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Impact of the South African Carbon Tax on the Clay Brick Industry

EcoMetrix Africa

Funded by the SDC, as part of the EECB Project implemented by Swisscontact.
This publication is based on an in-depth industry assessment undertaken by Ecometrix Africa (Pty) Ltd.
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Foreword

As the South African Government forges ahead with plans to introduce a 'Carbon Tax' on those sectors of commerce considered as carbon intensive, the need to understand the implications of this pricing mechanism on the clay brick sector in this country, saw the Clay Brick Association of Southern Africa enter into a collaborative initiative with the SDC (Swiss Agency for Development and Cooperation) and Swisscontact (Swiss Foundation for Technical Cooperation), that would also provide the basis to facilitate further policy dialogue on behalf of the industry.

Prepared by leading experts in the field of climate change and emissions management, Ecometrix Africa (Pty) Ltd, this publication the 'Impact of the South African Carbon Tax on the Clay Brick Industry' serves as a snapshot of an in-depth sector assessment, which looks at the industry's exposure to the proposed 'Tax', and the potential mitigation options available to the independent producers in this country.

The Clay Brick Association is the industry body representing all producers committed to the manufacture and supply of quality clay brick and paving products, in compliance with national legislation. Its role is to provide strategic direction to its members on issues pertinent to the industry. Central to this function is a dedicated team of brickmaking experts, who are proactively involved with issues such as air quality, sustainable manufacturing practices, fossil fuel reduction, as well as ongoing research and development.

To this end, this publication aims to equip the clay brick producers, as well as the South African Government and other relevant stakeholders, with an enhanced understanding of the Carbon Tax, in context of the clay brick sector. It looks at climate change in this country, and explains what the 'tax' essentially is, and why it will be implemented, taking into consideration clay brick's contribution towards sustainable development and employment in this country.

This research forms part of the 'Energy Efficient Clay Brick (EECB) Project', which is funded by the SDC as part of the Swiss Global Climate Change Programme, with the implementation carried out by Swisscontact. The EECB Project comprises of a unique market development approach, which aims to facilitate energy efficient production practices in the clay brick sector, that also meet the climate change mitigation objectives of this country. This project represents Phase II of the Vertical Shaft Brick Kiln (SA-VSBK) Project, following the success of this South-South technology transfer programme, which saw the anchoring of this brick-firing method in this country.

The Clay Brick Association, as well as the SDC and Swisscontact are pleased with the outcome of this research, and expressly acknowledge the clay brick producers that came forward to support this study.

Whilst the core focus of this publication is on, Carbon Tax in the Clay Brick sector, the fundamental principles are applicable to all sectors of industry. It is hoped that the guidelines herein will facilitate a smooth transition towards being Carbon Tax compliant.

Thank you

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1 At the time of this research, the anticipated date for implementation of the Carbon Tax was January 2015. This publication describes the situation and process leading up to this date. However, at the time of going to print, National Treasury had extended this date to January 2016. As such, the possibility exists that as and when the final version of the tax is employed, whenever that may be, it could be quite different.

1. Executive Summary

In December 2009 President Zuma, during CoP15 (the 15th Conference of Parties as in the 15th annual gathering of the UNFCCC) in Copenhagen pledged to reduce the country's total annual emissions by 34% below 'business-as-usual' levels by 2020, and by 42% by 2025[1]. In February 2013 (and in support of this pledge), the Minister of Finance announced that a Carbon Tax would come into effect from 2015. The Carbon Tax would constitute the largest stick approach developed by the South African government in this area a and will cover the bulk of the emitting industries within the country's sectors.

In late 2012 Swisscontact Southern Africa, implementing the South Africa Vertical Shaft Brick Kiln (SA-VSBK) project in consortium with the Swiss Resources Centre and Consultancies for Development (SKAT) and on behalf of the Swiss Agency for Development and Cooperation (SDC), contracted EcoMetrix Africa (Pty) Ltd. ('EcoMetrix') to conduct an assessment of the potential impacts of the South African Carbon Tax (the 'Carbon Tax') on the South African brick Industry ('the Industry') and several of the key producers within the industry.

In order to fully understand implications of the Carbon Tax, EcoMetrix had to obtain all known and relevant data about the Industry and apply the principles of the Carbon Tax, albeit in its development stage. As a result, the findings and recommendations of the Carbon Tax Impact study (the 'study') were compiled and are presented herewith.

The Carbon Tax is one of the instruments that the South African government is planning to implement towards the realisation of the pledge made by President Zuma in December 2009. The tax will be applied as an 'upstream tax' based on the volume of fossil fuels consumed per year multiplied by an appropriate emission factor to determine the gross taxable emissions, also known as the Basic Carbon Tax. Depending on the sector a company fits in and the characteristics of its operations, an organisation will be afforded a number of discounts on the Basic Carbon Tax which can be applied to so called 'Tax-free thresholds'. These thresholds can then be staggered to reduce the Carbon Tax burden by a maximum of **90%** of the Basic Carbon Tax to determine the net carbon taxable volume. A levy of **120 ZAR/tCO_2** (Rand per tonne of carbon dioxide) emitted will be raised over this net taxable volume and will escalate by **10% per year** from the first year of implementation of the Carbon Tax.

The study indicated that one of the key drivers behind the introduction of the Carbon Tax is to incentivise company's within the clay brick industry to become less carbon intensive. This is mainly reflected within the so called Z-factor correction via which a company has a higher or lower basic free threshold if they are more or less carbon intensive when compared with their peers in the sector.

Furthermore, the study assessed the practicality of the carbon intensity benchmark for the production of clay bricks as suggested by National Treasury ('Treasury') in the Carbon Tax Policy Paper (the 'Policy Paper'). The Policy Paper provides an indication of the carbon intensity benchmark for the production of clay bricks of **0.12 tCO_2/ton of output**[2] or **0.40 tCO_2/brick equivalent**.

1 http://www.climateaction.org.za/cop17-cmp7/sa-government-position-on-climate-change

The diagram below provides a schematic representation of the workings of the Basic Carbon Tax, some detail on the thresholds and how they result in the net carbon tax.

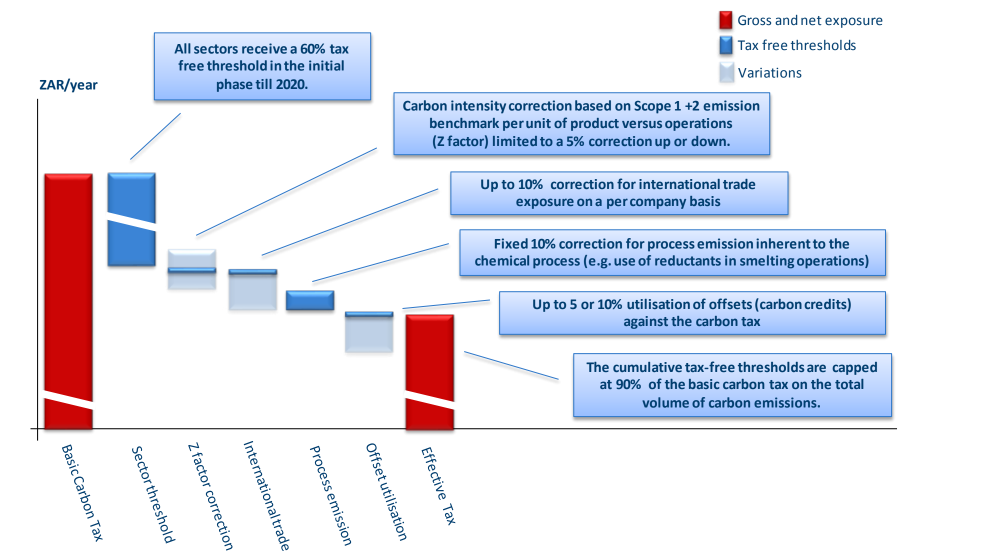
Despite the detailed design, aspects of the Carbon Tax are still however uncertain. All the known elements of the Carbon Tax were therefore included in the study to determine the Industry's exposure and to identify potential actions that can be undertaken to mitigate this exposure to the tax.

Although the source for this benchmark (the EU ETS) may be the most advanced benchmarking system in the world, according to the Policy Paper, it does not factor in the South African context and therefore provides a very unrealistic benchmark to apply. For illustrative purposes the graph below provides insight into the Industry's carbon intensity per firing technology.

As indicated in the graph the weighted average emissions per brick equivalent for a clay brick produced within South Africa is around **0.941 tCO_2/brick equivalent.** (1 Brick Equivalent correspond to 1000 Standard Bricks)

However, the Carbon Tax guidance indicates that the Z-Factor should only consider the average fossil fuel and electricity consumed within the operations (Scope 1 and 2 according to the guidance), and therefore excludes fuel emissions from transporting the clay brick, against the benchmark for which the brick producer should be assessed, from a Z-Factor correction perspective to 0.820 tCO_2/brick equivalent **0.820 tCO_2/brick equivalent.**

This **(0.820 tCO_2/brick equivalent)** is almost double the carbon intensity, envisaged by Treasury at **0.40 tCO_2/brick equivalent**. This benchmark lies below the most



Source: National Treasury, Carbon Tax Policy Paper, May 2013 and EcoMetrix team analysis

Figure 1: Carbon Tax Waterfall

2 Based on the average of 0.114 tCO_2/t for low and high density clay blocks and 0.133 tCO_2/t for facing bricks and pavers.

carbon efficient firing technology included in the study.

The clay brick producers of South Africa utilise a range of different firing technologies, e.g. TVA, Clamp, Tunnel, VSBK, amongst others, and will most likely be affected to various extents depending on the source of energy used in producing bricks. For the purpose of the study other types of firing technologies such as Hoffman and Zigzag kilns were not included, as they do not represent a material element of the Industry.

The findings of the study indicated the total emissions of the Industry to be around **4,837,448 tCO_2/year** of which **4,216,186 tCO_2/year (i.e. around 87%)** is considered its Basic Carbon Tax exposure, under the Carbon Tax. This excludes emissions resulting from electricity consumption, transport and fuel used.

At the announced tax rate of **120 ZAR/tCO_2** the total Basic Carbon tax exposure for the Industry would be **505,942,309 ZAR/year.** However if all the thresholds could be utilised (e.g. Industry threshold, Z-Factor correction, international trade and process emissions) the Industry's effective Carbon Tax exposure would be reduced to **177,079,808 ZAR/year.** The diagram below provides an overview of the Industry's Carbon Tax exposure, in relation to the thresholds, and the impact thereof should no mitigation measures be implemented.

