

# APPENDIX 1: ABSTRACTS FROM THE BIOFUEL STRATEGY

## 1.1 BIOFUELS INDUSTRIAL STRATEGY OF THE REPUBLIC OF SOUTH AFRICA

Department of Minerals and Energy

December 2007

(Relevant abstracts)

### 1.1.1 Executive Summary

The following crops are proposed for the production of biofuels in the country: for Bioethanol, sugar cane and sugar beet and for Biodiesel sunflower, canola and soya beans. The exclusion of other crops and plants such as maize and Jatropha is based on the food security concerns. Further research is still needed to test usability of these in the country.

In terms of the first and second economy trajectory, government will have to support the development of the under utilised land to a level that will compete commercially. Farmers located in underdeveloped land will be encouraged through cooperatives (where possible) to participate in the running of biofuels refineries.

The existing fuel levy exemption, for biodiesel that is a product (as opposed to producer) incentive should continue.

\_ Biodiesel currently enjoys a 40% fuel levy exemption. It is proposed that once the Strategy is approved, this levy exemption be increased to 50% from the 2008/9 financial year. Thereafter the percentage will remain the same but the absolute value of the support will increase with increases in the fuel levy. It is impractical to increase the exemption beyond 50% due to the impact of the current diesel tax refund scheme.

A 100% fuel tax exemption is proposed for bioethanol as it can also be used in markets other than petrol e.g. ethanol gel that competes with illuminating paraffin. Illuminating paraffin carries no levies.

To reduce project risk related to feedstock provision, further support to the farmers and particularly communities living on the under utilised land, will be needed. This can be done through existing agricultural support programmes as well as from support of investments made by the project in agricultural development.

### **1.1.2 Background**

**2005** – The National Treasury approved the increase of the Fuel Levy exemption for biodiesel from 30% to 40%. The exemption was introduced in 2003. SARS allows for 100% exemption for small biodiesel producers (less than 300 m<sup>3</sup> annually). Biofuels investments also qualify for a tax-depreciation write-off of 50:30:20 percent over three years. This equates to support of about 10 cpl.

September 2005 – The National Treasury approved a *Renewable Energy Capital Subsidy Scheme* administered by the DME. In 2006/7. The *Subsidy* provides for 16.7 c/l subsidy for bioethanol and 27.3 c/l for biodiesel, up to a maximum of R20 million. However, cost competitive world scale projects typically require an investment in the order of R1 billion. Effectively this proposed support amounts to 2% of the required investments.

### **1.1.3 Objectives of this Strategy**

The National Biofuels Industrial Strategy is driven predominantly by the need to address issues of poverty and economic development. The focus of the Strategy, therefore, will be the promotion of farming in areas previously neglected by the apartheid system and areas that did not have market access for their produce. Most of these areas are in the former homelands. The strategy is also aimed at creating a development balance between previously disadvantaged farming areas and commercial farming areas.

### **International Situation**

Comparative analysis of international experience shows that the biofuels industry particularly as an infant industry is at the mercy of volatile oil prices, crop prices and exchange rates. It therefore requires government support in the initial stages.

### **Issues Involved**

The Biofuels Industrial Strategy is premised on the development of partnerships along the value chain and across the affected sectors.....

The proposed blending ratio for South Africa is B2 or 2% biodiesel and E8 or 8% Bioethanol blend.

.....It is expected that farmers supplying the biofuels plant with feedstock, particularly emerging farmers, could organize themselves into co-operatives to maximise benefits and market power and also participate either fully or partially in the ownership of the biofuels plants.....

Cabinet, on 7 December 2005, approved the development of an industrial strategy targeted at creating jobs in the energy crops with the bio-fuels value chain, acting as a bridge from the second economy to first economy status." It is in this regard that development of the industry based on imported feedstock has not been supported. This can only be supported at times of adverse agricultural production and when local producers cannot meet the investors demand.

Lastly, the Strategy targets areas of South Africa that are worst hit by poverty and deprivation. It hopes to generate economic activity, mainly, in the former homelands. Furthermore, only agricultural products grown in the previous homelands by historically disadvantaged farmers will qualify for the support. Only biofuels plants that have been identified to assist in achieving the initial target will be supported and their location will be a condition of the issuing of a manufacturing licence. The plants will be located throughout the country depending on the investor's choices and also as per the conditions of licences.

