THE POSSIBLE IMPACT OF THE PROPOSED CARBON TAX ON THE MINING INDUSTRY

by

Theola Okkers

27506194

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Study leader:
Mr S.G Nienaber

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Last but not least I want to give all the praise and glory our heavenly Father for His guidance, strength, wisdom and unfailing love. As I journey through life he has carried me from strength to strength.

ABSTRACT

THE POSSIBLE IMPACT OF THE PROPOSED CARBON TAX ON THE MINING INDUSTRY

By

THEOLA OKKERS

STUDY LEADER: GERHARD NIENABER

DEPARTMENT: TAXATION

DEGREE: MAGISTER COMMERCII

National Treasury is proposing that the carbon tax be implemented on 1 January 2015. With the rise in electricity costs and this additional carbon tax, the gold mining industry will be under a lot of pressure.

The objective of this study is to compare the proposed South African carbon tax to the carbon tax implemented in Australia and to determine the potential impact on gold mining companies in terms of cost.

The research was in the form of a case study. One of South Africa's leading mining houses was used to demonstrate the possible effects that the carbon tax may have.

It was found that compared to Australia, South Africa's carbon tax is much more lenient with a rate much lower than Australia's as well as higher tax-free thresholds. It also found that based on 2010 figures it will cost AngloGold approximately R70 million. If this be the case some of AngloGold's' mines which are already breaking even will go past the breaking line into making losses. This could result in mine closures as well as major job losses.

It is recommended that government and mining houses work together towards a mutual agreement, one that will benefit both mining and government and in the end the South African economy.

KEY WORDS:

Greenhouse gas emissions

Carbon dioxide tax

Global warming

OPSOMMING

THE POSSIBLE IMPACT OF THE PROPOSED CARBON TAX ON THE MINING INDUSTRY

deur

THEOLA OKKERS

STUDIE LEIER: GERHARD NIENABER

DEPARTEMENT: BELASTING

GRAAD: MAGISTER COMMERCII

Die doelwit van hierdie studie is om die voorgestelde Koolstofdioksied Belasting van Suid Afrika te vergelyk met dié van Australia en om die potensiële impak op die goudmyn-bedryf in terme van koste te bepaal.

Die navorsing was in die vorm van ’n gevallestudie. Een van Suid Afrika se vooraanstaande mynhuise was in hierdie gevallestudie gebruik om die moontlike effek van die koolstofdioksied belasting te demonstreer.

Die studie dui aan dat Suid Afrika se koers baie laer as Australië s’n is. Daar was ook, gebaseer op 2010 syfers, bevind dat dit AngloGold omtrent R70 miljoen sal kos. Indien dit die geval is, beteken dit dan dat sommige van AngloGold se myne wat al reeds gelyk breek, verliese gaan begin toon. Dit sal versoorsaak dat myne moet sluit en ook werksverliese inhou.

Dit word voorgestel dat die regering en mynhuise vergader en tot ’n ooreenkoms kom – een wat voordelig vir beide partye, sowel as die Suid Afrikaanse ekonomie is.

SLEUTELWOORDE:
Groenhuisgas uitlaatgasse
Koolstofdioksiedbelasting
Aardverwarming

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LIST OF ABBREVIATIONS

CDP	Carbon Disclosure Project
CO_2	Carbon Dioxide
CH4	methane
CH3OH	methanol
CO_2-e	Carbon Dioxide Equivalent which is the accepted unit of measurement for greenhouse gases.
COP	Conference of Parties
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DME	Department of Minerals and Energy
EITI	energy intensive and trade intensive
Eskom	Eskom is a South African electricity public utility, established in 1923 as the Electricity Supply Commission (ESCOM) by the government of South Africa in terms of the Electricity Act (1922). It was also known by its Afrikaans name Elektrisiteits-voorsieningskommissie (EVKOM). The two acronyms were combined in 1986 and the company is now known as Eskom. (http://en.wikipedia.org/wiki/ Eskom)
ETS	Emissions trading scheme
GHG/s	Greenhouse gas
ICMM	International Council on Mining and Metals
JSE	Johannesburg Stock Exchange
SA	South Africa(n)
SARS	South African Revenue Services
t CO^2	Tonnes of Carbon Dioxide
t CO^2-e	Tonnes of Carbon Dioxide Equivalent

UNFCCC	United Nations Framework Convention on Climate Change
NCCS	National Climate Change Strategy
NGER	National Greenhouse and Energy Reporting.
NOAA	National Oceanic and Atmospheric Administration
SGG	Synthetic Greenhouse Gases

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

“All across the world, in every kind of environment and region known to man, increasingly dangerous weather patterns and devastating storms are abruptly putting an end to the long-running debate over whether or not climate change is real. Not only is it real, it is here, and its effects are giving rise to a frighteningly new global phenomenon: the man-made natural disaster” (Barack Obama, , 2006).

The World Wide Fund (WWF) describes climate change as an alteration of the earths’ weather conditions over time. In recent decades trends have shown the average temperature on the planet to be constantly increasing. This constant increase in temperature is leading to more extreme and irregular weather conditions across the world. As a result some places are experiencing temperatures which reach new and extreme levels, with some places getting hotter, colder, and wetter and others drier than usual (WWF, not dated).

Climate change is largely driven by the emission of greenhouses gases (GHGs), such as carbon dioxide. Because GHG emissions continue to constantly increase at an alarming rate the planet’s temperatures are increasing at a faster rate in response to the increase in these emissions (WWF, not dated).

The effects of global warming will be catastrophic. Some of the effects are rise in sea levels, droughts, floods, storms and heat waves, impacting on everyone, including disruption and in some case the degradation of the production of food, which may have an impact on the world's poorest and most vulnerable people, and threatening the food chain and various vitally important species, habitats and ecosystems (WWF, not dated).

At the 2009 Copenhagen climate change negotiations meeting South Africa voluntarily announced that it intends reducing domestic GHG emissions of business by 34 percent by

2020 and 42 percent by 2025, subject to the availability of adequate financial, technological and other support (National Treasury, 2010).

The National treasury in 2012 proposed that that the carbon tax would be implemented in 2013/2014 at a rate of R120 per ton of carbon dioxide equivalent (CO_2-e) on direct emissions (National Treasury, 2012). However in 2013 the date of implementation was moved forward to 1 January 2015.

For many industries this carbon tax will merely be passed on to the end consumer as companies will push up their sales prices to compensate for the increase in expenditure as a result of the carbon tax.

One industry that will be most affected by the proposed carbon tax is the gold mining industry of South Africa. Mining companies in South Africa use and produce fossil fuel energy products which produce GHGs but, nevertheless underpin economic growth and development in South Africa.

Gold mining companies export just about all of its goods. The company does not set the price at which gold is sold; this is set on international commodity exchanges. As a result there is a high possibility of gold mining companies being exposed if some countries like South Africa impose a price on carbon such as carbon tax while others do not (AngloGold Ashanti, 2010:59).

With the rise in electricity costs and this additional carbon tax the gold mining industry will be under increased pressure (AngloGold Ashanti, 2010:59).

This paper seeks to analyse the impact that the carbon tax will have on the gold mining industry of South Africa.

1.2 PROBLEM STATEMENT

National Treasury is proposing that the carbon tax be implemented on 1 January 2015 (National Treasury, 2013a)

With the rise in electricity costs and this additional carbon tax, the gold mining industry will be under a lot of pressure (AngloGold Ashanti, 2010:59). The aim is therefore illustrate the possible financial impact the proposed carbon tax may have on one of South Africa's largest gold mining company.

1.3 RESEARCH OBJECTIVES / RESEARCH QUESTIONS

The study will be led by the following specific research objectives:

- To compare the proposed South African carbon tax to the carbon tax implemented in Australia. Australia has been chosen as comparable as AngloGold Ashanti has operations in Australia and Australia has a large gold mining industry.
- To determine the potential impact on mining companies in terms of cost in South Africa.

1.4 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

The importance and benefits of this study is to enable government to further investigate and make informed decisions in relation to the implementation of the carbon tax and the effect it will have on the mining industry and in effect the South African economy as a whole.

This document will discuss what climate change is and the effect it has on the earth. It will investigate exactly how the carbon tax would influence the emissions of GHGs as well as the mining industry and the effect the carbon tax will have on it, if any.

1.5 DELIMITATIONS

This study is an explorative study. It will be exploring the impact that the proposed carbon emissions tax will have on the gold mining industry as well the impact on a sample of large corporations.

To arrive at certain conclusions, the carbon tax and its effects on gold mining industries in developed and developing countries will be considered.

1.6 ASSUMPTIONS

The assumptions on which this study are based on are as follows:

- The financial information used can be relied upon.
- The voluntary disclosure of CO_2 emissions by the Johannesburg Stock Exchange (JSE) listed corporation is complete and reliable.

1.7 DEFINITION OF KEY TERMS

This study contains a number of key terms, namely *carbon dioxide equivalent*, *carbon emissions tax*, *global warming* and *price takers* amongst others. These definitions are very specific and are quoted directly from the source.

For the purpose of this study these terms are defined as follows:

Carbon dioxide equivalent – "a metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential. Carbon dioxide equivalents are commonly expressed as "million metric tons of carbon dioxide equivalents (MMTCO²Eq)". "The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated global warming potential" (http://www.epa.gov/climatechange/glossary.html). [Accessed: 2013-04-05].

Carbon Emissions Tax – "A Carbon Emissions Tax is an environmental tax applied to the burning of fossil fuels in order to discourage the production of greenhouse gas emissions such as carbon dioxide" (http://www.ecolife.com/define/carbon-tax.html). [Accessed: 2013-04-05]

Climate change – "Climate change is the long-term shift in weather patterns in a specific region or globally. Unlike global warming, which refers to just one aspect of climate change

- a rise in the surface temperature of the earth's surface – climate change refers to changes in a region's overall weather patterns, including precipitation, temperatures, cloud cover, and so on" (http://www.ecolife.com /define/climate-change.html).

Global warming – The U.S. Environmental Protection Agency defines global warming as "an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities" (http://www. definitionofglobalwarming.com/)

Greenhouse gas – A greenhouse gas (GHG) is a gas that absorbs and releases radiation within our atmosphere. While greenhouse gases allow the sun's energy to enter the atmosphere, instead of letting it re-radiate back into space as infrared radiation, these gasses absorb infrared radiation and trap it in the atmosphere. This is called the greenhouse effect and is the primary contribution humans are making to climate change (http://www.ecolife.com/define/greenhouse-gas.html).

Kyoto Protocol – "The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1977 and came into force 16 February 2005. The Kyoto Protocol is an internal agreement linked to the UNFCCC. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European community for the reduction of GHG emissions" (Odeku & Meyer, 2010). (http://unfccc.int/kyoto_protocol/items/2830.php)

Price taker – A market - such as a company or group of consumers - that is not significant enough to influence the price of a good or service. The market must accept the prevailing price because there is typically an insufficient competitive environment to influence supply. (http://www.businessdictionary.com/definition/price-taker.html)

Price maker – an individual or company which is influential enough to affect the price of an item. Someone who holds a large majority of a stock would likely affect the price of the stock if they bought or sold it. The term is most often applied to companies, specifically

those who have a monopoly in their market, and are therefore able to choose and demand a specific price for their goods. Companies or individuals can exert varying degrees of influence, so it is not always easy to classify someone as a price maker opposed to a price taker. (http://www.investorwords.com/6888/price_maker.html)

Social license- The 'social licence to operate' is a practitioner term used in the Australian mining industry and is parallel to the theoretical notion of the 'social contract', which encapsulates society's current expectations (Deegan, 2006, 2007a in Pellegrino & Lodhia, 2012).

