convincing the users of these vehicles to switch over to more fuel efficient vehicles may not be easy without some incentive or policy directive.

Current total emissions from subsidized vehicles are 206.09 tons. Replacing the current fleet of medium to large size petrol driven vehicles with smaller, diesel powered vehicles will reduce emissions by 16% to 173.44 tons of CO_2.

Replacing the existing vehicles with a hybrid-type vehicle such as the Toyota Prius or the soon to be released Honda Civic hybrid is not realistic at this stage. Hybrid vehicles only realize low emissions in city traffic and loose their emission advantage if the majority of trips are long distance in nature. If fully implemented, hybrid vehicles could reduce emissions by 45.5% to 112.74 tons of CO_2 .

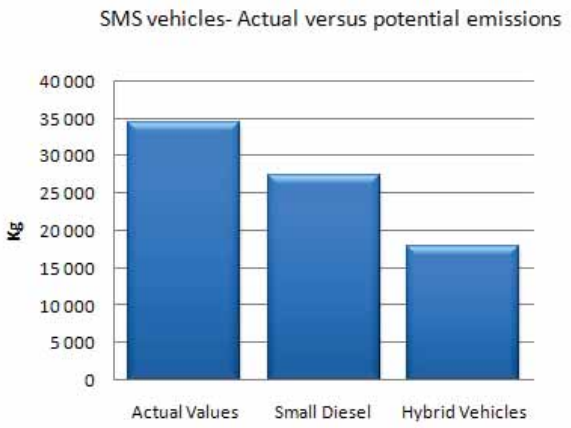


Subsidized vehicle emissions can be reduced by 10-15% by 2015 or 20.6-30.9 tons
This will require the introduction of incentives or policy changes

Towards defining realistic reduction target for SMS vehicle travel

SMS are allowed to use their own vehicles for official business travel. SMS members may purchase any type of vehicle and usually this is catered for in the structuring of their remuneration package. Some tax benefits may arise from this arrangement.

Currently most of the vehicles used by SMS members are in the medium to large vehicle category. There is no incentive for purchasing and using smaller, more fuel efficient vehicles. Convincing the users of these vehicles to switch over to more fuel efficient vehicles may not be easy without some incentive or policy directive.



Current total emissions from SMS owned vehicles are 34.44 tons. Replacing all medium to large size petrol driven vehicles with smaller, diesel powered vehicles will reduce emissions by 20% to 27.52 tons of CO_2.

Replacing the existing vehicles with a hybrid-type vehicle such as the Toyota Prius or the soon to be released Honda Civic hybrid is not realistic at this stage. Hybrid vehicles only realize low emissions in city traffic and loose their emission advantage if the majority of trips are long distance in nature. If implemented hybrid vehicles could reduce emissions by 48% to 17.89 tons of CO_2 .

SMS vehicle emissions can be a reduced by 10-15% by 2015 or 3.4-5.1 tons
This will require the introduction of incentives or policy changes

Towards defining realistic reduction target for air travel

Business travel by plane is responsible for more than 80% of all travel related emissions (excluding staff commuting). Flights are split 53% long distance (typically international flights), 42% medium distance and 5% short distance flights.

In total, some 10,038 flights were undertaken in 2008/09. Of these 1,148 were long distance flights, 6,862 medium distance flights and 2,028 short distance flights. There may be considerable opportunities for reducing emissions by:

- Travelling less often
- Attending only those international meetings that are absolutely necessary
- Reducing the size of delegations attending international meetings
- Using video or tele-conferencing instead of flying to business meetings.

Flight emissions can be reduced by at least 20% by 2015
369.32 tons

Towards defining realistic reduction targets for electricity consumption

The department has introduced a number of energy saving measures over the last couple of years. Though further savings can still be achieved through initiatives aimed at behavioural changes such as intensified information sharing, education and awareness programmes, the most realistic option for significant reduction of emissions would be through technological interventions such as the phasing in of renewable energy and/or purchasing carbon offsets.

Commissioning the building of new offices for the department creates an excellent opportunity for incorporating green building design principles, including renewable energy technologies that can significantly reduce electricity consumption.

Electricity emissions can be reduced by about 5% by 2015
692 tons

Reduction targets proposed for the department

Several South African companies have begun to formalise their emissions reduction efforts and set themselves targets to improve their performance. Company-wide reduction targets for some companies are indicated in the table below.