### **Animal Feed**

Biofuels production will also contribute to food security by increasing the availability of byproducts that can be used for animal feed. These include protein oilcake, from biodiesel production from sources such as soya beans, which are currently being imported. Concerns have been raised that biofuels production could lead to an oversupply of these by-products. The analysis undertaken during the development of the Strategy showed that this would not be the case for biofuels production of up to 4.5%. Therefore the 2% incubation level proposed on this revised Strategy will also not have any impact.

### **Water Resources**

The impact of biofuels production on water resources was raised as an important concern during the consultation process.

Dryland crops such as soya and maize are not listed as water users.....

Where dryland crops are found to have an undue impact on other users, these will have to be regulated, much as the forestry industry is currently controlled today.

### **Biofuels Production Plants**

The conventional technology to produce biofuels is well established, and production processes are mature, even in South Africa.....

The 2% that will be supported by a fixed margin scheme will only apply to proven commercial processes and agricultural feedstocks.

### **Fuel Industry**

Internationally, the oil industry is becoming more active in the development of biofuels.....

The draft Strategy supported the use of existing oil industry infrastructure to accommodate biofuels efficiently and allow biofuels to be regulated under existing oil industry regulations.

### **Biofuels contracts**

The agricultural sector has a number of active market instruments because agricultural products are generally sold on forward contract basis.....

Without such contracts, farmers cannot get funding to grow and harvest their produce. The failure of homeland farmers is largely attributed to a lack of market for their produce.....

The price at which biofuels producing plants buy crops will have to be on par with that paid to producers for the food sector.

### **Mandating Biofuels Uptake**

Mandatory off-take can be introduced only when security of biofuels supply can be guaranteed.

However, the different biofuels manufacturers will enter into supply and off take agreements with the individual oil companies.

### **Integration**

The biofuels industry provides an opportunity to link the second economy.....

The integration of the value chain needs clearly defined partnerships. Specifically, the producer incentive scheme should be limited to litres produced using agricultural feedstock supplied from currently under utilised land in the former homelands.

#### **1.1.4 The Strategy**

.....  
The Biofuels Strategy initially aims to develop the biofuels industry to achieve a market penetration of 2% of road liquid transport fuels.....

This is to be based on local agricultural and manufacturing production. Imports are limited to ensure increased use of the local produce and local economic development, and in consideration of the biofuels strategy objectives such as job creation, bridging the gap between 1st and 2nd economies and promotion of BEEs.....

The biofuels industry strategy further recommends that the following blending levels be achieved: for Biodiesel B2 or 2% blending requirement and for Bioethanol E8 or 8% blending requirement. For the initial investments and development of biofuels in the country, the following crops will be used for the production: for Bioethanol sugar cane and sugar beet and Biodiesel soya bean, canola and sunflower.

#### **1.1.5 Specific Interventions**

##### **Licensing of Producers**

Biofuels producers, like any other petroleum product producers, need to be licensed by the Petroleum Products Controller: "A person may not- (a) manufacture petroleum products without a manufacturing licence... issued by the Controller of Petroleum Products". Thus under the act all petroleum producers small and large will have to apply for a manufacturing licence. Biodiesel producers are already registered with SARS for the fuel levy exemption. This registration needs to be extended to bio-ethanol producers.....

Biofuels producers will have to meet the licensing condition which will include amongst others, crop selection, feedstock availability, quality requirements, environmental standards (Environmental Impact Assessment) and water restrictions.

##### **Off-take by Petroleum Wholesalers Based on Discounting**

Biofuels economics are optimised when logistics and costs are minimised. Hence the preferred off-takers, excluding own use by producers and directly by consumers close to biofuels plants, will be via the existing oil industry at the depots, or refineries closest to the biofuels plants. This would involve blending biofuels components in accordance with SANS standards. Currently this amounts to 5% for biodiesel..... Higher levels, particularly of biodiesel, could be used in dedicated fleets. Using the existing oil industry helps ensure quality control.....

Mandatory blending is not recommended for the 2% incubation phase.

