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BIOFUELS

# Impact analysis of the Biofuels Industrial Strategy on the South African Agricultural and Biofuel Subsectors

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National Agricultural Marketing Council

Strategic positioning of South African Agriculture in dynamic global markets

# BFAP Biofuels Report 2008

Impact analysis of the Biofuels Industrial Strategy on the South African Agricultural and Biofuel Subsectors.

# BFAP Background

BFAP is an independent research unit involving the Universities of Pretoria and Stellenbosch, the Department of Agriculture: Western Cape, the Food and Agricultural Policy Research Institute (FAPRI) and associated organisations.

The main objectives are:

1. To facilitate informed decision making by South African policy makers, agribusinesses, trade negotiators and farmers through improved analytical capabilities;

2. To enhance the quality and quantity of applied disciplinary, multi-disciplinary and cross-institutional research relating to applied trade and policy modelling and commodity market analysis;

3. To provide analyses of future policy and market scenarios and measure the impact of these on farm and firm profitability.

Acknowledgements:

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# The Biofuels Industrial Strategy

## 1. Introduction

The biofuels industrial strategy issued in December 2007 reviewed the government's goals and objectives, as well as its intended strategic approach to biofuels production within South Africa. In short, the strategy is aimed at achieving a number of goals, including attracting investment into rural areas, promoting agricultural development, and import substitution of foreign oil which should result in balance of payments savings. Other factors also mentioned as key issues are; adding to the renewable energy pool in order to create cleaner energies, adding downward pressure to crude oil prices, and creating a more energy secure environment.

One of the primary objectives of the strategy is to realise economic development in rural areas by creating a downstream market for the agricultural commodities produced in these areas. To achieve this objective, government intends to regulate the geographic location of biofuel production plants, and also the type of agricultural commodity used as an input to the production process. The crops that have been proposed include sugar-based commodities for bioethanol production, such as sugarcane and sugar beet, and sunflower, canola and soybeans for biodiesel. Maize and Jathropa have been excluded for the 5 year pilot period, since the use of these commodities could have a negative impact on food security and environmental conditions within the country.

Given that a potential biofuel sector has to survive and grow within a larger macro-economic context in order to reach the stated goals as described by the biofuel strategy, it is critical to understand the relationship between macro-economic factors and the resultant viability of a biofuel sector.

Previous reports by BFAP in 2005 and 2007 analysed the potential sustainability and impacts of various policies on both the agricultural and biofuel industries. However, given the publication of the Government's Biofuels Strategy the objective of this report is to quantify the impact of different macro-economic factors on the viability of a potential South African

biofuel sector. It is hoped that this will contribute to improved understanding of the relationship between the viability of a potential biofuel sector and the macro-economic environment.

Factors that are included are global crude oil, sugar and biofuel prices. To analyze the various impacts of the different selected factors, a baseline and scenario of which the macro-economic conditions differ significantly is simulated and analyzed by means of the BFAP model.

This report serves as part of the continued output in terms of quality research that the Bureau for Food and Agricultural Policy is committed to achieving[1].

# 2. Achieving the objectives

The strategy proposes various methods through which it aims to achieve the aforementioned objectives and ultimately plans to develop a biofuel sector. Such methods include a fuel levy exemption scheme, farmer cooperatives and their direct participation in the running of biofuel refineries, quantity control through the issuing of licences, and encouragement of the use of biofuels in the fuel mixture currently produced by the existing refineries.

## 2.1 Fuel levy exemption

Retail fuel prices in South Africa are currently the function of a number of taxes and levies aimed at covering the cost of maintenance and the upgrading of road and logistical infrastructure, as well as profit margins and crude oil prices. These taxes and levies are adjusted every year to keep up with the impact that inflation has on the overall industry. Table 1 (on the next page) represents a complete breakdown of the petrol price and the associated costs and taxes that come along with it. BFP stands for the basic fuel price and represents the import parity price of the refined product. In other words BFP is the price at which one litre of refined fuel is landed at Durban harbour without any taxes or profit margins being added. Various other taxes and costs are added to the price, namely transport, delivery and pipeline costs, road accident fund, custom-and-excise duty, equalisation fund and slate levies and wholesale and retail margins. The strategy proposes the reduction of the fuel tax as a support

[1] The reader of this report should note that sorghum and other winter cereals have been excluded from this analysis. The direct production of ethanol gel from maize has also only been take into consideration for the baseline scenario. This report focuses solely on the major commercial agricultural products produced in South Africa.

mechanism to the biofuel industry, the idea being that a lower tax rate on biofuels will increase their competitiveness with fossil fuels and in so doing make them more viable.

**Table 1: Petrol price composition in South Africa, March 2008**

| March 2008 | Cents/litre | % of price |
|---|---|---|
| BFP | 523.413 | 63.8 % |
| Fuel tax | 121 | 14.8 % |
| Customs & excise | 4 | 0.5 % |
| Equalisation fund | 0 | 0.0 % |
| Road accident fund | 41.5 | 5.1 % |
| Transport cost | 13.9 | 1.7 % |
| Pipeline cost | 0.19 | 0.0 % |
| Wholesale margin | 39.487 | 4.8 % |
| Retail margin | 59.7 | 7.3 % |
| Slate levy | 4.81 | 0.6 % |
| Delivery cost | 7 | 0.9 % |

Source: *Department of Minerals and Energy, 2008.*

The proposed reduction in the fuel levy reduces the fuel tax by 100 % for bioethanol and 50 % for biodiesel. This will drop the biofuels price by between 7 % and 14.8 % below conventional fossil-based petrol and diesel. Since April 2007 fuel tax has totalled R 1.21 per litre for petrol and R 1.00 per litre for diesel, but from April 2008 the amount increased to R 1.27 per litre for petrol and R 1.05 per litre for diesel.

According to the Industrial Strategy the fuel levy tool plays a very important role in the indirect subsidisation process. The strategy proposes that the current biodiesel fuel levy exemption be increased from its current level of 40 % by 10 percentage points to 50 %. It also proposes that the fuel levy exemption on bioethanol be increased to 100 % as ethanol gel could be a substitute for illuminating paraffin, which currently carries no levy. This would translate into R 1.21 per litre and R 0.53 per litre support for bioethanol and biodiesel, respectively, in 2007. The tax increases would augment the support to biofuels and would translate into R 1.27 per litre for bioethanol and R 0.56 per litre for biodiesel in 2008 (DME, 2007).

## 2.2 Rural development and licence allocation

According to the strategy the main focus of rural development will be on the former homeland areas in South Africa, especially those neglected under the apartheid system. It is hoped that these initiatives will stimulate development in rural areas and reduce poverty by creating sustainable income earning opportunities.

As poverty alleviation and the generation of economic activity in the former homelands are the strategy's most important objectives, it becomes clear why only those agricultural products grown in the former homelands for energy use will qualify for support, and why only the biofuel plants that can assist in achieving the abovementioned targets will be supported and qualify for a manufacturing licence. Thus the department that ultimately issues the licence will, to a large extent, control the location of biofuel plants and their operating conditions (DME, 2007). It is important to note that should this be the case, sugarcane for ethanol production will then be excluded from any benefits, as almost all of the current industry's production areas fall outside the former homelands and as a result do not qualify for support. This could have an impact on the various targets that are to be achieved.

The government plans to increase agricultural production in order to support biofuel investments by using existing support programmes such as the Comprehensive Agricultural Support Programme (CASP). CASP is expected to prioritise those aspects of production that will enhance effective cropping for biofuels, and in so doing make the supply of feedstock to the biofuels industry more reliable and efficient.

## 3. Contracting and mandates on biofuels

According to the strategy, the specifics of the biofuel uptake still need to be negotiated with the oil industry. These include maximising efficiencies, reducing costs and ensuring that fuels adhere to the correct standards, thus allowing them to be sold and used as standard quality fuel. The South African Bureau of Standards has recently established a working group among relevant stakeholders to finalise possible future regulations for a biodiesel quality management procedure to be applied in South Africa. These regulations don't affect the biodiesel product standard, but rather the quality assurance process.

The strategy recommends that biofuels be sold on a contract basis, and bought at a price that will ensure the long term viability of both the biofuels refining and feedstock growing processes. The contract will come with an obligation to use approved crops grown only in designated areas, such as the former homelands, with the guarantee that crops will be bought at a given price, regardless of the price of crude oil. On

the other hand the price at which biofuel producers buy crops should be comparable with the price that processors pay for crops destined for the food sector, in other words a market related price.

The strategy suggests that mandatory biofuels uptake can only be guaranteed once there is security in the supply of biofuels. It is at this stage of the bargaining process that both biofuel suppliers and oil refineries will enter into off-take agreements. In other words, the oil company will submit a claim to a certain slate account for the value of biofuels bought. During the initial phases of production, the mandating of biofuels is not favoured. It is instead suggested that biofuel producers be enabled to reduce their prices and, through this initiative, parties who are traditionally supplied by the oil companies are able to purchase fuel directly from the biofuel producers. The strategy further examines the concept of selling petrol containing bioethanol at a deregulated price to facilitate off-take.

The strategy envisages that costs and logistics should be minimised to optimise efficiency. To achieve this, existing oil refineries closest to the biofuels plants should be utilised. Furthermore, biofuels should be blended in accordance with the South African National Standards (SANS), which currently limit biofuel content to 5 % for diesel and approximately 10 % for petrol. This would ensure that the appropriate quality blends of biofuels are produced (DME, 2007).

