

## **6.1 Industry specific output**

### **Simulation 1**

It is no surprise that the effect of the proposed sales tax increase in the first simulation is a decline in output of every industry. The higher price of electricity, chemical products and base metals result in a loss of purchasing power and households will decrease their consumption across all industries, however, the industries of which the products are taxed carries the highest burden in terms of a decline in output, as illustrated in figure 1. The result with regards to industry specific output when the tax revenue is redistributed by means of a decreased income tax change quite significantly with the output of industries such as tobacco, furniture, beverages and printing increasing, as the substitution effect start to take effect. The “taxed” industries do however carry a heavier burden in this scenario than in simulation 1. Figure 2 illustrates the industry specific results for output under the second scenario.

## **6.2 Industry specific employment**

With reference to simulation 1: With wage rates fixed in the short term, wages cannot adjust to provide for the decrease in output and the subsequent decline in labour productivity. The consequence of the decline in output is therefore a decrease in unemployment across all industries in simulation. Figure 3 illustrates the decline in employment. Once again, it is no surprise that the electricity, chemical and base metal industries shed the most labour. The same reasoning holds for simulation 2, however, as the output increase in certain industries result in an increase in labour productivity, employment will increase in these industries, as figure 4 illustrates.

## **6.3 Economic Growth**

The same explanation holds for the decline in the real GDP for both simulations. The decline in household consumption result in a direct decline in GDP as the other components (investment expenditure, government expenditure and exports) are held at fixed levels. The decline in consumption, however is smaller in simulation 2 than in simulation 1, resulting in a smaller decline in GDP. From the income side of the economy, the decline in the GDP is a direct result of the decrease in the activity of each industry. Once again, the decline in activity is larger in simulation 1, than in simulation 2, resulting in a larger fall in GDP in the first case, than in the second.

## **6.4 Utility per household (Welfare effect)**

As mentioned above, the utility per household decreased in the first simulation but increased in the second simulation, as a result of an increase in household income. The decline in utility in the first simulation constitutes a decline in welfare, while the increase in utility constitutes an increase in utility.

## **6.5 Double dividend effect**

Although welfare has increased by the introduction of sales taxes on the use of electricity, base metals and chemical products, and the subsequent cuts in marginal income tax rates, it is difficult to prove that a double dividend is achieved by the incorporation of such a policy. The reason for this is that economic growth and employment has decreased under such a measure, and although utility has increased, consumption and disposable income has decreased.

## **7. CONCLUSION**

The conclusion that can be reached from the above simulation exercise is that a sales tax on the use of products, which are associated with high levels of CO<sub>2</sub> pollution, will decrease the use of the products. The net effect of such a tax will, however, be a decline in employment and GDP growth. The effects of such a policy will differ from industry to industry, with some industries experiencing an increase in output and employment, while others experience the opposite.

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# The Economic Impact of an Increasing Health Risk due to Global Warming

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## ABSTRACT

Vulnerability and adaptation studies have shown that global climate change (*sic.* global warming) has a serious impact on health, which, in turn, has a direct impact on the economy of a country. Until recently the impact on health of the accompanying changes in natural phenomena due to global climate change, through an increase in contaminating tropical diseases and the frequency and scale of natural disasters, had been ignored. This is because either it was thought too difficult to establish direct cause-effect relationships, or placing monetary values on those health effects was not possible. Under conditions of natural disasters, it is generally the poor and, within a South African context, the historically disadvantaged communities, who suffer the most, since they are unable to hedge or protect themselves against the consequences of these health hazards such as cholera and malaria. Efforts to reduce the consequences of climate change in developing countries are mostly ignored. Having said the above, the direct impact of global climate change on health in southern Africa is substantial. The focus of this study is to explore the economic impact of global climate change on the southern African economies through its impact on public health, with the focus on the prevention and treatment cost of malaria specifically.

### *Keywords*

Global climate change	Health
Diseases	Malaria
Prevention	Treatment
Cost	Incidence ratio

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## 1 INTRODUCTION

Climate change (*sic.* global warming), the economy and changes in the exposure to the health risk of people are inextricably linked. These three subject matters were treated in isolation for a long period and, according to conventional wisdom, are still regarded as completely independent disciplines. Evidence is mounting, however, that these precepts and subject boundaries are due to disappear.

Recent estimates suggest that premature death and illness due to major environmental health risks, of which climate change is a dominant contributor, accounts for one-fifth of the total burden of disease in the developing world (Lvovsky *et al.* 2000). This is comparable to malnutrition and larger than all other preventable risk factors and groups of disease causes. Watson *et al.* (1998) state furthermore that:

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<sup>11</sup> The views expressed are those of the authors and do not necessarily express those of any institution they may

The spectrum of global environmental hazards includes global climate change due to the accumulation of greenhouse gases in the lower atmosphere.

Africa has contributed the least to climate change by emitting greenhouse gasses (Houghton 2001) but Africa's poor populations tend to be the most vulnerable to the health impacts of climate change. Poor people suffer more than affluent people do, mainly because they don't have the information or financial resources readily available to pay for medical services needed. They live on marginal land and cannot hedge themselves against environmental catastrophes.

The economic evaluation of health impacts due to climate changes is a relatively new field of research. Dixon (1999) mentions three reasons why economics of health are so important:

To compare benefits and costs. Cost-benefit and cost-effectiveness analyses play an important role in policy decisions;

To set priorities. The analysis mentioned above can help ensure the effective use of scarce resources; and

To get the attention of decision-makers. It is easier to get the attention of authorities when problems are quantified.

To address these issues this paper will elaborate on the problem statement in the ensuing section, followed by an investigation of the link between health risk and climate change. Thereafter a section on the cost of malaria follows with a section on some methods to reduce malaria thereafter. Some concluding remarks are then offered.

## 2 PROBLEM STATEMENT

Average global surface temperature increased by  $0.6^{\circ}\text{C}$  in the 20<sup>th</sup> century according to the Third Assessment Report (TAR) of Working Group I of the Intergovernmental Panel on Climate Change (IPCC) (Houghton *et al.* 2001). Most of the warming occurred during two periods, namely between 1910 to 1945 and 1976 to 2000. The IPCC identified the 1990s as the warmest decade with 1998 as the warmest year since 1861. The 20<sup>th</sup> century experienced the largest increase in temperatures in the past 1000 years. The IPCC projected, based on a number of climate models, an increase of  $1.4$  to  $5.8^{\circ}\text{C}$  in global temperature over the period 1990 to 2100. This result was higher than those projected by the Second Assessment Report (SAR), which were  $1.0$  to  $3.5^{\circ}\text{C}$  (Watson *et al.* 1995)

General consensus exists amongst health scientists that this temperature rise will increase the relative size of the population at risk of various diseases of which malaria is the most dangerous in southern Africa (McMicheal *et al.* 1996). Apart from the health risks there are also other human systems that are sensitive to climate change, such as water resources, agriculture (food supply) and forestry, coastal zones, marine systems, human settlements and other energy resources (Watson *et al.* 1995). The collaborate effect of all the possible effects can place an enormous burden on economic resources in regions and countries.

As will be discussed in the next section, various valuation methods exist to quantify the total cost of a change in human health and quality of life due to global climate change. Such estimates will, however, demand an extensive analysis of all the variables involved. These variables include a number of health effects such as, an increase in the number of vector and water borne diseases, and other economic effects such as a loss in GDP because of losses in production, which contributes to the cost of changes in human health due to climate change. Such an approach, which investigates all the cause-and-effect relationships and quantifies them, would be necessary to give justice to the concept of total economic value (TEV), which underpins this research. The different cause-and-effect relationships, however, cover a wide field of research that could be explored separately in different studies. Therefore it has been decided to focus on the cost of health care in this paper of the disease which are the most likely to be affected the most by climate change and also identified as one of the biggest health threats to southern Africa namely, malaria (McMicheal *et al.* 1996). The research question therefore is: What is the most likely additional health care cost (i.e. prevention and treatment cost) due to an increased prevalence of malaria as a result of climate change? This research is based on secondary data and information and aims at building a basis on which

primary research on the issue of climate change and the cost effect on health can be conducted later. Whilst this paper endeavours to estimate the additional prevention and treatment cost of malaria due to climate change, the next section provides the broader context within which these estimates should be viewed.