### **Fuel Levy Exemption**

The existing Fuel Levy exemption should continue.....

It is proposed that the biodiesel exemption be fixed at 50% from the 2008 financial year, taking into account the limitations imposed by the diesel tax refund.

### **Agricultural Support**

The Department of Agriculture has a number of programmes to support development of local agricultural production and value addition. These include programmes for small-scale and emerging farmers. Such programmes can be targeted to support farmers in crop selection, hedging, agricultural methods, logistics, infrastructure, research and development, and in negotiating contracts with biofuels manufacturers.

### **Capacity Building and Development**

Government should ensure the training and capacity building of previously disadvantaged communities and emerging entrepreneurs to maximise transformation and the benefits inherent in this industry. These activities should be performed in conjunction with the Sector Education and Training Authorities (SETAs), particularly in the agricultural and energy sectors. It is envisaged that the new biofuels industry be a driver of transformation and skills development, coupled with sustainable job creation.

### **Government Agencies**

Bringing under utilised agricultural land into production not only creates greater macroeconomic benefits but also entails higher investment risk. To ensure such development takes place, which may correspond with poverty nodes, government agencies, such as the Central Energy Fund (CEF) and the Industrial Development Corporation (IDC) should become involved, with support from the provincial agricultural departments.

### **Monitoring and Evaluation**

Monitoring and evaluation will primarily be enabled by the licensing system for biofuels producers and petroleum wholesalers.

### **The Way Forward**

The immediate focus is on incubating the industry to a 2% biofuels penetration level and encouraging the use of agricultural feedstocks from currently under utilised lands.....

The support level should be fixed for the first 2% biofuels investment through to 2020 to give investors some certainty and a decent rate of return on their assets..... only litres produced from agricultural feedstock grown on under utilised land in the former homelands will qualify.

# APPENDIX 2: DETAIL ON COMPLIANCE REQUIREMENTS

(Related abstracts from legal documents)

## **PETROLEUM PRODUCTS ACT 120 OF 1977**

[a120y1977s1]<sup>1</sup> Definitions

'petroleum product' means any petroleum fuel and any lubricant, whether used or unused, and *includes any other substance which may be used for a purpose for which petroleum fuel or any lubricant may be used;*

## **Act 58,1993 PETROLEUM PRODUCTS AMENDMENT ACT, 2003**

Section 2B(6):

(6) It shall be a condition of a manufacturing license or a wholesale license, as the case may be, that the licensee must purchase sell, or purchase and sell, petroleum products-

- (a) manufactured from coal, natural gas or vegetable matter;
- (b) that meet prescribed specifications and standards where applicable;
- (c) when such petroleum products are available in the Republic, before purchasing or selling, or purchasing and selling, petroleum products manufactured from other raw materials

System for allocation of licenses

2E. (1) The Minister must prescribe a system for the allocation of site and their corresponding retail licenses and the supply of prescribed petroleum products to such licensees, by which the Controller of Petroleum Products shall be bound: Provided that the Controller of Petroleum Products shall only be bound by the provisions of such a system for the period set out in that regulation or any amendment thereto or any substitution thereof which period may not exceed 10 years from the date of commencement of that regulation

2 E (3) (f):

(3) A system contemplated in subsection (1)-

(f) may specify that petroleum products which-

(i) are manufactured from coal, natural gas or vegetable matter, when available in the Republic;

(ii) meet prescribed specifications and standards, where applicable

12.1 Offences and Penalties:

12. (1) Any person who contravenes a provision of this Act, shall be guilty of an offence and be liable on conviction to a fine not exceeding R1 000 000,00, or to imprisonment for a period not exceeding 10 years, or to both such fine and such imprisonment: Provided that if a directive issued in terms of section 2A(2)(c) or (3) is complied with within the period specified therein, the person concerned shall be absolved from criminal liability.

#### **NO. 2 OF 2005: PETROLEUM PRODUCTS AMENDMENT ACT, 2005**

Amendment of section 2B of Act 120 of 1977, as inserted by section 3 of Act 58 of 2003

3. Section 2B of the principal Act is hereby amended by the deletion of subsection (6).

Amendment of section 2E of Act 120 of 1977, as inserted by section 3 of Act 58 of

2003

4. (e) by the deletion in subsection (3) of paragraph (f).