Table 14. Company-wide carbon emissions reduction targets by company

Company	Targets
Anglo American	10% reduction of CO2 emissions per unit of production by 2014 (2004 baseline)
Anglo Platinum	10% reduction of CO2 emissions per unit of production by end 2014 (2004 baseline)
AngloGold Ashanti	30% reduction in GHG emissions per ounce produced ("medium- to longer term target")
BHP Billiton	13% reduction in GHG emissions intensity by 2012 (2006 baseline)
Gold Fields	2% reduction per annum in emissions over the next 5 years (2007 baseline)
Kumba Iron Ore	10% reduction in CO2 emissions by 2014 (2004 baseline)
Lonmin	5% reduction of GHG emissions by 2012 (2007 baseline)
Mondi Plc	15% reduction in total CO2 emissions by 2014 (2004 baseline)
Nedbank Group	12% reduction in carbon emissions intensity by 2015 (2007 baseline)
Sasol	minimum 10% reduction in GHG emissions per tonne of product by 2015 for Sasol globally (2005 baseline)
Woolworths Holdings	30% reduction in relative amount of carbon produced directly by the business by 2012 (2007 baseline

Source: Carbon Disclosure Project 2008.

Several South African companies also report an energy related reduction target as their emissions reduction target. Some emission intensity targets are set in accordance with DEAT and are specific and regulated in each licence issued in terms of APPA or NEMAQA. The table below shows these targets for low-carbon companies.

Table 15. Low-carbon companies disclosing energy-related targets

Company	Targets
Absa Group	EEA target: Investigating 15% reduction in energy consumption by 2015 (2000 baseline)
Nedbank Group	12% reduction in energy intensity by 2015 (2004 baseline)
Pick n Pay Holdings	20% reduction in electricity consumption by 2012 (2007 baseline)
Truworths International	Responding to Eskom's national target of 10% reduction in energy consumption
Woolworths Holdings	30% reduction in relative electricity consumption by 2012 (2007 baseline)

Source: Carbon Disclosure Project 2008.

Considering the departmental emissions, some reductions targets[25] are proposed for consideration.

Table 16. Proposed emission reduction targets

Type	Target	Emissions reductions
General targets		
Total	Reduce greenhouse gas emissions by 10 % [realistic figure is 7%] by 2015 (2008 baseline).	Reduction of about 2,458 tons of CO_{2e}.
Total	Reduce emissions by 10% per capita by 2015.	
Targets linked to scopes[26]:		
Scope 2: Electricity - high	15%[27] of electricity consumption from renewable resources by 2020 (2008 baseline).	Reduction of 2,140,890 kWh[28] and 2,050 tons of CO_{2e}.
Scope 2: Electricity - low	Respond to Eskom's national target of 10% reduction in energy consumption (2008 baseline).	Represents a reduction of 1,364 tons of CO_{2e}
Scope 1&3: Business travel	Reduce emissions from business travel by 18-25 % by 2015 (2008 baseline).	Reduction of between 400 and 555 tons of CO_{2e}.
Scope 3: Travel by plane	Reduce emissions from business travel by plane by 20% by 2015 (2008 baseline).	Reduction of 369 tons of CO_{2e}
Scope 3: Subsidized vehicles	Reduce emissions from subsidized vehicles by 10-15% by 2015 (2008 baseline).	Reduction of between 20.6 and 30.9 tons of CO_{2e}

[25] Targets do not take into consideration the new Government structures announced in May 2009.
[26] These targets do not take into account the new government structures established in 2009 and the subsequent splitting up of the department.
[27] Government has a renewable energy target of 15% by 2020, and 10,000GWh by 2013.
[28] This is equivalent to the power generated by two of the wind turbines at the Darling Wind Farm.

Chapter 8: Offsetting

To reduce CO_2 emissions can be challenging. Often, even with reduction efforts it may still not be possible to eliminate our emissions of greenhouse gasses, or even to reach the emission reduction target set by the organisation. Carbon offsetting is a means by which individuals and organisations can balance out their unavoidable emissions and become Carbon Neutral[29].

A carbon offset is a financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases.

Box 16. Carbon Offsets

A carbon offset is a service whereby the benefit of implementing a greenhouse emissions reduction project in one location "offsets" or equalises greenhouse gas emitting activities in another location.

Emissions reduction projects can take many forms. To be a valid carbon offset (Gold Standard or VCS) the project must be a renewable energy or energy efficiency project.

We like the idea of afforestation and trees do sequester carbon dioxide but the offset period is often very long (generally over 25 years) and it is extremely difficult to ensure the long term security of a forest area without actual ownership of the land.

There are two markets for carbon offsets. In the larger compliance market, companies, governments, or other entities buy carbon offsets in order to comply with caps on the total amount of carbon dioxide they are allowed to emit. In 2006, about $5.5 billion of carbon offsets were purchased in the compliance market, representing about 1.6 billion metric tons of CO_2e reductions.

In the much smaller voluntary market, individuals, companies, or governments purchase carbon offsets to mitigate their own greenhouse gas emissions from transportation, electricity use, and other sources. For example, an individual might purchase carbon offsets to compensate for the greenhouse gas emissions caused by personal air travel.