It is important to note that the Industry's Carbon Tax exposure diagram assumes that the thresholds, as defined in the basic outline of the Carbon Tax by Treasury, are applicable as if the Industry was fully eligible, and has not taken any action to reduce its exposure.

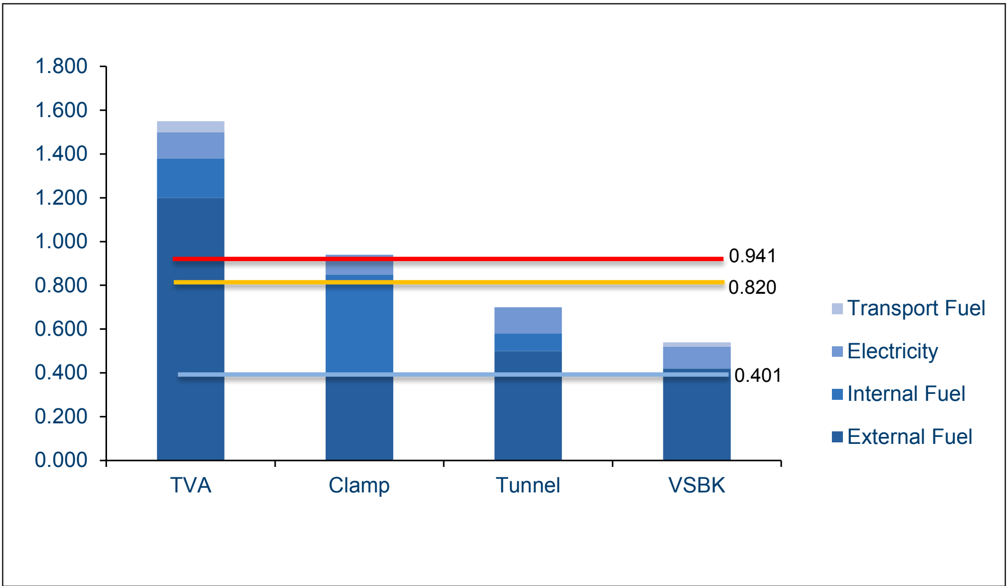


Figure 2: Carbon Intensity in tCO_2/brick equivalent per firing technology

From a production cost perspective the direct impact of the Carbon Tax will result in an average cost increase of **33.39 ZAR/brick equivalent.** Additionally, it is estimated that the cost of electricity will go up by **57.60 ZAR/MW** (over and above the price increases approved by NERSA earlier this year) which will result in another cost adjustment of **5.95 ZAR/Brick equivalent.** The cost increases resulting from the Carbon Tax per brick equivalent, in relation to the the firing technologies used in South Africa, is shown in Table 1.

Table 1: Cost increase per brick equivalent

Firing Technology	Average Carbon Intensity/Brick Equivalent	Carbon Tax/Brick Equivalent
Clamp	0.935 tCO_2	37.26 ZAR
Tunnel	0.759 tCO_2	24.01 ZAR
VSBK	0.529 tCO_2	19.23 ZAR
Weighted Average	**0.820 tCO_2**	**33,39 ZAR**

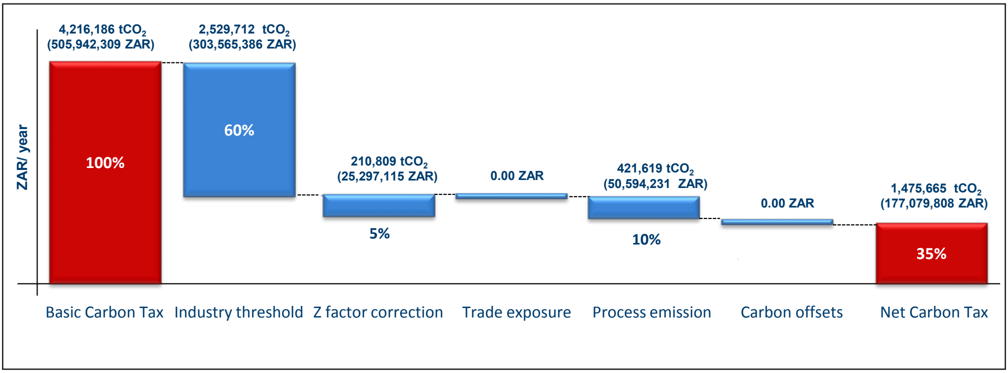


Figure 3: Industry's Carbon Tax exposure

The main mitigation measures at the Industry's disposal and their impact on the industry's Carbon Tax exposure if implemented are highlighted in the next table.

This is based on extensive rendering of potential design amendments to the Carbon Tax draft legislation, as well as the Industry's characteristics, options to mitigate the Industry's exposure to the Carbon Tax were identified and quantified.

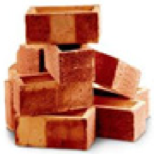
Evidently the Industry and its participants have a range of options to reduce their exposure to the Carbon Tax to the minimum level of **10%** of the Basic Carbon Tax of **50,594,231 ZAR**. This could effectively bring down the direct exposure to **9.54 ZAR/brick equivalent** and the combined exposure (direct and indirect) to **15.49 ZAR/brick equivalent** from **33.39 ZAR/Brick equivalent** or even less if more carbon efficient operating procedures are adopted in the Industry.

It is important to consider that it is Treasury's stated ambition to periodically increase the Carbon Tax exposure by reducing certain thresholds and in this way motivate industries to switch to more climate sustainable methods of production. The Indusry participants therefore should strongly consider the more material and long term mitigation options at its disposal, such as converting its operations to include a VSBK and/or convert its external fuel to be non-fossil based. In this way participants can completely reduce thier exposure under the Carbon Tax. Also if the VSBK is made eligible to generate carbon credits, players in the Industry would be in a better position to generate additional income from the introduction of the Carbon Tax.

In summary the introduction of the Carbon Tax will have winners and losers at Industry as well as the company level. Being informed, responsive and focal will increase the chances of coming out of the introduction of the Carbon Tax as a winner and effectively addressing the global and domestic focus on climate change and environmental issues.

Description	Comments
Develop a robust Industry benchmark	The Carbon Tax policy paper proposes to work off a 'jointly' agreed benchmark to determine the Z-Factor correction per installation. The Industry should therefore develop a credible benchmark (the data collection could be acquired as part of the Clay Brick Life Cycle Impact Assessment (LCA), and submitted to Treasury by August 2013 for inclusion in the draft legislation to be put before parliament in 2014, so as to prevent the use of the EU benchmark which is less than half of the sectors average carbon intensity in this country.
Response to Carbon Tax Policy Paper	The Industry should investigate if the requirement towards the trade exposure threshold can be amended to include the limited export and import activities that are endemic to the sector in a meaningful way, or alternatively request that the sector is granted an increase in the process threshold or is able to use offsets.
Conduct Carbon Tax Impact Assessment	The Industry's specific exposure is based on industry averages and therefore does not represent the actual exposure of a company, as this is production process and fuel type intake specific. To determine a company or installation's specific Carbon Tax Impact Assessment, the exposure should be identified and potential mitigation options conducted.
Implement Emission Reduction Measures	A wide range of options to reduce a company or installation's carbon footprint and therewith its exposure to the Carbon Tax should be investigated (e.g. change in firing technology, switch to use of non-fossil fuels, etc.) as the Carbon Tax is here to stay.

2. Clay Brick Manufacturing in South Africa



In addition to outlining the objectives and scope of the study, this chapter provides an overview of the South African clay brick industry, as the basis on which the assessment of the impact of the South African Carbon Tax has been conducted.

2.1 Clay brick manufacturing

A clay brick can be defined as a block or a single unit of a ceramic material used in masonry construction. Typically bricks are stacked together or laid using various kinds of mortar to hold the bricks together as a a permanent structure. Bricks are typically produced in common or standard sizes in bulk quantities.

More commonly bricks are fired in a kiln to form a ceramic. Although a wide range of production methods are used globally, a brick produced by firing clay follows more or less the same high level processes as outlined in the diagram below; including the fuel and electricity consumption throughout the process.

Clay bricks are laid in horizontal courses, sometimes dry and sometimes with mortar. When the term is used in this sense, the brick may be made from clay, lime-and-sand, concrete, or shaped stone. In a practical sense, bricks are made from earth, usually from clay-bearing soil.

The production process remains generic throughout the clay brickmaking industry, and tends to vary according to local conditions, such as types of clay (specific to that area), mining practices and availability of different fuels.

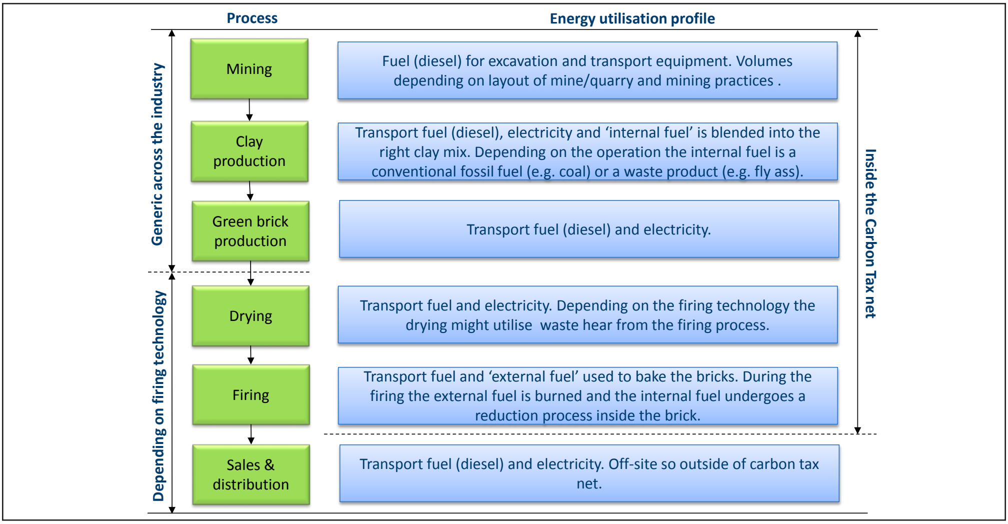


Figure 4: High level overview of the brick making process

The drying and firing processes differ and are dependent on the firing technology used. The firing process, in most instances, consumes the majority fossil fuels, and is therefore regarded as the main contributor to a company's exposure to the Carbon Tax.