#### **REGULATIONS REGARDING PETROLEUM PRODUCTS MANUFACTURING LICENCES (GOVERNMENT GAZETTE, 27 MARCH 2006)**

Definitions

1. In these Regulations any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned and unless the context indicates otherwise-

"biofuel" means a biodegradable and renewable petroleum product or petroleum product component extracted from vegetable matter;

"the Act" means the Petroleum Products Act 1977, (Act NO. 120 of 1977).

"the Amendment Acts" means the Petroleum Products Amendment Act, 2003 (Act No. 58 of 2003), and the Petroleum Products Amendment Act, 2005 (Act NO. 2 of 2005)

#### Lodging of manufacturing license application

(2) An applicant contemplated in sub regulation (1) in respect of whom section 2D of the Act is not applicable must not commence with the construction of a manufacturing facility until a manufacturing license has been issued by the Controller.

*(Note: section 2D refers to an existing facility)*

#### Acceptance of manufacturing licence application

5. Before accepting a manufacturing licence application, the Controller must be satisfied that-

(a) applicant is the owner of the property or has the written permission of the owner of the property on which the manufacturing facility is or will be located;

#### Conditions with regard to manufacturing licence

11. (1) The licensed manufacturing activity must remain a going concern.

(2) A licensed manufacturer may only manufacture petroleum products within the maximum design capacity stated on its licence.

(3) A licensed manufacturer must-

(a) maintain minimum working stock levels in compliance with applicable regulations;

#### Increase of capacity

12. If a licensed manufacturer wishes to increase the maximum design capacity of a manufacturing facility, that manufacturer must apply to the Controller in terms of regulation 3(1).

#### Transfer Of manufacturing licence

14. (1) If the ownership of the relevant property or the manufacturing activity changes, a licensed manufacturer must within six months of the change apply to the Controller for an amendment to the licence.

#### Commencement and continuation of business under manufacturing licence

15. A licensed manufacturer must commence with the construction or

expansion of a manufacturing facility within a period of 24 months after the date on which a manufacturing licence has been issued to the licensee, failing which the licence shall lapse.

## **REGULATIONS REGARDING PETROLEUM SPECIFICATIONS AND STANDARDS, 23 June 2006**

### Definitions

1. In these Regulations any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned and, unless the context indicates otherwise-

“biodiesel” means a fuel or fuel component for diesel engines derived from natural oils extracted from vegetable matter and that conforms to the South African National Standard, Automotive biodiesel fuel, SANS 1935;

### Scope of regulation

2. These Regulations set out specifications and standards for petroleum products that may be sold for consumption in the Republic.

### Permitted diesel grades

5. (1) Only permitted grades of diesel may be sold to an end consumer in the Republic, which grades are-

5.(1) (Note: *Different grades, containing varying addition of biodiesel are listed*)

5. 2 (a) Subject to paragraph (b), diesel referred to in sub regulation (1) must conform to the South African National Standard, Automotive diesel fuel SANS 342;

(b) In the case where the maximum biodiesel content specified in the South African National Standard, Automotive diesel fuel, SANS 342 differs from that specified in sub regulation (1), the maximum biodiesel content specified in sub regulation (1) must apply

## **HAZARDOUS SUBSTANCES ACT NO. 15 OF 1973**

Declaration of grouped hazardous substances.-

(1) The Minister may, subject to the provisions of subsections (2) and (3), by notice in the Gazette, declare-  
any substance or mixture of substances which, in the course of customary or reasonable handling or use, including ingestion, might, by reason of its toxic, corrosive, irritant, strongly sensitizing or flammable nature or because it generates pressure through decomposition, heat or other means, cause injury, ill health or death to human beings, to be a Group 1 or a Group 11 hazardous substance;

### **OCCUPATIONAL HEALTH AND SAFETY ACT, Act NO. 85 OF 1993**

[DATE OF COMMENCEMENT: 1 JANUARY, 1994

Definitions.-(1) In this Act, unless the context otherwise indicates:

"major hazard installation" means an installation

(a) where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or

(b) where any substance is produced, processed, used, handled or stored in such a form and quantity that it has the potential to cause a major incident;

"hazard" means a source of or exposure to danger

### **WHITE PAPER ON RENEWABLE ENERGY**

November 2003

This White Paper on Renewable Energy (herein referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognises that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The *White Paper on Energy Policy's* position with respect to renewable energy is based on the integrated resource planning criterion of:

*Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options.*

### **WHITE PAPER ON THE ENERGY POLICY OF THE REPUBLIC OF SOUTH AFRICA**

The *White Paper on Energy Policy* (DME, 1998) sets out Government's policy with regard to the supply and consumption of energy for the next decade.