Offsets are typically achieved through financial support of projects that reduce the emission of greenhouse gases in the short- or long-term. The most common project type is renewable energy, such as wind farms, biomass energy, or hydroelectric dams. Others include energy efficiency projects, the destruction of industrial pollutants or agricultural by-products, destruction of landfill methane, and forestry projects. Some of the most popular carbon offset

[29] For an organisation to be carbon neutral it must have zero net carbon emissions. This can be achieved through reducing carbon emissions, using renewable energy and offsetting the remaining any unavoidable emissions. Carbon Neutral is a concept which has gained much attention recently, it is a word much in the media and many businesses are now considering becoming carbon neutral. However it must be noted that becoming carbon neutral is quite a significant commitment to make and would involve making serious changes.

projects from a corporate perspective are energy efficiency and wind turbine projects. The table below outlines some of the offset schemes available.

What are the schemes that "offset" carbon dioxide?			
Method	**What Happens**	**How does it work?**	**Notes / Criticisms**
Tree planting - reforestation	Trees are planted on your behalf somewhere in the world.	The trees take up carbon dioxide as they grow. The scheme may also provide jobs in developing countries.	To be a real solution, the forests created would need to be there untouched forever. Can cause more harm than good in Northern countries. Inappropriate species can (and have been) planted.
Renewable Energy Investment	The money you pay is used to sponsor renewable energy projects that are frequently in developing countries. .	Many sources of renewable energy are currently more expensive than burning fossil fuels. Investment in renewable energy encourages their use against the financial incentive not to do so. The scheme prevents an amount of carbon dioxide being produced equal to what you were responsible for.	Nothing happens about the carbon dioxide you emitted; it is still in the atmosphere. Investment can lead to technology and uses that continue to be effective potentially indefinitely, so the benefits can really be long-term.
Promoting Energy Efficiency	Energy efficient schemes are sponsored, these are generally either lighting schemes where energy efficient light-bulbs are given to (usually) a developing community, or energy efficient wood-burning stoves are provided or subsidized for developing countries.	Energy efficient light bulbs release less carbon dioxide from the fossil fuels that are used to produce the electricity. Fuel efficient stoves use less wood than the traditional open fire, so releasing less carbon dioxide. The same number of trees can now support a greater number of cooking fires. Wood is a renewable fuel and so is sustainable in a way that fossil fuels aren't.	More efficient light bulbs reduce the further production of carbon dioxide (which is still produced) rather than deal with any already produced. Smoky traditional open wood fires cause illnesses for many millions of people. More efficient fires reduce this problem. More efficient wood stoves lead to better usage of renewable natural resources - trees that provide fuel.

Cleaner development mechanism

The Kyoto Protocol has sanctioned offsets as a way for governments and private companies to earn carbon credits which can be traded on a marketplace. The protocol established the Clean Development Mechanism (CDM), which validates and measures projects to ensure they produce authentic benefits and are genuinely "additional" activities that would not otherwise have been undertaken. Organizations that are unable to meet their emissions quota can offset their emissions by buying CDM-approved Certified Emissions Reductions.

BOX 17. Cleaner Development Mechanism

How does the CDM work?

A CDM project is a development project, driven by market forces, that reduces GHGs. In a CDM project, an investor from an industrialised country supplies capital or technology, based on the future value of Certified Emission Reduction Units (CERs), also known as carbon credits, which measure the reduction of GHGs in the developing country. The procedure starts with the industrialised country keeping a regularly updated inventory of its emissions. The country may then choose to allocate its national target (set by the Kyoto Protocol) across a number of domestic emitters, in much the same way that resources such as fishing rights or logging rights are allocated. A domestic emitter can meet its allocated target through mitigation activities within the country - or make use of the two Kyoto Protocol project-based flexibility mechanisms: the CDM and the Joint Implementation (JI) procedure.

The CDM allows the emitter to invest in a project in a developing country or buy CERs from someone who has invested in such a project. Under the CDM all parties benefit - the host country is assisted in achieving sustainable development, the owner of the project receives financial and technological assistance, and the emitter in the industrialised country receives carbon credits.

Developing countries already have experience in projects relevant to climate change like energy supply, demand side management, fuel switching, and forestry. These projects typically use equity and debt to raise capital, and produce financial returns for the investor. CDM projects are different because they include another kind of input - carbon investment. The project generates carbon credits with monetary value. Additional financial resources flow to the project to gain carbon credits. This finance is different from equity investments made for financial returns, even if these are made by the same investor. The project must also generate sustainable development benefits for the developing country as a whole, even if these benefits do not accrue directly to the project developer. While it is not always clear how these benefits are to be measured, they are a fundamental component of CDM projects.

