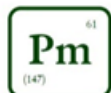


REPORT

Supply and Demand Modelling in the Proposed South African Carbon Offset Scheme

SEPTEMBER 2014

PROMETHIUM
C A R B O N



Executive Summary

This report describes the findings of carbon offset supply and demand modelling, conducted by Promethium Carbon in response to the 'Carbon Offsets Paper' (National Treasury, April 2014).

The types of projects allowed to generate offsets to be used under the South African Carbon Tax will largely determine the supply of carbon offsets. It is of importance that offset supply is sufficient to provide economies of scale. At the same time it is important to have a balanced supply and demand to ensure that the market price will be reasonable stable.

Carbon offset supply and demand modelling was conducted for two sets of assumptions with regard to the allowance or eligibility of project types as offsets:

1. The types of offsets allowed as described in the Draft Carbon Offset Paper as released by National Treasury in April 2014;
2. An extended set of eligibility criteria, the rationale of which was described in Promethium Carbon's report '*Carbon Trading in South Africa – Trading Offsets against the Proposed Carbon Tax*', published in March 2014.

The total **carbon offset supply** based on the eligibility criteria presented in the National Treasury Carbon Offset paper results in approximately 13 MtCO_{2e} per annum. The total carbon offset supply based on the eligibility criteria proposed by Promethium Carbon results in approximately 25 MtCO_{2e} per annum.

The **carbon offset demand** analysis was based on the assumption that companies may offset the allowed percentage of their Scope 1 emissions as well as 10% of their Scope 2 emissions. The demand volumes were estimated to be in a range of 18-30 Million tCO_{2e} per annum. This range is similar to other studies referenced by National Treasury in its draft Carbon Offset Paper.

Following the results from carbon offset supply and demand modelling, offset supply in accordance with the eligibility criteria presented by National Treasury will fall short of the anticipated low end range of the demand. The total supply of carbon offsets in accordance with the eligibility criteria proposed by Promethium Carbon is expected to fall within the range of anticipated demand for carbon offsets.

It is therefore recommended that additional eligibility criteria be included in the final offset design in order to create a viable market.

The potential demand – and associated supply-of 20 million t has the potential to reduce GHG emissions in South Africa by 3% by 2020. This is 10% of the Copenhagen pledge.

Table of Contents

1. Introduction.....	3
2. Potential Offset Supply.....	4
3. Potential Offset Demand	12
4. Conclusion	14

1. Introduction

This report describes the findings of carbon offset supply and demand modelling, conducted by Promethium Carbon in response to the draft *Carbon Offsets Paper* released by National Treasury in April 2014 for public comment.

This project formed part of a larger initiative around offsetting and has been funded by the British High Commission in Pretoria.

The proposed carbon offset trading system forms part of the announced carbon tax due to be implemented at the beginning of 2016 (National Treasury). In this context the analysis was framed by the need to address the following issues:

1. The potential success or failure of the offset trading system will depend on whether or not there will be sufficient and balanced supply and demand to create a viable market.
2. The potential market must be shown to generate sufficient liquidity to provide economies of scale and make the market feasible from a cost perspective.
3. A viable market will require sufficient early liquidity. This means that sufficient supply must be available when the market starts up.
4. The market must have a long term growth potential.

The demand for credits will largely be determined by the carbon tax regulations. The types of projects allowed to generate offsets to be used under the South African Carbon Tax will largely determine the supply of carbon offsets.

Carbon offset supply and demand modelling was conducted for two sets of assumptions with regard to the allowance or eligibility of project types as offsets:

1. The types of offsets allowed as described in the Carbon Offset Paper as released by National Treasury in April 2014;
2. An extended set of eligibility criteria, the rationale of which was described in Promethium Carbon's report '*Carbon Trading in South Africa – Trading Offsets against the Proposed Carbon Tax*', published in March 2014.

This report will firstly discuss the differences between the types of offsets allowed as per the Carbon Offset Paper and proposed to be eligible in the extended set of eligibility criteria. Next, the impact these different eligibility criteria will have on supply is presented. This is followed with a section on expected offset demand and concluded with a comparison of supply and demand of carbon offsets.