# 4. Comments on the Strategy

Policies and pricing strategies are decisive factors for the future of the biofuel industry, and investors need to feel comfortable and have no uncertainties regarding the implications of these policies. A number of policies have been proposed to support the biofuel industry. The first policy category involves levy exemptions, tariffs and import protection, and can be summarised as follows:

- **Fuel levy exemption**

Bioethanol fuel levy exemption: 100 %.
Biodiesel fuel levy exemption: 50 %.

- **Tariffs and import protection**

Import tariff structure for bioethanol: 0 %.

Feedstock crops for bioethanol: No alteration to the existing tariff structure.
Import tariff structure for biodiesel: 0 %

Feedstock crops for biodiesel: Reduction of the import tariff on soybeans, no alteration to the existing tariffs.

The Biofuels Industrial Strategy does not mention protection of the industry by means of tariffs. The only time it mentions some form of support is when it is stated that "only agricultural products grown in the previous homelands by historically disadvantaged farmers will qualify for support". The type of support that the producers will receive is still unclear. Perhaps existing programmes such as CASP would fall under this category. The effect of this policy is that biofuels produced from crops grown outside designated areas other than the former homelands will not qualify for support. According to the strategy "Biofuels are a key driver in ASGISA, for socio-economic development. On 7 December 2005, Cabinet approved the development of an industrial strategy targeted at creating jobs in energy crop production with the biofuels value chain, acting as a bridge from the second economy to the first economy". It further stated that the development of an industry based on imported feedstock is not supported, except in times of adverse agricultural production and when local producers cannot meet investor demand.

Another very important policy directive is the mandatory blending, which in many other countries forms the backbone of the biofuel industry. The Strategy for South Africa follows a somewhat different approach in that it will be voluntary at first and perhaps, at a later stage, mandatory. This approach can be summarised as follows:

- **Enforced mandate**

Potential Bioethanol blend: 8 % in certain areas with a maximum of 2 % nationwide.
Potential Biodiesel blend: a maximum blend of 2 % nationwide.
Enforced mandate: 0 % for the initial phases.

The Strategy is not clear as to what the biofuels mandate will be and how serious it will be when it comes to enforcement. The strategy mentions an overall mandate of 2 % for all biofuels and refers to this rate as the "penetration level of biofuels into the national liquid fuel supply". Thereafter it is mentioned that "[t]he option of enforcing or mandating biofuels uptake in the initial phase is not favoured" and yet it refers to "the proposed blending ratio for South Africa is B2, 2 % biodiesel, and E8, 8 % bioethanol". A 2 % national blend could result in some petrol stations selling a

blend of up to 8 % while others will not sell bioethanol, since such requirements will not be enforced in the initial phase of the industry's establishment. The question remains, though, whether oil refineries will take the risk of incurring additional capital expenditure costs in terms of refining capacity when in fact there is no mandate compelling them to uptake biofuels? Is this a viable option for a business and are the incentives sufficient?

In terms of industry revenue generation, the Strategy document outlines a revenue-sharing scheme, called the Slate Account.

This account would be generated from the sale of biofuels at retail level, which oil companies will then submit claims against. This will only be possible if the respective oil companies are contracted and if they can provide receipted of proof of sales. It is further proposed that petrol containing bioethanol should retail at a deregulated price to facilitate off-take. It is envisaged that this will contribute to oil industry liberalisation and will give support to new entrants in the market.

# Background of Study and additional work

This study aims to provide an analysis of agriculture related industry role players and decision makers, and to further improve the debate that has surfaced around the production of biofuels in South Africa.

The authors of the report acknowledge that the production of biofuels is not only limited to maize and sugarcane as other grains, such as sorghum, have definite potential. Analyses have indicated that the price relationship of sorghum to maize could make it beneficial to use as a primary feedstock in ethanol production. Despite producing slightly lower yields of ethanol and DDGS, 370 litres per ton of grain and around 16 – 17 % less volume than yellow maize, respectively, production costs could definitely provide higher profit margins (Togkoz and Elobeid, 2008). The BFAP sector model has been updated to include sorghum as a feedstock, but due to the relatively small production in comparison to maize in South Africa, and the slightly lower returns on farm level, ethanol capacity for sorghum is not expected to increase independently over time to a point where sorghum can used as a substitute for yellow maize when prices are higher. It is important to remember that the price relationship of sorghum and maize could change as the demand for sorghum increases, which in turn could affect the economic viability of sorghum – ethanol production. Other winter cereals, such as wheat, have not been included in the model as their use as a feedstock for South African biofuels does not make economic sense at this stage. Firstly, South Africa is a net importer of wheat and even though a surplus is produced for the Western Cape region, national demand exceeds supply and is still increasing, together with higher income levels. Secondly, transportation costs within the country also make it too expensive to distribute the grain locally, so the market faces competition from imports and trades at import parity. In essence the costs of ethanol production from wheat are just too high at current world prices. Also, wheat does not offer the same ethanol and DDGS yield as, for example, maize.

Ethanol gel is another new ethanol use that has been included in the BFAP sector model. More directly, BFAP has attempted to capture its interaction within the paraffin market. At present approximately 1 million litres of ethanol gel are produced locally without the benefit of any tax rebates or subsidies.

The increased safety that ethanol gel offers makes product use beneficial in poor households, where paraffin has, developed a reputation for being a dangerous household fuel due to the way that it is handled and the way in which appliances have been designed (Lloyd and Truran, 2008). Industry experts producing this fuel source believe that due to Eskom's current electricity crisis ethanol gel has the potential to substitute paraffin in its original use.

Cost comparisons and retail prices indicate that ethanol gel is currently clearly cheaper than paraffin, given current oil price levels.

It should be noted that at present ethanol gel competes with the maximum retail price of paraffin. Paraffin consumption has followed a clearly decreasing trend from 1999 onwards, and this is expected to accelerate in various scenarios as fuel prices increase and alternatives such as ethanol gel and electricity become more readily available, at least theoretically.

The figure below gives an indication of how the industry could develop, given the assumptions made in this baseline scenario.

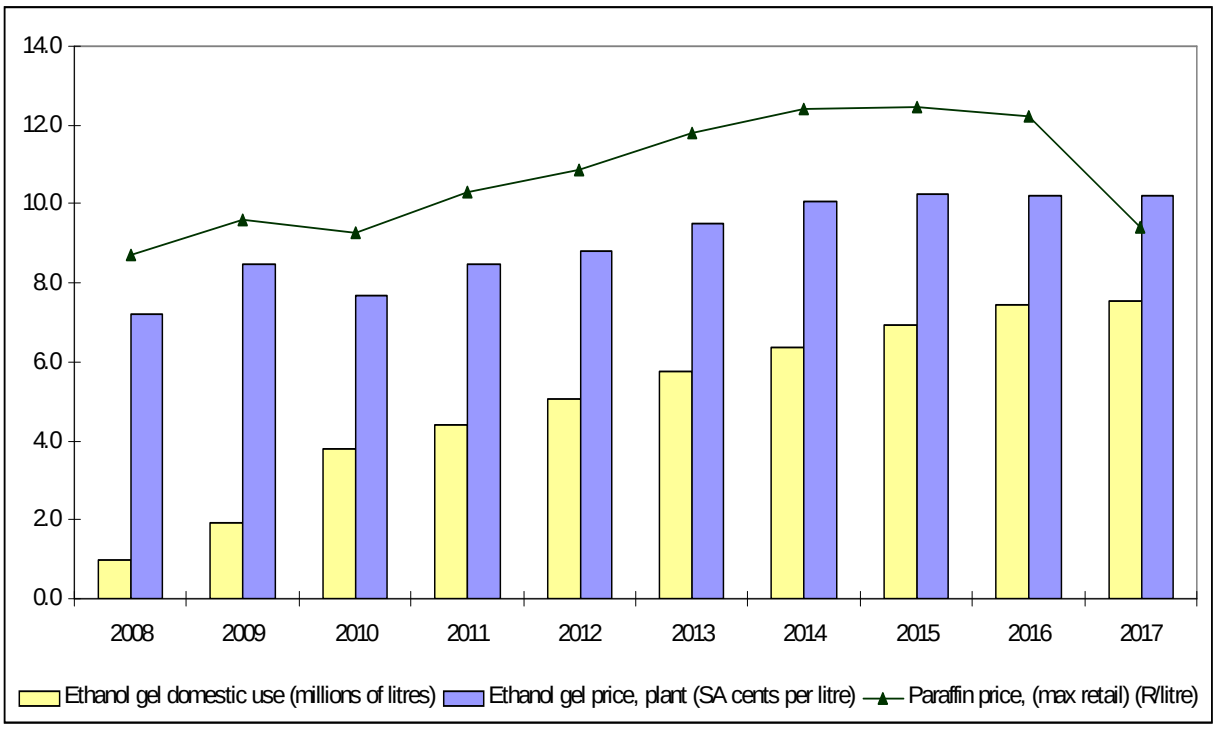


**Figure 1: Ethanol gel production in South Africa**

# 5. Scenario analysis and impacts on the sector

## 5. Introduction

This section of the report sketches a set of scenarios that analyse the possible impacts that the Industrial Biofuels Strategy could have on the South African biofuel and agricultural industries. These impacts are based on the assumed behaviour of various macroeconomic factors and the assumed costs associated with the various existing production technologies. The BFAP sector model is used for the simulations of the baseline and the scenario. A scenario is an imagined sequence of plausible events, a representation of what could occur, given different logical and plausible combinations of driving forces and uncertainties. It should, however, be noted that it does NOT constitute a forecast, and thus the possibility exists that the scenario may not occur in reality. The purpose of the scenario is therefore NOT to predict, but rather to sensitise decision makers in terms of the key driving forces and uncertainties that could potentially change the future viability of biofuel production, given the strategy as set out in the previous sections.