Tax incentive– Deduction, exclusion, or exemption from a tax liability, offered as an enticement to engage in a specified activity (such as investment in capital goods) for a certain period (http://www.businessdictionary.com/definition/tax-incentive.html).

UNFCCC – The United Nations Framework Convention on Climate Change is an organisation that sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other GHGs. The Convention came into force on 21 March 1994.

1.8 RESEARCH DESIGN AND METHODS

1.8.1 Description of inquiry strategy and broad research design

This study will consist of a combination of empirical and non-empirical research.

A qualitative research method is used in this research proposal because of the type of investigation that will be conducted in order to determine whether this is a feasible study.

The aim of this qualitative research will be to conduct research by means of a case study that will be based on the impact of carbon tax on the gold mining industry in South Africa.

Baxter and Jack (2008:1) refers to a qualitative case study as a research approach that helps in exploring a phenomenon within the set of facts or circumstances that surround a situation or event using different sources of data.

A case study is the obtaining and presenting of comprehensive information concerning a specific person or small group. A case study often includes the record or narrative description of past events by the focus parties themselves. It is a qualitative descriptive research method which observes the individual or group and draws conclusions about the individual or group that was studied and only in the context in which it was studied (Becker, Dawson, Devine, Hannum, Hill, Leydens, Matuskevich, Traver, & Palmquist, 1994-2012:1).

Obwalaju (2012) in Adesina (nd) further states that when doing a case study one is required separate and consider the crucial issues against the theoretical aspects as well as the bigger comparative environment. You are also required to find a suitable strategy for the solution of the case by weighing the advantages and disadvantages of the proposals and advise and give reasons for the best solution.

Since this study is about a particular industry, i.e. the gold mining industry, it would make sense to do a case study as the researcher would need to intensively investigate the gold mining industry and draw conclusions only about that industry and in that specific context.

1.8.2 Characteristics of a case study

According to Wills (2007:13) a case study possesses the following characteristics):

- The focus is on a particular context such as one person, an office, a company or a building.
- The focus is on real events.
- Case studies have descriptive data.
- Case studies rely on logical reasoning.

- Case studies enlighten understanding of the researchers regarding the phenomenon that has been studied. It can add to it the finding of fresh meanings or experiences, or it can validate what the researcher already knows.

1.8.3 Data collection

The data collection of this study will mostly be qualitative consisting of the research of literature that relates to carbon tax in the gold mining industry.

The following approaches/methods will be used to collect the data required:

- Acquiring secondary data which will include both raw and published data
- Analysing the content of documents through content analysis

The secondary data collected can further be analysed to provide additional or different knowledge, interpretations or conclusions (Bulmer et al., 2009 in Saunders, 2012). Data types will include the use of Anglo Gold Ashanti's financial statement, sustainability reports as well as carbon emissions disclosed as part of the carbon disclosure project.

1.8.4 Assessing and demonstrating the quality and rigour of the proposed research design

In assessing and demonstrating the quality and rigour of the proposed research design one should provide answers to two generic questions. Firstly, which sources of bias or error could influence the research findings? And secondly, which specific criteria and techniques will be used to provide evidence for the quality, credibility and rigour (e.g., the reliability and validity) of the research effort?

There are a few factors which could potentially distort the research findings. These include but are not limited to:

- provided data that were inaccurate or have changed significantly since the last audit of the financial data.
- a restriction on the data that are needed to conduct the case study.

- the complexity of data that relate to the technical sections. If these are too complex to understand, then the data could be interpreted incorrectly.
- data recorded incorrectly on purpose, known as deliberate distortion.
- changes in the way that the data was collected.

From the above it is clear that there is a possibility that the research findings could be distorted. The following can be done to ensure that data distortion is minimised:

- All the data collected must be from a reliable source.
- The financial statements must be audited and signed off.

1.8.5 Research ethics

The case study is based on one of South Africa's leading gold company, AngloGold Ashanti. The information used in the research is information that has been publically released and therefore is not confidential in nature. As a result it is not required to obtain permission from the company in question.

1.9 BRIEF OVERVIEW OF CHAPTERS

This study consists of five chapters. Chapter 1 gives a broad background on the overall study. Chapter 2 is a literature review, which provides more detail on climate change and its effects as well as carbon tax. Chapter 3 is a practical case study based on one of South Africa's leading gold mining companies. Chapter 4 deals with comparison within a South African context and that of Australia. Chapter 5 provides the conclusions that are reached based on the case study and literature review.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Before one can debate the need for carbon tax and its effects, it is important to understand what climate change is and the effect it has on the earth. What are these GHGs that everyone is talking about, what is all the excitement about and is its reduction really necessary? In this chapter we will be discussing exactly that as well as the carbon tax and its effects on the mining industry.

2.2 CLIMATE CHANGE

The Oxford dictionary defines climate change as change within the earth's weather being understood as temperature, wind patterns and rainfall and the temperature of the earth's atmosphere, caused by increase of particular gases, especially the increase of carbon dioxide.

In recent decades trends have shown the average temperature on the planet to be constantly increasing. This constant increase in temperature is associated with more extreme and unpredictable weather across the world than before. As a result some places are experiencing temperatures which reach new and extreme levels, with some places getting hotter, some colder, some wetter and others drier than usual (WWF, not dated).

The increase in the temperature of earth is largely regarded as global warming. The U.S. Environmental Protection Agency consider global warming to be a standard increase in the temperature of the atmosphere close or closest to the earth’s surface as well as in the troposphere, all of which have proven to add to alterations in global climate patterns. There are various causes of global warming. These include both natural and human induced global warming. Global warming is commonly referred to as a rise in temperature

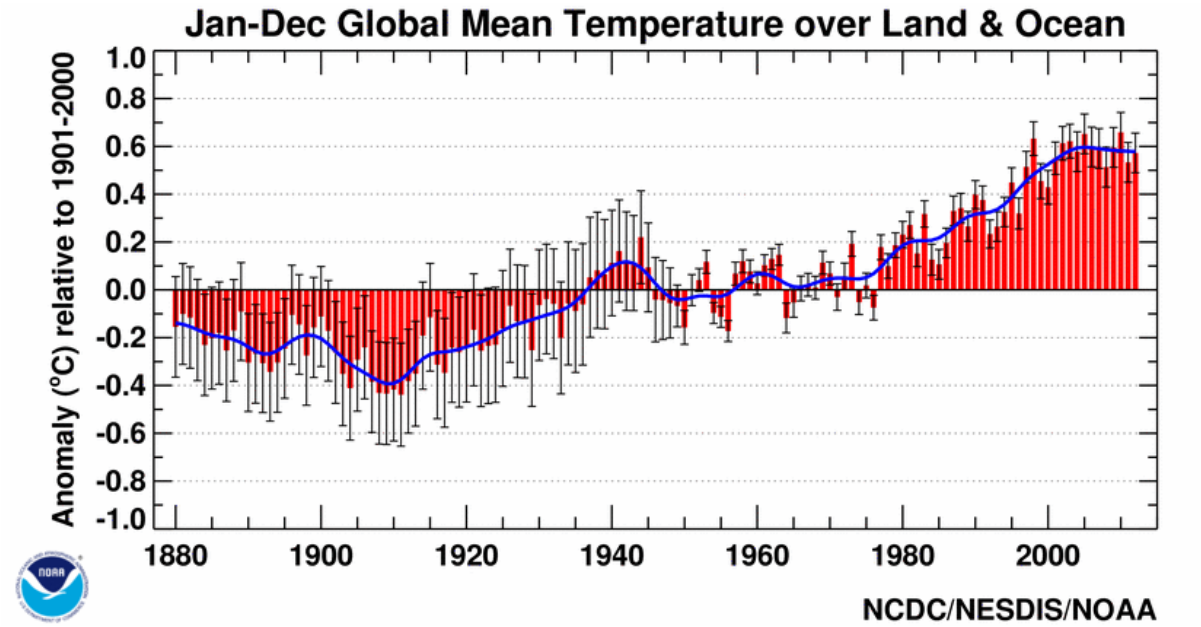
that can take place as a consequence of the increasing production of greenhouse gas emissions from the actions of man (http://www. definitionofglobalwarming.com/).

Climate change is therefore the quantifiable effects of that constant warming of the earth's temperatures. Ways to measure climate change include the following weather patterns which last for decades or more.

- major shifts in temperature,
- rainfall,
- snow, and
- wind patterns

In Figure 1 (NOAA, undated) below the yearly movement in average global air temperature measured in degrees Celsius from 1880 to December 2012 is indicated. In the figure the grey vertical bars point out the range of precariousness whilst the blue line indicates the trajectory of weather changes over time.

Figure 1: Global average temperature since 1880



Source: Adapted from Statistics South Africa (2002:34).

There are two categories of factors which cause climate change: those related to natural processes and factors related to human activity. Changes internal to the climate system,

for instance changes in ocean currents or perhaps atmospheric circulation, along with natural causes of climate change have a strong influence in the climate for short periods of time. This short-term natural internal climate sporadic fluctuation is superimposed on the long-term forced climate change (Canada's Action on Climate Change, not dated).

2.3 THE EFFECTS OF CLIMATE CHANGE

The effects of global warming will be disastrous. The effects include the accelerated rise in sea levels, shortages in rainfall causing drought, floods caused by too much rain, tornados, hurricanes, rainstorms and a wave of unusually hot weather. The effects of global warming has an impact on the whole world, together with some of the world's poorest and most vulnerable people, causing disruptions in the production of food, and endangering vitally important species, habitats and ecosystems (WWF, not dated).

GHGs, such as carbon dioxide, ensnares heat in the atmosphere and normalise our climate. These GHGs exist naturally, on the other hand as human beings, by burning fossil fuels such as coal, oil and natural gas for energy as well as by cutting down forests we have been adding even more carbon dioxide ($CO_{2)}$ into the earths' atmosphere. CO_2 is absorbed and removed from the atmosphere by forests. As a result those areas that undergo excessive deforestation are experiencing higher carbon emissions (WWF, nd).

The second largest GHG emitter after fossil fuels is agriculture. Other major sources of GHGs are methane from livestock, compost management, the burning of flat grassland in tropical or subtropical regions, as well as the transformation of forests to grazing land (earth hour, not dated)

Since more GHGs are trapping an increased amount of heat, the worlds' average temperatures have been increasing. The world's seas are also simultaneously absorbing some of this extra carbon dioxide that is being emitted, thereby making the oceans more acidic and less receptive for sea life (WWF, nd).

A tendency of increased heat in the earth's temperatures has been indicated together with increased amounts of moisture. Even though some places, particularly the Arctic, are

warming more rapidly than other places, the average temperature of the world surface has gone up almost one degree Fahrenheit in the past forty years. In 2010 the average surface temperature was 58.12°F, which is the same temperature as the highest recorded temperature in 2005 (Miller, 2012:41).

Satellites have calculated a four percent average increase in water vapour in the air column during the past 25 years. The more water vapour there is, the larger the potential for extreme rainfalls. Evidence suggests that the average world temperature may rise anywhere from three to eight degrees Fahrenheit by the end of the century, which depends on the amount of carbon that is emitted between now and then (Miller, 2012:41).