### 3 CLIMATE CHANGE, HEALTH AND THE ECONOMY: THE LINKS

As stated earlier, climate change will potentially have serious health consequences. Some health effects will result from direct-acting effects such as weather disasters whilst others will result from disturbances to complex ecological processes such as changes in patterns of infectious diseases. It is also true that climate change may also have some benefits to human health, e.g. reduction in winter deaths (Kovats *et al.* 2000). The following impacts of global climate change can be identified, but the list is by no means complete (Dixon 1999, Kovats *et al.* 2000):

Health impacts

Increase in vector and water borne-diseases

Threat to food security

Increase in pain and suffering

Productivity impacts

Losses in production

Changes in the quality and quantity of the factors of production

Ecosystem impacts

Increase in the frequency of heat waves

Increase in the number of extreme weather events

Increase in the severity of extreme weather events

Changes in water quality and quantity

Aesthetic impacts

Heat stress and air pollution

Social disruptions

Changes in quality of life

Economic impacts

Prevention cost

Treatment cost

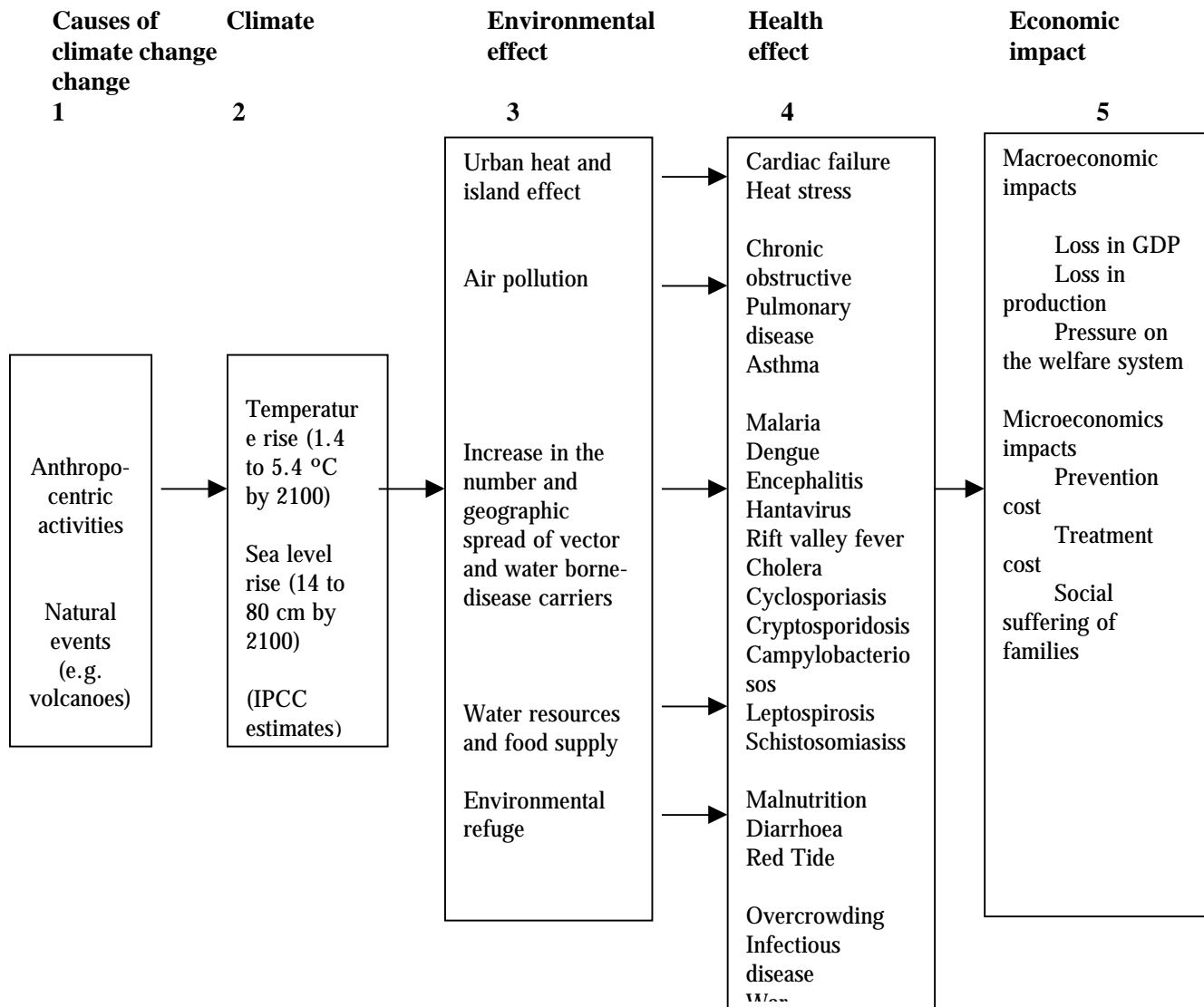
Fiscal pressures

Increased dependency on the employed

Increased pressure on the social and welfare systems (medical aid and pensions)

The causal relationship between the causes of climate change, its effect on the environment and health and also the economic impact of these changes are shown in Figure 1. Though the causal relationships are indicated linearly in Figure 1, it is done so for the sake of simplicity. There are, however, a number of non-linear relationships as well as feedback loops, such as from the economic impact to the causes of climate change and from the health effect to the environmental effect.

**Figure 1 Health effects of Climate Change**



Source: Adapted from Patz *et al.* (2000). The potential health impacts of climate variability and climate change for the United States: Executive summary of the report of the health sector of the US National Assessment. *Environmental Health Perspectives*, 108:367-376.

Various methods could be adopted to identify the health impacts of climate change, in other words following the causal relationship from column 3 to 4 in Figure 1 above. McMichael and Kovats (2000) identified the following methods to estimate the health impacts of climate change

Analogue studies

Empirical/Statistical

Analogue of a warming trend. .e.g. Increased malaria in highland region correlated with a local trend in warming

Analogue of extreme events. E.g. assessment of the mortality impact of a heatwave

Description of basic or recurrent climate/health relationships. E.g. international variation in malaria correlated with minimum seasonal temperature using time series data

Predictive models

Empirical statistical models

Extrapolation of simple/climate diseases relationship using univariate regression, e.g. daily temperature and

Extrapolation of climate/vector/disease relationship using mapping and statistical methods for use with spatially correlated data, e.g. mapping tick abundance with climate and other variables.

Process-based or biological models

Models derived from accepted theory can be applied universally, e.g. forecasting changes in areas suitable for vector-borne disease transmission using a vectorial capacity model

Integrated assessment models

Multidisciplinary process-based and/or empirical statistical models linked together horizontally or vertically, e.g. impact of climate change on food supply and risk of hunger

Methods to analyse the costs of increasing health risks due to climate change (the quantification of column 5 in Figure 1) are limited in the literature. Apart from the economic losses to a region change such as lost productivity, loss in income and the costs of treatment and prevention, the economic tools of disability life years gained (DALY's) or quality adjusted life years (QALY's) can also be used to estimate the cost of human suffering due to climate change.

Quantifying the economic cost of health impacts due to climate change fringes on the concept of valuing life, which is controversial. There are justifiable ethical arguments against the valuation of life, usually because the quantification methods are biased against low-income earners and, also, since they equate the value of a person to the money he could earn. There are methods though, such as those mentioned in the next paragraph, that can be used to by-pass the problem. The important aspect is that the issue is not so much weighing life against money, but rather the length and economic productivity of a life span against money. Zweifel and Breyer (1997:24) summarise the issue as follows:

*Since many public decisions inevitably imply a weighing of prolonging statistical lives against other goods, it is advantageous for society to make such a valuation explicitly. However, the preferences of the citizen should be reflected in the valuation.*

Dixon (1999) proposes an estimation of the change in health outcomes due to exposure levels. When outcomes are quantified the following approaches can be used to assign economic values: for sickness, information on loss of earnings and medical care costs are most commonly used since they are direct use values that are observable. Contingent valuations studies can also be used to determine the more indirect cost such as the decline in quality of life, and the value of pain and suffering caused by the sickness.