The CDM is overseen and guided by the CDM Executive Board. The Executive Board supervises the CDM under the authority and guidance of the UNFCCC COP/MOP.

The CDM in South Africa

Under the rules of the CDM, each host country must establish a Designated National Authority (DNA). The DNA for the CDM in South Africa is located within the Department of Minerals and Energy (DME). The tasks of the DNA are described in the rules for the CDM. The primary task is to provide a formal letter of approval for the project, confirming how the project will assist South Africa in achieving its sustainable development goals. The DME is currently developing a framework and a set of sustainable development criteria to guide the approval process.

Source: http://www.brightgreencar.co.za/; http://www.dme.gov.za/dna/index.stm

Offsetting opportunities in South Africa:

Because offsets provide a revenue stream for the reduction of some types of pollutants, they can in some cases provide incentives to pollute more, so that polluting entities can later get credit for reducing emissions from an artificially high baseline. This is especially the case for offsets with a high profit margin.

BOX 18. Offsetting controversies

Some activists disagree with the principle of carbon offsets, likening them to papal indulgences, a way for the guilty to pay for absolution rather than changing their behaviour. For example, George Monbiot, an English environmentalist and writer, says that carbon offsets are an excuse for business as usual with regards to pollution. Proponents hold that the indulgence analogy is flawed because they claim carbon offsets actually reduce carbon emissions, changing the business as usual, and therefore address the root cause of climate change. Proponents of offsets claim that third-party certified carbon offsets are leading to increased investment in renewable energy, energy efficiency, methane biodigesters and reforestation and avoided deforestation projects[citation needed], and claim that these alleged effects are the intended goal of carbon offsets.

Carbon offsetting is quiet a contentious issue, with many people doubting its merits. If the department wishes to go down the route of offsetting there are a number of considerations which need to be kept in mind. Most importantly, any offsetting credits purchased must come from verified projects that genuinely create emissions reductions. For example any tree planting schemes should be avoided; as large scale plant can damage biodiversity, displace people and cause social disruption. There is also scientific doubt as to how much tree's outside the tropics contribute to any reductions in global warming. The main points to consider are:

1. Reduction – Before buying an offset consider whether emissions are actually being reduced. Offset purchase as a sole response without efforts to reduce emissions will not prevent climate change.
2. Verification – both of project existence but also how it delivers carbon balance.
3. Emissions calculation – the calculated emissions method must be understood to enable a clear match with any offset product.
4. Viability – there must be clarity on the long term viability of any project, where carbon savings are delivered over a long period of time.
5. Value – what is the offset value in terms of carbon saved/stored and wider benefits in the context of CO_2 reduction?
6. Content – what does the offset unit include and is this specified by the broker or project originator?
7. Delivery – how does the offset unit actually deliver the content and value that it claims?
8. Reason for purchase – the purpose of offset will help to determine choice. Companies in a regulatory framework must purchase certified credits. Individuals may choose offsets according to personal taste. Unregulated companies may choose projects that fit their brand or product profile in terms of project location and type.

Monwabisi Booi of Cape Town's environment department in Kuyasa, Khayelitsha, site of the low-cost clean development project. (Image: SouthSouthNorth)

There are a number of options for sourcing offset credits.

- Certified Emission Reduction credits are part of the UN Clean Development Mechanism (CDM) and came about under article 12 of the Kyoto treaty. All of these credits are sourced from developing countries and are verified and certified by a third party.
- A number of private companies are also offering offsetting credits, these credits can be sourced but it should be confirmed that they are credible projects before investing.
- Gold standard credits: ensure that key environmental criteria have been met by offset projects and only offsets from energy efficiency and renewable energy projects qualify for Gold Standard. Tree planting projects are explicitly excluded and all projects independently audited and are sourced from the developing world; this ensures that they are credible projects.

The department may consider a number of specific offsetting options:

- Investing in CDM projects, using socially responsible investment (SRI) funds.
- Develop CDM projects.
- Increasing investments in renewable energy or demand to finance the development of renewable energy projects – for example create partnerships with municipalities and local authorities.
- Offsetting emissions from flights through any one of the existing offsetting schemes.

BOX 19. Offsetting Carbon emissions from flights

Carbon offsets can be purchased when flights are booked, and some companies provide an offset service for companies.

Offsetting through Wings is through Sustainable Travel International who offsets in projects in China (Reforestation), Ghana (Efficient Cook Stoves), India (solar water heaters, solar electricity units, and energy efficiency appliances), Madagascar (forest protection), Turkey (wind turbines) and the United states (wind turbines)

FlightCentre's offsets portfolio managed through Cleaner Climate include a 1.2 MW wind farm facility located at the World Institute of Sustainable Energy (WISE) in Karnataka, India. Cleaner Climate is also involved in numerous renewable energy projects in conjunction with the Central Energy Fund. Using a basket approach these projects include landfill remediation (extracting methane from landfill), solar and wind farms. These projects are being implemented in the cities of Johannesburg and Cape Town.

