

The regulatory regime for bio-fuels in South Africa

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By

Derek Brits

20272367

Study supervisor: Prof. W du Plessis

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Abbreviations

1 st G	First generation bio-fuels
2 nd G	Second generation bio-fuels
AIDS	Acquired immune deficiency
BFIS	Bio-fuels Industrial Strategy
CEG	Co-operative environmental governance
CNMA	<i>Conselho Nacional do Meio-Ambiente</i>
CPP	Controller of Petroleum Products
CPS	Cleaner Production Strategy
DA	Department of Agriculture
DE	Department of Energy
DEAT	Department of Environmental Affairs and Tourism
DMC	Deming Management Cycle
DME	Department of Minerals and Energy
DSD	Department of Social Development
DST	Department of Science and Technology
DWA	Department of Water Affairs
EIA	Environmental impact assessment
GHG	Greenhouse gas
GWh	Gigawatt hour
HIV	Human immunodeficiency virus
IEM	Integrated environmental management
IEP	Integrated Energy Planning
IE-plan	Integrated energy plan
IPCC	Intergovernmental Panel on Climate Change
JPOI	Johannesburg Plan of Implementation
MCT	Ministry of Science and Technology
MDA	Ministry of Agrarian Development
MDGs	Millennium Development Goals
NCCRS	National Climate Change Response Strategy

NEA	National Energy Act
NEMA	National Environmental Management Act
NFSD	National Framework for Sustainable Development
NGOs	Non-governmental organisations
NMC	National Monetary Council
NPC	National Petroleum Council
NPIFA	National Programme for the Improvement of Family Agriculture
NPPUB	National Programme for the Production and Use of Bio-diesel
<i>PNMA</i>	<i>Política Nacional do Meio-Ambiente</i>
PPA	Petroleum Products Act
<i>Proálcool</i>	National Alcohol Programme
RETs	Renewable Energy Technologies
SABREG	South-African Bulk Renewable Energy Generation
SCS	Selo Combustive Social
SEA	Strategic environmental assessment
<i>SEMA</i>	<i>Secretaria Especial do Meio-Ambiente</i>
<i>SNMA</i>	<i>Sistema Nacional do Meio-Ambiente</i>
WPoEP	White Paper on Energy Policy
WPoRE	White Paper on Renewable Energy
WSSD	World Summit on Sustainable Development

Opsomming

Titel: Die Regulerende Raamwerk vir Biobrandstof in Suid-Afrika

In hierdie studie word biobrandstof geïdentifiseer as 'n moontlike oplossing teen die gevolge en impakte van klimaatsverandering en gebruik om sodoende 'n meer stabiele en versekerde vorm van energieverkaffing te voorsien. Daar word bepaal of daar enige beleide bestaan wat 'n raamwerk daarstel vir die regulering van die biobrandstofindustrie op 'n volhoubare wyse. Die bestuur en reguleringsmetodes wat gebruik word in energieverwante beleide ten einde die konsep van volhoubare ontwikkeling na te streef binne die energiesektor is geïdentifiseer. Die konsep van strategiese omgewingsevaluering (SOE) is bespreek ten einde te bepaal of Suid-Afrika se energiebeleide strategies ontwikkel was om vir 'n volhoubare energietoekoms te voorsien.

Die eerste deel van hierdie studie fokus op die aspekte rondom omgewingsreguleringsmetodes soos omgewingsimpakstudies, die projeklewensiklus en SOEs in die lig van die konsep van volhoubare ontwikkeling hoe hierdie aspekte met mekaar geïntegreer kan word om 'n volhoubare energiesektor te bevorder. Die studie beveel aan hoe sekere energiebeleide gebruik kan word om 'n volhoubare raamwerk vir hernubare energie te skep.

Die tweede gedeelte van die studie handel met die omgewings en energiewetgewende raamwerk van Suid-Afrika wat indirek verband hou met biobrandstof. Brasilië se biobrandstofreguleringsraamwerk word bespreek met verwysing na beleid en wetgewing om te bepaal wat Suid-Afrika kan leer van Brasilië met betrekking tot 'n hernubare energiereguleringsraamwerk.