2.2 Clay brick production technologies

Clamp

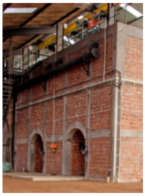
The clamp is still currently the most widely used technology in South Africa to fire clay bricks. It consists of a 'pyramid' of green bricks stacked on top of, and in between, an external fuel (most commonly coal) and is covered by a layer of mostly old unusable bricks which act as an insulator. When the external fuel is fired, the clamp continues to burn for several days or weeks until the external fuel is fully consumed.

Once the clamp has cooled down the layers of old bricks are removed along with the newly fired bricks (which are removed mostly by hand). They are inspected for imperfections and stored for sale and distribution.

Tunnel Kiln

In a tunnel kiln bricks are fired as they move slowly through the kiln on conveyors, rails, or kiln cars, while the kiln is continuously fired. This process, when operated effectively, will achieve a more consistent brick product than would be the case when using a clamp. This is due to the higher level of control when it comes to the firing process itself via the regulation of the temperature and use of external fuel. Some of the thermal energy generated during the firing process is captured and used to partly dry the bricks.

VSBK



VSBK stands for Vertical Shaft Brick Kiln. In essence, a VSBK is a vertical kiln built inside a chimney where the fire zone is in the middle of the shaft. Bricks are loaded from the top and unloaded from the bottom. Due to the chimney effect VSBKs tend to suffer from less energy loss generated by their external fuel than most other firing technologies used.

TVA

A Transverse Arch (TVA) kiln consists of a continuously fired kiln in which green bricks are placed in chambers, in front of the fire and fired bricks are removed from behind it, with two or three adjacent wickets being kept open for this purpose. When a chamber is full, the wicket is bricked up and fuel (coal, oil or gas) is fed in among the bricks through holes in the crown or roof of the kiln. The fire is made to move forward by "taking on" a row of fire holes at the front and dropping a row at the back, every 2 to 4 hours in an average sized kiln. In this way the fire moves right around the kiln from 10 to 14 days. The hot gases from the firing zone are drawn forward to preheat and dry out the green bricks, while the fired bricks are cooled down by the flow of air passing from the open wickets behind the firing zone.

The 4 firing technologies described are the most commonly used technologies and are used within South Africa with different levels of success and efficiency. Although there are a few other technologies (e.g. Hoffman, Zig Zag, etc.) in operation they do not represent a material element of the South African brick making industry and therefore were not included in the study.

3. Climate Change in South Africa

Since the start of the industrial revolution the levels of Green House Gases (GHGs) in the atmosphere have steadily increased. Global concern about this increase and the increasing scientific evidence around it, being the cause of anthropogenic (man-made) climate change resulted in the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and represents an international agreement to stabilize GHG concentrations in the atmosphere at 1990 levels.

3.1 Global framework for Climate Change

United Nations
Framework Convention on
Climate Change

The convention, ratified by 99% of the formally recognised countries, divides the world into developed countries including countries with economies in transition (annex I countries according to the Protocol) and developing countries (so called Non-Annex I countries) and aims at keeping the emissions of GHG to result in an increase in global temperature of less than 2 degrees Celsius.

As a party to the convention, South Africa is considered to be a Non-Annex I country which in terms of the convention meant that it is not required to actively participate in realising the aims of the convention as it is considered to be part of the group of countries that did not materially contribute to the creation of climate change and therefore it was not expected to put measures in place to reduce its GHG output into the atmosphere.

3.2 Pledge to reduce emissions

However during the middle of the last decade South Africa started the process of becoming a member of the BRIC (Brazil, Russia, India and China) group of nations. With the exception of Russia (an Annex I country) all of the members of the now BRICS (S for South Africa) are considered developing countries under the UNFCCC. In recent years all of the BRIC countries have implemented far reaching GHG emission reduction measures and pledged voluntary reduction ambitions to the UNFCCC. Hence for South Africa to be admitted to the, up till recently completely informal grouping, thought up by a few bankers at Goldman Sachs to indicate the largest of the economies in transition, it would have to make some sort of pledge about its GHG emission reduction objectives.

As indicated in the executive summary, a pledge was made to reduce the country's total annual emissions with 34% below 'business-as-usual' levels by 2020 and by 42% by 2025.

Although the President did mention that this could only be accomplished with financial and technological support from developed countries it represented the voluntary commitment that made the country 'eligible' to join the BRIC and make it into the BRICS as we know it today.

With an annual output of approximately **450 million tonnes of CO_{2e} per year** South Africa ranks as the **12th largest emitter on the planet** in absolute terms per capita. The majority of emissions can be attributed to the generation of electricity by burning coal **(43%)** and the production of liquid fuel, such as petrol from coal **(11%)**.

Although the pledge made by the President is widely regarded as an ambitious and unrealistic objective, the South African government has to be seen to (at least) put measures in place to steer the economy towards an emission profile that could result in a 34% reduction by 2020 and a 42% reduction by 2025.

In line with most governments around the world the South African government has two types of instruments at its disposal. It can either introduce legislation that rewards (Carrot approach) industry and/or consumers for emitting less GHGs or institute penalties (Stick approach) for industry and/or consumers for emitting GHGs.

The diagram below provides an overview of the Carrot and Stick instruments[3] currently enforced or under development by the South African government and their financial impact(s).

As is apparent it was found that once operational, the South African Carbon Tax (the 'Carbon Tax') will be the instrument with the largest financial impact of either the stick or carrot instrument deployed by the government and as such was the primary focus of the study.

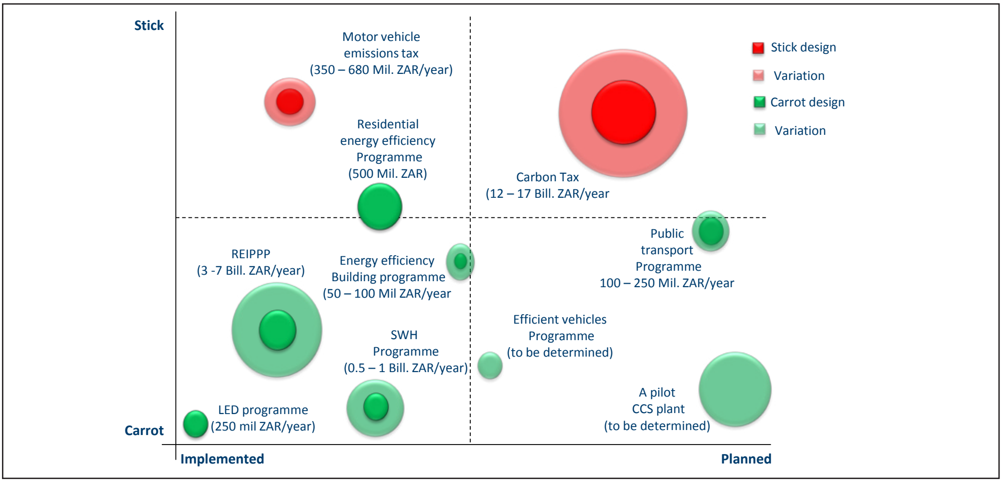


Figure 5: South African emission reduction carrot and stick policies

3 Sources: Long Term Mitigation Scenarios, Department of Environment Affairs and Tourism South Africa, October 2007, IEA Energy, Treasury and EcoMetrix team analysis.

4. The South Africa Carbon Tax

Although the Carbon Tax is still in its design phase with all the details of the relevant legislation not known at this stage, a detailed overview of the proposed working of the Carbon Tax can be provided based on the information available to date. Included are historic and future stages of the process according to which the South African Government proposes to implement the Carbon Tax. Also included is insight into the timing and method via which the brick producers provided input into the consultation process imbedded in the development of the legislation.

4.1 The basic design of the Carbon Tax

In its aim for a transition to a low carbon and more sustainable economy, the South African government plans to implement a Carbon Tax in 2015[8]. The objective of the tax is to reduce carbon emissions to mitigate the effects of global warming and to raise revenue. The tax will be at a levy of **120 ZAR/tCO_{2e}** emitted with an escalation of **10%** per year to **176 ZAR/tCO_{2e}** by the end of the first phase of the tax in **2020**.

As described by Treasury in the Policy Paper for public comment; 'The Carbon Tax Policy Paper, May 2013' , the Carbon Tax will be applied as an 'upstream tax' based on the carbon content of the fossil fuels at the start of the production process.

An appropriate emission factor will be applied to determine the taxable emissions. Industry would have a self-monitoring system to evaluate emissions using a structured standard. The emissions would then be reported to the South African Revenue Services (SARS) and the Department of Environmental Affairs (DEA) would verify these emissions on behalf of SARS.

Initially the Carbon Tax was scheduled to be implemented from the 2013/2014 however the Finance Minister Pravin Gordhan announced in Parliament during the tabling of his Budget Speech on the 27th of February 2013 that the Carbon Tax would only take effect from the 1st of January 2015.

This leaves ambiguity regarding the effective date of the Carbon Tax, which could either be from the beginning of the 2015 tax year (1st of March 2014) or the beginning of the 2016 tax year (1st of March 2015). Regardless the sectors covered under the tax and their annual GHG emissions as reported at an industry level or collated from company specific information are shown below.

Table 2: Emissions per sector

1	Sector	tCO_{2e} per sector
1	Electricity	199 040 000
2	Iron and Steel	92 620 000
3	Petroleum - Coal to liquid	60 047 000
4	Agriculture, Forestry and Land Use	38 000 000
5	Waste	21 000 000
6	Petroleum - oil refinery	13 288 900
7	Cement	9 3000 000
8	Pulp and Paper	7 490 000
9	Glass and Ceramics	6 585 985
10	Chemical	5 030 000
11	Aluminium	2 000 000
12	Fugitive emissions	1 800 000
13	Sugar	1 393 200
14	Other	-
	Total	**457 595 085**

4 http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20

5 *Source: CDP 2012, ERC 2007/2010, SAF SAM 2003, Coaltech 2012, ipcc-nggip.iges and EcoMetrix team analysis, 2014*

The above annual emissions per sector covered under the tax only provide an ‘indication’ as to the size of the emissions in comparison to one another and is not a reflection of the volume over which companies within these sectors will be exposed to the Carbon Tax.

The primary reason for this is that the Carbon Tax is a so called ‘proxy tax’ and aims at taxing a theoretical number of tCO^2 emitted per year based on a range of assumptions and corrections per sector (thresholds). The Glass and Ceramics sector has **6,585,985 tCO_2** and ranks 9th out of a total of 14 sectors under the tax.

In the next section we provide a detailed description of the assumptions and thresholds as defined under the Carbon Tax. These thresholds can be staggered to reduce the Carbon Tax burden depending on the sector a company fits in and its characteristics.