The Promoting Access to Carbon Equity (PACE) Centre is a South African based non-profit organization, focused on facilitating emission reduction projects in Southern Africa to help reduce poverty. PACE www.carbon.org.za focuses on small scale renewable energy and energy efficiency projects in South Africa. Purchasing offsets through PACE will cost R150.00 per ton of CO_2e.

Offsetting the department's flight emissions will cost R 276,990.00 per annum

To offset all emissions will cost about R 3 million per annum[30]

[30] Carbon offsets were trading from $2.75 for personal offsets on the Chicago Climate Exchange and between $33 and $99 for some renewable type offsets. All prices as on 15 July 2009. Calculation based on $15 per ton and exchange rate of R8/$.

Offsetting should only be used as a last resort, after all steps have been taken to cut emissions as ultimately there is no solution to climate change other than to emit less greenhouse gases. The carbon offsetting portfolio registered as CDM projects are listed in Table 17.

Table 17. South Africa's registered CDM projects

CDM portfolio[31]				
Project name	Project description	CO_2 annual emission reductions (tons)	Date registered by CDM	Project proponent/owner
Kuyasa Low-Cost Housing Energy Efficiency Upgrade	Energy efficiency project involving the installation of solar water heaters, ceiling insulation and compact fluorescent light bulbs (CFLs) in RDP houses.	7,000	August 27, 2005	City of Cape Town
Lawley Fuel Switch Project	The project entails the conversion from coal to natural gas as thermal fuel used in clay brick baking kilns at the Lawley Corobrik factory.	19,000	March 6,2006	Corobrick
PetroSA Biogas-to-energy Project	The project aims to utilize waste gas presently flared to generate electricity to be used onsite.	29,000	September 29, 2006	MethCap (Pty) Ltd
Rosslyn Brewery Fuel-Switch Project	This is fuel switching project replacing coal with natural gas and biogas as energy source.	107,000	November 29, 2006	South African Brewery
Durban Landfilling-gas-to electricity project - Marrianhill and La Mercy Landfills	The project involves the recovery of landfill methane for electricity generation.	69,000	December 15, 2006	eTthekwini Municipality
Tugela CFB10 Conversion from Coal to Bark Fired	The project entails fuel from coal to biomass at Tugela pulp and paper mill.	70,000	February 12, 2007	Sappi Kraft Ltd
EnviroServ Chloorkop Landfill Gas Recovery Project	The project aims at the recovery and utilization of methane gas from EnviroServ's Chloorkop landfill.	188,000	April 27, 2007	EnviroServe Waste Management (Pty) Ltd
Omnia Fertilizer Ltd Nitrous Oxide Reduction Project	The aim of this project is to reduce emissions of Nitrous Oxide from Nitric Acid Production.	576,000	May 3, 2007	Omnia Fertilizer Ltd
Mondi Richards Bay Biomass Project	The project entails generation of electricity from biomass.	222,000	May 20, 2007	Mondi Business Paper
Sasol Nitrous Oxide Abatement Project	The objective of the project is to reduce the Nitrous Oxide emission from the nitric acid plants of the Sasol Nitro operations at Secunda and Sasolburg.	610,000	May 25, 2007	Sasol Nitro Division
Nitrous Oxide Emission reduction project	This project aims at reducing waste gas emissions of nitrous oxide (N_2O) produced during the production of nitric acid (HNO_3).	250,000	November 5, 2007	African Explosives Ltd. South Africa
Transalloys Manganese Alloy Smelter Energy	The project is an industrial energy efficiency project that will reduce the electricity consumption in the production of silicomanganese (SiMn) alloy (a key component in steel making) at the Highveld Steel and Vanadium Corporation Ltd's Witbank facility.	83,000	October 19, 2007	Ecosecurities South Africa (Pty) Ltd

Source: DME. http://www.dme.gov.za/dna/pdfs/SA_Reg_CDM_Projects_Aug_07.pdf
http://www.dme.gov.za/dna/pdfs/South%20Africa's%20CDM%20project%20portfolio%20up%20to%2011E%20June%202008.pdf

[31] South Africa's CDM project portfolio: There are 80 CDM projects submitted to the DNA (as on 11 June 2008), – 58 Project Idea Notes (PINs) and 22 Project Design Documents (PDDs). Out of 22 PDDs, 13 have been registered by the CDM Executive Board as CDM projects (1 requesting CER's), and 7 are at different stages of the project cycle - validation stage and/or request for review. The projects submitted to the DNA for initial review and approval cover the following types, bio-fuels, energy efficiency, waste management, cogeneration, fuel switching and hydro-power, and cover sectors like manufacturing, mining, agriculture, energy, waste management, housing and residential. Source: http://www.dme.gov.za/dna/dna_project_portfolio.stm visited on 22 June 2009.