In the past there has been much speculation as to what the possible impacts could be, and this section is designed to inform the reader of these impacts. The analysis section of the report is two pronged. In the first section the baseline serves as a benchmark of the outlook for biofuels and the agricultural sector given the current set of policies (including the Industrial Strategy) and macroeconomic conditions. In other words, it is the identification of a middle road and the resultant impact analysis of policies, given a specific set of assumptions. The alternative scenario introduces the shock of dramatically increasing crude oil and agricultural commodity prices into the model, then analyses the possible impact. The entire set of assumptions made for these individual sections can be found in Tables 3 and 5, respectively. The aim of the scenario analysis section is to give the reader a better understanding of the impact that the Industrial Biofuels Strategy will have on the agricultural sector when certain exogenous factors are allowed to change.

# 5.1 Scenario 1: The Baseline

## 5.1.1 Background

The latest statistics on energy supply in South Africa reveal that most of the local fuel supply is derived from crude oil imports, while 35 % is sourced from coal through SASOL and is 7 % supplied by PetroSA from natural gas production (DME, 2006). Figure 2 represents the raw materials that constituted the local fuel supply during 2004. Coal makes up the largest proportion of the total energy supply at 68 %, followed by crude oil at 19 %, and renewables (meaning all types of wood and biomass) with 8 %, nuclear 3 %, gas 2 % and hydro 0.1 %.

Table 2 represents the country's energy balance sheet in terms of total supply and demand for the different types of energy fuels. The latest statistics are from 2005 but they will give a good indication of the size of the entire industry, including the liquid fuels market. All crude oil that is used in South Africa is imported and only a small volume of natural gas is produced locally.

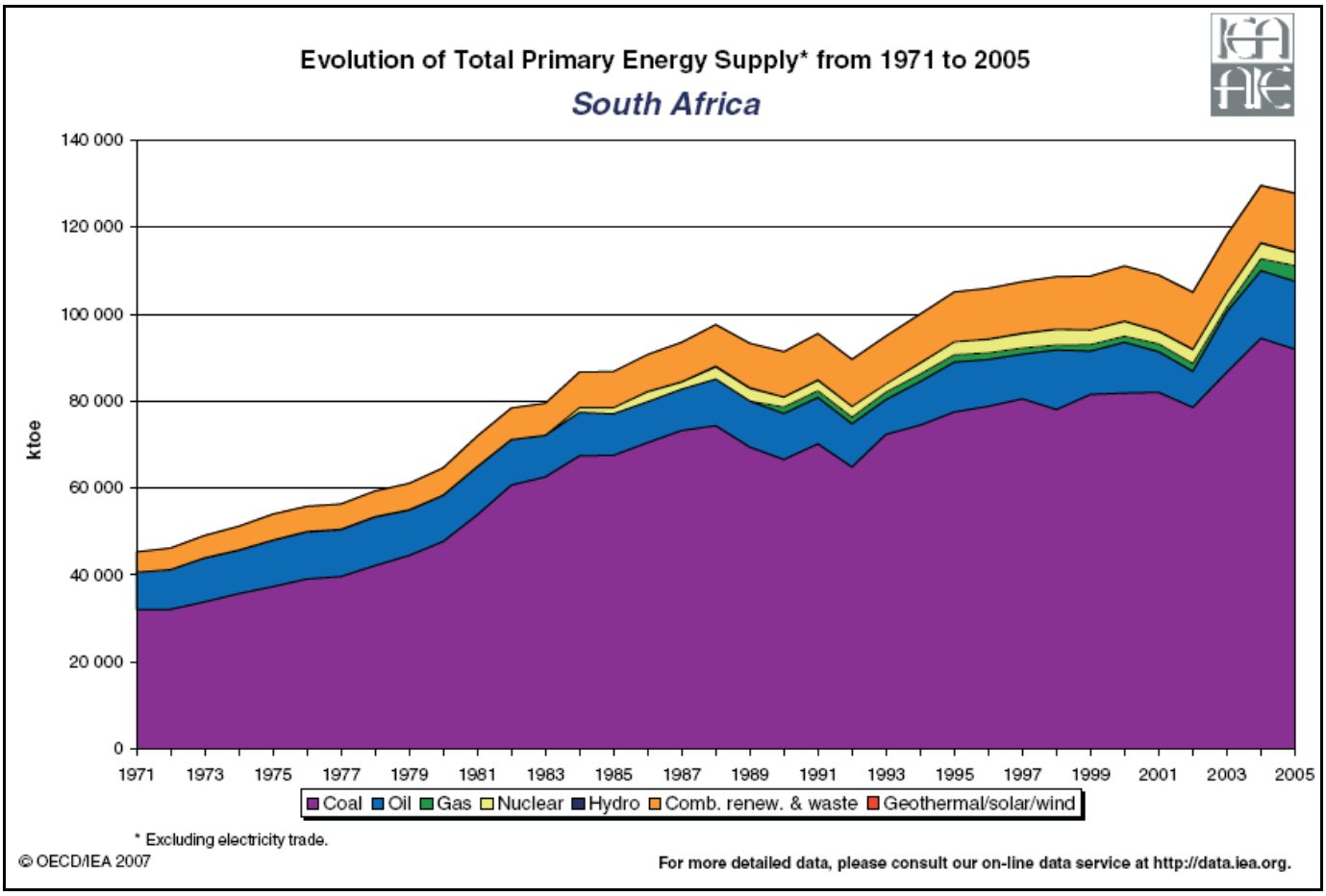


**Figure 2: Primary energy supply in South Africa, 1971 - 2005.**

**Source:** *International Energy Agency, 2007.*

**Table 2: Energy Balance Sheet for South Africa, 2004.**

| Sourcing of commodities | Crude oil | Natural gas | Petrol | Diesel |
|---|---|---|---|---|
| | *tons* | *Tons* | *kilo litres* | *kilo litres* |
| Local production | 0 | 183,203 | 11,554,692 | 8,526,883 |
| Imports | 23,589,797 | 0 | 751,389 | 554,264 |
| Exports | -592 | 0 | -1,014,328 | -1,167,074 |
| Intl. Marine Bunkers | 0 | 0 | 0 | -231,747 |
| Stock changes | 0 | 0 | 0 | 0 |
| **Domestic supply** | **23,589,205** | **183,203** | **11,291,753** | **7,682,327** |
| **Domestic consumption** | **0** | **0** | **11,291,753** | **7,682,327** |

Source: *Department for Minerals and Energy, 2006.*

### 5.1.2 The Setting

The South African government has decided to implement a strategy on biofuels due to the high but stable oil prices, and based on the fact that various policy incentives could significantly boost the rural economy, with the main focus being to create an alternative and stable market for farmers in the second economy. To achieve this goal the government implements the policy incentives set out in Table 3 below.

**Table 3: Policy incentives in the Industrial Biofuels Strategy**

| Description | Incentive for Bioethanol | Incentive for Biodiesel |
|---|---|---|
| Fuel levy exemption | 100 % exemption | 50 % reduction |
| Blending percentage | Voluntary | Voluntary |
| Import tariffs | 0 % | 0 % |
| Crops to be used | Sugar cane, sugar beet | Sunflower, soybeans, canola |

These policy incentives include mandating biofuels at a later stage, an increase in the fuel levy exemption to 100 % for bioethanol and 50 % for biodiesel and a licensing structure to regulate the exact location of biofuel plants and the quantities and types of crops to be used to meet the envisioned biofuel targets. The government does not make any provision for the protection of the local industry via import tariffs. This creates a real opportunity for biofuel imports should a blending mandate be enforced. Presently there is no mandate mentioned for the near future, and therefore the blending of biofuels is purely on a voluntary basis. The strategy is designed in such a way that local refineries which import biofuels, and therefore don't source local crops as feedstock for their production, risk not qualifying for the fuel levy exemption and could end up making a loss as a result. It is further stipulated by the government that only refineries complying with the rules and regulations as set out in the manufacturing licence, such as purchasing biofuels from the former homeland areas, will qualify in full for the levy exemption.

Table 4 lists the macroeconomic variable assumptions underlying the simulations. The policies vary from a fuel levy exemption to a mandate, or at least initial voluntary inclusion levels, and additional support of the existing agricultural support programs such as CASP. As mentioned previously, these support mechanisms will only apply if certain regulations are adhered to, most of which will be enforced in the granting of the manufacturing licence.