4.2 Thresholds under the Carbon Tax

Although the specifics are still being discussed, the thresholds that can be applied by a company to reduce the volume of tCO_2 over which it is taxed are deducted from the so called Basic Carbon Tax. The Basic Carbon Tax is calculated by multiplying the total volume of each fossil fuel consumed by a company on an annual basis by an emission factor of the specific fuel. Annex 1 provides the table that was published by Treasury in its Policy Paper (page 55). Although the table does not provide consistent and sufficient information it does provide an indication of the sources that are envisaged to be used to determine the emission factor of each fuel, being the International Panel on Climate Change (IPCC) and/or the World Business Council for Sustainable Development (WBCSD).

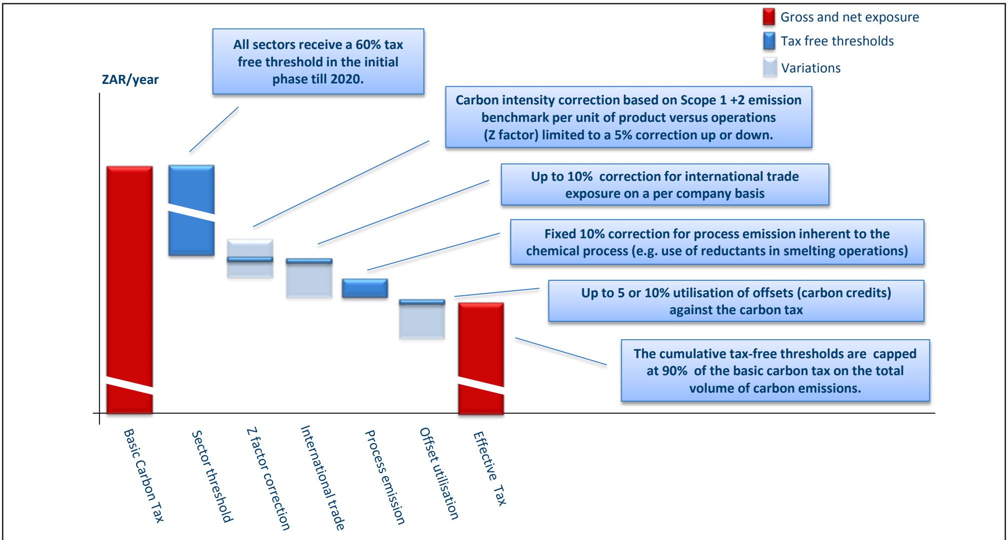


Figure 6: Carbon Tax Waterfall

6 Values are quoted per ton of product as well as per Giga Joule and unit of electricity
7 Not all sectors and fossil fuels covered under the Carbon Tax are listed
8 February 2014: The South African Government announce that the implementation of the Carbon Tax has been extended to 2016

This indication is later on strengthened in the Carbon Tax Policy Paper by providing an example of the benchmarking as proposed for the third round of the European Union Emission Trading Scheme (EU ETS) benchmarking *(see Annex 2)* and an open invitation by Treasury for industry associations to provide input towards a relevant benchmark for their specific industry.

In the diagram below we provide a schematic overview of the working of the Basic Carbon tax and the thresholds followed by a more detailed explanation of the individual thresholds.

As a starting point we use the information provided by the IPCC in its 2006 publication as this is considered global best practice *(see Annex 3)*.

Before deducting thresholds from the Basic Carbon Tax one adjustment is made. An emission factor expressed in tCO_{2e}/ton of fossil fuel assumes that all the fossil fuel is combusted and therefore results in the emission of a fixed amount of CO_{2e} emitted into the atmosphere. In summary the Basic Carbon Tax is determined by multiplying the volume of fossil fuel consumed by the company multiplied by an emission factor before any thresholds are deducted from it.

Industry threshold

A tax-free threshold of 60% for all sectors will be taking into account an adjustment of the basic threshold and allowances to be applied. This initial reduction of 60% of the emissions that are taxed is envisaged to be reduced over time as it serves to gradually allow companies to adapt to the new taxation regime.

Z-factor

The Industry threshold of 60% can be corrected on a per company basis to accommodate for organisations that have already become less carbon intensive than their sector peers. This correction of the Industry threshold is adjusted by the so-called Z-factor.

The Z-factor aims to incorporate the measured and verified carbon intensity of the output of an installation in relation to the benchmarked intensity for the sector the installation is categorized within and is limited to 5% up or downwards. In this way, installations emitting higher than the sector benchmark would have a lower basic percentage tax-free threshold and vice versa.

Except for Treasury's statement that it should be an 'agreed' benchmark' it is at this moment in time unclear how the sector benchmarks will be determined and how individual companies will be benchmarked against them.

However the wording used by Treasury to explain the working of the Z-factor defines it as the division of the average measured and verified carbon intensity of the output of a firm by the agreed benchmark carbon intensity (including both scope1 and 2 emissions) for the sector. The adjustment to the tax free threshold is then determined by multiplying the original 60% Industry threshold by the Z-factor.

For example:

A sector has an agreed benchmark of **0.91 tCO_2/ton** of output and the companies have a carbon intensity of **0.85, 0.91** and **1.1 tCO_2/ton** respectively. Their Z factors can be calculated as follows.

Company A: $Z = 0.91 / 09.1 = 1.00$
Company B: $Z = 0.91 / 0.85 = 1.07$
Company C: $Z = 0.91 / 1. = 0.83$

Hence the adjusted basic percentage tax free thresholds for the three firms are as follow:

Company A = 0.6 × Z = 0.6 × 1.0 = 0.60000 = 60.000 per cent

Company B = 0.6 × Z = 0.6 × 1.0706 = 0.64236 = 64.236 per cent

Company C = 0.6 × Z = 0.6 × 0.8273 = 0.49638 = 49.384 per cent

The basic percentage tax free emissions would be:

Company A = 60.00% of 100 000 tons = 60,000 tons
Company B = 64.24% of 100 000 tons = 64,236 tons
Company C = 55.00% of 100 000 tons = 55,000 tons (49.38% technically but effectively 55% due to the capping of the Z-factor correction at 5% up or downwards)

Given that the carbon emissions intensity for Company A is the same as the benchmark figure, its Industry threshold remains unchanged. Company B is doing better than the carbon emissions intensity benchmark hence it qualifies for a higher Industry threshold. Firm C on the other hand is doing worse than the carbon emissions intensity benchmark, for this poor performance it is penalised. Its Industry threshold is reduced from **60%** to **55%**.

Trade exposure threshold

To prevent companies from becoming uncompetitive on the international market, a trade exposure threshold of up to 10% of the total Basic Carbon Tax can be deducted depending on the extent of the company's overseas trade (both import and export) and the sector it sits in. Treasury proposes an optional model that allows companies to include their exports or their exports and imports.

Where both exports and imports are used, the additional percentage threshold will be calculated as follows:

Y1 = 0.2 × (E + I)

where E + I = exports plus imports, expressed as a percentage of output or sales (it must be greater than 5 per cent), up to a maximum of 10 per cent.

Where only exports are used, the additional percentage threshold will be:

Y2 = 0.4 × (E)

where E = exports expressed as a percentage of output or sales (it must be greater than 5 per cent), up to a maximum of 10 per cent.

Although an alternative formula for both imports and exports is hinted at; Treasury provided the following table clarifying the proposed structure.

Table 3: Trade exposure analysis

Exports + Imports (E + I)		**Exports only (E)**	
0.2		**0.4**	
Below 10	0	0	**Below 5**
10	2	2	**5**
20	4	4	**10**
30	6	6	**15**
36	7.2	7.2	**18**
40	8	8	**20**
50	10	10	**25**
60	10	10	**30**
70	10	10	**35**
Y1 = 0.2 x (E+I) E + I must be >10%		**Y2 = 0.4 x E E must be >5%**	
Maximum for Y1 or Y2 = 10%			

It is apparent therefore that the full 10% threshold can only be realised if 50% of a company's total production is as a result of imports and exports or if 25% or more of the annual production is exported.

Process emission threshold

When a fossil fuel is not converted into thermal energy via the means of combustion it is used in a different fashion for example as a reductant in a metal smelting furnace or Fischer Tropsch synthesis to convert coal into liquid fuel. In most cases chemistry dictates that the use of fossil fuel in this way will result in a fixed volume of CO_2 emissions.

This in practice means that virtually no efficiencies can be realised and therefore the 'incentive' the Carbon Tax would provide is mute. For this reason Treasury has included a so called process emission threshold of 10% for each sector which is perceived to be subject to such a limitation when reducing its emissions without having to reduce its annual output.

Carbon offset utilisation threshold

Carbon offset utilisation is different in nature to the thresholds in that it is not the result of a company characterisation but rather a purchase or in-house production.

This production of carbon credits allows for the further reduction of the Basic Carbon Tax to between **5%** and **10%**. These carbon credits are used by a company to offset the emissions assumed under the Basic Carbon Tax. Although not completely defined these offsets could be generated or purchased from so called Clean Development Mechanism (CDM) projects that have issued Certified Emission Reductions (CERs) under the CDM Kyoto protocol. It is assumed that such a CDM project has to be located within the border of South Africa as otherwise this threshold would result in the procurement of overseas carbon credits with the aim to reduce the local tax burden.

In addition to providing companies exposed to the Carbon Tax with a financial alternative (e.g. procurement of CERs to reduce its Carbon Tax exposure) carbon offset utilisation also creates a substantial market for the generation of CERs from CDM projects at a long term attractive carbon price.

At this moment in time the global price of a carbon credit lies between 5 and 10 ZAR/tCO_{2e} (1 tCO_{2e} equals 1 carbon credit).

It has been indicated by Treasury that the Carbon Tax requires that the offsets are generated within South Africa and that the total demand of CERs lies at approximately 30 million CERs/year. The current supply lies at around **600,000 CERs/year** and it is estimated that a CER that can be used under the Carbon Tax can also be traded at between **50** and **100 ZAR**.

In the near future the price gap between local CERs and the Carbon tax will almost completely close leaving the price at between 100 and **110 ZAR/CER** to offset the Carbon tax at **120 ZAR/tCO_2**.

Net Carbon Tax exposure

Treasury has indicated that although companies can stagger and utilise the thresholds the maximum tax-free threshold provides (all the thresholds added together) it cannot exceed 90% of the total Basic Carbon Tax. Hence a company will always be exposed to a Carbon tax of **120 ZAR/tCO_2** over **10%** of its Basic Carbon Tax. The table below outlines the thresholds and their percentages as proposed by Treasury.