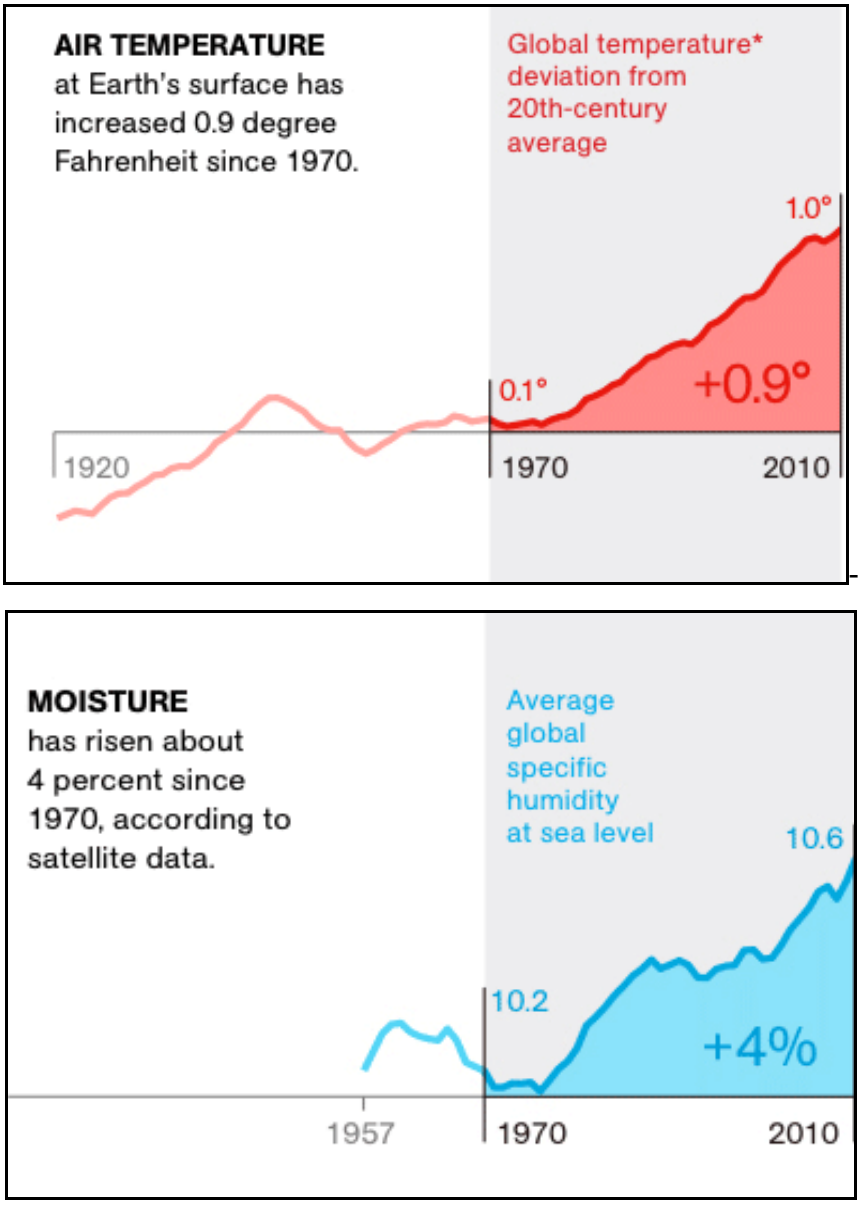
Scientists are unsure what the effects of global warming may be when it comes to individual storms. Extra water vapour in the atmosphere pumps the heat into huge storms such as hurricanes and typhoons, adding buoyancy that causes them to grow in size and power. Predictions are that because of global warming the average intensity of hurricanes and typhoons could be increased by two to eleven percent by 2100 (Miller, 2012:48)

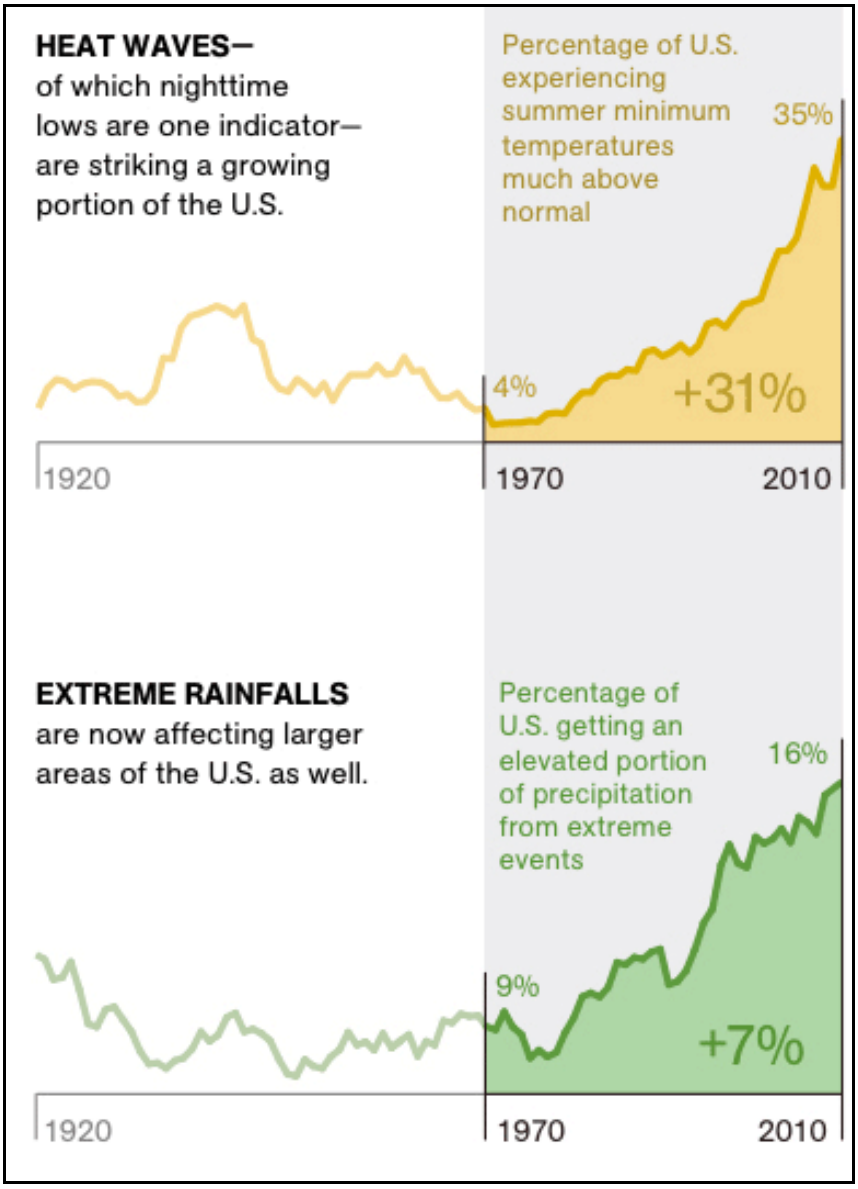
In order for global warming to be better managed, the earth's increase in global average temperatures needs to be kept below 2°C (3.4°F) compared to pre-industrial times. There is currently a host of technologies which are accessible and which can assist in curbing and controlling global warming. It is possible that by the year 2050, all energy sources could be obtained from renewable sources. If achieved, this will resolve the majority of the climate change problems and declining fossil fuel resources. There is also a need to increase steps to save energy in all sectors (WWF, nd).

With earth's atmosphere getting warmer and wetter there is an increased chance of heat waves, heavy rains and possibly other extreme weather conditions.

Figure 2 below highlights the change in air temperature, moisture, heat waves and extreme rainfalls as a result of climate change (Miller, 2012).

Figure 2: Change in Air temperature, Moisture, Heat waves and Extreme rainfalls





Source: National Geographic, 222(3): 30-53

The figure illustrates the following changes over a period of four decades from 1970 to 2010:

- The air temperature at the earth's surface rose nearly one degree Fahrenheit.
- According to satellite data the moisture rose about four percent.
- In the United States of America (USA) about 35 percent of the country is experiencing summers that are far above the normal temperatures.
- Sixteen percent of the USA is experiencing extreme rainfalls.

From the above it is clear that for the past forty years the earth's atmosphere has become warmer and wetter causing increased chances of heat waves, heavy raining as well as other extreme weather. As the water vapour increases, so does the risk of potential intense rainfalls.

Stern (2006) indicates that global warming will have a big impact on everyone. The different effects, of which a great deal is as a result of water, is discussed below:

- Due to the earth's temperature heating, ice floes will start to melt. At the beginning this will increase the risk of flooding, after which the supply of water will significantly be reduced. In the end a portion of the world's inhabitants will be threatened by drought.
- Should the earth's temperatures rise by 4°C and more the amount of food produced across world will severely be affected. A decrease in amount of crop harvested per unit of land area could leave many of the world's population without the means the produce or buy adequate amounts of food.
- In places at high latitudes where death is usually as a result of extreme cold weather, deaths will decline. However the change in climate will result in escalated global death rates because people will die from malnutrition and heat strokes. More and more people are at risk of getting malaria and dengue fever if proper control measures are not put in place and the diseases become widely spread.
- If temperatures increase by 3 or 4°C the rise in sea levels will lead to between ten to a hundred million more individuals being flooded each year .It is estimated that by the middle of the century, 200 million individuals might come to be permanently displaced as a result of the rise in sea levels, heavier floods, and more intense droughts.
- After only 2°C of increase in temperatures approximately 15 to 40 percent of species face potential extinction as the ecosystem will on the whole be vulnerable to the changes in earth's temperatures. The rise in carbon dioxide levels is a direct cause of the ocean becoming acidic this will have a huge impact on marine ecosystems, with possible adverse effects on fish stocks (Stern, 2006).

2.4 SOUTH AFRICA'S GREENHOUSE GAS EMISSIONS PROFILE

South Africa's economy is currently energy intensive. Fossil fuels account for more than 90 percent of the main energy demand, coal accounts for a total of 75 percent of total fossil fuel demand and a total of 93 percent of electricity generation. During 2004 South Africa's carbon emissions amounted to approximately 387 million metric tons of CO_2, amounting to just below half of the CO_2 emissions for the whole of Africa and approximately 1.6 percent of world-wide emissions. This made South Africa the twelfth largest emitter of CO_2 in the world. The per capita emission of South Africa is approximately 10 tons CO_2e (UNEP, 2004).

Because South Africa's economy is still growing, the CO_2 emissions will increase as these developments are pursued by the country. In South Africa, production activities use large amounts of coal or electricity. Together with the transportation sector these two sectors generate the highest emissions of carbon dioxide. South Africa relies greatly on coal as an input, and consequently the power sector, which accounts for 48 percent of total CO_2 emissions, is the largest emitter of CO_2 in South Africa. Metallic products use coal to fire up furnaces, emitting approximately 22 percent of the total CO_2 emissions. The transportation sector together with the usage of petroleum by households accounts for 10.5 percent of total CO_2 emissions emitted. Other sectors which also contribute to the GHGs emitted is the chemical industry, rubber industry, water supply industry, as well as other mining and food manufacturing sectors.(National Treasury, 2010).