Conclusions and recommendations

The purchase of offset is similar to the purchase of any technical consumer item or even a financial instrument like a share. They are created and priced based upon the best available data, which itself will continue to evolve and improve. The purchaser must satisfy themselves on key product issues and establish a basic understanding of the mechanics of offset projects. They must look beyond the immediate surface content and consider the key points that have been outlined above.

There are various options for DEAT to quantify and offset greenhouse gas emissions. It can be summarized as follows:

The Carbon Disclosure Program (CDP) – This is a voluntary carbon (more accurately carbon dioxide) disclosure initiative. It is a simple questionnaire which indicates ballpark annual emissions and plans to reduce and offset these emissions. Currently the JSE Top 100 companies are participating in this initiative, but any company/organisation/government structure can take part. The accuracy of the GHG emission estimation is ±15%. This is also the cheapest initiative to partake in and outsourcing this work to consultants will cost ±R80,000.

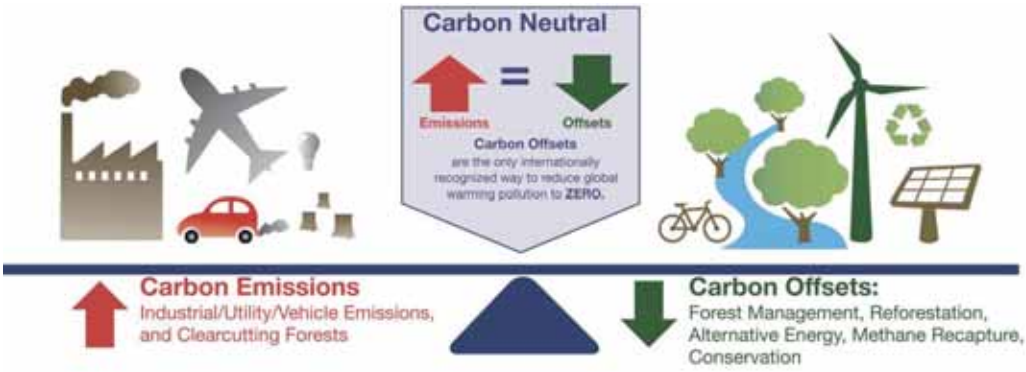
The second tier of increased accuracy regarding GHG emission quantification is a company specific carbon footprint report. The carbon footprint quantifies the amount of emission associated with the institution. Doing a carbon footprint report is more work as compared with the CDP questionnaire mentioned above, but the emission estimation is much more accurate. The cost of such a study varies greatly depending on the scope but can be in excess of R150,000. This report is the first attempt at calculating and reporting on the departmental carbon footprint.

Emission reduction incentive schemes are the 3rd possible tier and the most complex. In these systems the department could invest or develop a project(s) in which GHG emissions will be lower as compared to normal operation and claim emission reduction credits. Such a system could possibly be retrofitting energy intensive lighting with say smart sensors and energy efficient light bulbs. The emission reduction credits are then used to offset emissions in another part of the department.

Broadly speaking two major systems exist for emission reduction credits: The Certified Emission Reductions (CERs) system is governed by the UN and functions on a cap and trade system. It is an extremely rigorous regulatory environment with the most expensive credits (mostly). A typical CER will cost ±€12/tCO2e if you are buying the credits. Doing a CDM project can easily cost R600,000 – R1,500,000. The 2nd system is the Voluntary Emission Reduction (VER) market. VERs are not produced by a single system, but rather are the collective name or emission reductions achieved voluntary – as opposed to the UN' CER cap and trade system. VER systems are not as regulatory rigorous as CERs and generally are cheaper to buy and easier projects to do. VERs varies greatly in price - 3rd party audited VERs will be ±€3 - €8.

It is therefore recommended that the department should:

a. Establish a carbon footprint unit to calculate and report on emissions on an annual basis.
b. Participate in the Carbon Disclosure Programme.
c. Decide on a realistic emission reduction target or targets.
d. Put policies and procedures in place to commit to the set target or targets.
e. Monitor and report on the attainment of the reduction target or targets.
f. Only use offsets as a last resort.
g. If offsets are to be purchased, give preference to renewable energy and energy efficiency projects that are verified under the United Nation's clean development mechanism. Preference should be given to projects in South Africa.