For death, on the other hand, the important measurement is to value the economic life lost due to the premature death of a person as a result of the disease. If a life can be saved at a relatively low cost then no analysis is really necessary. The higher the cost becomes, the more difficult it is to make decisions off the cuff and an in-depth analysis is necessary. In essence this is calculating the marginal cost of determining the cost of the disease versus the marginal benefit thereof. Should the marginal cost of determining the cost exceeds the marginal benefit for determining the cost of the loss in economic life then no study is required. This decision will heavily be influenced by the value of the economic life lost. Two approaches are most frequently used. The first is the human capital approach which focuses on foregone earnings. This method, however, is less attractive than the willingness-to-pay approach which will include a whole range of costs associated with premature death, such as loss in productivity, income, suffering of family, etc.

In sum, this section has illustrated the causal effect between the sources of climate change, climate change, its respective environmental and health effects and the cost implications thereof. The health effect may either result in sickness or death. In the section that follows attention will be paid only to the direct health care cost of either treating or preventing malaria.

#### 4 CONSEQUENCES OF CLIMATE CHANGE ON MALARIA IN SOUTHERN AFRICA

##### Malaria

McMichael *et al.* (1996) and others have identified malaria as the disease most likely to be affected by climate change because of the sensitivity of malaria transmission to weather and climate conditions. This can clearly be seen from the evidence in Table 1.

**Table 1 Major tropical vector-borne disease and the likelihood of change with climate change: A comparison**

Disease	Likelihood of change with climate change	Vector	Present Distribution	People at risk (millions)
+++ =most likely, ++ = Very likely, + = Likely, ? = Unknown				
Malaria	+++	Mosquito	Tropics/Subtropics	2020
Dengue	++	Mosquito	All tropical countries	2500-3000
Schistosomiasis	++	Water Snail	Tropics/Subtropics	600
Leishmaniasis	++	Phlebotomine Sandfly	Asia/southern Europe/Africa/Americas	350
African Trypanosomiasis (Sleeping sickness)	+	Tsetse Fly	Tropical Africa	55
Lymphatic filariasis	+	Mosquito	Tropics/Subtropics	1100
Onchocerciasis (River blindness)	+	Blackfly	Africa/Latin America	120
Yellow fever	+	Mosquito	Tropical South America and Africa	-
Dracunculiasis	?	Crustacean	South Asia/ Arabian peninsula/ Central west Africa	100

Source: Houghton 2001 and McMichael, A.J., Haines, A., Sloof, R., & Kovats, S. 1996. *Climate change and Human Health*. Geneva: World Health Organisation.

Malaria is the eleventh most important cause of death globally, claiming an estimated 856 000 lives each year and is rated the third greatest environmental health threat globally (Lvovsky *et al.* 2000). Of these, it is believed that 90% of malaria cases now occur in Sub-Saharan Africa, the greatest toll falling on children below the age of five (Kiker 2000). Malaria contributes 80% of the climate-related disease burden in Africa (Houghton 2001). It also contributes to more than 80% of the loss of disability adjusted life years (Lvovsky *et al.* 2000) (see Table 2).

**Table 2** Burden of disease from major environmental risks

<b>Environmental Health Group</b>	<b>% of all disability life years in Sub-Sahara Africa</b>
Water supply and sanitation	10
Vector diseases (malaria)	9
Indoor air pollution	5.5
Urban air pollution	1
Agro-industrial waste	1
All causes	26.5

Source: Lvovsky *et al.* (2000). *Health and Environment*. Washington DC: World Bank.

The poor are affected the most because of limited access to health services, information and protective measures. Access to labour opportunities also limits their mobility. However, the possibility of moving to a risk-free area is limited because in southern Africa it is only in Namibia, Botswana and South Africa's drier, colder and higher altitude areas where malaria is currently no threat. The problem is that it is precisely these areas that are faced with an increasing malaria risk because of the impact of global climate change.

The impact of these climate changes on malaria is likely to be the greatest in regions where malaria transmission was previously limited by low temperatures. The lower temperature limit for transmission is 18 °C and thermal death for mosquitoes occurs around 40 to 42 °C. In addition, 80 mm of rain is required for at least five months of stable transmission (Kiker 2000). Increased temperature will increase transmission and will lengthen the transmission season. Therefore, the threat is to regions where malaria did occur, but only for short time periods (less than 5 months) where these periods will lengthen (to more than 5 months) as well as to areas that were malaria free that will become invested. This is especially the case for southern Africa where malaria is limited to certain regions. High-elevation locations such as Johannesburg and Harare may become vulnerable to malaria epidemics because the malaria parasite may be able to survive in warmer conditions (Houghton 2001).

### **The cost of malaria**

Malaria has a potentially large economic impact limiting the productivity of a country's two major assets and factors of production, its people and its land. Limited household resources are used for prevention and care while the extra burden on the health sector influences the allocation of resources by the government.

Malaria and poverty go hand-in-hand and pose a threat to the current income of countries as well as to future economic growth. Coincidentally, highly malaria infected countries are of the poorest in the world, and have typically very low rates of economic growth and declining per capita income (Sachs *et al.* 2000). The cost of preventing, treating and control of malaria as a percentage of their per capita income is therefore so much higher. These costs are as difficult to estimate or more so than the economic impact of any another health programme. Despite these difficulties several studies estimating the cost of malaria have been undertaken. Four of these studies will subsequently be discussed.

Sachs *et al.* (2000) estimate that Sub-Saharan Africa's GDP could be 32% higher if malaria had been eliminated 35 years ago and that economic growth in Africa is annually reduced by 1.35% due to malaria. According to the report this would add US\$100 billion (five times more if compared to the \$20 billion development and aid provided to Africa in 1999) to the current GDP of US\$300 billion. Table 3 below shows the loss in economic growth due to malaria for a number of southern African countries.

**Table 3** Loss from economic growth penalty due to the malaria endemicity in southern African countries 1980-1995

Country	Aggregate Loss (millions of purchasing power parity (PPP)-adjusted 1987 US\$)	Per person loss (PPP-adjusted 1987 US\$)	Percentage of actual 1995 income
Botswana	503	347	5
Kenya	5272	198	18
Lesotho	0	0	0
Madagascar	2280	167	18
Malawi	1072	110	18
Mauritius	0	0	0
Namibia	832	539	10
Nigeria	17315	156	18
South Africa	4056	98	1
Zambia	1359	151	18
Zimbabwe	4214	383	18

Source: Sachs *et al.* 2000. *Economic of Malaria*. Centre for International Development, Harvard University and the London School of Hygiene and Tropical Medicine. London.

Shephard (1991) estimates direct and indirect costs of malaria in 1987 to be US\$791 million for all Sub-Saharan Africa. This corresponds to 0.6% of GDP or about \$2.34 per capita for the region. Leighton and Foster (1996) estimate the output lost due to malaria in Kenya and Nigeria to be between one and six percent (see Table 4).

**Table 4** The loss in output due to malaria

	Kenya	Nigeria
Production loss as a percentage of GDP	2 – 6%	1 – 5%
Percentage of workdays lost	3 – 14%	1 – 8%

Source: Leighton and Foster. 1996 *The economic impacts of malaria in Kenya and Nigeria*. Abt Associates. Bethesda. Maryland.

Mills (1991) estimates that household spending on prevention through mosquito coils, aerosol sprays, treated bed nets and repellents range between US\$0.05 to US\$2.08 per person per month in six Sub-Saharan African countries. Treatment costs are estimated at US\$0.39 to US\$3.84 per person. On average a family of five spends almost 19% of their per capita income annually on malaria prevention and cure, given an average per capita income of less the \$800 per annum (World Bank:1999). Sachs *et al.* (2000) estimate this annual figure to be as high as 25% of annual income. From the studies mentioned here it is evident that the cost of malaria is significant as it is. This cost is likely to increase because of the increased prevalence of the disease due to climate change.