8. *Source: National Treasury 2012*

Table 4: Proposed thresholds percentage allocation per sector

Sector	Industry threshold	Trade exposure	Process emission	Carbon offset utilisation	Cumulative thresholds
Electricity	60%	-	-	10%	70%
Petroleum (coal to liquid)	60%	10%	-	10%	80%
Petroleum - oil refinery	60%	10%	-	10%	80%
Iron & steel	60%	10%	10%	5%	85%
Aluminium	60%	10%	10%	5%	85%
Cement	60%	10%	10%	5%	85%
Glass & ceramics	60%	10%	10%	5%	85%
Chemicals	60%	10%	10%	5%	85%
Pulp & paper	60%	10%	-	10%	80%
Sugar	60%	10%	-	10%	80%
Agriculture, forestry and land use	60%	-	40%	-	100%
Waste	60%	-	40%	-	100%
Fugitive emissions: Coal	60%	10%	10%	5%	85%
Other	60%	10%	-	10%	80%

It is apparent from the table that the cumulative thresholds per sector range between **70%** and **85%** with the exception of the Agriculture, Forestry, Land Use and Waste sectors which have a cumulative threshold of 100% which basically creates a sort of nil return scenario or indirect exemption to the Carbon tax in the initial phase.

4.3 The policy development process

In-line with the adoption process of most (if not all legislation) the Carbon Tax goes through several rounds of public comments before being tabled in parliament.

The first publication on the Carbon Tax for public comment was released in December 2010 entitled; 'Reducing Greenhouse Gas Emissions: The Carbon Tax Option'.

Due to the new nature of the proposed legislation Treasury opted for an additional call for written comments. As is customary, Treasury also organised a Carbon Tax Consultation Workshop in March 2011 in which stakeholders were invited to present their understanding of and responses to the publication.

Upon receipt, Treasury incorporated the comments into an updated version of the White Paper and published it for a final round of comments in May 2013 as a Carbon Tax Policy Paper for public comment by August 2013. From there Treasury indicated that it would process inputs made for about 3 months to incorporate these comments and finalise the policy document before submitting to parliament for consideration for approval which is expected in 2014.

The diagram below provides a historic timeline of the publications made by government underpinning the Carbon Tax and an estimation of the timeline for the activities still to be completed before Carbon Tax becomes law and is made effective.

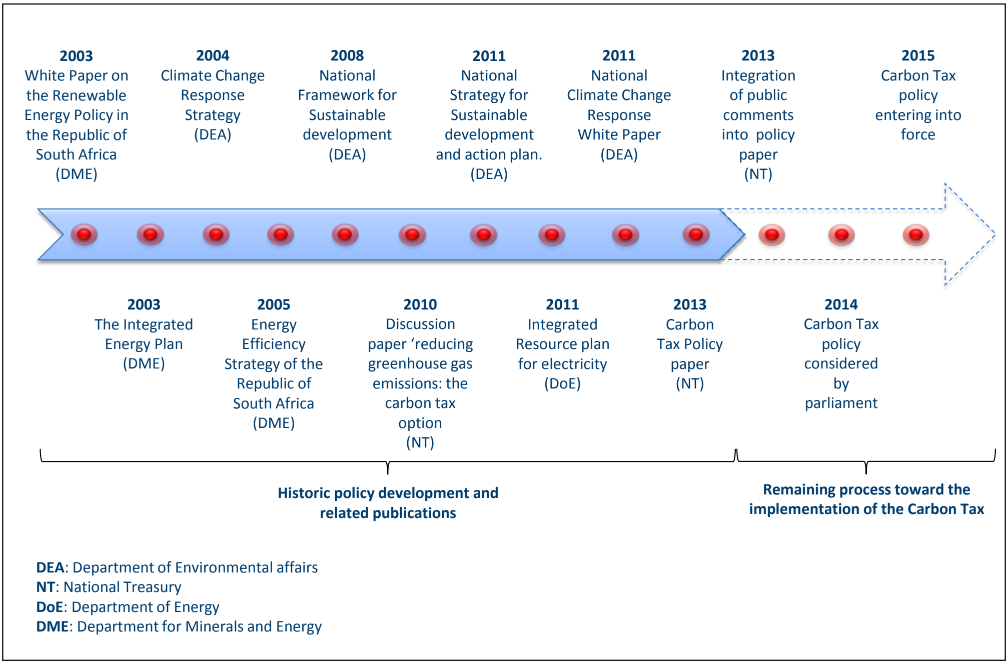


Figure 7: Carbon Tax policy development timeline

5. The Carbon Tax Impact Assessment

5.1 Objective of the study

The aim of the study was to determine the Industry's exposure to the proposed Carbon Tax, identify potential mitigation options and provide inputs into the consultation process as envisaged by the South African government. Together with similar studies conducted at 3 brick making facilities using different firing technologies and collected industry information this study is the first attempt to determine the impact of the Carbon Tax on the whole brick making sector in South Africa.

5.2 Scope of the study

In studying the impact of the Carbon Tax on the clay brick industry, we limited the scope to the formal clay brick production industry and used data provided by industry participants regarding their fuel and electricity consumption and production data. To be able to utilise one unit of measurement when discussing volumes of different sizes and shapes of bricks they are often converted into their brick equivalent. The definition of a brick equivalent is a 1000 standard brick (also known as a "Imperial Brick" which is 222 mm long, 106 mm wide x 73 mm high with a mass between 3 and 3.5 kg). For the purposed of this study all results are expressed in their brick equivalence where relevant.

Although the study provides findings and recommendations that could be utilised by the industry and its participants to reduce its exposure under the Carbon Tax the scope explicitly excludes the drafting of a response to the White Paper on behalf of the industry, its participants and/or the design and implementation of other mitigation measures identified.

5.3 The impact assessment model

At this moment in time the Carbon Tax is only a rough outline of what the legislation would look like once implemented. Although this might be considered a concern in that not enough information is currently available to determine a company's or sectors exposure to the Carbon Tax, it does however provide an opportunity to identify at an early stage which elements of the proposed tax could be refined in such a way that the impact of the Carbon Tax can be mitigated and/or managed.

The Carbon Tax impact assessment model is designed to identify the most material elements of the proposed Carbon Tax from the Industry's perspective by modelling through the different known elements of the tax and allocate probabilities to the different design options that not have been clarified by Treasury at this moment in time.

By utilising actual operational data from within the Industry the model will indicate where the main contributors towards the Industry's Carbon Tax exposure are vested and identify options on how these can be mitigated. The below diagram provides a schematic overview of the working of Carbon Tax Impact Assessment Model used as the basis of the study.

Despite the shortage of information that still exists around the detailed working of the Carbon Tax, the model is designed to identify potential mitigation options. A number of basic assumptions is made and used consistently throughout the study. These assumptions are indicated in the modelling assumptions table.

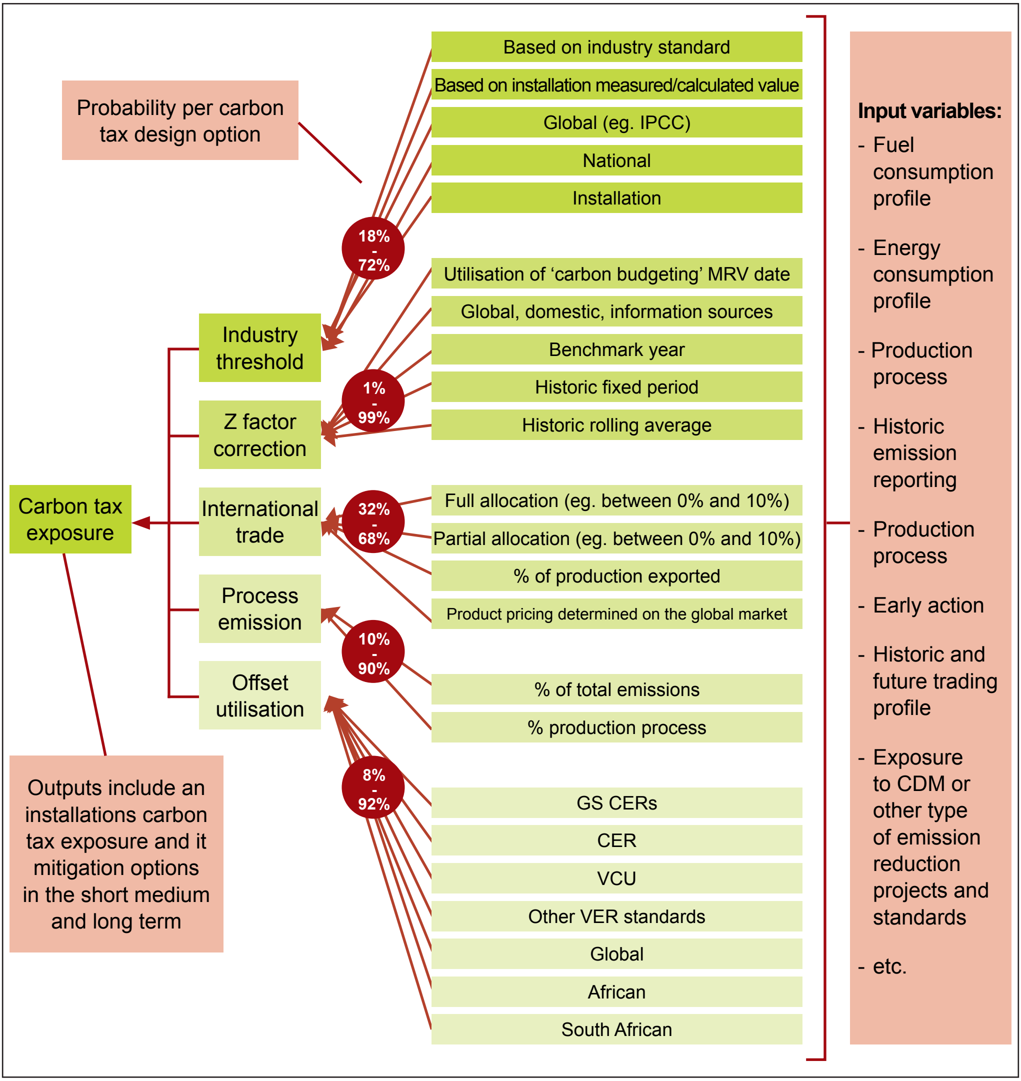


Figure 8: Carbon Tax Impact Assessment Model

Table 5: Modelling assumptions

Modelling assumption	Value	UoM[1]	Rational
Carbon intensity of SA grid	0.94	tCO_2/ MWh	Based on the Eskom 2012 annual report
Electricity pass through rate	57.60	ZAR/ MWh	Based on 3% increase on Mega flex rate and corrected for pass through exemptions
South African inflation	5%	%	Based on the historic average and compounded annually from 2015 till 2020

When looking at the sectors classified under the Carbon Tax, the brick industry is not explicitly mentioned. From a Carbon Tax perspective however clay brick producers are included under the Glass and Ceramics sector together with glass producers, tile producers, etc.