2. Potential Offset Supply

The potential supply of carbon offsets can be determined by a number of factors. Previous modelling attempts focussed on the extrapolation and estimation of rollout potential of the existing CDM and VCS pipelines. Such analyses do however not take sufficient cognisance of the barriers faced by CDM and VCS project implementers. The analysis presented in this report is based on a fundamental analysis based on the volume and cost data presented in the Mitigation Potential Analysis.

Offset supply is determined by a number of factors, including:

- Types of projects eligible to generate offsets;
- Any cut-outs from the eligibility criteria (such as limitations on specific project types such as industrial gasses);
- Any concessions made on the eligibility criteria (such as positive lists);
- The cost of implementing the intervention that generates the offset (marginal abatement cost);
- Price that can be obtained for carbon offsets; and
- Accessibility to the systems and processes to have a project recognized as a carbon offset project.

This supply modelling only assessed the supply as a function of the types of projects allowed to generate offsets and was based on two sets of assumptions;

- The types of offsets allowed as per the National Treasury, Draft Carbon Offset Paper; and
- A set of extended eligibility criteria as presented below.

The offset supply calculations are largely based on information presented in the Mitigation Potential Analysis (MPA) of which a draft was released by the Department of Environmental Affairs in 2013. This report presents the types, costs and timelines for implementation of emission reduction projects within South Africa. Project costing in this document is presented as Marginal Abatement Costs (MAC), which are the net costs (lifetime financial benefit of the project minus the lifetime expenditure of the project) of a project per functional unit (for example per tCO₂ reduced by the project). This analysis is presented taking the limitations of the MAC curve approach into consideration, and some of the limitations are addressed in the set of extended eligibility criteria presented below. Some of the more important limitations of the MAC curve approach that must be kept in mind in the interpretation of the results are:

- Non-cost barriers to project implementation are not factored into the MAC curves. It is for this reason that measures such as the positive list needs to be introduced;
- The discount rates used in the calculation of the MAC curves are not always transparent and almost always differ from the investment hurdle rates applied by individual companies in taking investment decisions;
- MAC curve calculations assume full access to and total efficiency of barriers and incentives such as taxes and tax incentives. In practice the implementation and administration of these barriers and incentives are not 100% efficient.

The starting point of the analysis is that companies may decide to implement projects that have positive abatement costs (i.e. projects that are not normally economically viable to implement) because the revenue from the carbon offset credits will make the projects economically viable. Seeing that the market will probably cap the price of the offset credits at the marginal value of the carbon tax, only offset interventions with a marginal cost of up to the value of the carbon tax were taken into consideration.

Figure 1 and 2 present the offset supply modelled based on the eligibility criteria in the National Treasury Carbon Offset Paper and the extended set of eligibility criteria. The top line (MAC Supply 100%) is the total mitigation potential identified in the MPA study. All red bars are project types that are not eligible as offset projects under the two scenarios presented and therefore deducted from the total mitigation potential. The green bars represent interventions that are eligible to be traded against the carbon tax and therefore counted back in.

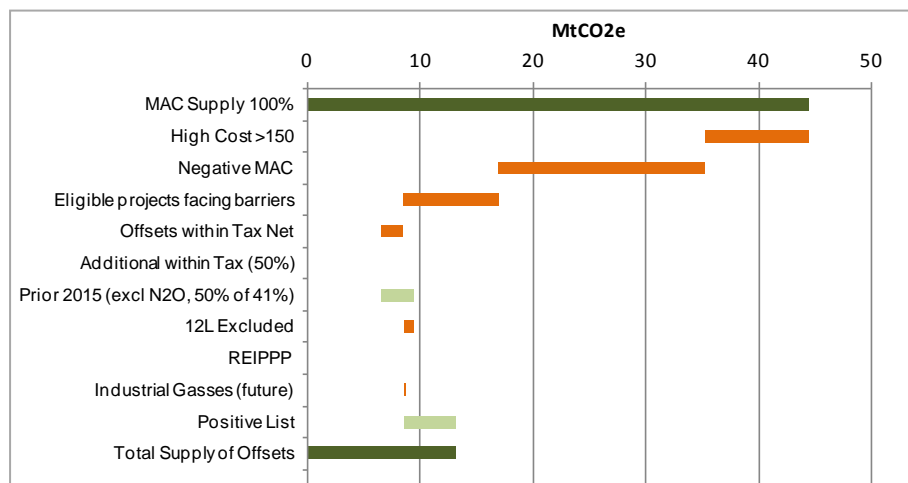


Figure 1: Offset supply as per eligibility criteria in the National Treasury Carbon Offset Paper