**Table 4: Macroeconomic assumptions made for the scenario analysis**

| Description | Units | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| Crude Oil | US$/bbl | 72.35 | 90.00 | 90.00 | 91.07 | 92.82 |
| Exchange rate | SA cents/US$ | 709.98 | 766.99 | 814.06 | 857.60 | 899.51 |
| CPI: Food | 2000=100 | 224.99 | 245.47 | 259.46 | 273.80 | 287.49 |
| World sugar price | US cents/lb | 11.90 | 10.39 | 11.32 | 11.92 | 12.00 |
| Brazilian anhydrous ethanol price | US$/gallon | 1.68 | 1.84 | 1.83 | 1.74 | 1.65 |
| Soybean oil, Argentina FOB | US$/ton | 684.00 | 1423.85 | 1462.28 | 1566.22 | 1663.71 |
| Sunflower oil, NW Europe | US$/ton | 846.00 | 1860.00 | 1716.65 | 1765.90 | 1817.99 |

**Table 5: 2008 Technical Data used in the BFAP Model**

| Commodity | Extraction rate | Capital costs | Variable costs | Income from by-product | Feedstock costs |
|---|---|---|---|---|---|
| Sugar cane[1] | 81.36 *l* ethanol | 71.76 *c/l* ethanol | 124.14 *c/l* ethanol | - | 265.81 *c/l* ethanol |
| Maize[2] | 402.32 *l* ethanol | 70.96 *c/l* ethanol | 125.34 *c/l* ethanol | 121.81 *c/l* ethanol | 441.42 *c/l* ethanol |
| Sorghum | 370 *l* ethanol | 70.96 *c/l* ethanol | 125.34 *c/l* ethanol | 96.50 *c/l* ethanol | 449.20 *c/l* ethanol |
| Sunflowers | 398.5 *l* biodiesel | 94.10 *c/l* biodiesel | 95.00 *c/l* biodiesel | (240.05 *c/l* biodiesel) | 1281.70 *c/l* biodiesel |
| Soybeans | 194.1 *l* biodiesel | 94.10 *c/l* biodiesel | 137.20 *c/l* biodiesel | (1464.02 *c/l* biodiesel) | 2291.83 *c/l* biodiesel |

[1] assuming that no by-product, such as electricity produced from bagasse, is sold back into the grid

[2] cost of ethanol gel production is equal to that of ethanol fuel with an additional 100 cents per litre for thickening.

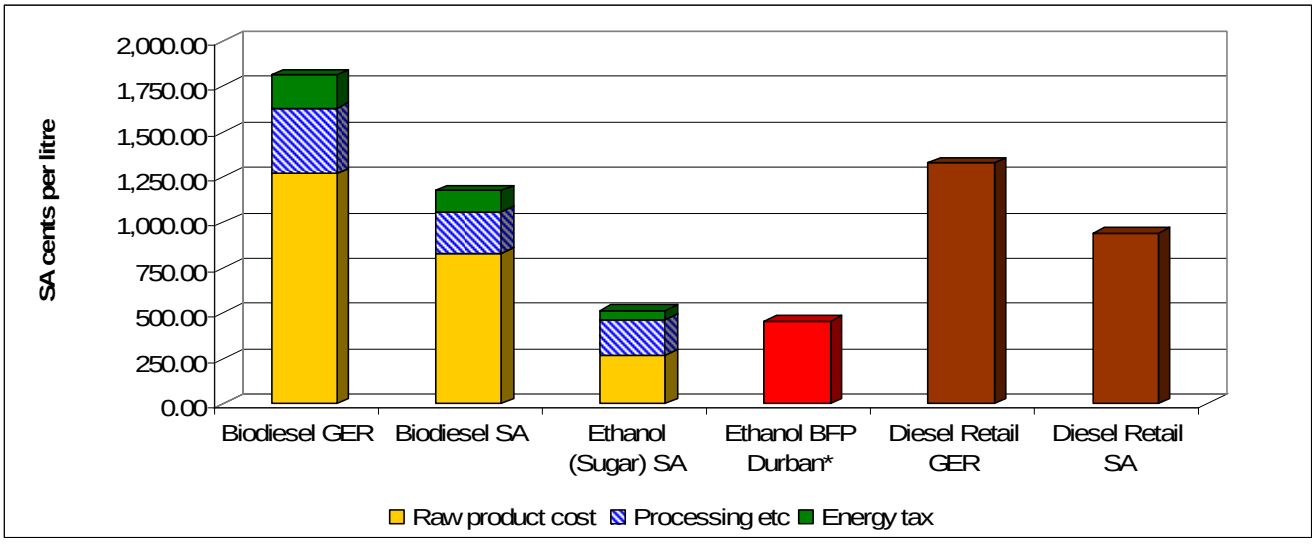


**Figure 3: Production cost and retail price comparison of biodiesel and bioethanol. Source: *Oilworld, SAPIA, 2008***

A number of production costs derived from standard and readily available biofuel technologies also form an important part of the model's structure in determining the profitability of producing biofuels from certain types of feedstock. The extraction rates are also mentioned, as this is an important aspect of the plant's overall profitability.

The nature of the Industrial Biofuels Strategy and the minimum commitment from the government to kick-start the industry into operation makes the production cost of biofuels extremely important. Figure 3 reveals how the cost of producing biodiesel in South Africa compares to that of Germany. Rapeseed is the main feedstock used in Germany while the South African example uses soybeans. Figure 3 gives a further indication of the international competitiveness between the South African ethanol industry and the ethanol produced in Brazil. The different prices have been calculated from different sources and are representative of the following: The ethanol BFP Durban price represents the price at which Brazil could possibly land its ethanol in Durban harbour. In other words, it represents the import parity price of ethanol for South Africa. The column on the left denotes the price at which ethanol can be produced locally, together with the fuel levy exemption. Currently, ethanol from Brazil can be landed in Durban at approximately R 4.80 per litre compared to local production of R 4.90 per litre. Production costs of biodiesel in South Africa and Germany are very different. According to various sources the production costs of biodiesel in Germany come in at around R 17.50 per litre inclusive of taxes, while the cost of producing a litre of biodiesel in South Africa is closer to R 11.00 (Oilworld, 2008). At present the average cost of producing biodiesel in South Africa, in comparison to fossil diesel, could still be one of the obstacles facing the local industry. This indicates that the South African industry could face either a serious threat if local mandates are to be imposed, or perhaps a great export opportunity given the prices in the international market!

## 5.2 Model output

The model output is represented as part of the analysis of the Industrial Biofuels Strategy and represents the output of what could potentially be expected, given the set of policies that will come into place, and also the macroeconomic assumptions that have been gathered from other research institutions.

The respective biofuel industries, namely the bioethanol and biodiesel industries, are split as they consume different types of feedstock for the production of biofuels and thus are driven and influenced by different markets, namely the sugar-based market for ethanol and the oilseed market for biodiesel.

## Baseline: The Ethanol industry

The ethanol industry only uses sugar-based commodities as a feedstock for biofuel production is as per the Industrial Strategy. For the time being the use of maize as a biofuel feedstock has been excluded from the overall industry. The figures below show that local ethanol production will be very limited if ethanol from maize produced by small-scale farm operations is included, such as the ethanol gel project near Sannieshof, while ethanol production from sugar increases to around 100 million litres as sustained higher oil prices make it more profitable.

Figure 5 illustrates changes in sugar exports as the crude oil price increases and the world price of sugar remains relatively constant. Historically sugar exports totalled in excess of 1.1 million tons but this, together with a higher crude oil price, is expected to reduce exports to around 880 thousand tons in 2015. The local sugar cane price is also expected to increase as ethanol producers will mainly use sugarcane as a feedstock to diversify the sugar industry. The increased local sugar cane usage supports the local sugar cane prices, which are projected to increase over time. In 2015 the price is expected to average around R 287 per ton.

Interestingly enough, prices of ethanol are expected to trade below the retail price of petrol if they are to trade in a deregulated market. In other words, the price of ethanol will be cheaper than the price of petrol at the pump given the tax structure, blending levels and other macroeconomic variable assumptions used for the baseline's simulation. The idea behind letting the price trade in a deregulated environment is that a cheaper free trading price will allow ethanol to sell at higher volumes, and therefore make it more profitable for fuel companies to sell it at their retail outlets. Figure 6 depicts the prices at which ethanol trades.