Generally clay brick producers are potentially allocated a carbon intensity benchmark for the production of clay bricks of **0.12 tCO_2/ton of output**[9] or **0.40 tCO_2/brick equivalent.**

Although the source for this benchmark (the EU ETS) might be the most advanced benchmarking system in the world (according to the Carbon Tax Policy Paper), it does not factor in the South African context and therefore provides an unrealistic benchmark to apply.

A questionnaire was sent out to obtain the information required to determine more accurately the realistic carbon intensity. The data collated was used to determine the Z-Factor for the Industry. 35 of the estimated 129 South African clay brick producers provided information on their historic production in brick equivalence as well as their historic fuel consumption. It is important to note that although this represents a reasonable sample and therefore the results can be considered statistically significant it should not be construed as being sufficient for consideration by Treasury as the agreed benchmark.

When extrapolating the information provided to cover the whole Industry the following diagram can be constructed to provide insight into the CO^2 emissions resulting from the fossil fuel consumed in the production of a brick equivalent on a weighted average basis. It is important to keep in mind that this would not represent the actual emissions resulting in a brick equivalent as it considers several firing technologies and types of fuel that in practice would not be used in conjunction with each other.

As visualised in the below diagram the main contributor to the carbon footprint of the Industry is the utilisation of external fuel (**67.4%)** when firing bricks.

The main component consists of the emissions associated with the combustion of coal **(47.2%).** From a Carbon Tax perspective only the direct use of fossil fuel is considered (i.e. external and internal fuel consumed).

Electricity, which contributes **11.5%** to the total footprint, is only indirectly considered as part of the industry benchmark and transport fuel is excluded under the Carbon Tax.

The carbon intensity graph below provides insight into the Industry's' carbon intensity per firing technology. As indicated the weighted average emissions per brick equivalent for a clay brick

9 Based on the average of 0.114 tCO_2/t for low and high density clay blocks and 0.133 tCO_2/t for Facing bricks and pavers
10 Clay Brick Association, April 2013

produced within South Africa is approximately **0.941 tCO_2/brick equivalent.** However the Carbon Tax guidance indicates that the Z-Factor should only be based on the average fossil fuel and electricity consumed within the operations (Scope 1 and 2 according to the guidance) and therefore excludes transport fuel emissions. This brings the clay brick benchmark against which a brick producer should be assessed from a Z-Factor correction perspective to **0.820 tCO_2/brick equivalent** which is almost double the carbon intensity envisaged by Treasury as the benchmark and lies below the most carbon efficient firing technology included in the study. When assessing the Z-factor corrections per firing technology it becomes apparent that these vary significantly on a per brick equivalent basis. From a Carbon Tax exposure perspective this has a material impact on the amount of Carbon Tax a brick producer has to pay. According to this study the most carbon intense firing technology is TVA with an intensity of **1.487 tCO_2/brick equivalent** and the least carbon intensive firing technology as VSBK with an intensity of **0.529 tCO_2/brick equivalent.**

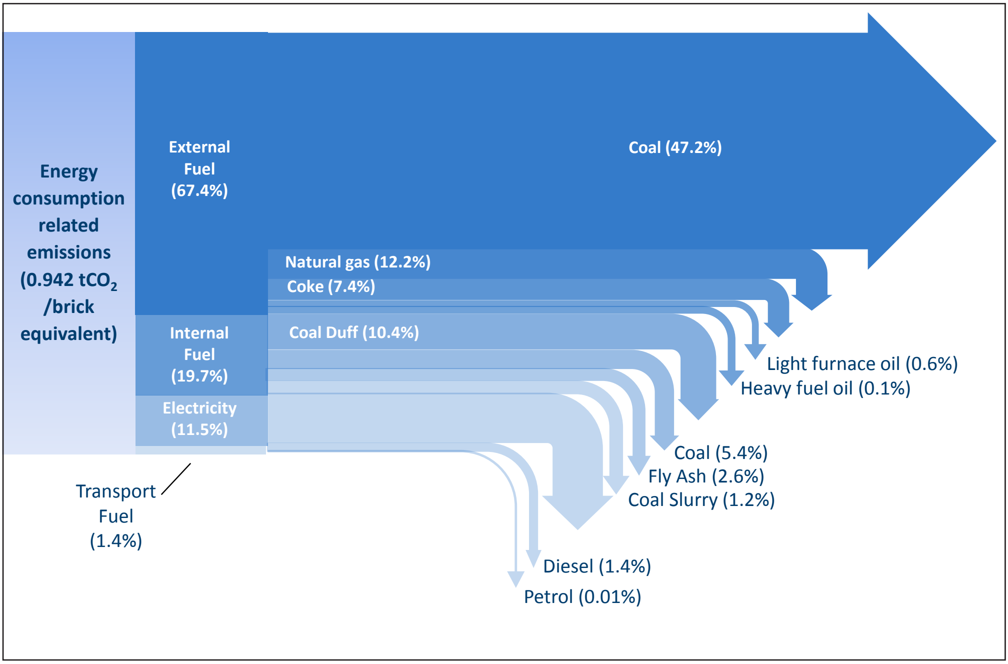


Figure 9: Sankey diagram outlining the fossil fuel consumption on a brick equivalent basis in tCO_2

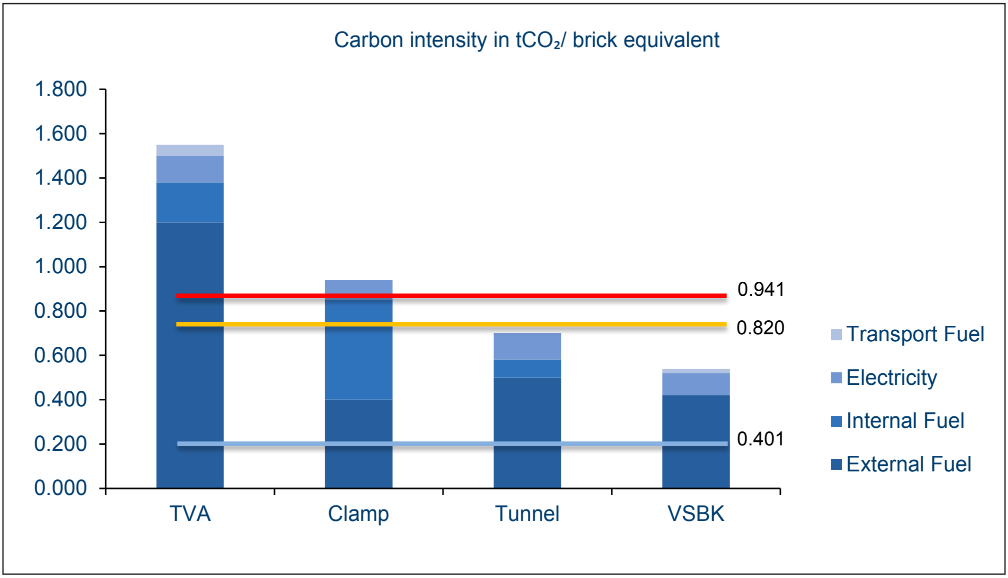


Figure 10: Emission profile and Z-Factor of the clay brick sector

6. Modelling results analysis

The outcomes of the Carbon Tax Impact Assessment are discussed in relation to the Industry's operation. Indicated is the operational information provided by the Industry followed by a section in which the modelled parameters of the Basic Carbon Tax, the different thresholds and the net Carbon Tax exposure are described and assessed. The final section provides a summary of the findings and recommendations towards the Industry and its participants on how to manage its Carbon Tax exposure.

6.1 Industry operational parameters

It is estimated that the Industry consists of 129 brick producers across South Africa and utilises a range of different technologies (e.g. TVA, Clamp, Tunnel, VSBK and others) to produce approximately **3.5 billion bricks per year.** For the purpose of this study only producers that use TVA, Clamp, Tunnel and VSBK firing technologies where considered/ included as not enough information on the other technologies was received to provide statistically significant results.

To determine the exposure under the Carbon Tax, the brick producers were requested to complete a detailed questionnaire. In summary the following operational parameters where provided by the producers and used to determine the exposure to the Carbon Tax.

The understanding of the Carbon Tax as described in chapter 4, the modelling assumptions as defined in the table above and the details behind the above listed operational parameters of the Industry's operation were pivotal in compiling the Carbon Tax Impact assessment model and central to determining each brick producers Carbon Tax exposure.

Table 6: Operational parameters
(values based on 3 years historic average)

Parameter	Values	UoM	
Firing Technology		TVA, Clamp, Tunnel, VSBK	Excluding other firing
Historic Production	3,447,338	Brick equiva-lent/ year	As produced for stock and/or sales
Transport Fuel	27,556,134	Litre/ year	Diesel and petrol
External Fuel	225,218,502	Tonne/ year	Used for firing of bricks and drying
Internal Fuel	1,031,941	Tonne/ year	Also known as body fuel
Electricity Consumption	583,074	MWh/ year	Including extrusion and lighting

6.2 Carbon Tax impact modelling results

From a Carbon Tax perspective the Industry's operations have an annual GHG output of **4,216,186 tCO_2/year** which would equate to a Basic Carbon Tax of **505,942,309 ZAR/year.** To determine the Net Carbon Tax the following thresholds need to be taken into account.

Industry threshold

A tax-free threshold of 60% for all sectors will be taken into account and an adjustment of the basic threshold will be applied. This would reduce the Industry's Basic Carbon Tax exposure by **303,565,386 ZAR/year.** This figure needs to be corrected with the Z-factor to adjust for better (or worse) performance.

The carbon Intensity benchmark currently proposed by Treasury for the Industry lies around **0.401 tCO_2/Brick** equivalent which is less than half of the average emissions within the Industry which was calculated at **0.820 tCO_2/brick equivalent.** In effect this means that the Industry as a whole and all its participants individually will be exposed to the maximum 'penalty' of 5% as a result of the Z-Factor correction leaving the remaining exposure at this stage at **227,674,093 ZAR.**

Trade exposure threshold

Although the design of the Carbon Tax would allow the Industry to deduct up to 10% of its basic Carbon Tax exposure, reducing the Industry's exposure with an additional **50,687,393 ZAR** due to international trade would be further beneficial.