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Annexure A Commuting survey

Carbon footprint emission study:

Staff commuting survey

Do you have green feet? Reducing our carbon footprint

Dear Colleague

A decision to calculate the carbon footprint of the Department of Environmental Affairs and Tourism was taken at the DEAT Lekgotla held from the 29-31 October 2008. As part of the calculation process of the total carbon footprint of the Department, information regarding the commuting patterns of DEAT employees needs to be taken into account. To this end we extend a friendly request to please take the time to complete the survey below. Please note that in addition to the paper based survey an electronic survey is also available through the following link and can be completed in place of the paper based survey.

www.surveymokey.com/DEATFootprint

If you have any questions/suggestions regarding the completion of the survey please do not hesitate to contact one of the team members of the carbon footprint study.

Contact details are as follows:

Telephone
012 310 3183
012 310 3938

Alternatively you are welcome to send an email to the following e-mail address:

Footprint@deat.gov.za

Structure of the survey

Please note that the survey contains a total of seven sections. We request that careful attention is paid to the instructions provided under each section as it will not be necessary to complete all the sections in some cases.

Information required to complete the questionnaire

Before you start filling in the questionnaire, please make sure that you have the following information at hand:

- Your **Persal** number or E-mail address
- The name of the **Branch and Chief Directorate** that you fall under
- The **distance you travel to work** in kilometres. If you do not know what the distance is, you can calculate it by using the following internet site or, alternatively, the carbon footprint team will calculate it for you as long as you can provide us with the relevant information as requested in the questionnaire: http://maps.yellowpages.co.za/
- If you travel to work in a private motor vehicle, motorcycle or scooter, the **fuel economy** of the vehicle, motorcycle or scooter (expressed in kilometres/litre) or the engine capacity of the vehicle (expressed in CC)
- The AVERAGE number of leave days apart from annual leave taken in the past year (sick leave, maternity leave, study leave etc.). **Please note that this EXCLUDES annual leave.**
- The **period** you have been employed at DEAT

Which Sections you will be required to complete:

What type of category do you fall under	Please complete sections:
Part time employee travelling to and from work by the **same** method	1 3 4 5 7
Part time employee travelling to and from work by the **different** methods	1 3 4 5 6 7
Full time employee travelling to and from work by the **same** method	1 2 4 5 7
Full time employee travelling to and from work by the **different** methods	1 2 4 5 6 7

Section 1 – General Patterns

Section 1: General

1. Persal number

2. E-mail address

3. Branch and Chief Directorate

Branch Name	Chief Directorate	Tick one
Biodiversity and Conservation		
	CD - Biodiversity and Heritage	
	Transfrontier Conservation Areas and Protected Areas	
Other		
Chief Operating Officer		
	CD - Business Performance	
	CD - Ministry	
	CD - Planning, Coordination & Information Management	
	CD - Social Responsibility Policy & Projects	
	Office of the COO	
Other		
Corporate Affairs		
	CD - Buildings and Admin Services	
	CD - Communication	
	CD - HR & Transformation	
	CD - Information Technology	
	CD - Legal Services Management	
Other		
Environmental Quality and protection		
	CD - Environmental Impact Management	
	CD - Pollution & Waste Management	
	CD - Regulatory Services	
Other		
Tourism		
	CD - Tourism Industry Development	
	CD - Tourism Industry Promotion	
Other		

Office of the Chief Financial Officer		
	DR - Budget Management	
	DR - Financial Management	
	DR - Supply Chain Management	
	SD - Public Entities and Risk Management	
Other		
Specialist Unit – International Coorporation		
	CD - Environmental & Sustainable Development Cooperation	
	CD - International Marine & Biodiversity Cooperation	
	International Conventions	
Other		
Other		

4. How many kilometres do you travel to work (**one way**)?

OR

*If you are not sure of the total distance covered please enter your departing address/station in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Departing Station Name	
Arrival Station Name	
Suburb	
OR	
Street Number/nearest crossing street	
Street Name	
Suburb	
City	

5. How long have you been employed at DEAT

Years	
Months	

Section 2 – Full time employees

Section 2: Full time employees

*Section 2 to be filled in by **full time** employees only. Part time employees please go to Section 3.*

1. Are you a full time employee (please tick the appropriate box)? *If **no**, please ignore the rest of the questions in this section and go to section 3*

Yes	
No *Please go to section 3 if **no** is ticked*	

2. **Average** number of days that you work from home annually

3. **Average** number of days per year spent on business travel (this refers to the number of working days that you don't commute to DEAT)

4. Other than vacation, how many [**days**] have you taken of extended leave, such as study leave, sick leave, maternity leave (over the last year)?