Government policy on renewable energy is concerned with meeting the following challenges:

- ☒ Ensuring that economically feasible technologies and applications are implemented through the development and implementation of an appropriate program of action.
- ☒ Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options.
- ☒ Addressing constraints on the development of the renewable energy industry.

### 3.1.6 Legal Context

At present legislation covers the areas of electricity and liquid fuels. The *White Paper on Energy Policy* encourages the entry of multiple players into the power generation market.

The *Central Energy Fund Act* (Act 38 of 1977) is enabling legislation in terms of which, *inter alia*, levies may be imposed on liquid fuels products for collection into of the Central Energy Fund and or the Equalisation Fund. These funds can be employed for dedicated energy purposes in a manner prescribed by the Act.

The high initial costs for renewable energy necessitates the establishment of funding mechanisms to promote their implementation. The Central Energy Fund has historically been focussed on the management of crude oil and locally produced hydrocarbons. However, increasing the use of renewable energy, biomass derived liquid fuels and energy sources such as bio-diesel, ethanol and landfill gas have been identified as one of its key focus areas in future. Mechanisms, such as the Central Energy Fund and Equalisation Fund, could be harnessed to extend the operational support available to renewable energy programmes. ....

Government has already stated that it will incentivize the production of bio-fuels produced from biomass in the form of a 30% reduction in the Fuel Levy (tax) on such fuels (Budget Speech Minister of Finance, February 2002). Government.

could take the lead by setting supply and demand targets e.g. a percentage of Government (national and provincial) and Government related financial institutions, agencies projects budget invested in renewable energy programmes and a target set for a percentage of renewable energy demand by Government (national and provincial) and related institutions and agencies.

A proposed Energy Bill (Energy Bill, 2003) will allow the Minister to make renewable energy regulations regarding:

"minimum contributions to the national energy supply from renewable energy resources, and may in regard thereto specify renewable energy technologies". This may create a market demand

for renewable energy which will speed up the commercialisation of renewable energy technologies with less government assistance.

# APPENDIX 3 – LISTED SPECIFICATIONS

## AS PER SANS 1935

SANS 1935:2004 Edition

Table 1 — Requirements for automotive biodiesel fuel

1	2	3
Property	Requirements	Test method <sup>a</sup>
Ester content <sup>a</sup> , % mass fraction, min	96,5 <sup>b</sup>	EN 14103
Density at 15 °C <sup>c</sup> , kg/m <sup>3</sup>	860 – 900	ISO 3675, ISO 12185
Kinematic viscosity at 40 °C <sup>d</sup> , mm <sup>2</sup> /s	3,5 – 5,0	ISO 3104
Flash point, °C, min	120	ISO 3679 <sup>e</sup>
Sulfur content, mg/kg, max	10,0	ISO 20846, ISO 20884
Carbon residue (on 10 % distillation residue) <sup>f</sup> , % mass fraction, max	0,3	ISO 10370
Cetane Number <sup>g</sup> , min	51,0	ISO 5165
Sulfated ash content, % mass fraction, max	0,02	ISO 3987
Water content, % mass fraction, max	0,05	ISO 12937
Total contamination <sup>h</sup> , mg/kg, max	24	EN 12662
Copper strip corrosion (3 h at 50 °C), rating, max	Class 1	ISO 2160
Oxidation stability, at 110 °C, h, min	6	EN 14112
Acid value, mg KOH/g, max	0,5	EN 14104
Iodine value, g of iodine/100 g of FAME, max	140	EN 14111
Linolenic acid methyl ester, % mass fraction, max	12	EN 14103
Polyunsaturated (> = 4 double bonds) methyl esters <sup>i</sup> , % mass fraction, max	1	-
Methanol content, % mass fraction, max	0,2	EN 14110
Monoglyceride content, % mass fraction, max	0,8	EN 14105
Diglyceride content, % mass fraction, max	0,2	EN 14105
Triglyceride content <sup>j</sup> , % mass fraction, max	0,2	EN 14105
Free glycerol <sup>k</sup> , % mass fraction, max	0,02	EN 14105, EN 14106
Total glycerol, % mass fraction, max	0,25	EN 14105
Group I metals (total of Na and K) <sup>k</sup> , mg/kg, max	5,0	EN 14108, EN 14109
Group II metals (total of Ca and Mg), mg/kg, max	5,0	prEN 14538 <sup>l</sup>
Phosphorus content, mg/kg, max	10,0	EN 14107
Cold Filter Plugging Point (CFPP) <sup>m</sup>		
Winter, °C, max	-4	EN 116
Summer, °C, max	+3	