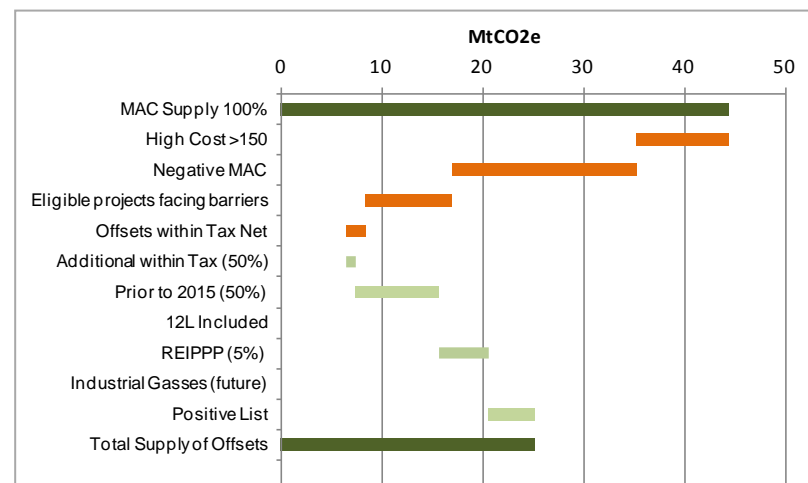


Figure 2: Offset supply as per the extended set of eligibility criteria

The total carbon offset supply based on the eligibility criteria presented in the National Treasury Carbon Offset paper results in approximately 13 MtCO₂e per annum. This is approximately one third of the national annual emission reduction potential as per the Mitigation Potential Analysis.

The total carbon offset supply based on the extended set of eligibility criteria results in approximately 25 MtCO₂e per annum. This is slightly more than half of the national yearly emission reduction potential as per the Mitigation Potential Analysis.

Table 1 below gives an overview of the different assumptions with regard to offset eligibility proposed by National Treasury and the extended set of eligibility criteria.

Table 1: Overview of carbon tax offset eligibility assumptions

Assumptions	Description	Eligibility criteria as in Carbon Offset Paper	Extended assumptions
MAC Supply 100%	The top bar in figures 1 & 2 above presents the total potential supply of projects identified in the MPA. The total emission abatement potential within South Africa is estimated at 44 MtCO₂ by 2020.	Assuming that all projects identified in the MPA are available as offsets as a starting point to calculate the final supply.	Same assumptions as the Carbon Offset Paper.
High Costs >150	Mitigation measures with a Marginal Abatement Costs of more than R150/tCO ₂ e are excluded as income from sales of carbon tax offsets is not expected to make them economically viable. Note that the amount of R150 per ton is conservative as the carbon tax amount of R120 per ton in 2016 will escalate at 10% per year (according to the Carbon Tax Policy Paper) to reach a value of R175 per ton in 2020. The total emission abatement potential within South Africa with a MAC above R150/tCO ₂ is 9 MtCO₂ by 2020.	Projects with MAC of more than R150/tCO ₂ e are excluded.	Same assumptions as the Carbon Offset Paper.
Negative MAC	The National Treasury Carbon Offset Paper proposes in paragraph 13 that initially carbon offsets are developed under the Clean Development Mechanism (CDM), Verified Carbon Standard (VCS), Climate, Community and Biodiversity Standard (CCBS) or Gold Standard (GS). These standards require that projects prove to be 'additional'. Generally project can prove additionality using either an investment analysis or by using a barrier analysis. We have excluded all of the projects with negative abatement costs at this step and counted the projects that can be proved to be additional with a barrier analysis back in under the projects covered by potential positives lists below. The total emission abatement potential within South Africa with a negative MAC is 18 MtCO₂ by 2020.	Projects with a Negative Marginal Abatement Cost are excluded as they are not expected to prove additionality, unless they are allowed by means of a positive list, in which case they are counted back in. (see Positive List below)	Same assumptions as the Carbon Offset Paper.