Sleutelwoorde: Energiereg; biobrandstofregulering in Suid-Afrika en Brasilië; volhoubare ontwikkeling en hernubare energie.

Summary

Title: The Regulatory Regime for Bio-fuels in South Africa

In this study bio-fuels are identified as a possible solution to the effects of climate change and a more secure supply of energy. It is determined if there exist any policies that could provide for the regulation of a bio-fuels industry in a sustainable manner. The management tools and regulatory measures used in the energy related policies to pursue the sustainable development of a secure energy sector are identified. Thereafter a discussion regarding the concept of strategic environmental assessment (SEA) follows to determine whether South African energy policies have been strategically developed to provide for a sustainable energy future.

The first part of this study focuses on the aspects regarding environmental management tools such as environmental impact assessment studies, life cycle assessments and SEAs and how these concepts can be integrated with each other as well as with the concept of sustainable development in order to promote a more sustainable energy sector. The study indicates how energy policies should be used to provide for an efficient framework for renewable energy.

The second part of the study deals with the environmental and energy legislative frameworks of South Africa which relate to bio-fuels. Brazil's bio-fuels regulatory framework is discussed to determine what South Africa can learn from Brazil with regard to renewable energy and the sustainable development and regulation thereof.

Key Words: Energy law; regulation of bio-fuels in South Africa and Brazil; sustainable development and renewable energy.

1 Introduction

1.1 Background

The Intergovernmental Panel on Climate Change¹ (IPCC) and various other international organisations, scientists and non-governmental organisations (NGOs) remarked that a global increase in the atmosphere's temperature is the result of an increase in greenhouse gas (GHG) emissions which again is the direct result of human activities.² Climate change involves extreme interruption of the world's weather and climate patterns.³ The scientific community is continually reminding the global community through facts and figures that climate change is a reality and already taking place due to unregulated human activities.⁴

The increase of these human activities is ascribed to the fact that economic stability and the development of countries require a continuation of stable supply of energy.⁵ The global energy sector is responsible for at least 65% of the total worldwide GHG emissions.⁶ According to the *Kyoto Protocol, 1997*⁷ major

1 The IPCC was established by the World Meteorological Organisation and the United Nations Environment Programme in 1988 to assess the scientific community with research of technical, scientific and socio-economic information that might be relevant to the effects of climate change and help to provide a better understanding of climate change and options for adaptation to climate change. See also Article 1(3) of the Kyoto Protocol (1997).

2 See generally Howes *Politics and the Environment* 3; International Energy Agency *CO2 Emissions* 9; Bond *Unsustainable South Africa* 7; Hunter Salzman and Zaelke *International Environmental law*; Burroughs *Climate Change*; Cowie *Climate Change*; Low *Climate Change and Africa*; Van Schalkwyk *Climate Change and Energy Insecurity* 1; Marrison and Larson *Biomass and Energy* 337; Bradbrook and Ottinger *Energy Law and Sustainable Development* 16.

3 Burroughs *Climate Change* 23; Bradbrook and Ottinger *Energy Law and Sustainable Development* 11-20; International Energy Agency *CO2 Emissions* 10; Brown *Plan B4.0: Mobilising to Save Civilisation* 55.

4 Richardson and Wood *Environmental law* 1; Low *Climate Change and Africa*; Bradbrook and Ottinger *Energy Law and Sustainable Development*; Van Schalkwyk *Climate Change and Energy Insecurity* 1.

5 Winkler *Energy Policies for Sustainable Development* 23-30; International Energy Agency *CO2 Emissions* 10; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2387; Saket *Food versus Fuel* 6; Dresner *The Principles of Sustainability* 28.

6 Demirbas and Demirbas 2007 *Energy Conversion and Management* 2388; International Energy Agency *CO2 Emissions* 10; Winkler *Energy Policies for Sustainable Development* 27; DEAT *Emerging Paper: Energy, the Millennium Development Goals* 3-6.