The main GHGs produced within South Africa are

- carbon dioxide (CO_2) at 79 %,
- methane (CH_4) at 16%,
- nitrous oxide (N_2O) at 5%and
- perfluorocarbons at 1 % (PFCs).

According to the National Treasury the total GHG emissions produced during the period between 1994 and 2009 went from 380 million tons in 1994 to 547 million tons in 2009 (National Treasury, 2013b:13).

The Climate Policy Paper issued during 2013 provided that Scope 1 emissions will be addressed by the proposed carbon tax. Scope 1 emissions result directly from the burning of fuel and from the process of turning the fuel into gas, as well as from manufacturing processes that do not use energy. Examples of scope 1 emissions are carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons and sulfur hexafluoride.

Table 1 summarises the different processes that generate Scope 1 emissions, the energy inputs, and the type of GHG emitted. It is very important to know what type of GHGs the sectors of processes emit as this will assist government as well as companies in decreasing their carbon footprint. Companies will also know which emissions group they emit, i.e. scope 1 or 2.

Table 1: Description of Scope 1 emissions from different processes and sectors

Process or sector	Energy inputs	Type of GHG	Description
Electricity generation	Coal, natural gas, petroleum products (e.g. diesel), renewable fuels	CO_2CH4	Fuel inputs are used to generate heat or steam in order to power boilers and turbines that generate electricity.
Coal and gas to liquid (gasification)	Coal, natural gas, crude oil, diesel	CO_2, CH4	Gas preparation in the coal-to-liquid process. Coal is converted to synthesis gas consisting of hydrogen and carbon monoxide, as feedstock into the Fischer-Tropsch process. The hydrogen-to-carbon ratio is adjusted by injecting carbon in the form of carbon dioxide.
Crude oil refining	Crude oil	CO_2	Direct emissions result from fired steam boilers, fired process heaters and catalytic cracking unit regeneration.
Mining	Electricity, coal	CO_2CH4	Surface mining and underground mining activities result in methane emissions.
Cement	Coal, electricity, limestone or calcium carbonate	CO_2	Process emissions result from the calcination of calcium carbonate to calcium oxide, which produces CO2 as a by-product and clinker production emissions.
Paper and pulp	Coal, gas, oil, biomass	CO_2	Direct process emissions derive from coal and gas-fired boilers used for electricity generation. Oil is used in the start-up phase. Biomass-based renewable fuel is combined with coal to generate electricity where the renewable fuel (e.g. black liquor) is deemed to be a

			waste product from the paper and pulp process.
Iron and steel	Coal, natural gas, electricity, liquid fuels	CO_2	Process emissions due to the production of iron and steel as follows: • Integrated or coal-based production route comprising coke making, sinter, blast furnace and basic oxygen furnace facilities • Coal-based direct reduction facilities where the main inputs are coal and electricity; here the primary role of coal is that of a reductant • Emissions from the recovery of waste metal. Direct use of electricity as an input in electric arc furnace operations where scrap metal is recycled.
Aluminium	Liquefied petroleum gas, low sulphur oil, diesel, petrol and electricity	CO_2,PFCs	Process emissions from melting primary and scrap aluminium, heating of ingots for hot rolling, and homogenising and annealing of metal in the process.
Chemicals		CO_2, N2O, CH4	Direct process emissions from: • Calcium carbide production ○ Carbon black formation ○ Titanium dioxide production ○ Ammonia production ○ • Nitric acid production.
Glass	Natural gas, electricity, liquid fuels	CO_2	Direct emissions from: • Processes at glass melting furnaces for melting raw materials, glass conditioning, container-forming machines, and glass annealing • Flat glass manufacture for glass melting • Decomposition of soda ash, dolomite and limestone. CO_2 emissions from natural gas used to produce electricity.
Transport	Diesel, petrol, compressed natural gas, aviation fuel, electricity	CO_2, CH4	Combustion of fuels used in vehicles, aircraft and railways.
Agriculture, forestry and land use		CO_2, CH4, N2O	Direct emissions resulting from specific processes, as well as net emissions arising from agriculture, forestry and land-use related activities. These include enteric

			fermentation, manure management and land use (forest land and cropland).
Waste		CO_2, CH4, N2O	Emissions arising from solid waste disposal, biological treatment of solid waste, incineration and open burning of waste, wastewater treatment or discharge. The treatment of wastewater from domestic, commercial and industrial sources contributes to anthropogenic emissions of methane and nitrous oxide.

Source: DEAT (2009); and responses to the list of questions circulated by the National Treasury in August 2011.

As indicated in the table above the electricity sector emits both carbon dioxide and methane. The energy inputs used to produce heat or steam in order to power the boilers and turbines that generate electricity are coal, natural gas, diesel and renewable fuels.

Besides the high usage of electricity, mining companies also produce methane which is a scope 1 emission.

2.5 CARBON EMMISSIONS TAX

At the 2009 Copenhagen climate change negotiations meeting South Africa voluntarily announced that it intends reducing domestic GHG emissions by 34 percent by the year 2020 and 42 percent by 2025, depending on the availability of sufficient financial, technological and other support (National Treasury, 2010).

The South African government is planning to introduce a price on carbon as part of its attempts to alleviate the results of the change in climate. A price will be set on external overheads associated with the emanation of CO_2 and some type of incentive will be ontroduced that will encourage the change in activities as well as ways of becoming more energy efficient.

The government proposes that the carbon tax will be introduced over a period of time using a phased approach (National Treasury, 2010).

Placing a price on carbon can cause alterations in the activities of producers and consumers, and in doing so also address climate change:

- Firstly, by changing the proportional costs of goods and services based on how intensive the emissions of providing those goods and services are, and by promoting the usage of economical options that are less carbon intensive, the price of carbon will spur on a change in production practices towards lower carbon and technology that is more energy-efficient.
- Secondly, by replacing the carbon-intensive factors of production with products and services with low-carbon-emitting alternatives.
- Thirdly, there will be incentives provided for studies, investigations as well as development and technological inventions aimed at new low carbon alternatives. This will assist in reducing the price difference between conventional, carbon-intensive technologies and low-carbon alternatives (National Treasury, 2013b:8).

Although the carbon tax will assist in changing the behaviour of consumers and producers there are two key things to consider in engineering environmentally related taxes, such as the impact that the carbon tax will have on households with low incomes and the impact on the competitiveness of industries. The outcome that the carbon tax will have on households will probably filter through to increased prices in energy transportation, fuel and electricity. The degree of the effect on the competitiveness of local firms will be influenced by:

- the type products sold;
- the market of the products; and
- whether the seller or service providers set their own prices or if prices are determined by other factors out of their control, i.e. price takers in the international market (National Treasury, 2013b:14).

Due to setting of various national GHG emission reductions targets and the different types of policies adopted globally, carbon taxation around the globe will vary.

Carbon leakage is the event of reduction of GHGs in a country or district directly causing increased GHGs in another. Carbon leakage occurs when one country puts a price on

carbon emissions either via a carbon tax, cap-and-trade system or both. The price put on carbon provides encouragement for a company to move and continue its production in another country where that additional cost either does not exist or is lower. This shift of production drives productivity, jobs and GHG emissions to areas where there is a lower or no fee on carbon emissions (Peart, 2010:2). Effectively this would decrease the GHG emissions in the country where the carbon price was imposed and increase the GHG emissions where no or a very low carbon price was imposed.

Carbon leakage could take place as some countries do not take active steps to reduce their carbon footprint.. As a result it has been indicated that certain measures or sanctions will be put in place, such as an additional tax imposed on exports of countries that make no effort to diminish their carbon production. It is possible that customers will start utilising goods and services that are produced by means of methods that are environmentally friendly even though sanctions may not be enforced. (National Treasury, 2013b:43).

There may be a reduction in the demand of exportations for South Africa. The imposition of a price on carbon will warrant that the goods exported from South Africa are to a lesser extent carbon concentrated, therefore averting retaliation trade and the actions of customers.

The introduction of Border Carbon Adjustments (BCAs) is being considered by some developing countries, meaning that should goods and services that are carbon intensive be imported into the country from countries which do not have any carbon mitigation plan or any carbon taxes in place, an increased import duty will be charged on those goods and services. (National Treasury, 2013b:59).

BCAs are changes made to the prices of products based on the computation of the amount of GHGs that the goods embody. One can apply these changes as a tariff when the goods are imported or as a rebate off the initial cost when goods are exported. This is very important in dealing with carbon leakage as well the decline in competiveness that can be caused as a result of placing a price of carbon. (Vivid Economics, 2012: 8)

A price on carbon should preferably reflect the marginal external damage costs relating to the emission of carbon. The range of carbon prices that are needed to attain the sought after level of reductions in emissions goes from an estimated US$8 to more than US$300 (National Treasury, 2013b:9).

During the 2013 Budget speech the Finance minister Pravin Gordhan announced that from the year 2015 to 2020, which will be the initial phase of the execution of the proposed carbon tax, there will be a basic tax-free threshold of 60 percent. In addition to this, there will be offset percentages of five to ten percent which will be granted to industries who are emission-intensive and trade-exposed in order for them to invest in tasks that are not part of their day-to-day operations to assist in reducing their carbon tax obligations (National Treasury, 2013a).

The proposed carbon tax will become effective from 1 January 2015 at a rate of R120 per ton of CO_2 equivalent (t CO^2-e). The carbon tax rate will increase by ten percent annually during the initial phase of implementation (National Treasury, 2013a, 2013b).

The energy-efficiency savings tax benefit will help organisations to decrease their energy intensity and the country's level of CO_2 emissions. Some of the revenues yielded through the carbon tax will be used to support the energy-efficiency savings tax incentive.

On 2 May 2013 Treasury published the Carbon tax policy paper (Policy paper) for comment. When developing the policy paper government considered the following as key:

- Implementation of the carbon tax should be technically and administratively practical.
- Eventually the rate of the tax charged should equal to the marginal cost of external damage caused by the emission of the GHGs. There is currently no global agreement on climate change as well as no global price set for GHGs emitted. As a result South Africa's carbon tax rate will be fairly modest during the initial phase.
- During the transition period certain thresholds which will have no tax implications as well as offsets, up to 90 percent maximum, will be introduced. The aim of this is to assist with a smooth transition from a no carbon tax environment to one with carbon tax. At the same time these thresholds will decrease any adverse effect that the tax

may have on the competitiveness of local entities as well as ease the load of the tax on the individual.

- The income received from carbon tax may be recycled by making use of tax swaps. Also to be looked at is funding for certain green projects. This ought to lessen the effect that the carbon tax will have on poor households with low incomes The green projects that may obtain funding include, but are not limited to:
    - projects that encourage or promote the efficient use of energy,
    - alternative energy,
    - public transport and
    - other green economy measures.

There are three different tax bases that may be used for the implementation of a carbon tax. These three bases are set out below:

- The tax levied directly on the amount of CO_2 emitted
- Fossil fuel input tax on coal crude oil and natural gas, based on their carbon contents)
- Tax levied on energy outputs such as electricity and transport fuels (Treasury, 2010).

From the three options mentioned above it may seem best to charge the tax directly on the GHG or CO_2 equivalents actually emitted: this however seems to cause some degree of administrative complexity.

After consulting extensively, the National Treasury prefers the use of a fuel input tax as a tax base. As opposed to the direct emissions tax base, the fuel input tax based emission factors and/or processes are obtainable to enable the quantification of CO_2 equivalent releases with a very high degree of accuracy for the different types of industries and processes.