Assumptions	Description	Eligibility criteria as in Carbon Offset Paper	Extended assumptions
Eligible projects facing barriers	Some projects identified in the MPA study will not be implemented due to non-financial barriers. Examples of such barriers could be capital availability, operational priorities, information availability as well as capacity of the company to implement such project. We have assumed that 50% of the projects that are not excluded due to high or negative abatement costs may face such barriers. This brings the total emission abatement potential within South Africa which is expected to face barriers is estimated at 8 MtCO₂ by 2020.	It is assumed that 50% of the projects can be implemented, and 50% of the projects are therefore excluded from the supply.	Same assumptions as the Carbon Offset Paper.
Offsets within Tax net	In the event that companies that are carbon tax payers are allowed to generate offset credits, it may result in such companies getting double benefits from the fact that it can trade the offset credits. This analysis included an estimation of the level of penetration of the carbon tax for each sector identified in the Carbon Tax Policy Paper in order to define the carbon tax net. The amount of emission reduction projects that falls within the carbon tax net as defined by this analysis was then estimated. The total emission abatement potential within South Africa which is estimated to fall within the tax net is 2 MtCO₂ by 2020.	Offsets generated within the tax net are excluded as a starting point. Different assumptions are made later as part of this analysis to count some of these credits back in.	Same assumptions as the Carbon Offset Paper.
Additionality within Tax net (50%)	If additionality of emission reduction projects within the tax net can be proven while including the economic benefit of reduced carbon tax, then it can be argued that such projects will not get double benefit from the carbon offset revenue. Access to carbon funding for such projects will help these projects to become financially viable. For modelling purposes it was assumed that 50% of the mitigation potential which fall inside of the tax net can prove additionality. The total emission abatement potential within South Africa which is estimated by Promethium Carbon to be additional within the tax net is 1 MtCO₂ by 2020.	Carbon credits generated within the tax net are excluded under all circumstances.	Carbon credits generated within the tax net that can prove additionality are allowed as offsets and therefore added back in. It was assumed that 50% of projects which fall within the tax net will be able to prove additionality.

Assumptions	Description	Eligibility criteria as in Carbon Offset Paper	Extended assumptions
<p>Credits from projects registered prior to 2015</p>	<p>Offset credits from projects registered prior to the date of introduction of the carbon tax could provide early liquidity to the offset market. Such liquidity is essential for the success of the market. The Carbon Offset Paper allows carbon credits registered under one of the accepted standards prior to implementation of the carbon tax to be traded as offsets, if the project is developed outside of the tax net. This analysis found that 41% of the projects currently registered are outside of the carbon tax net.</p> <p>The potential carbon offsets supply from prior to 2015 registered carbon credit project outside of the tax net is estimated at 3 MtCO₂ by 2020. The potential carbon offsets supply from prior to 2015 registered carbon credit project inside of the tax net is estimated at 8 MtCO₂ by 2020.</p>	<p>The credits generated from projects registered prior to 2015 are allowed to be used as offsets when they fall outside of the tax net. Following an assessment it was found that 41% of credits generated from the registered CDM projects fall outside of the tax net. It is estimated that 50% of these credits are still available to be traded under the proposed offset scheme. Carbon credits from all registered industrial gas projects are excluded (see the assumption 'Industrial Gasses' below).</p>	<p>It was assumed that all credits generated from projects registered prior to the date of introduction of the carbon tax are eligible to trade in the offset scheme irrespective of its position relative to the tax net. This extension is justified by a number of factors. Firstly, National Treasury has indicated that it would reward early movers for taking mitigation action. Secondly, the Department of Energy actively promoted the CDM scheme in South Africa. Thirdly, the credits are eligible to be used internationally and should therefore be eligible to be used inside SA. Fourthly, the projects fall outside the tax net on the time scale as they were implemented at a time when the carbon tax was not in place.</p> <p>It was assumed that 50% of total credits issued annually from projects registered prior to 2015 will be available.</p>