7 Kyoto Protocol to the United Nations Framework Convention on Climate Change 1992.

industrialised countries, defined as Annex 1 countries⁸ must reduce their overall carbon dioxide (CO₂) emissions with at least five percent below the levels of 1990 within the period of 2008 to 2012.⁹ While Africa's contribution as a region to the total GHG emissions of the world is described as insignificant, South Africa as a non-Annex 1 country's contribution of GHG emissions is on par with most European industrialised countries.¹⁰ This is due to South Africa's economical reliance upon fossil fuels as its primary energy source.¹¹ Coal as the main fossil fuel in South Africa provides for roughly 77% of the primary energy supply.¹²

The second largest sector responsible for GHG emissions is the transport sector which contributed to roughly 39% of CO₂ emissions produced from liquid fuel combustion in 2007 on the African continent.¹³ The transport sector largely depends upon liquid fuels such as oil and petroleum products.¹⁴ Although South Africa's liquid fuel in the transportation sector is mainly dependent on imported crude oil, almost 30% of South Africa's liquid fuel requirements are produced from coal combustion at the Sasol plant in Secunda which produces synthetic fuels for transportation.¹⁵

8 Most of the Annex 1 countries includes the developed industrial countries of the North such as Belgium; Bulgaria; Canada; Denmark; European Community; Finland; France; Germany; Japan; Netherlands; Russian Federation; United Kingdom of Great Britain; United States of America. The Annex 1 countries have agreed to implement policies and measures under the Kyoto Protocol in order to reverse the effect of climate change.

9 A 3(1) of the Kyoto Protocol.

10 Low *Climate Change and Africa* 126; International Energy Agency *CO2 Emissions* 10; Van Schalkwyk *Climate Change and Energy Insecurity* 3.

11 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 178; Von Maltitz and Brent *Assessing the Biofuel Options* 9; International Energy Agency *CO2 Emissions* 21; Lynd *et al* 2003 *South African Journal of Science* 504.

12 Lynd *et al* 2003 *South African Journal of Science* 505; International Energy Agency *CO2 Emissions* 21; Dlamini *Bio-fuels and Energy* 10-19. South Africa generated 95% of its electricity and heat through coal combustion in 2007. The electricity and heat sector provided for 64% of the total GHG emission in South Africa. This is the sector largely responsible for GHG emissions in South Africa.

13 Lynd *et al* 2003 *South African Journal of Science* 505; Dlamini *Bio-fuels and Energy* 10-19.

14 International Energy Agency *CO2 Emissions* 14; Dlamini *Bio-fuels and Energy* 10-19. These two sectors, namely the electricity sector and the transport sector are the two sectors that globally contributed respectively 41% and 23% (almost two-thirds) to the total of CO₂ emissions in 2007.

15 Winkler *Energy Policies for Sustainable Development* 27; Dlamini *Bio-fuels and Energy* 10-19.

It is anticipated that the transport sector will grow with at least 45% by 2030.¹⁶ This means that CO₂ emissions will also increase from its current levels and may worsen the effects of climate change.¹⁷ Climate change and various other socio-economic factors such as high crude oil prices, the need to alleviate poverty and promote sustainable development are all important and effective drivers for the introduction of bio-fuels.¹⁸ Bio-fuels are fuels that can be derived from any vegetable matter or organic which are renewable in the sense that they cannot be depleted.¹⁹ Bio-fuels are one of the options available to adapt to climate change, mitigate CO₂ emissions and become less dependent on non-renewable energy sources.²⁰

1.2 Policies and legislation

In 2003 South Africa introduced the *White Paper on Renewable Energy*²¹ (WPORE) in which the government acknowledged that the emissions of GHGs from the use of fossil fuels such as coal and petroleum products have led to international concerns about global warming and thus the government promised to develop a framework within which a renewable energy industry can operate, grow and contribute positively to the South Africa's economy and the global environment.²² In 2004 South Africa introduced a *National Climate Change*

16 Mathiesen, Lund and Norgaard 2007 *Utilities Policy* 108; International Energy Agency *CO2 Emissions* 14; Larson *Energy for Sustainable Development* 120.

17 See generally International Energy Agency *CO2 Emissions* 14; Van Drunen, Lasage and Dorland *Climate Change* 144; Low *Climate Change and Africa* 124-126. It is however evident that South Africa has very little responsibility for CO₂ emission in the past but could easily be held responsible for future emissions due to a rapid economic growth, infrastructure developments and thus increased emissions.