<sup>a</sup> See 5.4.1

<sup>b</sup> The addition of non-fatty acid methyl esters components other than additives is not allowed (see 4.1.1).

<sup>c</sup> Density may be measured by ISO 3675 over a range of temperatures from 20 °C to 60 °C. A temperature correction shall be made according to the formula given in annex C (see 5.4.2).

<sup>d</sup> If CFPP is -20 °C or lower, the viscosity measured at -20 °C shall not exceed 48 mm<sup>2</sup>/s. In this case, ISO 3104 is applicable without the precision data owing to non-Newtonian behaviour in a two-phase system.

<sup>e</sup> A 2 mL sample and apparatus equipped with a thermal detection device shall be used.

<sup>f</sup> ASTM D 1160 shall be used to obtain the 10 % distillation residue (see 5.3).

<sup>g</sup> See 5.4.5.

<sup>h</sup> Pending development of a suitable method, EN 12662 shall be used. The precision of EN 12662 is, however, poor for biodiesel.

<sup>i</sup> Suitable test method to be developed.

<sup>j</sup> See 5.4.1 and 5.4.4.

<sup>k</sup> See 5.4.1. See annex A for precision data for the total of Na and K.

<sup>l</sup> prEn standards are not final standards and are subject to possible change. At the time of preparation of this standard, it was however understood that the prEN standard quoted was undergoing final approval procedures.

<sup>m</sup> Winter shall be considered as being from 1 April to 30 September and summer shall be considered as being from 1 October to 31 March.

## Discussion of Biodiesel Specifications

The Petroleum Products Act stipulates that biodiesel shall be manufactured to comply with South African standard for biodiesel, SANS 1953. A copy of the listed specifications as per SANS 1935 is included as appendix G.1.

These specifications are most stringent and even more comprehensive than specification set for mineral diesel fuel.

A survey by the SABS among claimed biodiesel manufacturers, referred to as a "Biodiesel Audit" was conducted towards the end of year 2008. (The report has not been officially released by the time of this study but being involved as consultant in the said audit, members of this study team has had some insight in the results)

From the insight into the biodiesel audit results, it was noted that only two out of 20 biodiesel samples presented did comply with SANS1935. (The sample identities, being confidential, had not yet been revealed by the research manager of the audit) It can however be concluded that there is to the manufacturing of biodiesel than meets the eye and that most "manufacturers" might not understand the essentials of the chemical processing required to produce biodiesel. It is also suspected that the processing of spent cooking oil as a low cost base material was a major contributor to the poor results obtained.

The liquid fuels industry and the automotive industry, having been involved in the drafting of SANS 1935, is adamant not to accept biodiesel which does not comply with SANS 1935.

It is therefore imperative that the body appointed for the design and operation of the biodiesel manufacturing facility offer proof of being able to produce biodiesel that will comply with SANS 1935

# APPENDIX 4 – ESSENTIAL ELEMENTS OF SANS 1935

## Essential elements of SANS1935

Abstracting the elements below does not imply that the author suggests that non compliance to the others constitutes compliance to SANS 1935.

It is however postulated that if biodiesel does not comply with SANS 1935 in respect of these properties, it is unlikely that it will comply to the others.