### Global climate change and malaria

Houghton *et al.* (2001) state that climate change will have marked implications for seasonal epidemic diseases such as malaria. Reported malaria case numbers in South Africa over the last 30 years shows an exponential increase since the mid-1980s. Reported cases increased from less than 1000 in the seventies to more than 55 000 in 2000. Epidemic “jumps” occurred in 1989, 1997 and 2000 (HST 2000). An alarming fact is the district and sub-district geographic spread of malaria in South Africa over the same period, clearly indicating a spread to previous lower risk areas (HST 2000). This can be attributed to climate change and warmer weather conditions as discussed above. Regional figures released by the IPCC also indicate an increase in malaria cases between 1992 and 1996 (see Table 5).

**Table 5** Number of malaria cases within the southern Africa region

Country	1992	1993	1994	1995	1996
Botswana	415	14 615	5 335	2 129	19 340
Botswana % of total population (1996)	0.03	0.1	0.3	0.1	1.31
Namibia (Clinically diagnosed)	238 592	386 215	407 863	286 407	353 593 (Incomplete)
Namibia % of total population (1996)	13.70	22.18	23.43	16.45	20.30
South Africa	2 886	13 330	10 298	9 287	29 206
South Africa % of total population (1996)	0.01	0.03	0.02	0.02	0.07

Source: Houghton, J.T., Ding, Y., Griggs, D. J., Noguer, M., Van der Linden, P.J., & Xiaosu, D. (eds) 2001. *Climate Change 2001: The Scientific Basis*. Working group I. Third Assessment report. Intergovernmental Panel on Climate Change (IPCC: TAR). Cambridge University Press. Cambridge.

Kiker (2000) uses a climate-based model of malaria distribution to predict malaria distribution, using present and future climate data, taking into consideration the number of people at risk. In both the sulphate and no sulphate options of the scenario, the malaria-prone areas would more than double following projected climate changes. Kiker (2000) estimates that the number of people potentially at risk of malaria would increase from 7.9 to 23 million or 36 million (2010 population figures), according to the sulphate and no sulphate scenarios. Of these, 9.7 million would have lived in previously unaffected areas while 14.5 million people would have lived in areas where climate change would increase suitable periods from less than 5 months to more than 5 months. Of the 1.5 to 2 million people who presently live in high-risk areas climate change would only result in approximately 1 000 more cases.

There are, however, a number of other reasons for this upward trend apart from a possibility due to global climate change. The increase in the number of people at risk and the decrease in the effectiveness of prevention and curing due to the resistance of the parasite to current drug treatment are two of the more important reasons. Other factors such as the spread of HIV and the change from DDT to synthetic pyrethroids sprays and reduced spraying coverage also play a role.

### **The estimated cost of malaria due to climate change**

Estimating the cost of preventing and treating malaria requires four steps. These are:

The estimation of the population at a future date per country. For this study 2025 has been used due to the availability of data. (source: Du Toit and Jacobs (2000)).

The estimation of an incident ratio for various malaria risk scenarios. These incidence ratios indicate the portion of the population to contract malaria of those who was not at risk before or at a low risk category moving to a higher risk category due to climate change. Below the three main scenarios are highlighted, with the incident ration shown in brackets (source: Kiker (2000)).

from no risk to low and medium risk (0.269);

secondly from low and medium risk to high risk (0.402); and

then the increasing risk for people already living in high-risk areas (0.0007).

The estimation of the number of people in 2025 within each risk category by multiplying the population figure with the incidence ratio.

The estimation of the cost of preventing and treating malaria by multiplying the number of people at risk in each category with the cost of preventing and treating malaria (source: Mills (1991)). The cost estimates of Mills are adjusted to 2000 prices using purchasing power parity for the various countries.

The cost estimates shown in Table 6 are subject to the credibility of three sets of input data. They are:

The population growth rates for the different countries. The data that was used projected the population figures for 2025 based on the fact that HIV/AIDS will have a big impact on population growth in the region. Therefore, the growth rates are lower than generally published.

Since current prevention and treatment cost estimates are not available, the cost estimated by Mills is used.

The number of people exposed to malaria in 2025 following the model of Kiker.

**Table 6 Prevention and treatment cost of malaria due to an increase in incidence**

	South Africa		Botswana		Namibia	
Population (1999) (Millions)	42,6		1,5		1,6	
Population (2025) (Millions)	48,9		1,6		2,3	
Changes in number of cases from no risk to low and medium risk	13,2		0,43		0,62	
Incident ratio = 0.269						
Changes in number of cases from low and medium risk to high risk	19,7		0,64		0,92	
Incident ratio = 0.402						
Changes in number of cases in high risk areas	0,03		0,00		0,00	
Incident ratio = .0007						
Total incidence (number of people in millions in 2025)	32,8		1,07		1,54	
	Prevention cost (SA & Nam): Low cost scenario: \$0.08/capita – High cost scenario: \$3,36/capita Prevention cost (Bots): Low cost scenario: \$0.08/capita – High cost scenario: \$3,39/capita					
	Low	High	Low	High	Low	High
Total cost of prevention per month in 2025 (million 2000 PPP US\$)	2,62	110,25	0,09	3,64	0,12	5,19
Total prevention cost per year in 2025 (million 2000 PPP US\$)	31,50	1322,98	1,03	43,67	1,48	62,23
	Treatment cost (SA & Nam): Low cost scenario: \$0.63/capita - High cost scenario: \$6,20/capita Treatment cost (Bots): Low cost scenario: \$0.64/capita - High cost scenario: \$6,26/capita					
Total cost of treatment per month in 2025 (million 2000 PPP US\$)	20,67	203,43	0,69	6,72	0,97	9,57
Total treatment cost per year in 2025 (million 2000 PPP US\$)	248,06	2441,21	8,25	80,65	11,67	114,82
	Analysis					
Prevention cost per capita in 2025 (2000 PPP adjusted US\$)	0,64	27,0	0,64	27,3	0,64	27,1
Prevention cost per capita as percentage of GDP/capita	0.03	1.04	0.02	0.77	0.04	1.60
Treatment cost per capita in 2025 (2000 PPP adjusted US\$)	5,1	49,7	5,2	50,4	5,1	50,0
Treatment cost per capita as percentage of GDP/capita	0.2	1.92	0.15	1.42	0.3	2.96

Sources: Own calculations and IFS *Annual report*. Various editions. IMF. Washington DC. USA. Du Toit, J. & Jacobs, A.J. (2000). *Southern Africa Development Community: An Economic Profile*. ABSA Bank. Johannesburg: Monty Print. Kiker, G.A. (2000). *South African County study on climate change: Synthesis report for the vulnerability and adaptation assessment section*. School of Bioresources

Engineering and Environmental Hydrology. University of Natal. Durban. Mills, A. (1991). *The economics of Malaria control*: In: Waiting for the vaccine, G.A.T. Targett ed. John Wiley and Sons. Chichester, England.

Despite its deficiencies, Table 6 is still a source of a number of interesting observations. The problem of an increasing malaria risk due to climate change is very clear. If South Africa's high cost scenario is taken it indicates that out of a population of 48.9 million in 2025, 32.36 million (67%) will spend between US\$31 million and US\$1 322 (2000 PPP adjusted prices) on prevention cost in the year 2025 on malaria due to an increase in temperatures. Should all the people suffer from malaria once every year, treatment cost will be between US\$248 million and US\$2 441 million (2000 PPP adjusted prices). The values for Botswana and Namibia are considerably lower because of the smaller populations, though still significant.

However, because of a lower GDP/Capita, Namibia is experiencing the highest percentage of GDP/Capita for prevention (1.60) and treatment cost (2.96). The percentage prevention cost per capita for South Africa varies between 0.03 and 1.04 percent and for Botswana between 0.02 and 0.77. If one express this figure in dollar terms it will mean that South Africans will spend almost \$27 per capita on prevention cost (given a per capita income of \$2586). This seems very insignificant until compared to Shepard's (1991) estimation of \$2.34 per capita overall economic cost of malaria in all of Sub-Saharan Africa, which contributes 0.6 percent of the GDP/Capita for the region in 1991. If assume that all prevention is successful and that nobody needs treatment then the per capita spending estimation (\$27) is still ten times more than the per capita overall cost of malaria in 1991, that is significant.