18 Lynd *et al South African Journal of Science* 503; Manahan *Fundamentals of Environmental Chemistry* 1107; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2390; and Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174.

19 See generally Lynd *et al* 2003 *South African Journal of Science* 501; Saket *Food versus Fuel* 2; Rosamond *et al* 2007 *Environment* 34; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 176-178; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2389-2392; Manahan *Fundamentals of Environmental Chemistry* 1107-1109. For example sugar cane, maize, wheat or sunflower.

20 Mathiesen, Lund and Norgaard 2007 *Utilities Policy* 108; International Energy Agency *CO2 Emissions* 14; Larson *Energy for Sustainable Development* 120

21 DME *White Paper on Renewable Energy*.

22 DME *White Paper on Renewable Energy* vii.

*Response Strategy*²³ (NCCRS) stating that response and mitigation measures must be implemented while sustainable development is enhanced and improvement of the social, economical, cultural and environmental sectors are taken into account.²⁴

In 2007 the Department of Energy²⁵ (DE) introduced a *Bio-fuels Industrial Strategy*²⁶ (BFIS) which recognised that the growth of a bio-fuels industry would be in support of a renewable energy framework as proposed by the government in 2003; and also contribute to cleaner environmentally friendly energy sources and promote sustainable development.²⁷ The BFIS sets out an objective for the government to achieve a 2% penetration level of bio-fuels in the national liquid fuel supply within the period of 2008 up to 2013 and argues that this 2% penetration would not affect the food supply.²⁸ The fact that food supplies could be used for bio-fuels production in the developing world which already has shortages in food supplies, gave rise to a debate regarding the feasibility and sustainability of bio-fuels.²⁹ The stimulation of a feasible bio-fuels industry may have a negative impact on food security, water resources and even ecosystems, only to name a few issues.³⁰ The DE has however issued a set of guidelines and criteria with regard to licences for the manufacturing of bio-fuels.³¹

These guidelines are not law but provides for certain measures and criteria which must be met before a person or company can obtain a license to manufacture

23 DEAT *Climate Change Response Strategy*.

24 DEAT *Climate Change Response Strategy* 1.

25 In July 2009 the Minister of public services and administration amended schedule 1 of the *Public Service Act 103 of 1994*.

26 DME *Biofuels Industrial Strategy*. See 5.5 below.

27 DME *Biofuels Industrial Strategy* 5. The bio-fuels Industry Strategy intends to set out the government's approach to policy, regulations and incentives for the bio-fuels industry. A renewable energy framework as proposed by the Government in 2003 has, however, not yet been developed.

28 DME *Biofuels Industrial Strategy* 26.

29 Lynd *et al* 2003 *South African Journal of Science* 499; Giampietro, Ulgiati, and Pimentel 1997 *BioScience* 587; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2386; Ottinger *Biofuels: Potential, Problems and Solutions* 2.

30 Saket *Food versus Fuel* 5; Ottinger *Biofuels: Potential, Problems and Solutions* 2; Lynd *et al* 2003 *South African Journal of Science* 501.

31 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

bio-fuels.³² It seems that these guidelines are not known to bio-fuel manufacturers or the Controller of the Petroleum Products (CPP) who is responsible for the issuing and granting of petroleum licenses.³³ Neither the guidelines nor any other document prescribes penalties in the case of non-compliance with these bio-fuels licensing criteria.³⁴

The *Petroleum Products Act*³⁵ (PPA) refers briefly to bio-fuels and provides for a fuel industry regulatory framework in South Africa.³⁶ Other documents, above those already mentioned that provide for a framework for a bio-fuels industry are the *White Paper on Energy Policy* and the *National Framework for Sustainable Development* which will be discussed below.³⁷ These policies are applicable to a wide range of renewable energy sources and mitigation measures such as wind power, hydro power, biomass and solar energy, indicating that it only provides for a general framework.³⁸

Bio-fuels production should be developed within its project life cycle.³⁹ The project life cycle is an environmental management tool which is an assessment that helps a manufacturer to identify its responsibilities for the entire life cycle of the proposed project.⁴⁰ The three basic cycles in the project life cycle are the project, product and the management cycles, all with their characteristic sub-processes.⁴¹ The cyclical process of environmental management provides for three main phases namely the planning and design phase, the acquiring and

32 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

33 See 6.4 below.

34 See 6.4 below.

35 120 of 1977.