The most suitable emissions factors and processes will be approved by the Department of Environmental Affairs (DEA) to be consistent with information that has been internationally released by the Intergovernmental Panel on Climate Change (IPCC). The DEA will also,

according to the 2011 White Paper, make it compulsory for companies and installations that emit more than 100 000 tons of GHGs per annum or whose electricity usage results in excess of 100 000 tons of emissions from the electricity sector, to report on their GHGs emitted (National Treasury, 2013b).

2.6 GOLD MINING

2.6.1 Gold as a commodity

In South Africa the gold-bearing ore is extracted from underground mines, some of which are amongst the deepest mines in the world (Vosloo, undated). Once the ore is brought to the surface, the processing stages are determined by the grade of the ore. Low-grade ores are subjected to heap leaching, in which large amounts of crushed ore is treated with diluted cyanide. This dissolves the gold which is collected as it percolates from the bottom of the heap. Ore with a greater gold content go through more vigorous treatment by one of several processes involving chemical, thermal and/or mechanical treatment, but which also ultimately rely on cyanide extraction of the gold. Gold from either process is removed from the cyanide by activated carbon. It is then chemically redissolved from the carbon, forming a fluid from which the gold can be solidified by either electrolytic or chemical processes. Melting and casting of this gold produces Doré bars of raw gold. These are typically purified at specialist refineries to reach high purity (AngloGold Ashanti, 2010).

Over 90% of the energy required for gold mining in made up of electricity, with large demands for the provision of compressed air, ventilation, pumping and haulage in deep mines, and for the operation of processing equipment (Green House, 2012).

Due to the declining ore grades and deeper mines, the energy intensity of South African gold production has quadrupled since the 1970s, and as a result gold mines in South Africa are among the largest users of electricity in the country, according to the Department of Energy (DoE, 2010).

South African production of gold is dominated by Gold Fields, AngloGold Ashanti and Harmony Gold (DMR, 2010). A total of 188.7 tonnes of gold was produced in South Africa

(DMR, 2012), having declined steadily by more than 50% over the last decade. Of this production, 96% was exported with a value of R51 billion.

2.6.2 The gold mining industry

In 1970 South Africa's gold output was at its highest and it was at one stage the leading producer of gold in the world, supplying 62 percent, amounting to 1000 tons, of all the gold mined in the world. Between the years 1975 and 1992, the country on a reasonably constant basis produced about 600 to 700 tons of gold a year, declining slightly over time (Sergeant, 2013)

From 1993 production fell severely. South Africa's gold output has dropped from 600 tons of gold per year to barely 100 tons per year over the past 20 years. The serious labour conflict has been part of the country's gold mining scene for a very long time (Sergeant, 2013).

The gold sector used to employ about 500 000 workers prior to the strikes which occurred during 1990 and 1991. The amount of workers fell very quickly during the strikes leaving only 400 000 workers. There is currently around 100 000 miners still at work in South Africa (Sergeant, 2013).

It is estimated that the mining and metals sector globally contributes to approximately two percent of global emissions. Nearly half of the emissions of the industry are due to fuel used for mining and processing operations, for transporting the ore and for generating electricity at faraway sites and from fugitive emissions, known as Scope 1 emissions. The other half is from electricity usage, mainly in operations where the ore is refined and smelted; these are known as Scope 2 emissions. There is a wide range of different technical approaches to extracting and processing resources depending on the kind of resource, the locality of the resource and whether the electricity grid is accessible as well as the fuel mix of the electricity grid. Because of this there will be a different GHG profile for each site (ICMM, 2012:3).f

In the same way changes in the ore grades and the characteristics are important in determining the energy profile of a mine. The factors that need to be considered are how deep the ore body is, what the magnitude of the mine is and how widely dispersed the mineralised system is and the planned rate at which the minerals are produced. (ICMM, 2012:3).

The factors mentioned above add to the energy needed and the related GHG emissions per kilogram of mineral and metal extracted and processed. One driver towards energy efficiency in the metals and mining sector is the decrease of GHG emissions. (ICMM, 2012:3).

Because there is a variety of energy and emissions profiles throughout different mine sites, it is difficult to make sector-wide assessments. In other industries there are standard approached that are taken to report emissions. (ICMM, 2012:3).

The mining sector in South Africa has been subject to various environmental laws to assist in reducing the impact of mining on the environment. The impact of mining on the environment has been monitored by the South African government for at least 40 years. The Atmospheric Pollution Prevention Act (APPA) has regulated the emissions from mining and mineral processing activities since 1965. In 1994 the National Water Act, National Services Act, the National Environmental Management Act and the Local Government: Municipal Demarcation Act came into effect. All this is entrenched by Section 24 of the Constitution of South Africa, which does not prevent any social or economic development but rather preserves the right of every generation to an environment that is not detrimental to their health or their wellbeing, an environment that is protect through reasonable measures that prevent the degradation and pollution of South Africa’s natural resources.

In a study done by Deloitte in 2012 it was estimated that the greatest carbon tax liability initially will be that of Eskom (R11 billion), Sasol (R2.2 billion), ArcelorMittal SA (R285 million), PPC (R115 million) and BHP Billiton (74 million).

Andre Gilder, senior associate in law firm Edward Nathan Sonnenbergs environment department states that during the 2012/2013 Budget comment it was noticed that carbon tax was not directly aimed at the mining industry. Even though it looks as if there is no direct carbon tax on it, there will be an indirect impact on the industry. The total cost of tax will be passed on to electricity users as indicated by Eskom.

The mining industry accounts for 15 percent of the electricity produced by Eskom (Thomas, 2013:8)

Table 2 below shows the carbon intensity of the Johannesburg Stock Exchange's top 100 companies. From the table it is clear that the mining sector emits on average 264 t CO^2 per R1 million revenue earned.

Table 2: JSE top 100 companies Carbon intensity

CARBON INTENSITY			
JSE top 100 companies			
	tons CO^2 per R1m revenue		
Sector	Average	Highest	Lowest
Gold mining	264	454	99
General mining	150	235	45
Platinum mining	147	189	128
Paper	146	161	130
Food producers	96	167	25
Construction and material	39	43	35
Business support services	14	17	11
		SOURCE: TRUCOST	

Source: Financial mail, 2013(4):39.

According to Robie Louw the carbon tax will initially have a nonsensically small impact on the cost of electricity as the 3.5c/kWh levy on non-renewable energy will be removed. In comparison to the carbon tax of R48/t of CO_2 initially payable by Eskom, the levy will equal

R35/t of CO_2. Therefore meaning that the rise in the price of electricity will be approximately two percent which is for the most 1.3c/kWh, (Thomas, 2013 (4):39)

During 2012 Australia, one of South Africa's biggest mining competitors, introduced a carbon tax at AUD23/t (approximately R210) on companies emitting over 25 000 tons of CO_2 per year.

2.6.3 Electricity usage in the mining industry

The gold mining sector is arguing that it will not able to absorb a 21 percent increment in the price of electricity, neither will it be able to absorb the costs should it increase two-fold in 2017 to 2018 (Sergeant, 2013).

Representatives of the gold mining industry argue that in spite of the reasonably strong rand gold prices over the years, about forty percent of the local gold mining industry is either breaking even or making losses when looking at total production cost inclusive of capex. Bearing in mind that majority of the capex incurred is sustaining capital expenditure which is necessary just to sustain production. Additional significant increases in the electricity cost will cause the mines, which are already only breaking even, to be pushed over their threshold and as a result mine closure and loss of jobs will be become impossible to avoid (Sergeant, 2013).

In an Ernst and Young (EY) publication, EY states that:

> "Mining and metals companies are under pressure to adopt a more sustainable approach to doing business. Climate change concerns have increased the sensitivity of projects for regulators, external stakeholders and employees. For instance, in 2012, Australia introduced carbon pricing. Though the real impact of an Australian carbon tax will not really be known for some time, it will impact industries with higher energy costs and pricing of fugitive emissions."

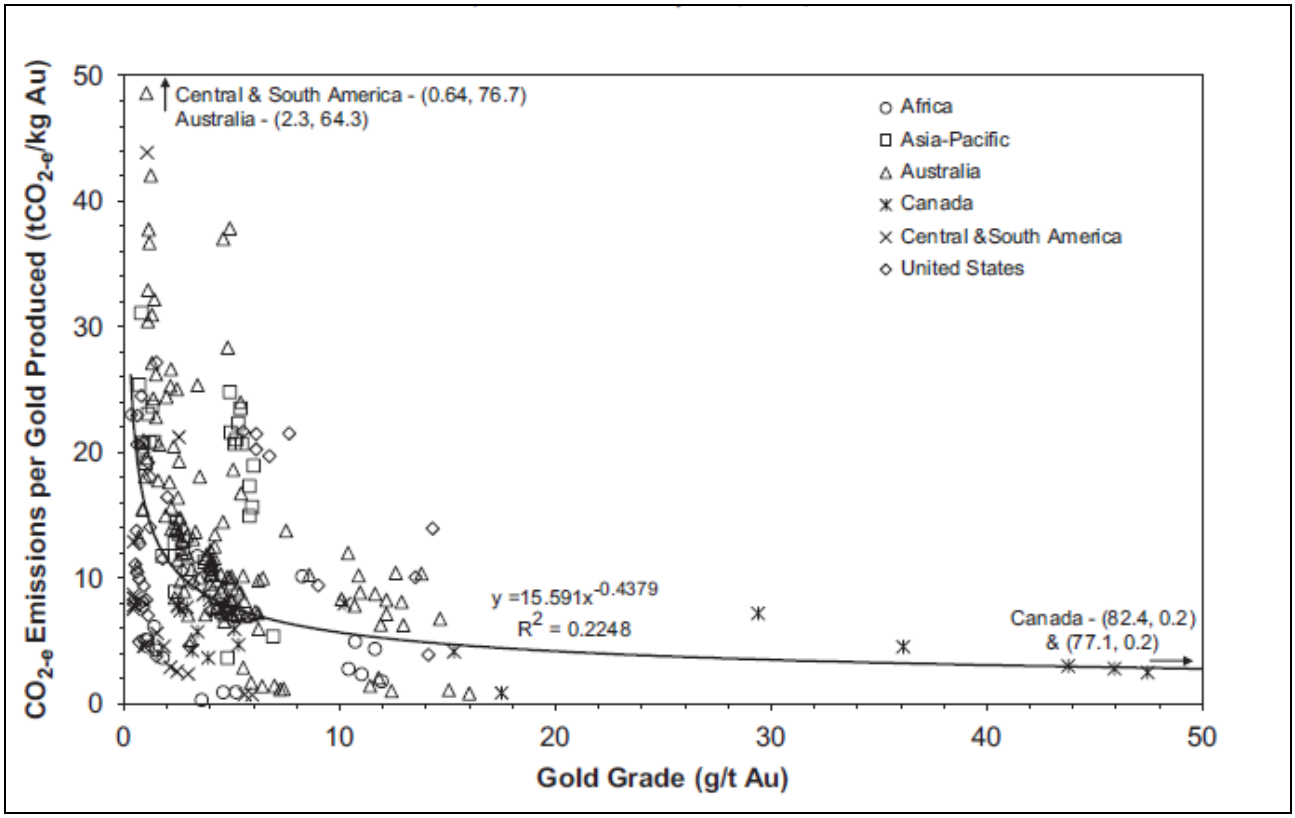
One of the key operational risks for mining companies is weather in the form of wind, floods or drought. The manner in which mining operations adapt or adjust to extreme weather conditions rising from the change in climate will come to be more and more crucial

to protecting value (EY, 2013:59). EY further states that there are issues that need to be considered which include:

- The transfer or transportation of energy and whether energy will be available for operations in remote areas.
- Health and safety of staff in extreme weather conditions
- The availability of safe and clean water for employees and for the processing of minerals.
- How plant and equipment will perform
- Foreseeing when extreme events will occur and preparation for minimum interruption of business operations.
- The financial effect that it will have on the business due to the risks associated with extreme weather conditions being uninsurable.