Assumptions	Description	Eligibility criteria as in Carbon Offset Paper	Extended assumptions
12L Projects	<p>The impact of excluding or including projects applying for financial benefit under section 12L of the Income Tax Act is estimated to be insignificant due to the fact that the benefit of Section 12L can only be earned for a period of 1 year. This is based on the requirement to restate the baseline on an annual basis. It is estimated (based on an assumption that 2% of all projects identified in the MPA will apply for funding under Section 12L) that projects with a total emission abatement potential of 0.9 MtCO₂ will be excluded as carbon offsets.</p>	<p>Projects applying for support via Section 12L of the income tax act are excluded offset generating projects under the carbon tax as the inclusion of these projects could be seen to give double benefit to the projects.</p>	<p>Projects applying for support via Section 12L of the income tax act are allowed to generate offsets to be sold under the carbon tax if they can prove additionality. This is justified by the fact that the additionality requirement will prevent projects from gaining windfall profits. Only projects that need the benefit of the layering of incentives will be eligible to generate credits.</p>
REIPPP	<p>Projects selling electricity into the Renewable Energy Independent Power Producer Programme (REIPPP) are being funded by an increase in the electricity tariff. This programme is a competitive bidding process where power purchase agreements (PPA's) are awarded to successful bidders. If projects representing 5% of the country's power supply are included in the offset trading programme, it would result in a supply of carbon offsets of 5 MtCO₂ by 2020.</p>	<p>All projects which are part of the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) are excluded as offset generating projects.</p>	<p>The first 5% of the planned REIPPP projects up to 2020 are included. This is justified by the fact that participation in the offset scheme can allow REIPPP bidders to lower their prices and thereby reduce the impact of the REIPPP on the electricity tariff. Additionally, these projects will create early carbon offset liquidity.</p>

Assumptions	Description	Eligibility criteria as in Carbon Offset Paper	Extended assumptions
Industrial Gasses mitigating projects	<p>The Carbon Offset Paper refers to the exclusion of nitrous oxide credits. This recommendation is based on alignment with international schemes such as the European Union Scheme. The Paper states: <i>Industrial gas-related credits have been disallowed in the EU ETS from 2013</i>. Not all nitrous oxide projects are however excluded in Europe, but only projects implemented on adipic acid plants. The European Union legislation states: <i>The ban will apply to projects which destroy two industrial gases: trifluoromethane (HFC-23) produced as a by-product of chlorodifluoromethane (HCFC-22) production, and nitrous oxide (N₂O) from adipic acid production</i>. As South Africa has no adipic acid plants, all of South Africa’s nitrous oxide projects should be allowed. Based on the mention of exclusion of industrial gasses, the carbon offsets paper would exclude a carbon offset supply of 0.01 MtCO₂ by 2020. This is based on the potential of industrial gasses projects identified by the report ‘South Africa’s Greenhouse Gas Mitigation Potential Analysis’ for future implementation.</p> <p>Existing nitrous oxide credits are excluded (eligibility criteria as in the Carbon Offset Paper) or included (extended assumptions) under the assumptions covering ‘credits from projects registered prior to 2015’.</p>	<p>Future N₂O abatement potential is excluded as the carbon offset paper mentions that industrial gas projects are not eligible to be traded as offsets.</p>	<p>Industrial gas projects taken as referring to adipic acid plants are in line with EU regulation. As South Africa has no adipic acid plants this exclusion is not relevant in South Africa. Future abatement potential from nitrous oxide abatement projects in South Africa is therefore recommended to be allowed as offsets.</p>