## 5 A REDUCTION IN THE HEALTH IMPACT OF CLIMATE CHANGE

It is important to note that for each anticipated adverse health impact there is a range of social, institutional, technological, and behavioural adaptation options to reduce that impact. Adaptation is a key response strategy to minimise potential impacts of climate change. The reduction of death, disease, disability and human suffering with the least cost should be the main objectives in adapting to global climate change. The ability to adapt will depend on resources, information, infrastructure, etc.

Sachs *et al.* (2000) report that the short-term benefits of malaria control can reasonably be estimated at greater than \$3 billion per year. Thus, if intervention costs amounts to \$1 billion annually and it substantially reduce the disease burden it will be more than justified. One health year of life is gained for every \$1 to \$8 spent on effectively treating malaria cases, which makes the malaria treatment as cost-effective as measles vaccination (Mills 1991). Sachs *et al.* (2000) point out that the benefits of committing substantial new economic resources to malaria will greatly exceed the costs.

To reduce the impact of climate change on health it is necessary to include all sectors involved. Many areas outside the health sector can play an important role such as education, tourism, water supply and other development issues (Kovats *et al.* 2000). In Sub-Saharan Africa remedial measures outside healthcare systems such as better water and sanitation, cleaner energy, housing, vector control and pollution management are estimated to be capable of reducing the total burden of diseases by 23 to 29% (Lvovsky *et al.* 2000). Table 7 indicates the routes to follow to reduce the potential health impacts of climate change on malaria transmission.

**Table 7** Types of adaptive strategies: the case for malaria

Level	Vector control	Vaccine development	Access to anti-malarial drugs	Preventive measures such as bed nets, housing design	Epidemic forecasting	Environmental management
+++ = very important strategy + = Not so important – = No strategy						
International	++	++	+++	+	-	-
Regional or federal	++	-	++	+	-	-
National or state	+++	-	+++	+	+++	+
Local or community	++	-	+	++	++	+++
Individual	+++	-	+	+++	+	++

Source: Kovats *et al.* (2000). *Climate Change and Human Health*. Geneva: World Health Organisation.

## 6 CONCLUSION

The global climate change effect on human health becomes more and more evident and more evidence will be produced in the near future. Research on the costs associated with that will be done for another few decades.

To measure the economic effect on health for long-term climate change is difficult. Not only does data vary from country to country, but it is also evident that other factors such as better reporting, better detection, treatment and improved health care programmes influence the health environment.

Recognition of the magnitude of the malaria problem within Africa has risen during the 1990's. In June 1997, African heads of states and governments declared their commitment to strengthening malaria control in Africa. In May 1998 the African Initiative for Malaria Control (AIM) was adopted by African Ministers of Health at the 52<sup>nd</sup> World Health Assembly. More recently the Abuja African Heads of States Meeting on Malaria there has been a strong commitment to tackle the malaria problem. Regional collaboration has also been improved through the formation of the southern African Malaria Control initiative of the WHO-AFRO.

So far this study is one of the first in the southern Africa Development Community (SADC) region to try and quantify the socio-economic impact of global climate change on health with special emphasis on malaria and the impact of climate change. There is a definite need to investigate the cost relationships between malaria and other diseases, which may also be affected by global climate change as well as the effect on the socio-economic development in the SADC region.

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## The South African Tax Consequences of Emissions Trading

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### ABSTRACT

There is international pressure on developing countries to set greenhouse gas emissions targets. On the local front there is also pressure to reduce air pollution in South Africa. Marketable permits are one of the tools recommended by the Department of Environmental Affairs and Tourism to curb air pollution caused by industries. The purpose of this paper is to determine what the South African tax consequences will be if South Africa implements an emissions trading system. The tax consequences may have an impact in the environmental goal set.

Based on the assumptions that the permits will be allocated free of charge for at least a period of five years it was found that the sale of marketable permits will be subject to capital gains tax and will be deemed to include VAT. In instances where permits are purchased, one can argue that they were bought to explicitly meet the short-term emissions targets and are therefore production costs. It is recommended that the selling of the permits be exempt from capital gains tax and from VAT. When permits are bought it means that the firm can not meet its environmental obligations. It is therefore recommended that no tax deductions or allowances are given.

### *Keywords*

Emissions trading, greenhouse gases, marketable permits, income tax, value-added tax

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## 1 INTRODUCTION

There is a world-wide concern over climate change caused by long-lived greenhouse gas (GHG) emissions. Climate change pose a threat to the whole world and this concern can only be addressed by international co-operation (Lubbe *et al* 1999; Ott 1998; Moshirian 1998; Department of Environmental Affairs and Tourism (DEA&T) 1998; Repetto *et al* 1992). The United Nations Framework Convention on Climate Change (UNFCCC) is an international attempt to address the issue of climate change (Lutter 2000; DEA&T 1998; Barrett 1998). Flowing from the Convention, the Kyoto Protocol sets GHG emissions reduction targets for developed (Annex 1) countries but not for developing (non-Annex 1) countries (Winkler *et al* 2001). It should be noted that the Protocol would only come into force when fifty-five countries, representing fifty-five percent of the Annex 1 emissions, ratify the Protocol (DEA&T 1998). South Africa is a party to the UNFCCC and although South Africa does not have any current responsibilities under the Kyoto Protocol to reduce GHG emissions, there is increasing pressure from developed countries that developing countries should also set GHG emissions targets (Winkler *et al* 2001; Maya 2000; Barrett 1998; DEA&T 1998).

Four flexible mechanisms are proposed in the Protocol to reduce GHG emissions, of which emissions trading is one (COM Documents 2000; International Emissions Trading Association (IETA) 2000). Emissions trading as an environmental management tool is not confined to international trading and can also be used on a national level to protect the environment and has been used in countries world-wide to address the local impact of short-lived air pollutants (Tietenberg *et al* 2000). DEA&T started with a comprehensive research project in 1993 on the use of market-based instruments to curb environmental degradation (DEA&T 1997). One of the instruments recommended by the DEA&T to curb air pollution (short-lived pollutants) in South Africa is an emissions trading system (DEA&T 1997).

Barrett (1998) warns that when dealing with the issue of reducing long-lived GHG emissions, any attempt made should take the benefits and the costs involved into account. The benefits should be more than the costs. The tax treatment of emissions permits under emissions trading system may increase the cost of abatement (reducing long-lived GHG emissions or short-lived air pollutants) and therefore reduce the benefits to curb emissions.

Currently there is no specific section in either the Income Tax Act or the Value-added Tax Act that directly deals with the taxation of marketable emissions permits used under a trading system. The objective of this paper is to determine what the South African tax consequence will be when South Africa implements a local emissions trading system. Tax consequences that may increase either the cost of abatement or decrease the benefits of reducing emissions will be identified and recommendations will be made where applicable.

The paper is organised as follows: Section 2 identifies the key features of an emissions trading system and its application in a world-wide as well as in a South African context. Assumptions are made regarding the allocation of permits. These features and assumptions are used to provide guidance on the tax treatment of marketable emissions permits. In sections 3 and 4 the general rules in the Income Tax Act and the Value-added Tax Act are examined and the potential South African tax implications for both the seller and the buyer are determined under current tax legislation. This information is used to identify potential negative impacts of the current South African tax system on the achievement of the environmental goal set. In section 5 a summary of the tax consequences are given and recommendations are made where applicable to ensure that the environmental goal is not negated by the tax system.

## **2 KEY FEATURES OF AN EMISSIONS TRADING SYSTEM AND ITS APPLICATION TO EMISSIONS CONTROL**

In order to evaluate the South African potential tax implications of marketable emissions permits, it is important to establish the key features of an emission's trading system and its application in a world-wide as well as a South African context.

### **Key features**

The principle on which emissions trading is based is that permits are allocated to polluters, based on a permissible pollution level. The key feature is then to have polluters exchange these "marketable" or "tradable" permits amongst themselves as dictated by their individual needs. Those that do not require the use of all their permits will be able to sell or lease the surplus ones. This gives the permits a financial value, which provides the incentive to capitalise on any opportunities that may exist for reducing detrimental environmental impacts (Barde and Smith 1997; Department of Environmental Affairs 1993).