In gold mining the broad usage of fossil fuels, mostly diesel, leads to a substantial amount of greenhouse emissions. In Figure 4 below it can be seen that there is a reasonable relationship between the units of GHGs per unit of gold produced and ore grade, as well as unit emissions per tonne of ore that was milled (Mudd, 2007:53). Unit emissions are increasing rapidly at around 5 g/t of gold. Mudd indicates that there is a number of large gold mines and corporations that simply do not report their GHG emissions when doing sustainability reporting. Based on the combined average of information that was available, approximately 21.7 kgCO_2-e/t ore or about 11.5 tCO_2-e/kg Au is generally released because of gold mining. He further mentions that even though the high mass ratio of CO_2-e to gold is due to the relatively small mass of gold produced, the primary function of gold for jewellery leads to major ethical and social issues in terms of accounting for the greenhouse costs" (Mudd, 2007:53).

Figure 3: Greenhouse gas emissions from gold mining



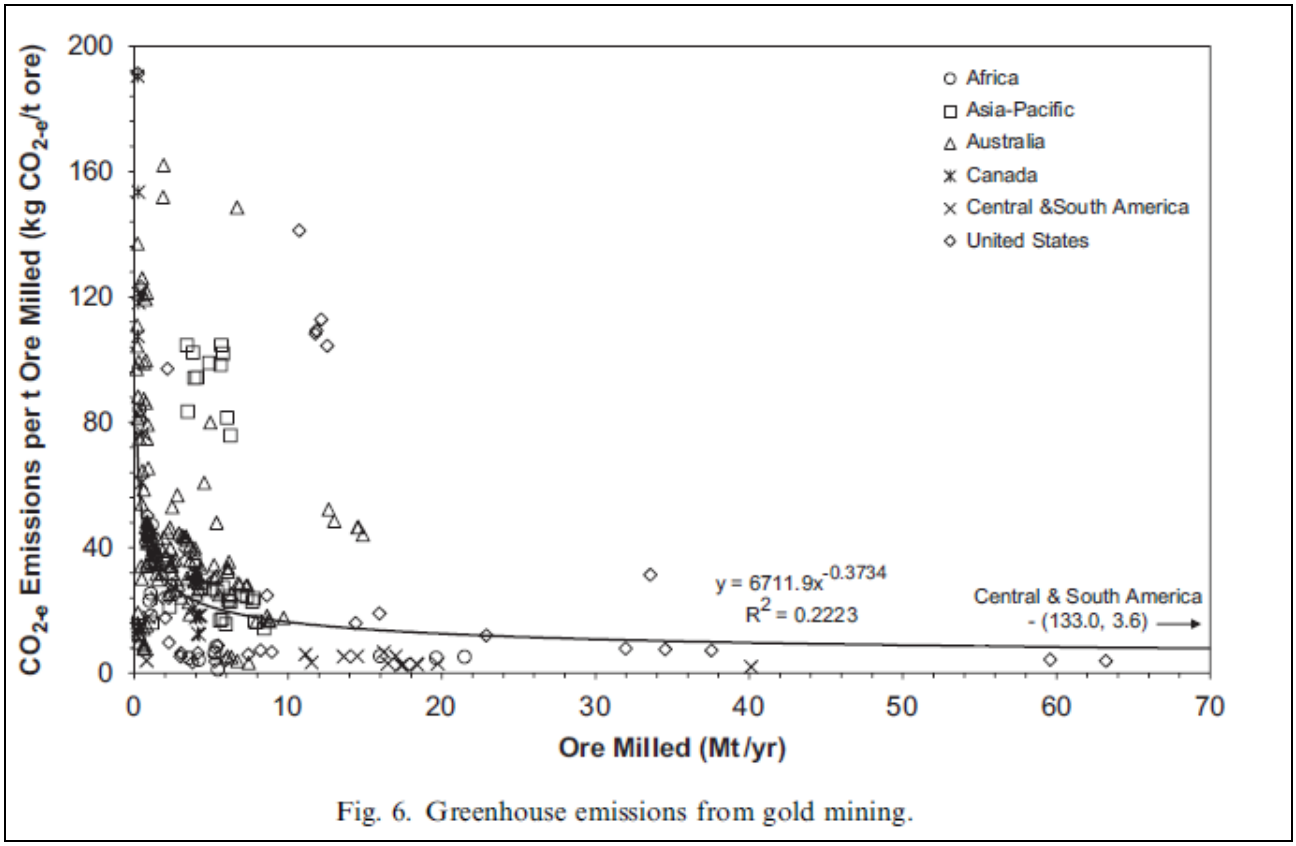


Fig. 6. Greenhouse emissions from gold mining.

Source: Science Direct: Global trends in gold mining, 2012: 52

Gold miners therefore argue that Nersa and the national government need to look at ways to lessen the increase in the price to assist in sustaining the important gold mining sector (Sergeant, 2013).

2.6.4 Carbon Tax in Australia's mining industry

Compared to other developed countries Australia produces more greenhouse gasses per person. There are 22 million people in Australia yet Australia is responsible for 1.5 percent of worldwide GHG emissions. Britain has almost three times the number of inhabitants but only produces 1.7 percent of the world wide GHGs(The Guardian, 2012:6)

During July 2012 Australia implemented a carbon tax to be followed by the implementation of a Cap and Trade emissions trading scheme (ETS) from July 2015. A carbon tax of AUD23 (approximately R210) per tonne of carbon dioxide equivalent (CO2-e) will apply for a fixed period of 3 years, increasing at 2.5 percent per year before transitioning to the ETS from 2015. Once the ETS is implemented the lowest price of carbon will be $15 per tonne. A maximum price of $20 above international carbon prices will also be set. Australians will be able to trade the carbon permit through the market with a limit set by Government to be in line with its target emissions set (Edwards, not dated)

Damien Edwards, who is a Senior Energy & Sustainability Consultant at SRA Information Technology, mentions in his industry white paper that a subsection of the GHGs are covered by the National Greenhouse and Energy Reporting ("NGER") legislation which covers the carbon tax. These GHGs comprise carbon dioxide, methane, nitrous oxide and perfluorocarbons emitted from aluminium smelting. The release of the following will be taxed by means of other legislation, for example by reducing fuel tax credits on

- Synthetic gases (SGGs)
- business transport emissions,
- non-transport use of liquid and
- gaseous fuels.

Companies will still have to report on these gasses although they are excluded from the determination of the carbon tax liability.

Industries involved in extracting operations can be detrimental to the environment; therefore they are required to have a very high regard to environmental issues. The mining sector has received a lot of criticism for its environmental performance in the past, resulting in the public having a negative opinion of the industry (Hilson, 2000; Azapagic, 2004; Driussi and Jansz, 2006; Lodhia, 2007 in Pellegrino and Lodhia, 2012). According to Peck and Sinding (2003, 131) mentioned in Pellegrino and Lodhia (2012) the "discovery, extraction and processing of mineral resources is widely regarded as one of the most environmentally and socially disruptive activities undertaken by humankind".

Mining companies have continuously been scrutinised by the public to ensure that they operate in a more environmentally sustainable way and thereby consider the effect their activities have on all the stakeholders (Lodhia, 2007 in Pellegrino and Lodhia, 2012).

Mining companies therefore realised that for them to succeed they need to be seen as adapting to the expectations society has of them when it comes to how they perform socially and environmentally; this is referred to their 'social licence to operate' (Lodhia, 2007 in Pellegrino & Lodhia, 2012). The term *social licence to operate* is widely applied in the Australian mining industry and is similar to the theoretic view of the 'social contract', which captures what society currently expects (Deegan, 2006, 2007a). According to Lodhia (2007: 189) in Pellegrino & Lodhia, (2012) "companies in the minerals industry must recognise the changing social (environmental) and political contexts in which they operate". In order for mining companies to keep their social licence to operate it must seem that they operate their business with the prevalent societal values and expectations (Mitchell et al., 1997; Peck and Sinding, 2003 in Pellegrino & Lodhia, 2012).

2.7 CONCLUSION

For many industries this carbon tax will merely be passed on to the end consumer as companies will push up their sales prices to compensate for the increase in expenditure.

One industry that will be most affected by the proposed carbon tax is the gold mining industry of South Africa. Mining companies in South Africa use and produce fossil fuel energy products which produce GHGs but, nevertheless underpin economic growth and development in South Africa.

Gold mining companies are price takers, meaning they do not set their own gold prices based on production or any other factors. Hence the carbon taxes paid by the industry will be borne by the company and not be passed on to the end consumer. With the rise in electricity costs and this additional carbon tax the gold mining industry will be under a lot of pressure.

At the same time mining companies have no choice but to conform and operate in a more environmentally sustainable way and think about the effect of their activities on various stakeholders.

In the following chapter a case study based on international gold mining company AngloGold Ashanti will be conducted taking into account their sustainability strategies as well as information made available in their sustainability report.

CHAPTER 3

CASE STUDY BASED ON LEADING GOLD MINING COMPANY ANGLOGOLD ASHANTI

3.1 INTRODUCTION

As a global gold mining and related activities company, AngloGold Ashanti operates on four continents and in a global exploration programme. Because of their vast operations AngloGold is concerned about the effect their operations may have the diverse communities and environments in which their operations are (AngloGold Ashanti, nd).

In the process of recovering the gold mined at AngloGold's various operations, depending on geology, valuable by-products including silver, sulphuric acid and uranium may be produced in addition to gold. These are inputs to other markets and industries and demonstrate a valuable contribution from AngloGold's mining.

AngloGold's primary direct customers of gold are bullion banks acting as intermediaries for gold markets. Jewellery consumption in countries such as India and China represents an important portion of physical gold demand.

The chart below illustrated the gold production from AngloGold as attributed to the different countries in which they operate.

Figure 4: AngloGold Ashanti's attributable gold production

Source: AngloGold Ashanti, sustainability report, 2012.

As a mining company, AngloGold Ashanti is a significant consumer of energy. AngloGold is very concerned about their energy intensity. Connected with this concern is the impact the company's emissions have on climate change, and, in turn, the impact that climate change could have on the companies' operations and local communities. Some of the impact on the climate change is threats to energy, water and food security.

According to AngloGold's Sustainability Report (2012:47), AngloGold is concerned about the following critical elements:

- a stable and cost-effective 24/7 supply of energy for their existing operations;
- access to energy for their projects that will be cost-effective and available at the right time;
- the optimisation of their energy usage to reduce their costs and minimise wastage as well as their environmental footprint, particularly in respect of GHG emissions; and
- adapting to the impacts of a changing climate.

In 2011 AngloGold recommitted themselves to minimising the consumption of energy and securing energy supplies for the future.