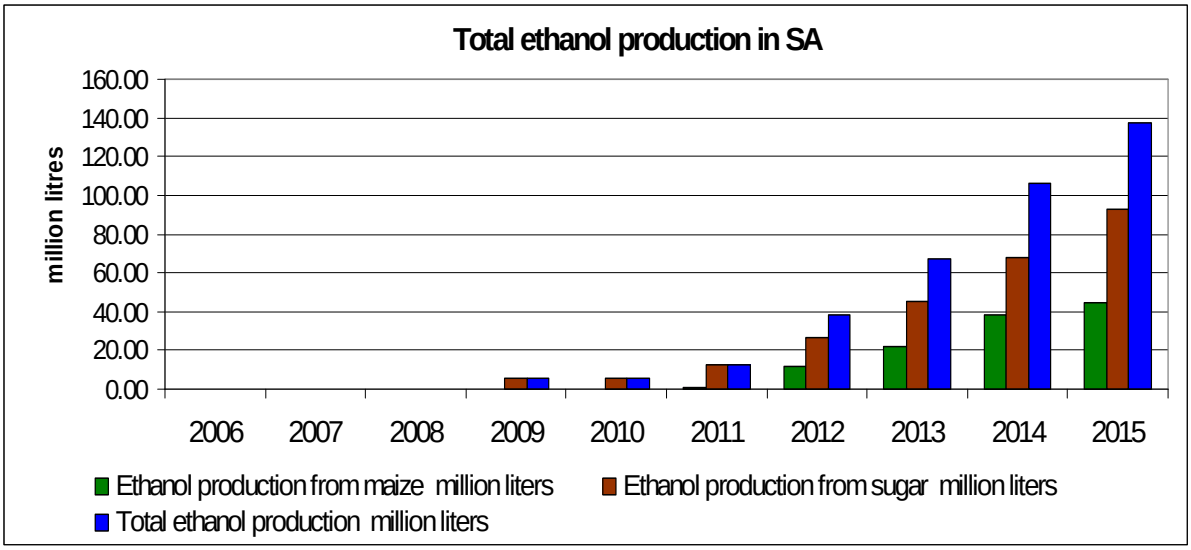


**Figure 4: Total ethanol supply in South Africa**

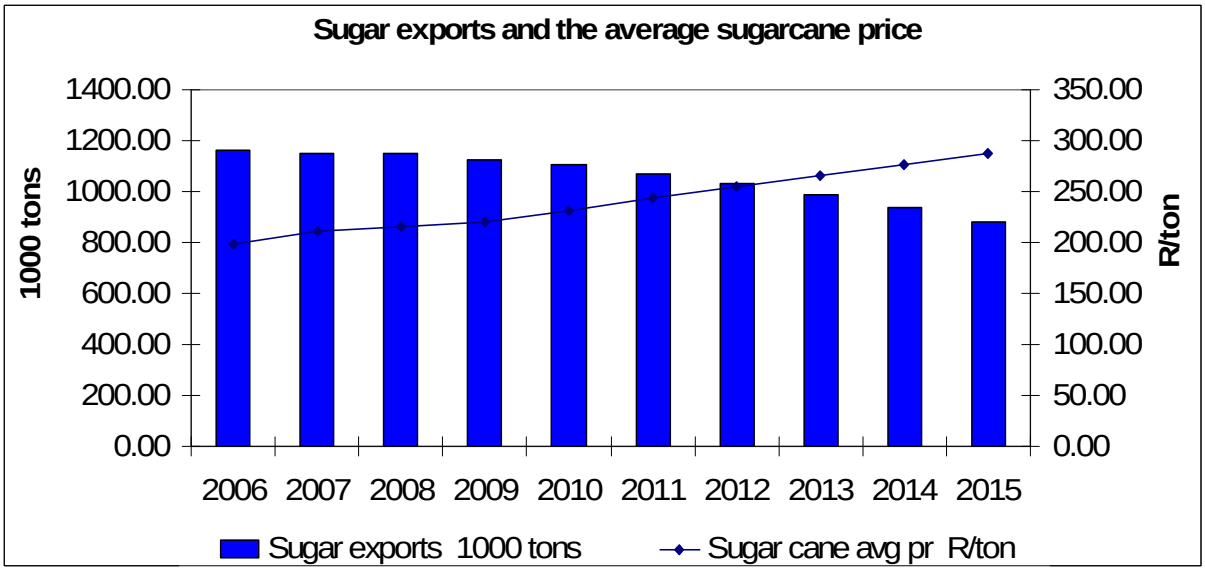


**Figure 5: Sugar exports and the sugar cane price**

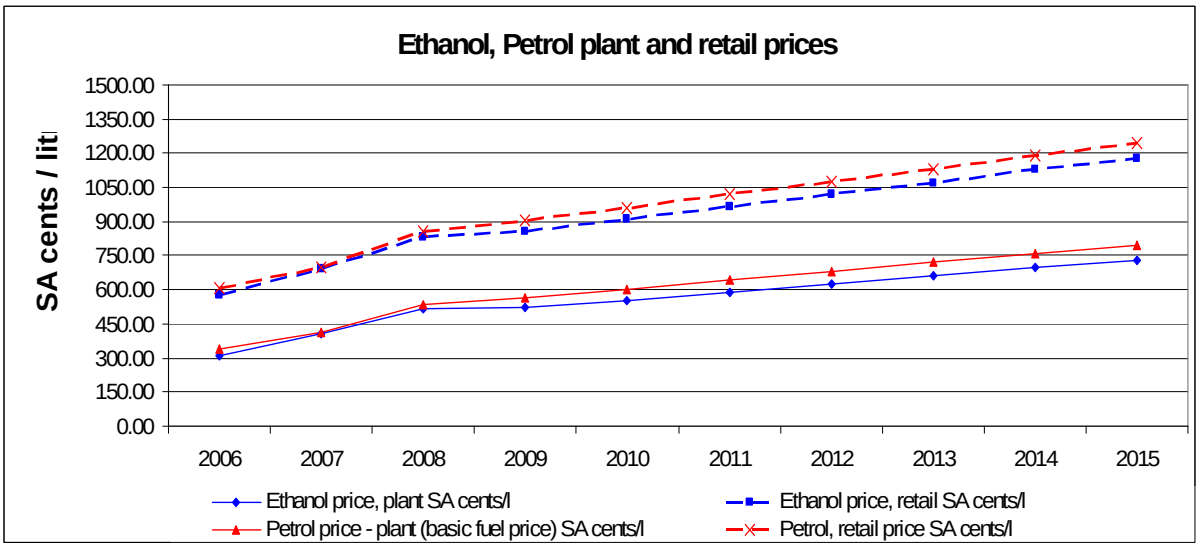


**Figure 6: Ethanol and Petrol plant and retail prices**

## Baseline: The Biodiesel Industry

It is envisaged that the biodiesel industry will use soybeans, sunflower and canola as the feedstock for producing biodiesel. World prices and local commodity production capacities have played a large role in both the baseline's simulation and the outcome of what could possibly occur given the macroeconomic assumptions used. Historically, South Africa has always been a net importer of oilcake, which is used mainly in the livestock industry. This means that the country has a high degree of dependence on the international market. Local prices, for example, will be directly dependent on international prices and local supply will be directly dependent on the international market and international policy developments, such as biofuels.

Figure 7 represents the total demand and supply of biodiesel in South Africa, given the policies agreed to in the Industrial Biofuel Strategy document. As the figure indicates, there are no imports of biodiesel as there is no local market. All of the fuel that is produced locally is exported to first world markets where the product fetches a better price. Figure 3, for example, indicates the difference in biodiesel prices in Germany and South Africa. . If these differences are taken into account, then the export market seems favourable.

Soybean production is likely to increase after the recent increases in producer prices and as a result imports are likely to fall. Although the production of biodiesel from locally produced soybeans is projected to be relatively small, it will shift the demand for soybeans to the right and ensure the local soybean price trades close to import parity prices.

The Strategy does not allow for an alternative retail price for biofuel. The effect of fuel tax exemption is that biodiesel will trade close to the fossil diesel price. Without the tax exemption, biodiesel will trade at a higher price.

Biodiesel prices have a different structure to the ethanol and petrol prices. Primarily, the biodiesel industry receives a smaller fuel levy exemption than the bioethanol industry. The biodiesel industry receives a fuel levy exemption of 50 %, and as fuel taxes on diesel are, on average, less than those on petrol, this results in less support.