Ester content: This constitutes the actual “Biodiesel” content as per the definition of biodiesel. Non compliance suggests that the chemical conversion of the base oil (identified as “tri-glycerides”) had been incomplete. An unacceptably high content of other impurities may also be suspected.

- Tri-glycerides: This parameter is a direct indicator of the success of the primary chemical conversion process. Tri-glycerides contribute to unacceptable carbon deposits in an engine.
- Cetane number: This property identifies the auto-ignition ability required for successful combustion in diesel engines. A high cetane is required.
- Flash point: This is the temperature of the biodiesel at which it will ignite when exposed to an ignition source. It is thus indicative of the flammability of the fuel, which should not be confused with the combustibility of the fuel under the conditions prevailing in an operating diesel engine. This is also a parameter to consider in the hazard classification of the fuel, which affects its safe handling and storage.
- A low flash point will result from too high levels of residual alcohol used during processing and/or presence of too high levels of volatile additives. Under diesel engine operating conditions, these substances might result in detrimental detonation during combustion.
- Methanol content: Too high residual methanol (Alcohol in general) will reflect a low flash point, with the detrimental effects referred to in “Flash point”
- Sulphur content: Apart from being an atmospheric pollutant, high residual sulphur from processing (if used) might lead to undue corrosion of the fuel and internal engine components. (Vegetable oils are characterised by very low sulphur levels)
- Acid value: This aspect is indicative of the corrosiveness of the fuel. It reveals the presence of other acidic substances, besides sulphur, like free fatty acids resulting inter alia from degradation of the fuel.
- Ash content: Ashes formed during combustion, resulting from the presence of metallic elements, is corrosive to engine parts.
- Metallic specifications: The presence of the listed metals will also be reflected in the Ash content, with subsequent effects.
- Water content: The presence of water in a fuel offers a friendly condition for corrosion and algae growth, which will clog a fuel system. Being of biological nature, biodiesel is degradable and has an affinity for water. Special appropriate storage conditions should therefore be assured.

- Oxidation Stability: This is an index indicating the oxidative stability of the fuel when exposed to air. It is an accelerated test, measuring the formation of free fatty acids (FFA's) at 110 OC when bubbling air through a test sample. The index is the duration in hours till the FFA formation accelerates. Industry has set this specified norm based on typical experience. If this norm is met, it is expected that the fuel will have an acceptable shelf life under normal storage conditions.
- Total glycerol: Glycerol, formed during biodiesel processing, contains high levels of impurities which might be detrimental to an engine and should be removed from the product.

# APPENDIX 5 – QUALITY ASSURANCE

## Quality assurance

Apart from providing ease of mind to the consumer, the application of a quality management system in the biodiesel plant will add to the credibility of the producer.

Documents which should assist the biodiesel producer to deliver consistent quality biodiesel, are being drafted by the SABS with the assistance of knowledgeable persons from the liquid fuels industry:

*A quality management document, SANS 833:2009* : “Biodiesel production — Quality Management System: Producer Requirements” has been drafted (See appendix H). This is a document based on the US document “BQ900”, which recognised ISO 9000. It addresses compulsory requirements to ensure consistency in compliance to SANS 1935.

This document addresses requirements regarding documentation, management responsibility, operational elements, laboratories, sampling and testing, Remediation elements, fuel blending and product load out.

It is evident that in order to meet these requirements, a biodiesel plant should be staffed by dedicated, disciplined and well skilled people, understanding the processes involved. An analytical laboratory in particular, which should form an integral part of the biodiesel plant, should be manned by experienced bodies, since some of the analytical procedures demand experienced interpretation.

In addition to SANS 833 (Draft), a *producer guideline document*, also based on BQ9000, is envisaged. This document is intended to assist the producer in terms of SANS 833.

**SANS 833:2009** Edition 1 (SANS draft document)

**Biodiesel production —**

**Quality management system: producer requirements**

### **Introduction**

This SANS document was based on BQ 9000 *Quality management system – producer requirements*. All references to ASTM procedures have been replaced by references used in SANS 1935, *Automotive biodiesel fuel*

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# APPENDIX 6: LIST OF REGISTERED RDP PROJECTS

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