During 2012 AngloGold's energy consumption was 31.01m GJ (2011: 30.5m GJ) (AngloGold Sustainability Report, 2012:47). The sustainability report (2012:47) further states that:

> "Traditional mining methods are becoming increasingly energy intensive as mine depth, complexity and haulage distances increase at our maturing mines. Much of

> our energy usage (37.6%) was in South Africa, where our deep underground mines are particularly energy intensive. The strike action in the latter half of the year distorted our energy performance to some extent since, although production was curtailed, our baseload energy consumption largely continued to protect our assets and provide safe working conditions for essential services."

With the rising cost of electricity in South Africa, AngloGold's total energy costs in 2012 constituted around 20% of their operating cash costs.

AngloGold's electricity and fuels usage accounts for most (98.9%) of their GHG emissions. In 2012 their GHG emissions were 4,586kt of CO_2e compared to 4,468kt CO_2e in 2011, translating into emissions per ounce of gold produced of 1.11tCO_2e/oz. of gold produced in 2012 (AngloGold Sustainability Report, 2012:47)

Because South Africa's reliance on electrical energy is sourced from coal-based power stations, AngloGold's South African region accounted for sixty eight percent, which is a significant portion, of the group's GHG emissions in 2012 (AngloGold Sustainability Report, 2012:48).

To reduce their generation of GHGs, AngloGold is considering the installation of low-carbon electricity generation capacity, such as hydro-power, and energy-efficient technologies, such as efficient compressed air systems. The company's operations in Ghana and Brazil already make extensive use of hydro power – both via national grids, and the latter through their own hydropower facilities. The Mponeng Mine in South Africa also uses an innovative in-shaft hydro-power system to power its drilling, cleaning and other equipment. During 2012, a total of 0.59m GJ (2011: 0.61m GJ) of hydro-electrical power was used by AngloGold Ashanti operations; 0.49m GJ (2011: 0.50m GJ) at the AngloGold Mineração operations in Brazil and 0.10m GJ (2011: 0.10m GJ) at the Mponeng operation in South Africa. Work has begun on upgrading a hydro-power facility in the Democratic Republic of Congo, which will initially service communities, but will later be upgraded to service their mining operation (Sustainability Report, 2012:47).

3.2 WHAT IS CARBON TAX?

3.2.1 Carbon tax defined

A Carbon Emissions Tax is a tax on the environment which is charged on the burning of fossil fuels with the purpose of discouraging GHG emissions such as carbon dioxide from being produced.

3.2.2 Is it a tax?

In an article Steyn, Franzen and Stiglingh (2013:239-252) state that it does not matter what government calls an “impost”, all imposts have the intention to raise revenue for the funding of government expenditure. But what is government revenue?

The three types of government revenues are discussed below:

- Derivative revenue. This is the taxpayers’ income that gets paid over to government because of impositions in term of revenue laws. This generally referred to as a tax (Adams; Lutz, Musgrave & Musgrave and Steenekamp in Steyn *et al.,* 2013: 241).
- Direct revenue. Adams (in Steyn *et al.,* 2013:241) states that direct revenue is income paid/owed directly to government for the provision of certain goods and services. This is usually referred to as user charges.
- Anticipatory revenue. This is money that government borrows to fund its functions. (Adams, Steenekamp, in Steyn *et al,* 2013:241).

In order to assess whether or not the price on carbon is a tax or a user charge, one should look into the inherent characteristics of each. Say (In Steyn *et al.,* 2013:241) defines a tax as being the transference of a share of nation-wide products from individuals to government, for the function of covering the public expenses.
The inherent characteristics of a tax are:

- That it must be compulsory, meaning it needs to be paid in terms of legislation.
- The purpose is for the raising of revenue which will finance general expenses in providing public goods and services.

- The provision of public goods and services for the shared benefit of the public for the revenue received.

In order for the “carbon tax” to be labelled by government as a tax it needs to meet the criteria set out above.

The carbon tax will be payable in terms of an Act. At this stage it is not clear if it will be brought into the income tax act or any already promulgated act or if it will have its own act. The revenue received will be recycled by either decreasing other taxes or by funding green projects. From this it is clear that the imposition is not made in return for public goods or services. As a result the carbon tax is not a tax in its true sense.

3.2.3 The benefits of a carbon tax

A carbon tax holds several benefits:

- it is quick to implement,
- its encourages the reduction of carbon emissions; and
- is enforceable on a smaller scale as well (Paul, Rahmat, Hai, Kwon and John (2011:39).

As companies would make every effort to avoid large sums of taxes, the implementation of a carbon tax would encourage the reduction of carbon emissions.

3.3 CARBON TAX IN SOUTH AFRICA

The Carbon Tax Policy Paper (2013) proposes that the tax be levied on Scope 1 emissions in the tax base, which are emissions directly from the burning of fuel and from non-energy industrial processes. The carbon tax will be brought in at an initial rate of R120 per ton CO_2e, increasing at an annual rate of 10% to R176 per ton CO_{2e} in 2019/20.
Deloitte (2013) summarises the key elements of the proposed carbon tax policy as follows:

- There will be a threshold that will be a percentage of actual emissions. Anything below the threshold will not be taxable for the initial five years. Industries in which the

decrease in emissions is limited due to either technical or structural reasons, such as emissions during processes, will be considered. The cement, iron and steel, aluminium, and glass sector is indicated as possibly being included.

- Sectors which are trade intensive will receive graduated relief. Firms can use offset to decrease their carbon tax charge up to a certain limit. Variable offset limits are proposed based on the mitigation potential of the sector. Initially, all companies in South Africa will be allowed a basic tax-free threshold of 60%. This implies that companies will pay, at the most, a tax of 40% of their absolute emissions. The maximum tax-free threshold is 90% of verified carbon emissions, dependant on the positioning of the entity in relation to the above given criteria. The agriculture and waste sectors are the only sectors that will be completely exempt from the carbon tax during its first phase.

Assuming that South Africa's emissions are 510 million tons CO_2e per year (based on Carbon Disclosure Project, 2011), and that the majority of organisations will only qualify for a basic 60% tax-free threshold, then National Treasury could collect as much as R24.5 billion from the South African economy in 2015/16. However, given the various tax free thresholds, the number should more accurately be between R15 billion and R20 billion. This collection will increase by 10% per annum until 2019/2020.

This tax rate could further indirectly imply a hike in the South African electricity price by 4.8 cents per kWh, given the indicated initial thresholds. It should be noted that this does not take into consideration the 8% year-on-year increases approved for the next five years. Currently the average price for electricity is 61 cents per kWh.

3.4 CARBON TAX IN AUSTRALIA

Australia's GHG emissions per capita are presently among the highest compared to other developed nations. Currently Australia contributes 1.5 per cent of global GHG emissions (Garnaut, 2008 in Barret, Maslyuk and Pambudi, 2012).

Australia's carbon pricing is a set carbon price resembling a tax for the first three years starting off at AUD23 per ton of carbon emitted. The rate of the carbon price will increase

by 2.5 percent per year. From 1 July 2015 which will be after the completion of the three years it will be going on to an ETS. Australia's' carbon pricing scheme applies to approximately five hundred of the country's biggest polluters and addresses all stationary Scope 1 emissions (Treasury, 2013b:38)

Companies will be able to utilise offsets up to a maximum of five percent of their carbon tax liability. With the purpose of protecting global competitiveness complementary aid programmes to support jobs, households, businesses and communities will be implemented (Treasury, 2013b:38).

In survey which included 485 businesses which was conducted by the Australian Industry Group (AI Group) at the end of November 2012 six months after the implementation of the tax, businesses estimated that the price placed on carbon raised their costs associated with energy by an average of 14.5 percent. The carbon tax has increased energy prices by an average of approximately 14.5 percent since its implementation. This outcome was widely consistent across sectors with the manufacturing entities reporting that their energy input costs were raised by an average of 14.5 percent as a whole due to the carbon tax. For those in the services sector and construction sector the total rise in energy cost was 13.6 percent and 14.8 percent respectively.

Then again, the direct cost burden of the carbon tax remains unclear for some minor businesses as they are not able to estimate what the direct effect of the tax has been on their own electricity costs. (AI Group, 2013).

3.5 COMPARISON OF CARBON TAX IN SOUTH AFRICA AND CARBON TAX IN AUSTRALIA

A comparison of the proposed carbon tax in South Africa to that of Australia's already imposed carbon tax is done below:

Table 3 Comparison of carbon tax is South Africa vs. that of Australia

	South Africa	Australia
Rate	Initial rate of R120 per ton CO_2e	AUD 23 per ton CO_2e

		(approximately R210 per ton CO_2e translated at R9.1683/AUD on 18/09/2013)
Increase per annum	10 percent for the first 5 years	2.5 percent for the first 3 years
Thresholds, if any	60 percent	5 percent of carbon tax obligation
Period of implementation	5 years	3 years then moving over to ETS
Maximum additional allowances	Combined to a maximum of 90%	none
ETS system	The government will investigate the feasibility of an ETS to complement and not replace the proposed carbon tax by around 2025 or sooner, if practically possible.	Yes, after 3 years of carbon tax.
Tax base	Scope 1 emissions	Stationary scope 1 emissions

From the above it is clear that South Africa's carbon tax is much lower than Australia's starting at an initial rate of R120 as opposed to Australia's R210. Even with South Africa's high annual increases South Africa's carbon rate remains lower.

It should be noted that on 16 July 2013 Australia's Prime Minister, Kevin Rudd, publically declared that they plan to replace the carbon tax with an ETS system a full year ahead of schedule. It is not clear what the exact reasons are but at this stage it all seems political (Siegel, 2013).