The DEA&T (1997) concluded in Discussion Document 4 that marketable permits should be used as an environmental management tool: "Marketable permits proved capable of providing incentives for changes to technology or management practices in three of the eleven case studies analysed: air pollution by industry, water pollution from chemicals in mining, and agrochemical pollution. ...Marketable permits are found to be very effective in terms of the criteria set for environmental effectiveness. Permits not only have the flexibility of all market-based instruments (MBI), but also the ability to set precise physical limits on the quantities of pollution or resource utilisation that will occur. ... Although marketable permits would require some form of administrative capacity in the initial introduction of the system, minimum effort and cost would be required from the authorities and the private enterprise to keep the system going. ...The trade of marketable permits would be taken care of principally by commercial markets and government institutional capacity would have to be created only for the initial introduction of the system."

The following key feature of emissions trading must be kept in mind when evaluating its application in a world-wide and South African context namely, that the precise physical limits of emissions are set for a given time. The environmental goal of setting limits is to promote the switching to cleaner technologies. The

DEA&T only focused their research on the use of market-based instruments in the South African context and recommended an emissions trading system for short-lived air pollution in South Africa.

#### Application

According to Kopp and Toman (1998) emissions trading can be used both as a domestic or international instrument in reducing carbon dioxide emissions. Developing countries could also opt into the trading system voluntarily by assuming national limits (Kopp *et al* 1998). It must be remembered that there is pressure on developing countries to set GHG emissions limits and that South Africa may find itself committed to reduce GHG emissions in the future (Winkler *et al* 2001).

Short-lived air pollutants, in contrast with long-lived greenhouse gases, have a local environmental impact and are harmful to the local environment and human health, if not controlled properly. Any market to be introduced to curb local pollution will only be tradable within a specified region in South Africa. Trading in SO<sub>2</sub> emissions permits will for example be allowed in a demarcated area such as the Vaal Triangle.

The following table gives an indication of contributors to air pollution and greenhouse gases in South Africa in 1990 (DEA&T 1999). The classification between long-lived greenhouse gases and short-lived pollutants was obtained from EnergyScan (2000).

**Table 1 Contributors to emissions in South Africa**

Classification	Long-lived GHG (kilotons)			Short-lived air pollutants (kilotons)			
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO	NO <sub>x</sub>	NMV OC	SO <sub>2</sub>
Energy: electricity, industrial, domestic, mining and refineries	238 554	751	7	1 660	1 221	88	1 695
Transport	31 390	39	5	2 707	995	569	37
Industrial processes (excluding energy)	23 461	4	2	28	13	194	28
Agriculture, land use, forestry *Net users of CO <sub>2</sub>	*-20 614	1064	61	1 286	39		
Waste (landfills and treatment of effluent and sewage)		380	3				

The energy sector in South Africa is the single largest source of CO<sub>2</sub> and SO<sub>2</sub> as it is in most countries (DEA&T 1999). This level of emissions is also mainly as a result of the high level of coal used by the electricity generation and synthetic fuels industries, and the high level of industrialisation producing high-energy content products (Department of Minerals and Energy (DME) 1998). Eskom provides 98% of the country's electricity requirements (ESKOM 2000). Currently 91% of the electricity is generated by coal-fired power stations (Energy and Development Research Centre (EDRC) 2000). South Africa is also responsible for 1,6% of global GHG emissions and the country's energy sector is the single largest source of GHG emissions in Africa, If the above statistics are taken into consideration it is clear that the energy sector should be targeted with set emissions levels.

#### Assumptions

Permits will be allocated to the energy sector free of charge for a minimum period of at least five years and only after reduction of emissions had been achieved these permits will become abundant and therefore marketable. This means that industry first has to invest in alternative sources of energy, for example solar, nuclear or wind energy before it will be able to sell off its excess permits. If these permits become taxable it means that the incentive to change to cleaner technologies will be reduced. In the following section the tax implications for the seller of permits will be investigated under the current tax legislation.

### 3 THE TAX IMPLICATIONS FROM A SELLER'S POINT OF VIEW

A permit can only become marketable after emissions' reductions have been achieved. This means that the seller had already invested in alternative cleaner technologies or better management practices to reduce emissions. The tax treatment of the proceeds or gain made when selling the marketable emissions permits will have an effect on the costs and benefits of the reduction program. Current tax legislation that might have an impact on an emissions trading system is income tax (including the taxation of capital gains) and value added tax (VAT).

#### **South African Income Tax** (Income Tax Act, No 58 of 1962 as amended)

Gross income is defined in section 1 of the Income Tax Act. "Gross income", in relation to any year or period of assessment, means-

- in the case of any resident, the total amount in cash or otherwise, received by or accrued to or in favour of such resident; or
- in the case of any person other than a resident, the total amount, in cash or otherwise, received by or accrued to or in favour of such person from a source within or deemed to be within the Republic, during such year of assessment, excluding receipts or accruals of a capital nature...

The various elements of the gross income definition are however not defined in this Act. The South African courts have therefore been called upon to interpret their meaning (Arendse *et al* 2000; Huxham & Haupt 2000). Two issues are of importance to make a conclusion on the taxability of the sale of emissions permits, namely the issue of residence / source and the issue of nature of the receipt or accrual.

#### Residence and source based taxation

Residents are taxed on their world-wide income from 1 January 2001 whereas non-residents will still be taxed on income from a source within or deemed to be within the Republic (King 2000). A "resident" is defined in section 1 and means any -

(b) person (other than a natural person), which is incorporated, established, or formed in the Republic or which has its place of effective management in the Republic (but excluding any international headquarter company).

The source and deemed source rules are still applicable to non-residents. In the case of Rhodesia Metals Ltd v COT<sup>i</sup> the courts held that: "Source means not a legal concept but something which the practical man would regard as a real source of income. The ascertaining of the actual source is a practical hard matter of fact."

The principal test of source was formulated by Watermeyer CJ in CIR v Lever Brothers and Unilever Ltd<sup>ii</sup>: "...the source of receipts, received as income, is not the quarter whence they come, but the originating cause of their being received as income..."

If there is a multiplicity of originating causes e.g. business activities are carried out in South Africa, but the sale of the goods takes place in an overseas country, the "dominant cause" must be established (CIR v Black<sup>iii</sup>). In the case of CIR v Epstein<sup>iv</sup> the courts used the activities test to determine whether income received was from a South African source. Even though goods were sold to a foreign country the court held that the income should be of a South African source as this is where the activities of the taxpayer took place.

After careful consideration of the above court cases and the principles laid down therein, it is clear that a South African business (whether regarded as a resident or not) engaging in emissions trading would therefore be receiving income from a South African source, as marketable emissions permits would be granted to it on account of its business activities in South Africa. The dominating cause of any emissions trading activities therefore is its business in South Africa. South African residents in any case are taxed on their world-wide income, including South African source income.

### Receipts or accruals of a capital nature

The final test in the gross income definition is to determine whether an amount received is of a capital or income nature. "It is normally not possible to have one amount of income which is partly capital and partly revenue. It is also not possible to have an amount, which is neither revenue nor capital." (Pyott Ltd v CIR<sup>v</sup>)

Over the years the courts have applied certain tests in determining whether income is of a capital or revenue nature. Of these tests the following two are the most important, namely the test of the tree and its fruit and the test of intention (refer to Meyerowitz 2001; Arendse *et al* 2000; Huxham *et al* 2000). The metaphor of the tree and its fruits is frequently used to illustrate the principles of capital versus revenue income (CIR v Visser<sup>vi</sup>). The tree is the capital asset, which is used to produce the fruits. The test is thus simple, namely that income is produced by some income-producing asset. The income so generated is of a revenue nature and taxable, while the income producing asset is of a capital nature and the proceeds on the disposal of such an asset therefore also of a capital nature.

If applied to the question at hand, it can be argued that the marketable emissions permits held by a company represent its capital assets, as its total production, which is its income generating activities, is dependant on the quantity of emissions allowable under the permits it holds.

The next question that needs to be answered is, if speculators will be allowed to participate under an emissions trading system. Emissions trading in South Africa will probably operate in a closed environment only allowing the relevant industries to participate. However, the probability of speculative trading cannot be excluded and it is submitted that it can happen that a South African business might engage in speculating with marketable emissions permits. In this case it is clear that the marketable emissions permits no longer represent capital assets, but have become "stock" in the taxpayer's hands. In such instances proceeds from emissions trading can no longer be seen as of a capital nature and should be included in gross income.