It is important to consider that for the Industry as a whole or for individual participants to be able to utilise this threshold they would have to demonstrate this exposure by reporting all exports (and if decided by the company its imports) so as to determine if exports and imports form o be a material part of its total production (>25% to obtain 10%).

This means that most companies will probably not be able to claim this threshold as it is common practise in the Industry to not export on a regular basis. Also the transportation of bricks over long distances is not economically viable.

Process emission threshold

When looking at the brick making process it is apparent that a substantial percentage of the fossil fuel consumed every year is used as internal fuel (also known as body fuel). This fuel cannot be considered as combusted but rather is 'reduced' in the absence of sufficient oxygen inside a brick when it is fired. **67.4%** of the Industry's fuel is used as internal fuel and therefore, Treasury has allowed the Sector a deduction of 10% from its Basic Carbon Tax across the board. This means an additional reduction of **50,594,231 ZAR** which leaves the remaining exposure at **177,079,808 ZAR.**

Carbon offset utilisation threshold

The current design of the Carbon Tax does not allow for the total exposure to be reduced below **10%** of the Basic Carbon Tax. This means that the exposure cannot be reduced beyond **50,594,231 ZAR.**

In addition the use of carbon offsets is limited to **5%** for the Glass and Ceramics sector which in this instance means, approximately **210,809 tCO_2** can be offset via the utilisation of CERs generated under the CDM in South Africa. The utilisation of offsets would come at a cost since the individual Industry participants would have to buy the offsets on the carbon market or develop a CDM project themselves.

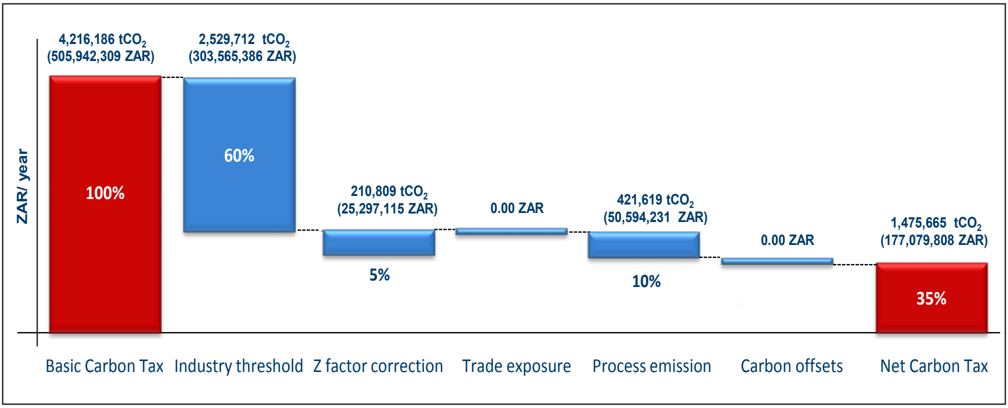
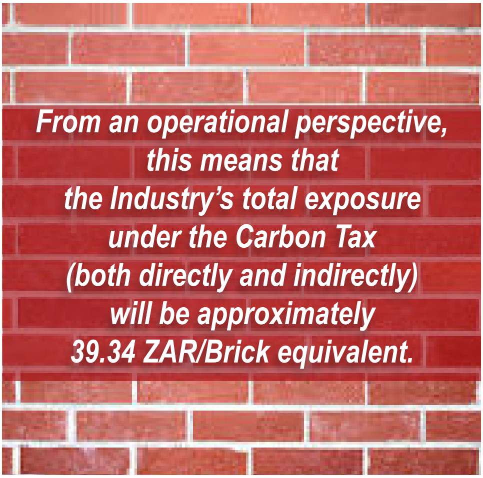


Figure 11: The Industry's Carbon Tax exposure

Assuming all participants were to purchase the full **5%** equivalent in CERs, the total demand from the industry on the carbon market would be approximately **210,809 CERs** (i.e. one CER equals one tCO^2 not emitted into the atmosphere). Below is an overview of the Basic Carbon Tax, the thresholds and the remaining Net Carbon Tax that the Industry would be exposed to.



It is important to consider that the above information assumes that the thresholds as indicated in the basic outline of the Carbon Tax and as provide by Treasury are all applied as if the Industry would be considered fully eligible for them without any attempt to reduce its exposure. From a production cost perspective the direct impact of the Carbon Tax will result in an average cost increase of **33.39 ZAR/brick equivalent.**

Indirect exposure

In addition to the direct exposure the Industry operations are also exposed in an indirect way to the Carbon Tax as a result of the increase in electricity price. This is in addition to other electricity price increases due to the pass through of the Carbon tax exposure by the national utility (Eskom).

It is estimated that this will result in an increase of **57.60 ZAR/MWh** of electricity consumed in the Industry. In total this result in an indirect exposure to the Carbon Tax of an additional **31,569,939 ZAR/ year** which results in an additional cost increase of **5.95 ZAR/Brick equivalent.**

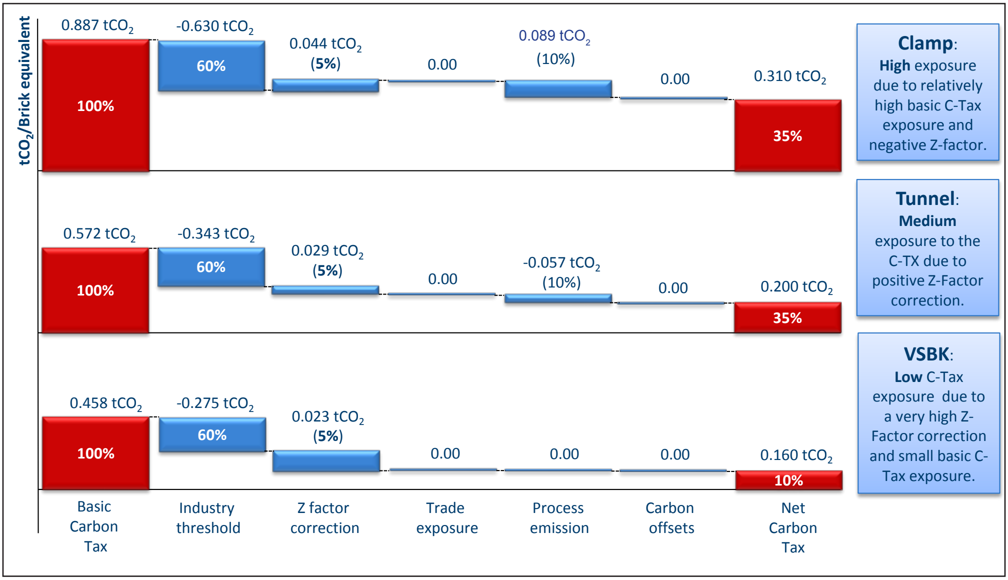


Figure 12: Carbon tax exposure per firing technology in brick equivalent

Due to the diverse nature of the firing technologies used within the South African clay brick industry the carbon intensity of the technologies differ substantially and in-turn their exposure under the Carbon Tax.

A breakdown of this exposure across the main firing technologies used within South Africa in tCO^2/ brick equivalent is indicated below.

Due to the inappropriate application of the carbon intensity for the Industry all firing technologies incur the same penalty via the Z-Factor correction of **5%** and therefore the threshold pattern is the same for all technologies.

However the net impact of the Carbon Tax does differ substantially between the technologies due to the differences in fossil fuel consumption per technology used on a per brick equivalent.

In practice this means that the operators of different firing technologies are exposed to different cost increases as a result of the introduction of the Carbon Tax.

The table below provides an indication of these cost increases per firing technology based on an average operator of the technology.

Section 6.3 addresses the different mitigation options at the Industry's disposal and how they would impact the Industry's net exposure to the Carbon Tax.

Table 7: Carbon tax exposure per firing technology

Firing Technology	Average Carbon Intensity/Brick Equivalent	Carbon Tax/Brick Equivalent
Clamp	0.935 tCO_2	37.26 ZAR
Tunnel	0.759 tCO_2	24.01 ZAR
VSBK	0.529 tCO_2	19.23 ZAR
Weighted Average	**0.820 tCO_2**	**33.39 ZAR**

6.3 Findings and recommendations

When considering the Industry's operations and modelling results the following recommendations should be considered with the aim to mitigate the exposure under the Carbon Tax.

The recommendations are separated into recommendations on an Industry level and recommendations on a company level.

The following recommendations aim to reduce the Industry's exposure to the Carbon tax:

Develop a robust Industry benchmark

The Carbon Tax works off a 'jointly' agreed benchmark to determine the Z-Factor. A credible industry inclusive benchmark was developed and submitted to Treasury by August 2013.

The recommendations to Treasury could be included in the draft legislation to be put before parliament in 2014. If the industry benchmark is included, more brick producers will be better able to reduce their exposure to the Carbon Tax.

Response to Treasury White Paper:

The Industry should investigate and determine if the requirement towards the trade exposure threshold can be amended to include limited export and import activities which are endemic to the sector in a meaningful way or alternatively request that the sector is granted an increase in the process threshold or ability to use offsets;

The following recommendations aim to reduce a company's or installation's exposure to the Carbon tax in:

Conduct Carbon Tax Impact Assessment:

The Industry specific exposure is based on industry averages and therefore does not represent the actual exposure of a company as this is production process and fuel type intake specific.

A Carbon Tax impact assessment would be conducted so as to determine a company or installations specific Carbon Tax exposure and identify potential mitigation options. A good starting point to determine if the Carbon Tax could have a material impact on a company or installation is to conduct a basic impact assessment using the tool as provided on the CBA website;

Implement emission reduction measures:

A wide range of options to reduce an operations carbon footprint should be investigated (e.g. change in firing technology, switch to non-fossil fuels, etc.) **as the Carbon Tax is here to stay;**

Acquire Carbon Credits:

Although the above described measures require time and capital, they do not guarantee success. To mitigate this risk, and basically buy time, a company could acquire CER's from South African CDM projects at this moment in time at a price far lower than they would be worth when used under the Carbon Tax. In this way a company can buy time for the other measures to come into effect. In the event that the CERs are not needed (e.g. the other measures do not require their use or the Carbon Tax is not or implemented later) the CERs can be sold again onto the global market.