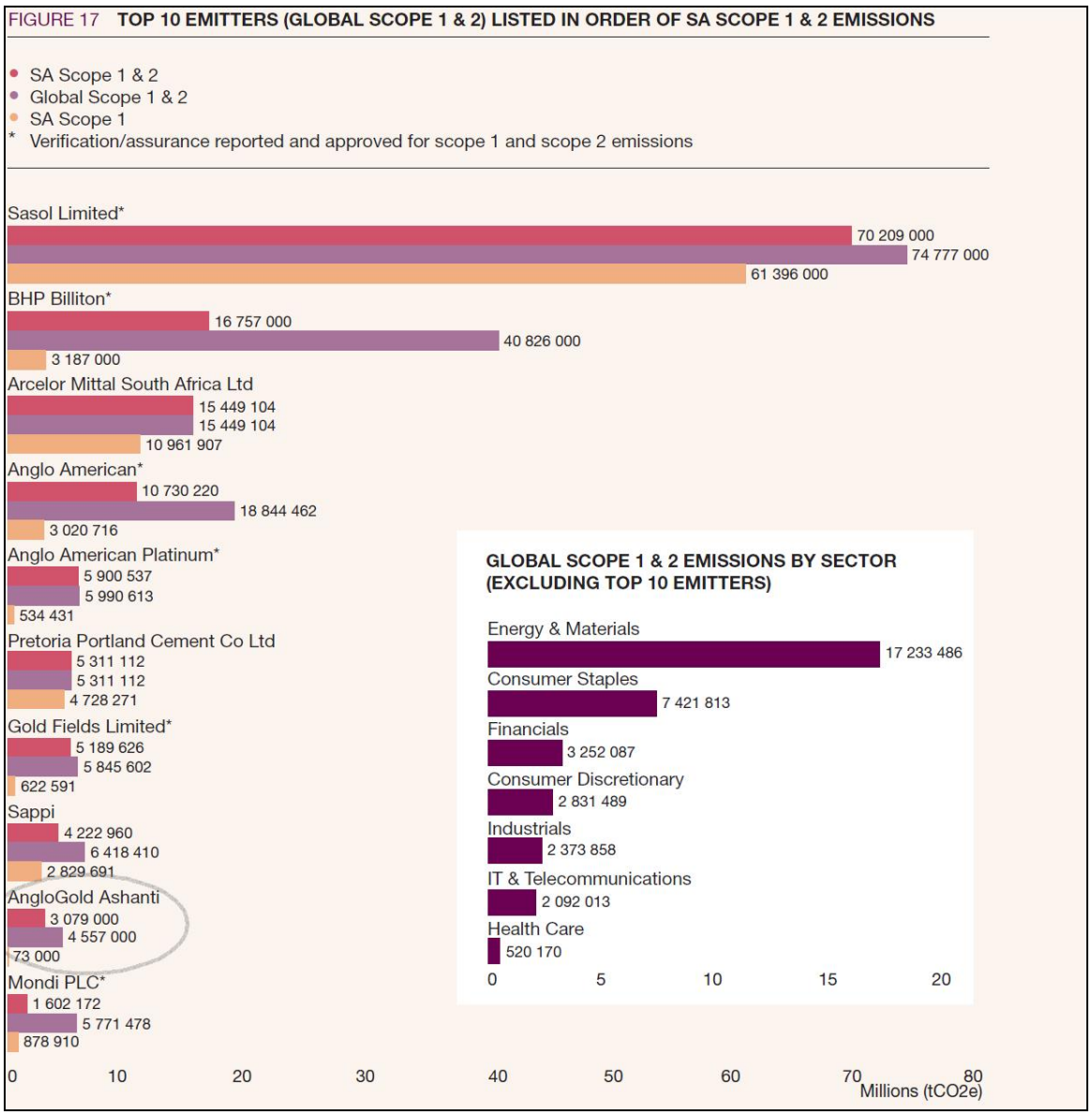
3.6 CASE STUDY

The first step in determining projections of GHG emissions is the calculation of the current Scope 1 emissions and electricity intensities associated with gold production in a year. The data used was obtained from AngloGold's company reports as well as from Carbon Disclosure Project (CDP) submissions, where such data was available.

Figure 4 obtained from the CDP report gives an analysis of the GHG emissions of the top ten emitters, in terms of their world wide scope 1 and 2 emissions, giving their world-wide

scope 1 and 2 emissions, their South African scope 1 emissions and their compounded South African scope 1 and 2 emissions. The ranking of the companies are according to their South African scope 1 and scope 2 emissions levels. The top ten emitting companies are all in the energy and materials and industrials sectors.

Figure 5: Top 10 emitters (Global Scope 1 & 2) Listed on order of SA scope 1 & 2 emissions.



Source: CDP South Africa 100 Climate Change Report 2012, 2012:29

The data in the figure above highlights the continuing predominant contribution of a few large emitters in terms of direct local emissions. Sasol produces significantly higher emissions than all other companies in the JSE100, with its annual scope 1 emissions reported at 61.4 million tCO_2e. Sasol is then followed by BHP Billiton (3.2 million tCO_2e),

Anglo American (3 million tCO_2e), and Sappi (2.8 million tCO_2e). Eskom published its calculated CO_2 emissions for the financial year ending March 2012 as being 231.9 million tCO_2e, constituting almost half of South Africa's total emissions. Collectively with Eskom, all the companies on the JSE 100 make up 64 percent of South Africa's estimated emissions.

As one can see on the figure above, AngloGold is ranked ninth on the top 10 emitters in South Africa. According to the CDP, AngloGold emitted 7 300 tCO_2e of scope 1 emissions in South Africa. With Gold Fields, also a gold mining company, seventh on the list emitting 622 591 tCO_2e.In a study conducted by the Green House (2012: 21) an analysis was done using 2010 annual reports to obtain the scope 1 emissions and electricity intensities on a per ton of unit produced bases. The analysis suggested Scope 1 emissions of 9.56 tCO_2e per kilogram gold and electricity consumption of 74.56 MWh per kilogram gold. It should be noted that these figures from individual producers were weighted according to their overall contribution to production to calculate the overall intensities for the commodity. A summary of the calculated electricity and emission intensity data for the four companies considered is shown in Table 3.

Table 4 Electricity and emissions intensity of various gold mining companies (2010)

Company	Scope 1 emissions intensity [tCO_2e/kg]	Electricity intensity [MWh/kg]
AngloGold Ashanti	10.8	58.05
DRD Gold	0.77	87.33
Gold Fields	16.08	78.91
Harmony	0.66	86.03
Weighted average according to production	9.56	74.56

From the table above it can be noted that AngloGold's Scope 1 emissions intensity is 10.8 tCO_2e/kg, meaning that for every kg of gold produced 10.8 tCO_2e is emitted. AngloGold's emissions are also higher than the weighted average of 9.56 tCO_2e/kg.

The carbon tax payable by AngloGold using the 2010 figures can be calculated as follows:

Table 5 Calculation of Carbon tax payable by AngloGold Ashanti

		AngloGold	
ASSUMPTIONS			
Scope 1 emissions (tCO2e)		1 215 000	
Trade exposed		No	
Process emissions		No	
Carbon intensity of production (tCO2e per unit of output) for the industry		9.56 tCO2e/kg	
Carbon intensity of production (tCO2e per unit of output) per company		10.8 tCO2e /kg	
Rate of tax (Rand per tCO2e)		R 120	
RESULTS			
Basic tax free allowance		60%	
Adjustment to free allowances for carbon intensity		= Industry benchmark of 9.56 / company carbon intensity of 10.8	
	RESULT	**0.89**	
Total net free allowances		=60%*0.89	
	RESULT	**53%**	
Additional free allowance for trade exposure		0	
Additional free allowance for process emissions		0	
Total gross free allowances		53%	
Total taxable emissions	[(100%-53%)*1215000]	569700	
Total carbon tax liability	**[569700*120]**	**R 68 364 000**	

The calculation in Table 4 above does not include the following elements that are yet to be decided:

- The increased cost of electricity due to carbon tax imposed on Eskom and passed through to final consumers (level of pass through and any relief mechanisms still to be determined by government)
- The use of offsets to potentially lower the total cost of compliance by 5-10% (the type of offsets that can be used still to be determined by government)
- The impact of expenditure on carbon tax on the income tax payable by companies

3.7 CONCLUSION

AngloGold will be facing carbon tax in both Australia and South Africa. The comparison between the two taxes shows that South Africa's tax in much lower than Australia's already implemented tax. South Africa's proposed rate is R120 per ton emitted and

Australia is R210 (translated value). Both countries have annual increases, South Africa's will be ten percent per year for five years and Australia two and a half percent for three years. Even after South Africa's higher increases the rate of tax paid will still be lower.

The case study provides evidence that, should the carbon tax be implemented, AngloGold will have to fork out approximately R70 million for carbon tax. Some mines in South Africa are already at break even, meaning that the income they make only cover their expenses and that no profit or loss is made. Should they have to pay this additional cost it may cause some of the mines to close as well as the need to dismiss some employees. This will add to the already straining mining industry as well as to the already high unemployment rate in South Africa.

CHAPTER 4

CONCLUSION

4.1 INTRODUCTION

Countries all over the world have been experiencing extreme weather conditions. This is as a result of climate change. Climate change is caused by increased GHG emissions in the earth's atmosphere.

To decrease the effects of climate change, the South African government wants to impose a carbon tax on GHG emissions. The carbon tax will be introduced at a rate of R120 tons of carbon emitted. The tax will only be on scope 1 emissions. Although it seems that mining companies are not direct taxed it should be born in mind that Eskom stated that they have every intention of passing on any increases in expenditure as a result of the tax to the consumers.

The specific objectives and the consequent results of this study are described below.

4.2 ADDRESSING THE RESEARCH OBJECTIVE

The research objectives are set out in chapter 1 as follows:

- To compare the proposed South African carbon tax to the carbon tax implemented in Australia. Australia has been chosen as a comparable as AngloGold Ashanti has operations in Australia and Australia has a large gold mining industry.
- To determine the potential impact on gold mining companies in terms of cost in South Africa.

The outcomes of this study were as follows:

- South Africa's carbon tax rate is very low when compared to that of Australia. South Africa has higher tax-free threshold which indicates that they are more sympathetic to effects that the tax will have business competitiveness as well as the impact on lower earning households (refer to chapter 3.5).

- AngloGold Ashanti was used as a case study to demonstrate the potential cost impact that the carbon tax may have on gold mining companies. In the analysis it was estimated that AngloGold would have to pay approximate R 70 million in carbon tax. This additional cost could cause mines which are breaking even to be pushed over breaking point and result in mine closure and job loss in the gold mining industry will become unavoidable (refer to Chapter 3.6).

4.3 CONCLUSION

Brekke & Johansson-Stenman 2008, in Brick and Visser (2010), stated that "Given that mitigation is a public good, climate change poses the ultimate social dilemma: curtailing greenhouse gas emissions entails a private cost while the benefits are shared equally by all – creating an incentive for individuals to free-ride, ultimately emitting more green-house gases than is optimal".

Some of the immediate actions required by businesses in South Africa in order to deal with the significant risks and opportunities arising from the national climate change policies include (PWC, 2011):

- Developing a clear understanding of the actions available to a company and sector to manage the risks and opportunities
- Understanding and quantifying the impact of carbon budgets and carbon taxes on the sector and company
- Developing the systems and processes required for monitoring, reporting and verifying carbon emissions data required to meet compliance
- Engaging in policy dialogue and advocacy with government to ensure that carbon budgets and the design of the tax captures the operational realities of the sector

In a 2011 publication PricewaterhouseCoopers discusses the effect that the carbon tax will have on Australia's competitive advantage internationally. Its states that the carbon price, carbon tax, will add additional cost to existing and potential future operations. It further states that

> "This cost will be factored into decision making when considering the economics of, for example, expanding an Australian mine again or expanding a mine elsewhere in the world. While the mines themselves are unable to be moved, capital is mobile and mining companies will invest their money on the projects that generate the best return. The carbon price, including its impact on input prices, will make Australian projects more expensive than they otherwise would be and will decrease the return generated. Of course, if these projects remain the best options available to a company, they are likely to continue to go ahead, so long as they still overcome internal return hurdles."

Due to the carbon price adding to the cost of constructing and operating a mine, the mines' operating margins will be reduced and the capital costs will be increased. As a result of this, those Greenfield projects which are marginal may struggle to generate sufficient return to support the capital investment (PWC, 2011).

AngloGold ranked ninth out of top 10 emitters in South Africa in 2012 according to the CDP report. This report also states that AngloGold's and Gold Fields scope 1 emissions for 2012 were 7 300 tCO_2e and 622 591 tCO_2e respectively. Based on these figures AngloGold's carbon tax payable will be R876 000 and Gold Fields R74 710 920. This is without taking into account any possible rebates.

4.4 RECOMMENDATIONS

The recommendation of this case study is to propose that government assess the effect that the carbon tax will have on the mining industry and the economy. This can be achieved by working with the mining companies and coming up with ways to reduce the mining companies' carbon footprint.

4.5 FUTURE RESEARCH

There are some aspects of the research that needs to be studied further:

- Quantifying the impact on the economy

- Others source of taxes
- Comparison to BRICS countries

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