Different taxpayers hold assets for different purposes and the courts have found it important to establish what a taxpayer's true intention is with regards to the assets. In CIR v Stott<sup>vii</sup> Wessels JA came to the following conclusion: "It is unnecessary to go as far as to say that the intention with which an article or land is bought is conclusive as to whether the proceeds derived from a sale are taxable or not. It is sufficient to say that the intention is an important factor and unless some other factor intervenes to show that when the article was sold it was sold in pursuance of a scheme of profit-making, it is conclusive whether it is capital or gross income."

The first rule in determining whether income is of a capital nature is therefore to establish the taxpayer's intention at the date of acquisition and secondly to determine whether his intention has changed in the intervening period before the sale of the asset. In the case of Lace Proprietary Mines Ltd v CIR<sup>viii</sup> the court held that where the objective of the acquisition was to resell at a profit and that was achieved, the profit obtained would be of a revenue nature.

Once it has been established what the intention of a taxpayer was at the time of acquisition of the asset, it is also important to determine whether the taxpayer's intention has changed in the intervening period. The term "change in intention" was used in the New Mines Limited v CIR<sup>ix</sup> case, where the judge came to the conclusion that the original speculative venture had been changed to an ordinary investment. The realisation of a capital asset does not however, per se, constitute a change in intention. This principle was established in the case of CIR v Stott<sup>7</sup> where Wessels JA held that: "Every person who invests his surplus funds in land or stock or any other asset is entitled to realise such asset to the best advantage and to accommodate the asset to the exigencies of the market in which he is selling. The fact that he does so cannot alter what is an investment of capital into trade or business for earning profits".

The mere fact that a decision was taken to realise an asset, therefore does not give rise to a change in intention. Something more is required. This was stipulated in the case of John Bell and Co (Pty) Ltd<sup>x</sup> where the judge indicated that: "Something more is required in order to metamorphose the character of the asset and to render its proceeds gross income. For example, the taxpayer must already be trading in the same or

selling such assets for profit, and, in either case, the asset in question is taken into or used as his stock in trade."

In general, South African companies will need the marketable emissions permits to allow them to emit a certain quantity of gases annually. According to Nieuwoudt (2000) the intention of the companies when acquiring the permits will, in most instances, be to secure their future production and business operations. These permits will normally form part of the company's income producing assets. When excess permits are sold the receipts from such transaction will in most cases be regarded as of a capital nature and not form part of gross income. However, any capital gains made after 1 October 2001 may be included in terms of section 26A of the Income Tax Act, 1962 as amended. The capital gain has to be calculated according to the rules of the Eighth Schedule to the Income Tax Act.

### **Capital Gains Tax (CGT)** (Eighth Schedule of the Income Tax Act, No 58 of 1962 as amended)

Taxable capital gains will only be included in taxable income as from 1 October 2001. Any natural or legal person, resident in the Republic, is liable for CGT on the disposal of any asset whether held in the Republic or outside (paragraph 2 of the Eighth Schedule). If a non-resident is carrying on a trade through a permanent establishment in the Republic then the disposal of an asset by the permanent establishment will also trigger CGT (paragraph 2). Asset is defined in paragraph 1 in the Schedule and includes property of whatever nature, whether movable or immovable, corporeal or incorporeal...and a right or interest of whatever nature to or in such property.

It is submitted that marketable emissions permits held by residents and permits held by non-residents in carrying on a trade in the Republic through a permanent establishment falls in the scope of the definition of an asset. The capital gain will be calculated as the amount by which the proceeds received or accrued exceed the base cost of the asset. Capital losses may only be deducted against capital gains and may not be offset against income from other sources (paragraph 9 and section 26A of the principal Act).

### **Value Added Tax** (Value Added Tax Act, No 89 of 1991 as amended)

Brettigny (2000) summarises the VAT calculation as follows: "Value-added tax payable by or refundable to a registered vendor is the difference between his output and input tax. Output tax, in general is the tax which the vendor charges on the supply of goods or services in the course or furtherance of an enterprise carried on by him..." In section 1 of the VAT Act "goods" are defined as "...corporeal moving things, fixed property and any real right in any such thing or fixed property..." "Services" mean anything done or to be done, including the granting, cession or surrender of any right or making available of any facility or advantage, but excluding a supply of goods, money, or any stamp, form or card contemplated in paragraph (c) of the definition of goods (section 1 of VAT Act). According to Deloitte & Touche (2000) and Ernst & Young (2000) virtually any type of economic activity that is not a supply of goods, could potentially be a supply of services. Huxham and Haupt (1994) also interpret "the granting, assignment, cession or surrender of any right or the making available of any facility or advantage" to be of extremely wide application.

Another important factor to consider is that the supply must be made in the course of an enterprise. Section 1 defines an "enterprise" as "...any enterprise or activity which is carried on continuously or regularly by any person in the Republic, or partly in the Republic, and in the course or furtherance of which goods or services are supplied to any other person for a consideration, whether or not for profit..."

Section 10 of the VAT Act deals with the value of all taxable supplies. Section 10(3) stipulates that the value to be placed on the supply of goods and services is: if the consideration is in money, such money. If the consideration is not in money, the open market value of the supply at the time of the supply less the portion that represents VAT (Huxham & Haupt 2000).

Where goods or services are traded on a national level it is clear that the supplies are made within the Republic and therefore subject to VAT at the standard rate of 14%. The buyer of these permits will be

## Summary

Income received from the sale of marketable emissions permits will be subject to normal taxation either through the inclusion in gross income or through the inclusion as a taxable capital gain in the taxable income of a taxpayer. An aggregate capital loss may not reduce taxable income but may be carried forward as an assessed capital loss.

Where permits have been sold as part of a profit making scheme, income derived by a corporate taxpayer will be subject to normal taxation at 30%. If the permits were not sold as part of a profit making scheme the taxable gain will be calculated according to the Eighth schedule and included in the taxable income of a corporate taxpayer at an inclusion rate of 50% of the gain. The effective tax rate on the capital gain will be 15% (50% x 30%).

The VAT implication of the selling of marketable emissions permits will depend if marketable emissions permits will be regarded as either "goods" or "services". The definition of "services" is extremely wide and for the purpose of this paper it is assumed that the permits can be classified as a right.

**Table 2 Emissions trading from the seller's point of view**

	Permits kept as investments to ensure future production	Permits kept as trading stock for speculative purposes
Included in taxable income in terms of the gross income definition	X	√
Included in taxable income in terms of the Income Tax Act as a taxable capital gain (when sold)	√	X
Value added tax (when sold)	√	√

## 4 THE TAX IMPLICATIONS FROM A BUYER'S POINT OF VIEW

When buying permits it means that the targeted industry cannot meet its emissions limits and can therefore be regarded as environmental unfriendly (CSERGE & EFREC Ltd UK 1996; Deloitte & Touch Consortium 1994). There is a view that the tax system should not subsidise such practices with tax incentives. The tax implications attached to buying transactions will be discussed in the next sections.

### South African Income Tax (Income Tax Act, No 58 of 1962 as amended)

All deductions for tax purposes are either allowed in terms of the general deduction formula (section 11(a) and section 23) or the specific deduction provisions (section 11 and section 19) as described in the Income Tax Act.

In order to determine whether expenditure incurred is therefore deductible, it is necessary to test the nature of the expenses against the above-mentioned provisions in the Act. The preamble to section 11 and section 11(a) states: "For the purpose of determining the taxable income derived by any person from carrying on any trade, there shall be allowed as deductions from the income of such person so derived-

expenditure and losses actually incurred in the production of the income, provided such expenditure and losses are not of a capital nature;"

Losses of a capital nature are dealt with in the Eighth Schedule to the Income Tax Act where taxable capital gains and assessed capital losses are calculated. Assessed capital losses may only be set-off against capital gains and may not reduce taxable income. Any loss not set-off against capital gains may be carried forward to the next year as an assessed capital loss.