It is important to consider that it is Treasury's stated ambition to periodically increase the Carbon Tax exposure by reducing certain thresholds and in this way motivate industries to switch to more climate sustainable methods of production. The Industry participants therefore should strongly consider the more material and long term mitigation options at their disposal such as converting its operations to include a VSBK and/or convert its external fuel to be non-fossil based. In this way participants can completely reduce their exposure under the Carbon Tax. If VSBK projects become eligible to generate carbon credits that can be used under the Carbon Tax, brick producers can maximise on the possibility of generating additional income from the introduction of the Carbon Tax.

The Industry and its participants have a range of short term and long term options to reduce its exposure to the Carbon Tax to the minimum level of 10% of the Basic Carbon Tax of 50,594,231 ZAR or below that if Industry wide more efficient operating procedures are adopted. This effectively brings down the direct exposure to 9.54 ZAR/brick equivalent and the combined exposure (direct and indirect) 15.49 ZAR/brick equivalent from 33.39 ZAR/Brick equivalent.

In summary the introduction of the Carbon Tax will have winners and losers on both the Industry level as well as company level. Being well informed, responsive and focused will increase the chances to coming out of the introduction of the Carbon Tax as a winner and in the process address the global and domestic increased focus on climate change and environmental issues.

Annexure 1

The table was published by Treasury in May 2013 in its ‘Carbon Tax Policy Paper’ and presents the emissions intensity ranges for the different processes from several sources including IPCC emissions factors (IPCC, 2006: Vol. 2 & 3) and those of the World Business Council for Sustainable Development (WBCSD) (NCASI,2005).

Activity / process	Emissions Intensity	PICC emissons factors	WBCSD emissions factors
Electricity generation			
Non-renewable-based power stations			
Return-to-service stations	1.05-1.28 tCO_2/MWh		
Existing power stations	0.8-1.3 tCO_2/MWh		
New power stations	0.80-0.90 tCO_2/MWh		
Existing fleet (average)	1.04 tCO_2/MWh		
Ultra-supercritical	0.716 tCO_2/MWh		
Natural gas (open cycle, combined cycle, and liquefied natural gas)	0.42-0.60 tCO_2/MWh		
Nuclear	0.04 tCO_2/MWh		
Renewable-based			
Hydro-biomass decay	0.249 tCO_2/MWh		
Biomass	0.036 tCO_2/MWh		
Wind	0.01 tCO_2/MWh		
Hydro	0.004 tCO_2/MWh		
Bark	0.094 tCO_2-eq/GJ	0.112 tCO_2/GJ	0.109 tCO_2/GJ
Black liquor	0.095 tCO_2-eq/GJ	0.095 tCO_2/GJ	0.0953 tCO_2/GJ
Liquid fuel production			
Coal-to-liquid gasification	3.4 tCO_2-eq/t		
Crude oil refining		0.073 tCO_2/MJ	0.0726 tCO_2/MJ
Iron and steel	1.4-8.5 tCO_2/t (range)		
Basic oxygen furnace		1.46 tCO_2/t of steel	
Open hearth furnace		1.72 tCO_2/t of steel	
Electric arc furnace	1.4-1.6 tCO_2/t	0.08 tCO_2/t of steel	
Electric arc furnace and direct reduction	1.6-2.8 tCO_2/t		
Integrated blast furnace	2.8-3.5 tCO_2/t		
Vanadium, iron and steel	7.8-8.5 tCO_2/t		
Paper and pulp			440 kg CO_2/t CaCO 415 kg CO_2/t Na_2CO_2
Cement	415-985 kg CO_2/t (depending on the type of cement)	0.43971 tCO_2/t carbonate	
Glass	0.2 tCO_2/t glass (decomposition of carbonate raw materials)	0.21 tCO_2/t glass	
Lime carbonates		0.75 tCO_2/t	
Chemicals			
Nitric acid		2-9 kg N_2O/t	
Cracker products			
Ammonia		1.666-2.772 tCO_2/t NH_3	
Adipic acid			
Hydrogen / synthesis gas (including methanol)		0.67 tCO_2/t CH_3OH	
Soda ash		0.138 tCO_2/t natural soda ash	
Carbon black		2.62 tCO_2/t	
Aromatics			

Note: Units are in kilograms (kg), metric tons (t), megawatt-hours (MWh), megajoules (MJ) and gigajoules (GJ), as indicated.

Source: Firms' responses to a list of questions circulated by the National Treasury in August 2011.

Annexure 2

The table provides an overview of the emission factors as proposed for phase 3 of the EU ETS benchmarking:

Sector	Product	Classification	Benchmark values[1]
Mineral oil refineries	CO_2 per complexity weighted ton (CWT)	Solomon	0.030 tCO_2/CWT[2]
Iron and Steel Industry	Coke	PC	0.090 tCO_2/t
	Sinter	PC	0.119 tCO_2/t
	Hot metal	Industry	1.286 tCO_2/t
	Electric arc furnace: non-alloy, high alloy and other alloy	PC	0.058 tCO_2/t
Alluminium	Alumina	PC	0.390 tCO_2/t
	Pre-baked anodes	PC	0.330 tCO_2/t
	Primary aluminium	Industry	1 570 tCO_2/t[3]
	Secondary aluminium	PC	0.220 tCO_2/t[3]
Cement	Clinker	PC	0.780 tCO_2/t[4]
Lime	Lime	PC	0.985 tCO_2/t
	Dolime	PC	1.113 tCO_2/t
Glass	Flat glass	PC	0.606 tCO_2/t
	Hollow glass	PC	0.250 tCO_2/t
	Continuous filament fibre	PC	1.003 tCO_2/t
Ceramic products	Low and high-density clay blocks	PC + Industry	0.114 tCO_2/t[5]
	Facing brickers and pavers	PC + Industry	0.133 tCO_2/t[5]
	Roof tiles	PC + Industry	0.151 tCO_2/t[5]
	Spray-dried powder	PC + Industry	0.055 tCO_2/t
	Dry-pressed wall and floor tiles	PC + Industry	0.300 tCO_2/t
	High heat-resistant refractory products	PC + Industry	0.335 tCO_2/t
	Low heat-resistant refractory products	PC + Industry	0.225 tCO_2/t
Gypsum	Raw gympsum / land plaster	Industry	0.010 tCO_2/t
	Plaster	PC	0.050 tCO_2/t
	Gypsum blocks, plaster boards, coving	PC	0.080 tCO_2/t
	Glass fibre-reinforced gypsum	PC	0.180 tCO_2/t
Pulp and paper	Kraft pulp	PC	0.048 tCO_2/t
	Sulphite pulp, (chemi-) thermo-mechanical and mechanical pulp	PC	0.000 tCO_2/t
	Recovered paper	Industry	0.019 tCO_2/t
	Newsprint	PC	0.381 tCO_2/t
	Uncoated fine paper	PC	0.405 tCO_2/t
	Coated fine paper	PC	0.463 tCO_2/t
	Tissue	PC	0.343 tCO_2/t
	Containerboard	PC	0.368 tCO_2/t
	Carton board	PC	0.418 tCO_2/t
Chemical Industry	Nitric acid	PC	1.210 kg N_2O/t
	Ammonia	PC	1.460 tCO_2/t
	Adipic acid	PC	5.600 tCO_2-eq/t
	Hydrogen / synthesis gas	PC	*0.03 tCO_2/CWT*[2]
	Soda ash	PC	0.730 tCO_2/t
	Aromatics	PC	*0.030 tCO_2/CWT*[2]
	Carbon black	PC	2.620 tCO_2/t[6]

Notes: PC = product classification.

1. Values in italics indicate that the value is based on a benchmark curve or a literature value that is not fully consistent with the methodology proposed in the first blueprint study of an allocation methodology for free allocation of emissions allowances under the EU ETS for 2013-20.
2. The value should be regarded as preliminary because it is unclear how speciality refineries have been treated and how the average of the 10 per cent most efficient refineries have exactly been determined.
3. The benchmark includes emissions from electricity calculated with an emissions factor of 0.75 kg CO_2 per kWh, instead of 0.465 kg CO_2 per kWh.
4. Values based on a process emissions factor of 538 kg CO_2 per ton of clinker instead of 523 kgCO_2 per ton of clinker, which would be in line with the EU ETS monitoring and reporting guidelines.
5. The benchmark value is based on linearisation of the 10th to 90th percentile of installations.
6. Value without a deduction for the caolonific value of tail gas.

Source: Adapted from Ecofys (2009: 67-72)

Annexure 3

The table below provides an overview of the emission factors as used in the Carbon Tax Impact assessment model:

#	Fuel type	Emission Factor (tCO_{2e})	NCV (TJ/Gg)	NCV (MU/kg)	EF (kg CO_2/ TJ)	EF kg CO_2/ MJ)	Density (kg/L)	Convert kg into t	Source
1	Petrol (L)	0.0023	44.30	44.30	69,300	0.0693	0.7400	0.0010	1
2	Diesel (L)	0.0027	43.00	43.00	74,100	0.0741	0.8500	0.0010	2
3	LPG (kg)	0.0030	47.30	47.30	63,100	0.0631		0.0010	3
4	Natural Gas (kg)	0.0028	44.20	44.20	64,200	0.0642		0.0010	4
5	Heavy Fuel Oil (HFO) (L)	0.0029	40.40	40.40	77,400	0.0774	0.9400	0.0010	5
6	Light Furnace Oil (L)	0.0030	47.30	47.30	63,100	0.0631		0.0010	6
7	Coal* (t)	2.4407	25.80	25.80	94,600	0.0946		0.0010	7
8	Coke* (t)	2.6677	28.20	28.20	94,600	0.0946		0.0010	8
9	Fly ash (t)	0.8700							9
10	Coal duff (t)	2.1234							10
11	Coal slurry (t)	0.8742							11

Sources of Reference:

1. IPCC 2006 Guidelines (Volume 2 Chapter 1)
2. IPCC 2006 Guidelines (Volume 2 Chapter 1)
3. IPCC 2006 Guidelines (Volume 2 Chapter 1)
4. IPCC 2006 Guidelines (Volume 2 Chapter 1)
5. IPCC 2006 Guidelines (Volume 2 Chapter 1)
6. IPCC 2006 Guidelines (Volume 2 Chapter 1)
7. IPCC 2006 Guidelines (Volume 2 Chapter 1)
8. IPCC 2006 Guidelines (Volume 2 Chapter 1)
9. EPA 2011, Climate Change life cycle study
10. IPCC 2006 Guidelines (Volume 2 Chapter 1) corrected for 13% less O_2
11. EPA 2011, Climate Change life cycle study

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