Continue to section 4 …

Section 3 – Part time employees only

Section 3: Part time employees only

1. On average, how many days a week do you work?

2. On average, how many weeks in a year do you work?

3. How many days a year do you work from home?

4. How many work days a year do you travel on business?

Section 4: Commuting to work

*Please note, all distances in this section are **one way** (from home to work) only!*

By car / motorbike / scooter

1. Do you drive on your way to work?

Yes	
No *If you selected **no** please continue to the next mode of transport on the list*	

2. How many days per week do you drive on the way to work?

3. How many kilometres do you drive to work (**one way**)?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/nearest crossing street	
Street Name	
Suburb	
City	

4. Fuel economy of the car (kilometres per litre) or the engine capacity of the vehicle (expressed as CC)?

5. What is the fuel source of your car?

Petrol	
Diesel	

6. How many people travel with the car/motorbike/scooter, including you?

Section 4 – Commuting to Work

Bike / walking

1. Do you walk or bike to work?

	Walk	Bike
Yes		
No *If you selected **no** for both options please continue to the next mode of transport on the list*		

2. How many days per week do you bike/walk to work?

3. How many kilometres do you walk/bike on the way to work?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/ or nearest crossing street	
Street Name	
Suburb	
City	

Train

1. Do you take the train to work?

Yes	
No *If you selected no please continue to the next mode of transport on the list*	

2. How many days a week do you take the train to work?

3. How many kilometres do you travel by train (one way) to work?

OR

*If you are not sure of the total distance covered please enter your Departing and Arrival Station Name in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Departing Station Name	
Arrival Station Name	
Suburb	
City	

Bus

1. Do you take the bus to work?

Yes	
No *If you selected **no** please continue to the next mode of transport on the list*	

2. How many days a week do you take the bus to work?

3. How many kilometres do you travel by bus (one way) to work?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/ or nearest crossing street	
Street Name	
Suburb	
City	

Taxi

1. Do you take a taxi to work?

Yes	
No *if you have selected **no** please ignore the rest of the questions under this mode of transport and continue on to section 5*	

2. How many days a week do you take the taxi to work?

3. How many kilometres do you travel by taxi (one way) to work?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/ or nearest crossing street	
Street Name	
Suburb	
City	

Section 5

Do you usually travel home using the same methods as you travel to work?

Yes *If you selected **yes** please continue to the last question of the survey (**SECTION 7**)*	
No *If you selected **no** please complete the next part of the survey (**SECTION 6**)*	

Section 6: Commuting to your home

*(Please complete this section **ONLY** if you don't use the same methods to travel home as you do to travel to work)*

*Please note, all distances in this section are **one way** (from work to home) only!*

By car / motorbike / scooter

1. Do you drive on your way to home?

Yes	
No *If you selected **no** please continue to the next mode of transport on the list*	

2. How many days per week do you drive on the way to work?

3. How many kilometres do you drive to work (**one way**)?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/ or nearest crossing street	
Street Name	
Suburb	
City	

Section 6 – Commuting to home

4. Fuel economy of the car (kilometres per litre) or engine capacity of the vehicle (expressed in CC)?

5. What is the fuel source of your car?

Petrol	
Diesel	

6. How many people travel with the car/motorbike/scooter, including you?

Bike / walking

1. Do you walk or bike to home?

	Walk	**Bike**
Yes		
No *If you selected no for both options please continue to the next mode of transport on the list*		

2. How many days per week do you bike/walk to home?

3. How many kilometres do you walk/bike on the way (**one way**) to home?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/nearest crossing street	
Street Name	
Suburb	
City	

Train

4. Do you take the train to home?

Yes	
No *If you selected **no** please continue to the next mode of transport on the list*	

5. How many days a week do you take the train to home?

6. How many kilometres do you travel by train (**one way**) to home?

OR

*If you are not sure of the total distance covered please enter your Departing and Arrival Station Name in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Departing Station Name	
Arrival Station Name	
Suburb	
City	

Bus

4. Do you take the bus to home?

Yes	
No *If you selected **no** please continue to the next mode of transport on the list*	

5. How many days a week do you take the bus to home?

6. How many kilometres do you travel by bus (**one way**) to home?

OR

*If you are not sure of the total distance covered please enter your departing address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/ or nearest crossing street	
Street Name	
Suburb	
City	

Taxi

4. Do you take a taxi to home?

Yes	
No *if you have selected **no** please ignore the rest of the questions under this mode of transport and continue on to SECTION 5*	

5. How many days a week do you take the taxi to home?

6. How many kilometres do you travel by taxi (**one way**) to home?

OR

*If you are not sure of the total distance covered please enter your departing Address in the table below. Please note that the items listed in **red** are compulsory and must therefore be completed*

Street Number/nearest crossing street	
Street Name	
Suburb	
City	

Section 7 – Additional information

Section 7: Additional information

Is there any other information about your commute that may influence the calculation of your carbon emissions not captured by this survey?

We sincerely thank you for taking the time to complete this survey