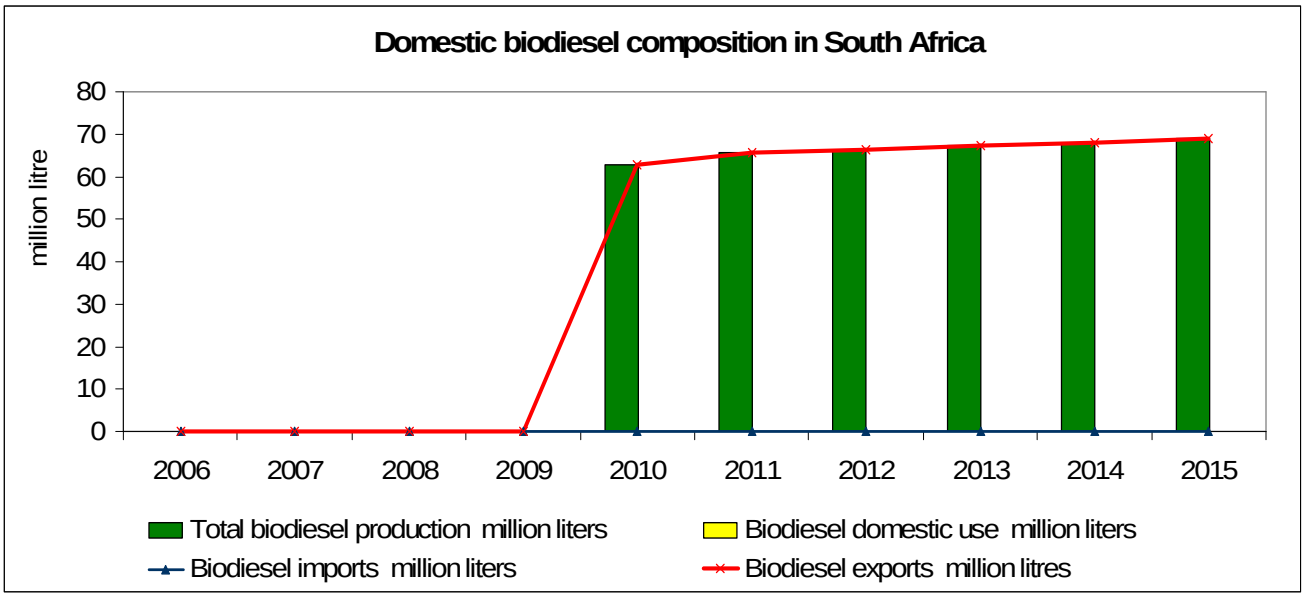


**Figure 7: Total biodiesel supply and demand.**

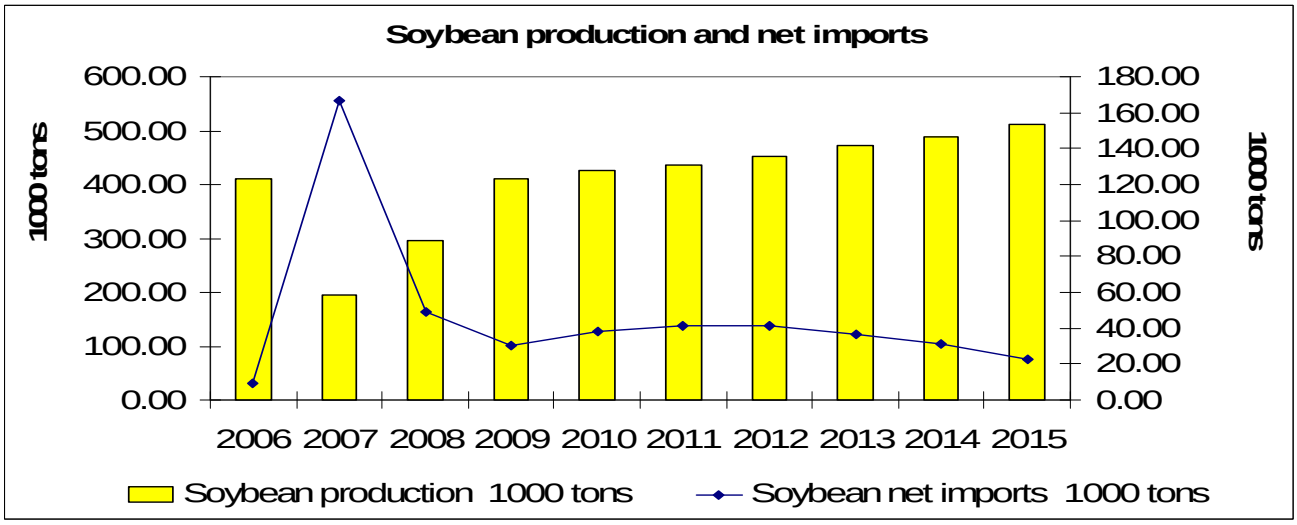


**Figure 8: Soybean production and net imports.**

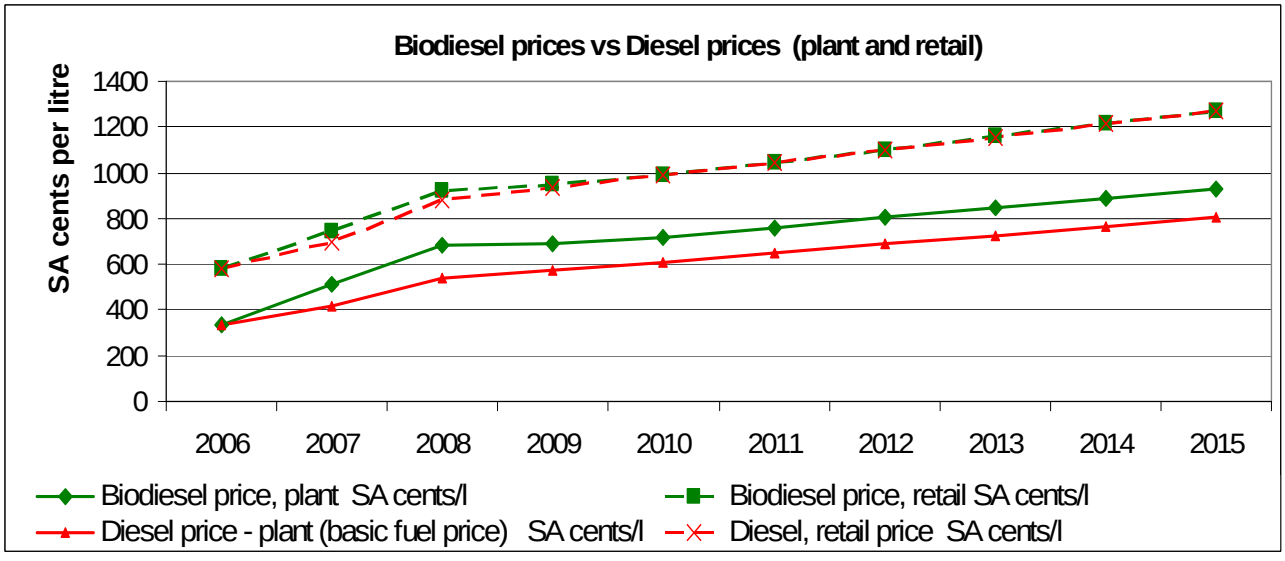


**Figure 9: Biodiesel and Diesel plant and retail prices.**

The biodiesel price is therefore expected to trade very close to the normal fossil diesel price. The plant price of biodiesel is, however, higher than the plant price of fossil diesel as it costs more to produce biodiesel. Biodiesel is expected to trade at around R 9 per litre in 2008, given that the baseline assumptions hold. Figure 9 is a graph representing the differences between the prices of fossil diesel and biodiesel. It should be noted that biodiesel is, on average, more expensive to produce as it does not include the historical subsidies and supports that were extended to the fossil fuel industry. The simulated plant price of biodiesel is a direct calculation of the costs of producing the fuel.

# 6. Scenario 2: An Alternative

The following scenario presents another possible outcome for the biofuel industry in South Africa and the related implications for the agricultural sector. This outlook was generated under an alternative scenario with a different set of policy assumptions and macroeconomic variables. Table 6 presents the set of macroeconomic variables used to simulate this scenario.

It presents an alternative picture of the global economy that some economists regard as "most likely", with oil and commodity prices rising constantly over the outlook period. It is important to remember that a scenario presents a combination of certain events that have to take place for it to unfold. For example, for this scenario the economic problems that the US has encountered should have a lesser effect on the emerging markets, such as India and China, and a relatively small impact on the developed markets, such as the EU. Furthermore, investors throughout the world are still risk averse and therefore opt to allocate their investments in favour of stable economies rather than developing countries, and as a result the Rand weakens.

High oil prices and a weak Rand put upward pressure on the local inflation rate, which in turn impacts on the interest rate. Interest rates remain high (14-15 percent), but no further increases are announced due to fears that further increases would have a profoundly detrimental effect on the South African economy. The bottom line is that the macroeconomic picture painted in this alternative scenario is likely to significantly benefit the potential biofuel industry in South Africa.

**Table 6: Macroeconomic assumptions made for the alternative scenario**

| Description | Units | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| Crude Oil | US$/bbl | 78 | 105 | 116 | 125 | 130 |
| Exchange rate | SA cents/US$ | 7.47 | 780 | 810 | 825 | 880 |
| CPI: Food | 2000=100 | 160.89 | 235 | 265 | 295 | 335 |
| World sugar price | US cents/lb | 11.90 | 11.67 | 11.92 | 14.11 | 18.12 |
| Brazilian anhydrous ethanol price | US$/gallon | 1.68 | 2.4 | 2.65 | 2.86 | 2.97 |
| Soybean oil, Argentina FOB | US$/ton | 684 | 1423.85 | 1462.28 | 1566.22 | 1663.71 |
| Sunflower oil, Argentine | US$/ton | 751 | 1761.86 | 1615.01 | 1660.67 | 1709.10 |
| Soybean price FOB Rotterdam | US$/ton | 335.00 | 592.55 | 604.77 | 571.21 | 576.79 |
| Sunflower cake price FOB Rotterdam | US$/ton | 178.00 | 316.97 | 273.45 | 258.50 | 249.76 |