**In the production of income**

Only expenditure incurred in the production of income can be deducted for tax purposes in terms of section 11(a) of the Act. The onus therefore lies upon the taxpayer to prove that expenditure incurred is in the production of income. It is however important to note that the expenditure itself cannot produce income, but that the expenditure is normally a consequence of the actions that produce income.

The following passage by Watermeyer A.J. in the *Port Elizabeth Electric Tramway Company Ltd v CIR*<sup>xi</sup> case has been accepted as being the approach to determine whether expenditure incurred was in the production of income: "The purpose of the act entailing expenditure must be looked at. If it is performed for the purpose of earning income then the expenditure attendant upon it is deductible...The other question is, what attendant expenditure can be deducted? How closely must they be linked to the business operations? Here, in my opinion, all expenses attached to the performance of a business operation bona fide performed for the purpose of earning income are deductible whether such expenses are necessary for its performance or attached to it by chance or are bona fide incurred for the more efficient performance of such operation, provided they are so closely connected with it that they may be regarded as part of the cost of performing it."

In the case of *COT v Rendle*<sup>xii</sup> the phrase "attached to it by chance" as stipulated in the above case was defined as follows: "In deciding whether such an expenditure is deductible, it seems to me the inquiry must be whether the 'chance' of such expenditure being incurred is sufficiently closely connected with the business operation." In the case of *Sub-Nigel Ltd v CIR*<sup>xiii</sup> it was held that expenditure incurred in the production of income will still be deductible even if the income has not been produced on the date of the claim. The only criterion is that the expense must have been incurred with the purpose of generating income.

**Not of a capital nature**

The tests for determining whether expenditure is of a capital nature can be obtained from the numerous court cases on this matter that have been decided over the years.

In the case of *New States Areas Ltd v CIR*<sup>xiv</sup> a test was suggested that would be applicable in most cases: "The conclusion to be drawn from all (the) cases seems to be that the true nature of each transaction must be inquired into in order to determine whether the expenditure attached to it is capital or revenue expenditure. Its true nature is a matter of fact and the purpose of the expenditure is the important factor; if it is incurred for the purpose of acquiring a capital asset for the business it is capital expenditure..."

In the case of *CIR v George Forest Timber Co Ltd*<sup>xv</sup> it was also held that money spent in creating or acquiring an income-producing concern, must be of a capital nature. There is thus a great difference between money spent in acquiring or creating a source of income and money spent on working it.

Where it can be proven that the marketable emissions permits were obtained to ensure the company's future compliance to the emissions limits stipulated by laws, the expenditure will be linked to the income-earning structure of the company and therefore be regarded as of a capital nature and not deductible. However, if the company buys these permits with the purpose of meeting its short-term emission targets one can reason that the permits were acquired as part of the cost of production. The cost will be deductible in terms of section 11(a). It is also possible that a company may acquire permits as trading stock for the purpose of generating a profit from the sale of such permits. Where this is the case the deductibility of the expense should again be tested against the general deduction formula. Where there is a profit motive it should not be difficult to prove that the expenses were incurred in the production of income. In these instances the cost price of the permits can be deducted for tax purposes when it is incurred.

**Value Added Tax (Value Added Tax Act, No 89 of 1991 as amended)**

Input tax is defined as the tax paid by a vendor when acquiring goods or services wholly for the purposes of consumption, use or supply in the course of making taxable supplies.

Where a vendor therefore acquires marketable emissions permits in order to ensure its future taxable supplies, input VAT should be claimed against all output VAT payable on the making of its taxable supplies.

Section 16(2) stipulates that no input VAT can be claimed unless: A tax invoice or debit note or credit note is held by the vendor claiming the input deduction at the time that the return is rendered.

Where marketable emissions permits are bought from a national source, VAT can be claimed as an input tax, to the extent that taxable supplies are made. However, before a valid claim can be made the buyer must be in possession of a valid VAT Invoice.

### Summary

Where it is necessary for a South African company to obtain emissions permits to ensure the future continuance of its business, the purchase can be seen as expenditure linked to the income-earning structure, and will be regarded as of a capital nature and not deductible for normal income tax purposes.

However, where a company embarks upon a scheme of profit making through the regular buying and selling of these permits, the permits will be considered part of its trading stock and will be deductible under the general deduction formula.

In both of the above-mentioned instances input VAT can be claimed to the extent that taxable supplies are made, provided the buyer is in possession of a valid VAT invoice as required by the Act. Imported services will not trigger VAT if the goal is to make taxable supplies. It is important to note that the net cash flow effect of buying permits from a national source are the same as importing these permits from an international source, the reason being that the VAT input tax is deductible.

**Table 3 Emissions trading from a buyer's point of view**

	Permits bought as trading stock for speculative purposes / part of production cost	Permits bought as investments to ensure future production
Normal income tax -Section 11(a)	√	X
Value added tax	√	√

## 5 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations will be divided into two parts namely, the tax treatment when selling the permits and the tax treatment when buying the permits.

### Selling permits

The biggest tax drawback for emissions trading is that when these permits are sold (after emissions reduction had been achieved) it would be subject to normal income tax as a taxable capital gain at an effective rate of 15%. If trading only occurs on a national level then the VAT effect on the first sale will also be negative as the compensation will be deemed to include VAT of 14%. The VAT effects on subsequent sales will not be that detrimental as a VAT input tax could be claimed when the permits were bought. When speculating with permits the proceeds will become taxable and a deduction of costs will be allowed. The gain will be taxed at a corporate tax rate of 30%.

It is therefore recommended that before any emissions trading system is implemented in South Africa that the following changes should be made to tax legislation to ensure that the environmental goal of reduction of emissions are met, namely:

The proceeds from the disposal of marketable emissions permits should be exempt from the taxation of capital gains; and

Marketable emissions permits should be excluded from the definition of services in the VAT Act.

It is recommended that when a taxpayer speculates with marketable permits that the rules regarding the income tax of trading stock should remain intact.

**Buying permits**

It must be remembered that when a taxpayer buys permits it indicates that the taxpayer cannot meet its environmental target. There is a strong view that environmental unfriendly practices should not be subsidised. When allowing a tax deduction it implies that the government is subsidising a harmful practice.

It is therefore recommended that no allowances should be given on the cost of marketable permits. When a taxpayer is speculating with permits the full proceeds will be gross income and the cost of the permits will be deductible. As recommended earlier that the definitions of goods and services should be adjusted to exclude marketable emissions permits meaning that no input VAT will be allowed.

**ENDNOTES (CASE LAW)**

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- <sup>i</sup> Rhodesia Metals v COT 1938 AD 282, 9 SATC 363  
<sup>ii</sup> CIR v Lever Brothers and Unilever Ltd 1946 AD 441, 14 SATC 44  
<sup>iii</sup> CIR v Black 1957 (3) SA 536 (A), 21 SATC 226, 1957 Taxpayer 172  
<sup>iv</sup> CIR v Epstein 1954(3) SA 689 (A), 19 SATC 221, 1954 Taxpayer 147  
<sup>v</sup> Pyott Ltd v CIR 1944 AD 128, 13 SATC 121  
<sup>vi</sup> CIR v Visser 1937 TPD, 8 SATC 271  
<sup>vii</sup> CIR v Stott 1928 AD 252, 3 SATC 253  
<sup>viii</sup> Lace Proprietary Ltd v CIR 1938 AD 267, 9 SATC 349  
<sup>ix</sup> New Mines Limited v CIR 1938 AD 455 at 46, 10 SATC 9  
<sup>x</sup> John Bell and Co (Pty) Ltd v SIR 1976 (4) SA 415 (A), 38 SATC 87, 1976 Taxpayer 208  
<sup>xi</sup> Port Elizabeth Electric Tramway C Ltd v CIR 1936 CPD 241, 8 SATC 13  
<sup>xii</sup> COT v Rendle 1965 (1) SA 59 (SRAD), 26 SATC 326, 1964 Taxpayer 225  
<sup>xiii</sup> Sub-Nigel Ltd v CIR 1948 (4) SA 580 (A), 15 SATC 38  
<sup>xiv</sup> New States Areas Ltd v CIR 1946 AD 610, 14 SATC 155  
<sup>xv</sup> CIR v George Forest Timber Co Ltd 1924 AD 516, 1 SATC 20

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