Assumptions	Description	Eligibility criteria as in Carbon Offset Paper	Extended assumptions
<p>Projects on a Positive List</p>	<p>Established carbon offset standards such as the CDM and VCS require that projects that do not prove additionality with an investment analysis can do so through the use of a barrier analysis. In practice this is however very difficult to do. Both the CDM and VCS allow for positive lists to be used to overcome the challenges of proving additionality with barrier analysis. These positive lists identify project types that are deemed to be automatically additional. For the purpose of estimating potential supply of offsets following this rule, 25% of the projects that were previously excluded due to negative Marginal Abatement Costs are assumed now to become eligible as offsets due to the positive list. The projects which have negative Marginal Abatement Costs are found to be projects within the residential and AFOLU sector. To put such projects on a positive list would be in line with the eligible project types as per the Carbon Offsets Paper. If 25% of the projects with a negative Marginal Abatement Cost would be allowed as carbon offsets by means of a positive list, the total supply of carbon credits would increase with 4.6 MtCO₂ by 2020.</p>	<p>Assuming that 25% of the projects previously excluded due to negative Marginal Abatement Costs can become eligible as offsets due to be included on a positive list.</p>	<p>Same assumptions as the Carbon Offset Paper.</p>

3. Potential Offset Demand

The demand for carbon offsets will be determined by several factors, amongst which the:

- Price of carbon offsets;
- Accessibility of the carbon offset market; and
- Amount of carbon tax liable entities and the total amount of emissions covered by the tax.

The price of carbon offsets will be determined through the balance of supply and demand. However, for the buyer to benefit from the option of offsetting under the announced carbon tax of R120/tCO₂, the price of the offset should be below the level of the carbon tax, which starts at R120/tCO₂ in 2016.

The demand modelling results presented in this report take into account the amount of carbon tax liable entities and the total amount of emissions covered by the tax. These results have previously been presented in Promethium Carbon's report 'Carbon Trading in South Africa – Trading Offsets against the Proposed Carbon Tax'.

The demand for credits is determined by the provision in the carbon tax policy paper that limits the use of offsets to a percentage of the tax liability of a company. The analysis of the potential demand therefore focuses on estimating the taxable emissions falling in each of the identified sectors.

This analysis is prepared on the basis of the latest available data. Energy demand projections were obtained from the Department of Energy¹, which is the same data as used for the Integrated Energy Plan for South Africa. By using IPCC emission factors, total emissions, excluding process emissions, were calculated. Process emissions were obtained from the report 'South Africa's Greenhouse Gas (GHG) Mitigation Potential Analysis' prepared for the Department of Environmental Affairs (2013).

Carbon offset demand projections were estimated by making certain assumptions about what portion of each industry will be covered by the tax net. These assumptions were made to project low-end demand, as well as high-end demand and are presented in Table 2 below.

¹ Personal communication with Rebecca Maserumule and Philip Goyns, 16-01-2014

Table 2: Estimated portion of emissions that fall within the tax net

	Low tax penetration rate	High tax penetration rate
Residential – energy	0%	0%
Transport- energy	25%	50%
Commercial – energy	25%	50%
Manufacturing - other – energy	25%	50%
Manufacturing- non-ferrous metals – energy	90%	100%
Manufacturing - chemicals – energy	75%	100%
Manufacturing - iron and steel - energy	100%	100%
Mining – energy	75%	100%
Agriculture – energy	0%	0%
Process & fugitive emissions	50%	75%

This analysis assumed that companies may offset the allowed percentage of their Scope 1 emissions as per the Draft Carbon Tax Policy Paper. It was further assumed that regulatory restrictions on Eskom limit the demand for offsets to 10% of the emissions associated with electricity consumption within the carbon tax net.

The projected demand results are presented in Figure 3 below.