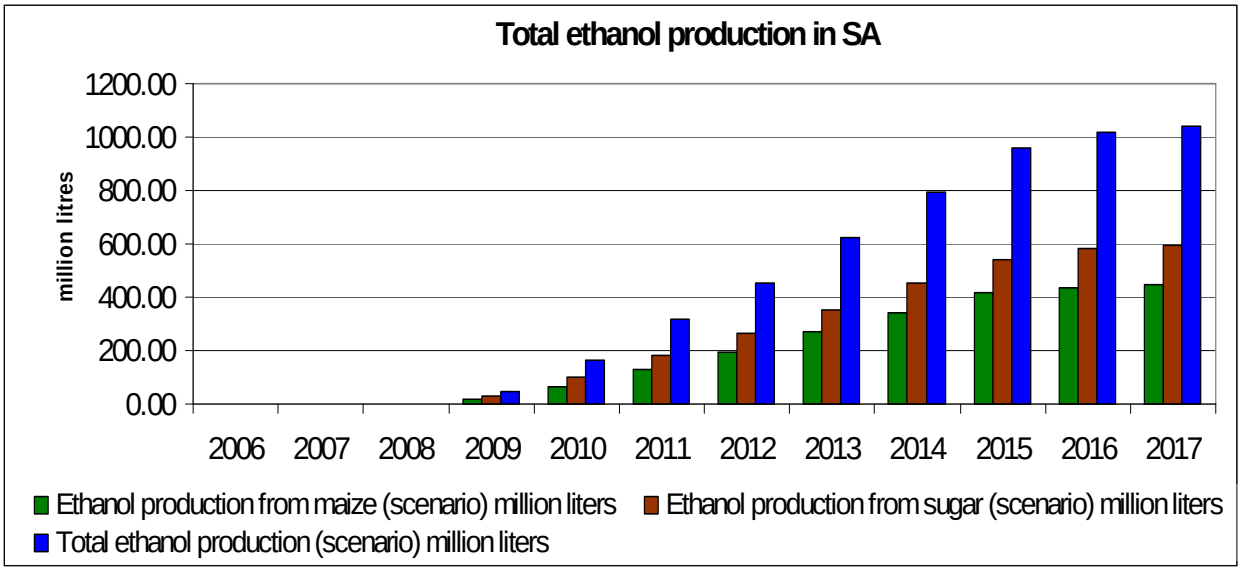


**Figure 10: Ethanol production in South Africa**

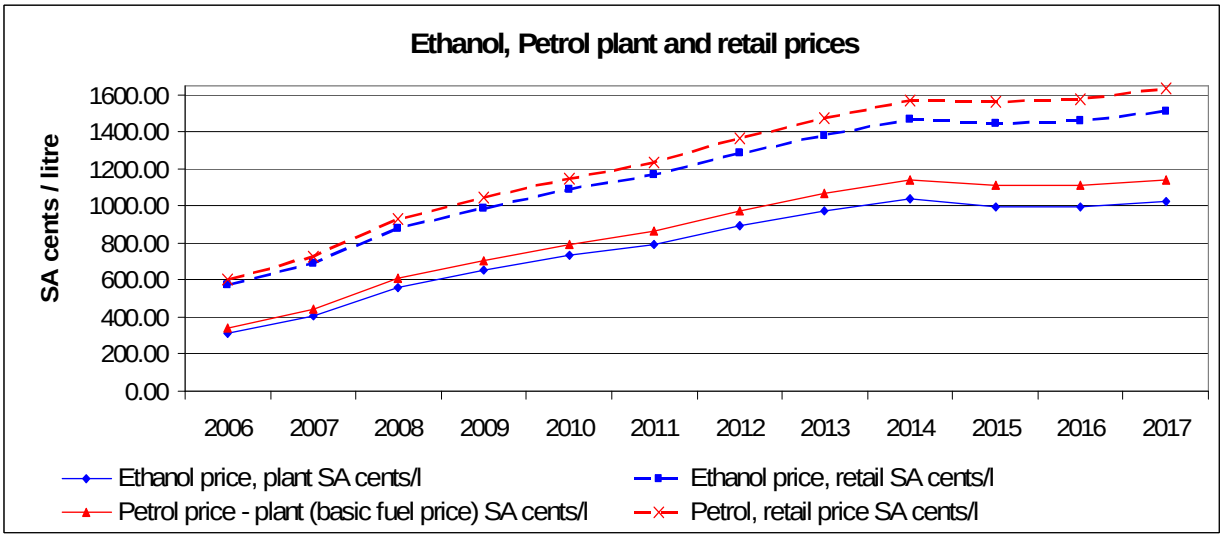


**Figure 11: Ethanol price versus the petrol price**

## 6.1 Model output

## Alternative Scenario: Ethanol industry

The contribution of maize to the ethanol pool can be seen in Figure 10. It is projected that by 2017 just over 1 billion litres of ethanol will be produced, with 600 million litres produced from sugar and just over 400 million litres from maize.

Figure 12 indicates that using sugar cane as a feedstock is more profitable than maize, given the policies and macroeconomic variables in place. Sugar cane therefore dominates as the feedstock for ethanol production. As a result more and more of the sugar cane destined for export sugar is diverted to ethanol production. Given the high fuel prices, producers sell ethanol at a wholesale price of more than R 6 per litre. Bioethanol is expected to trade at a lower price than petrol as the tax break enables blenders to "subsidise" the ethanol price at retail level. The model takes this theory into account and simulates the prices represented in Figure 11.

The sugar industry experiences a favourable change due to the production of bioethanol from sugarcane. Sugar exports increase at first as the international sugar price continues its upward trend. Thereafter, in 2010, the oil prices increase rapidly and benefit the local ethanol industry. As a result South Africa experiences a slight decline in sugar exports as sugarcane is diverted from the production of sugar to ethanol. The local sugar cane price is projected to increase as the local demand for sugar increases. This implies that the increased production of bioethanol from sugar cane results from increased profitability as a result of extremely high oil prices.

Under the alternative scenario the production of ethanol from maize increases as conditions become more favourable. As a result, DDGS production also takes place and reaches a point where it is fully absorbed into the market. It seems that two maize-to-ethanol plants with a capacity of around 150 million litres could be commissioned, given the profitability of the industry due to the changes in macroeconomic variables, as graphically represented in the figure below.

DDGS production will reach a maximum of around 350 thousand tons and is expected to trade at an average of around R 2000 per ton.

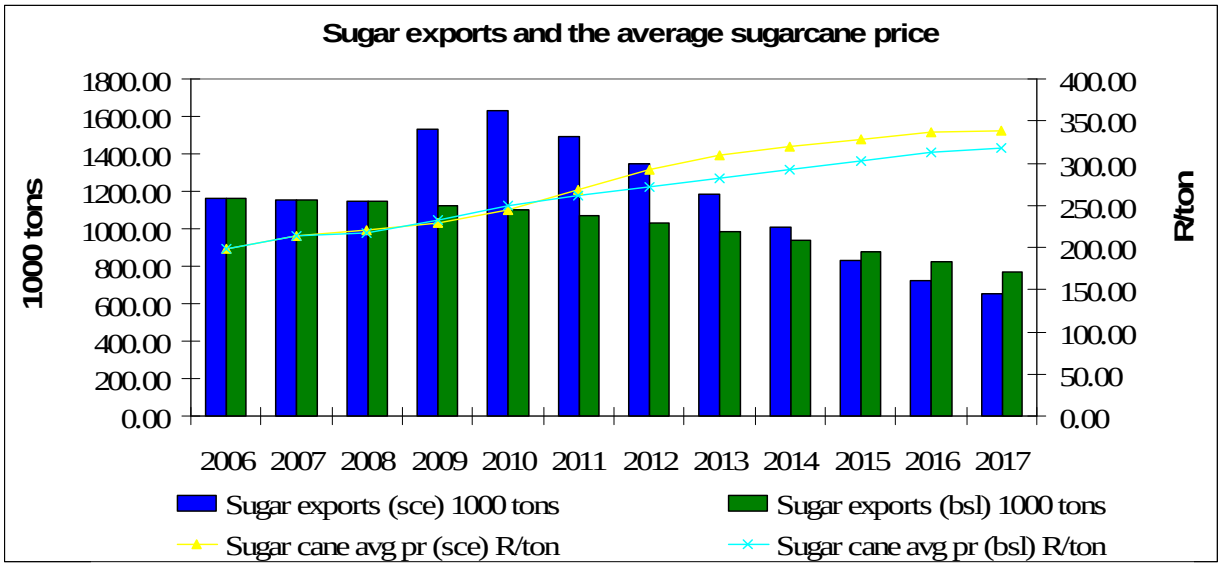


**Figure 12: Sugar exports and the change in the sugar cane price**

*bsl = baseline, sce = scenario

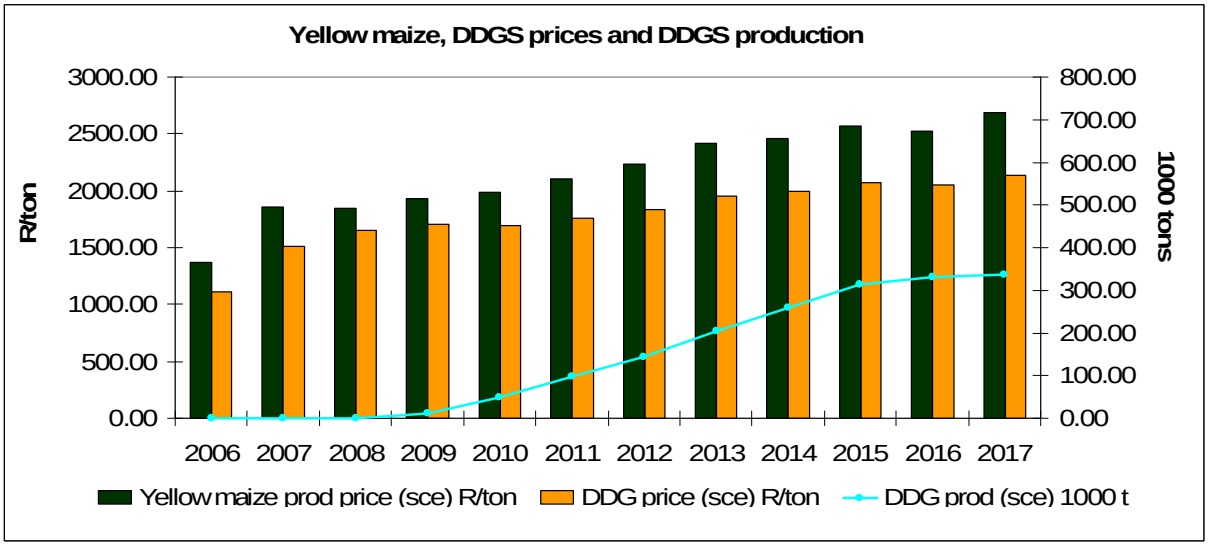


**Figure 13: DDGS prices and production relative to the yellow maize price**

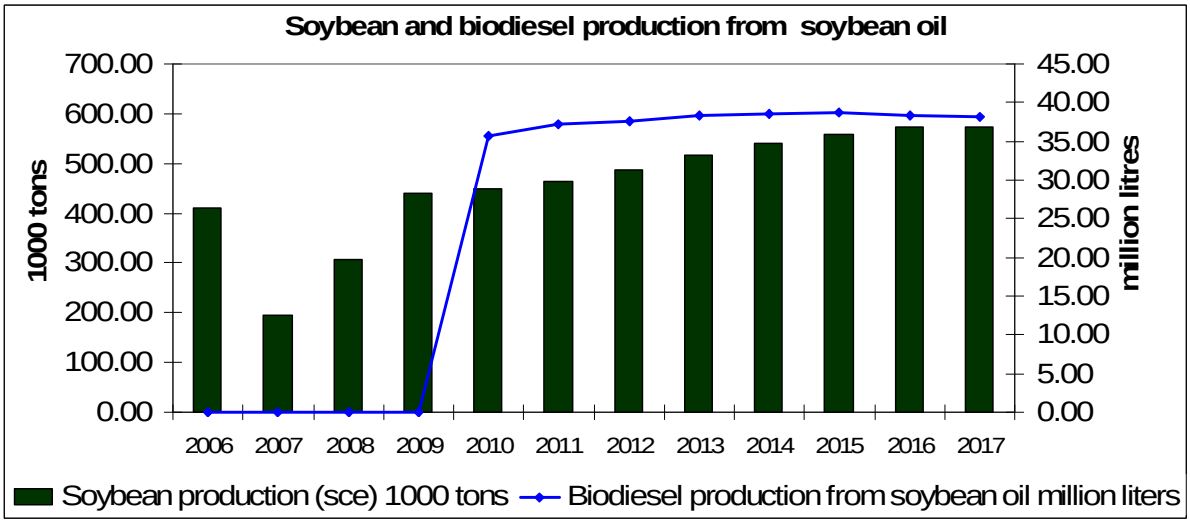


**Figure 14: Soybean oil use in the biodiesel industry**

## Alternative Scenario: Biodiesel industry

A variety of oilseed feedstock can be used to produce biodiesel. Soy oil is the largest contributor at approximately 57 % of the total volume of biodiesel produced, while sunflower oil makes up the remaining 43 %. Given the regulatory policies that will inhibit the sale of biodiesel by producers, the vast majority of consumption is expected to be directly on farm. There are no imports as there is no mandate, thus no official market and hence no demand. The figure below represents just how the use of soybean oil as a feedstock changes in the production of biodiesel, given the scenario's choice of macroeconomic factors.