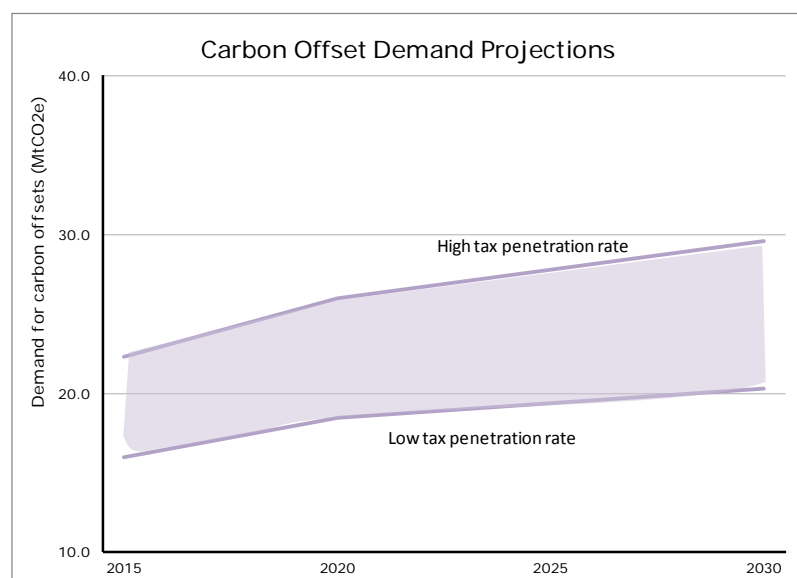


Figure 3: Carbon offset demand projections for both a high and low tax penetration rate

The demand volumes are therefore estimated to be in a range of 18-30 Million tCO₂e per annum. This range is similar to other studies referenced by National Treasury in its draft Carbon Offset Paper.

4. Conclusion

The results of the estimated supply and demand resulting from the 2 scenarios are shown in Figure 4 below.

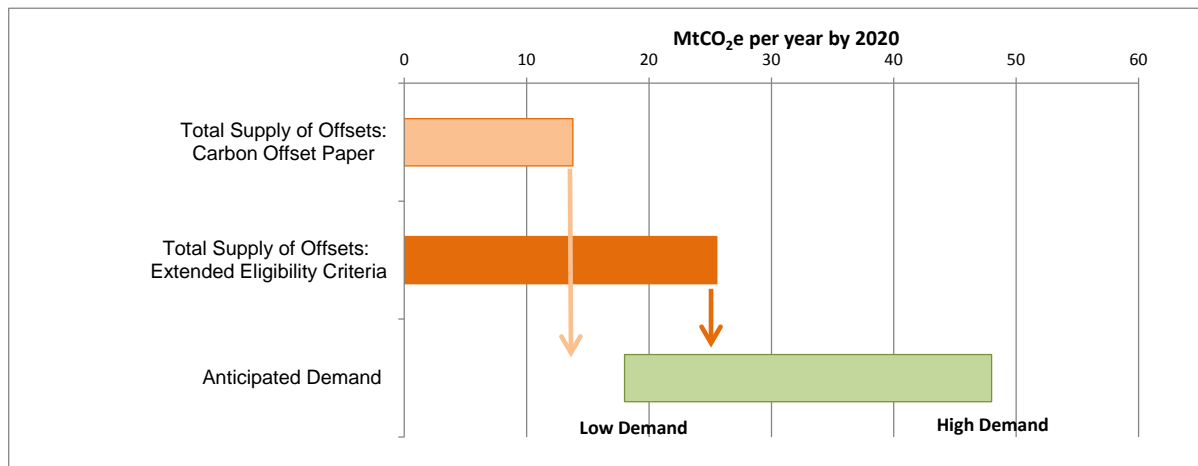


Figure 4: Supply and demand balance for project eligibility criteria as in the Carbon Offset paper and the extended eligibility criteria.

The total supply of carbon offsets in accordance with the eligibility criteria proposed by National Treasury is estimated at approximately 13 MtCO₂e per annum. This falls short of the anticipated low end range of the demand at 18 MtCO₂e per annum.

The total supply of carbon offsets in accordance with the extended eligibility criteria is estimated at approximately 25 MtCO₂e per annum. This supply falls within the range of anticipated demand for carbon offsets.

Promethium Carbon

is a dedicated carbon and climate change advisory firm helping major international clients gain global competitive advantage in the fast-emerging low carbon economy.

CONTACT NUMBERS:

0861 CARBON (0861 227 266)
Tel : +27 (0)11 706 8185

CONTACT DETAILS:

Robbie Louw

Director
+27 (0)82 557 8646
robbie@promethium.co.za

Harmke Immink

Director
+27 (0)83 228 1781
harmke@promethium.co.za

HJ Swanepoel

Director
+27 (0)82 460 8840
hj@promethium.co.za

OFFICE ADDRESS:

Ballyoaks Office Park
Lacey Oak House 2nd Floor
35 Ballyclare Drive
Bryanston
South Africa