Figure 15 indicates that net imports of soybeans are expected to increase relative to the baseline. Local production also benefits from better technology and a higher demand for the commodity. The use of more productive crop production techniques and better prices support the local increase in production of soybeans.

The price of biodiesel at retail level is expected to trade at the same price as diesel, as there is no real market for the product and local production is extremely low, relative to normal diesel usage. The illustrated figure proves that greater incentives are required to get the industry off the ground. Revised and more defined strategies are definitely required for significant benefits to be made from the industry. This in turn will benefit local farmers in the production of these commodities.

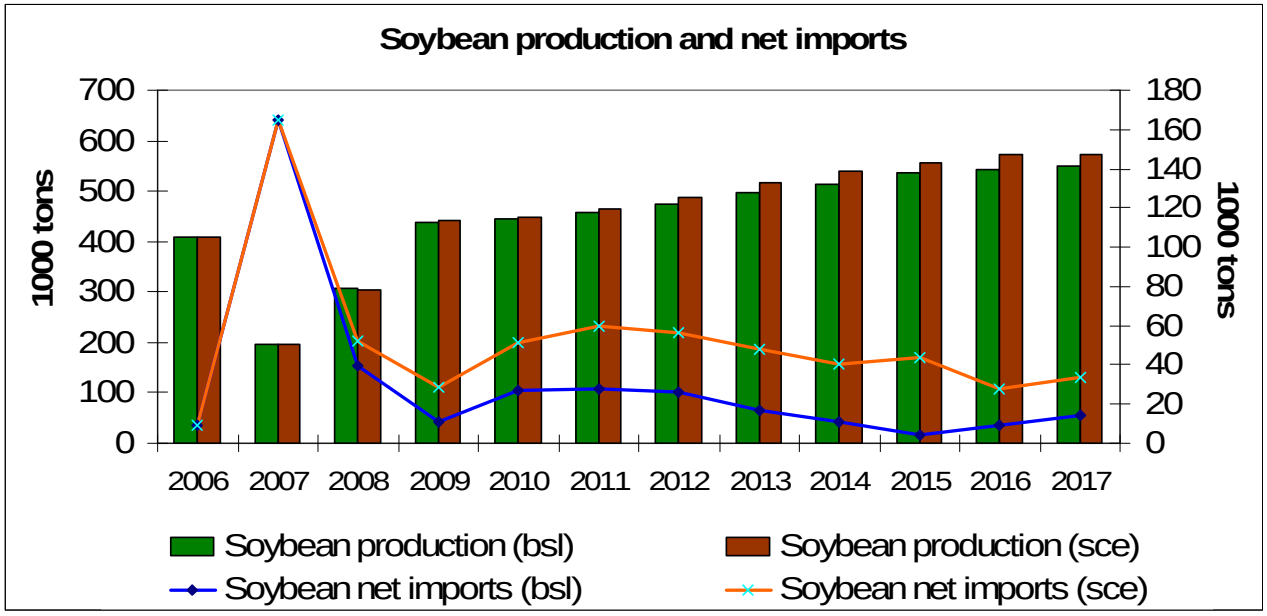


**Figure 15: Soybean production and imports to South Africa**

* bsl = baseline, sce = scenario

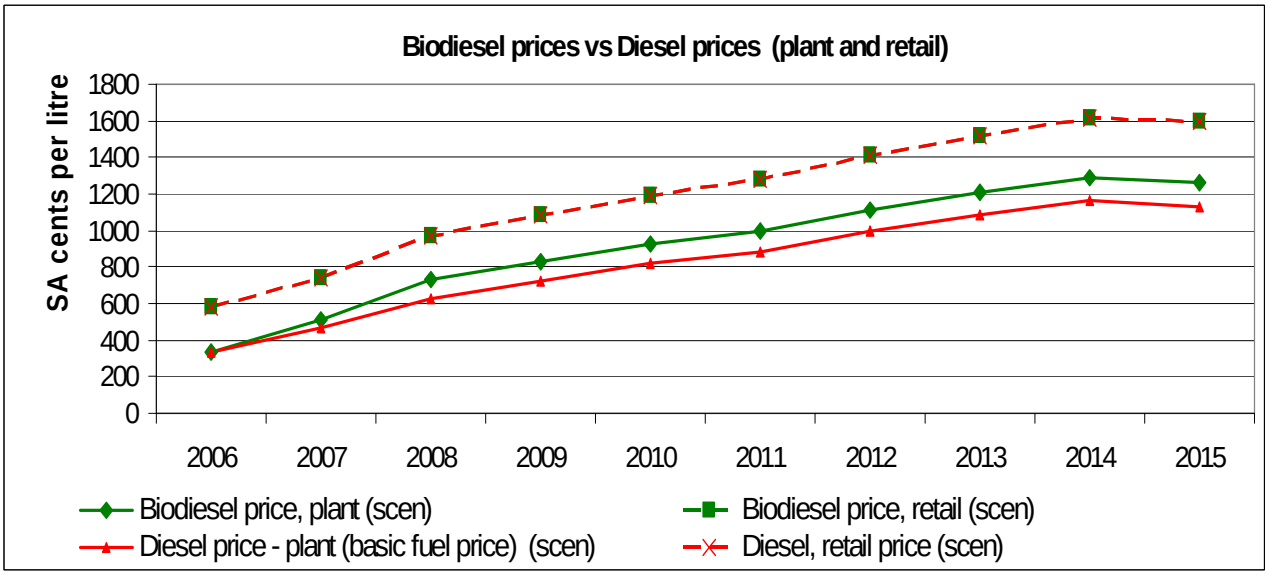


**Figure 16: Biodiesel and diesel plant and retail prices**

*scen = scenario

# 7. Conclusion

The tabling of the Industrial Biofuel Strategy for the South African biofuel industry has brought with it hope and expectation that the incentives proposed will be sufficient to kick-start the industry. The exclusion of maize from the Strategy did surprise stakeholders, as its inclusion in the feedstock mix could create an alternative market which would help boost the industry and support the government's rural development goals. However, in the light of rising food costs a cautious approach to implementing policies that could further exacerbate household purchasing power is understandable. The impact on food prices can be minimised by establishing quota limits through the issuing of licenses within the industry. On average, South Africa is food self-sufficient and is therefore not expected to trade at import parity. This could, however, change with an impact on supply due to externalities such as drought, and local prices could be driven towards import parity levels as a result. Such a policy should therefore go hand in hand with the support of local production. South Africa has the potential to produce more maize under the correct set of policy incentives.

The increasing global demand for sugar as a raw commodity input to ethanol production has put upward pressure on world sugar prices and resulted in a movement away from sugar for human consumption. For example, only four of the 30 recently commissioned plants in Brazil are geared to produce sugar alone. three can be operated to produce both sugar and ethanol and the remaining plants are commissioned to produce ethanol exclusively. The BFAP model shows that the move towards ethanol under the alternative scenario could influence the South African sugar industry to such an extent that, on average, 19.5 % more sugar exports are diverted to local ethanol production than in the case of the baseline. Simulation results indicate that more than one billion litres of ethanol could be produced in SA by 2017, most of it from sugar. A significant amount is also produced from maize, but maize prices are more sensitive to a shift in supply and therefore tend to increase faster than sugar prices, making sugar the more profitable and less risky feedstock. This implies that one maize plant and several sugar cane ethanol plants will make up the local ethanol production mix. The biodiesel picture looks somewhat different. Despite a 50 % fuel levy exemption, high oilseed and vegetable oil prices cause plant profits for biodiesel to remain under pressure. In

fact, even under the favourable scenario the potential profit margins for biodiesel production are so small and risky that only very little production is projected, which in turn puts the profit margin for biodiesel under a lot of pressure. This means that the Industrial Strategy incentives for the production of biodiesel are not sufficient.

High international oil prices, a relatively weak Rand, high but stable inflation and high interest rates result in positive gains for the domestic biofuel industry. In the absence of significant government support, the biofuel and agriculture sector are no different to other business sectors, being profit driven. Higher profits in the food industry will result in more of the raw material entering that industry, just as higher profits in the biofuel industry will have the opposite effect. As the two industries are so interlinked it becomes clear that prices and profits in one industry will also have an influence on the other. At the end of the day, high prices are their own worst enemy.

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