36 DME *Biofuels Industrial Strategy* 6. See 6.4 below.

37 See 5 below.

38 Winkler *Energy Policies for Sustainable Development* 27; Von Maltitz and Brent *Assessing the Biofuel Options* 12; Visagie and Prasad *Renewable Energy Technologies* 14.

39 See 4 below.

40 See 4 below.

41 Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Barrow *Environmental Management and Development* 15.

contractual phase and the implementation and operational phase.⁴² The operational phase consists of various sub-divided phases such as the construction, commissioning, operations, expansion and the last phase includes decommissioning, rehabilitation and termination.⁴³ The project life cycle is important to help determine which tools to use for the management of a bio-fuels production process.

If bio-fuels are not regulated, they could do more harm than provide a safe alternative and environmentally friendly form of energy.⁴⁴ Bio-fuels could potentially affect a wide series of social, economical and environmental issues.⁴⁵ If a bio-fuels industry was to be implemented without any proper regulation and management it may have detrimental effects on the social, economical and environmental sectors.⁴⁶

Brazil implemented legislative measures for the regulation of bio-ethanol and bio-diesel production in the initial stages of the bio-fuels industry, which seems to have introduced a successful bio-fuels industry.⁴⁷ Brazil has gained valuable and diversified experience with regard to bio-fuels, technologies, management measures and legislation to regulate the bio-fuels industry.⁴⁸ Brazil's primary reason for the introduction of the bio-fuels industry was to become independent

42 Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Barrow *Environmental Management and Development* 15.

43 See chapter 6 below.

44 Winkler *Energy Policies for Sustainable Development* 27; Von Maltitz and Brent *Assessing the Biofuel Options* 12; Visagie and Prasad *Renewable Energy Technologies* 14.

45 See 3 below. Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati and Pimentel 1997 *BioScience* 590; Rosamond *et al* 2007 *Environment* 36; National Biofuels Task Team *National Biofuels Study* 73; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.

46 Winkler *Energy Policies for Sustainable Development* 27; Von Maltitz and Brent *Assessing the Biofuel Options* 12; Visagie and Prasad *Renewable Energy Technologies* 14. See 4 below.

47 Colares 2008 *Syracuse Journal of International law and Commerce* 101. See 8 below.

48 Colares 2008 *Syracuse Journal of International law and Commerce* 101; Egler *Improving the Environmental Impact Assessment* 254. During the 1970s Brazil did not pay much attention to environmental protection and it was only in the 1980s due to this lack of attention to the environment that pollution levels started to surpass the carrying competence of the environment in Brazil.

and provide its own fuel and simultaneously uplift the socio-economical standings.⁴⁹

1.3 *Aim of the study*

The aim of this study is to determine how the bio-fuels industry is or could be regulated in South Africa as a developing country by distilling lessons from the Brazilian bio-fuels regulatory experiences.

1.4 *Research methodology*

Management tools and measures that can be used to plan and draft sustainable energy policies and provide for the incorporation and regulation of sustainable renewable energy forms will be identified. The study will determine how the identified energy legislative framework relates to bio-fuels and other forms of renewable energy. Legislative measures that could or already do regulate renewable energy, and in specific bio-fuels in South Africa will be identified.

The study will refer to issues and effects on the food versus fuel debate, change in land use, increased water use and competition for land in relation to the bio-fuels industry in a developing country. An analysis of the current policies in South Africa that relates to energy, sustainable development and which can, if any, specifically address and cater for the issues, identified in the first part of this study, regarding bio-fuels will be conducted. Based on the findings of the study, proposals and recommendations regarding the use of environmental management and regulatory tools and practices within the bio-fuels industry will be made in order to illustrate the incorporation of sustainable development into the bio-fuels industry through policy measures.

49 See 8 below.

A brief overview of the Brazilian legislation and policies relating to energy and bio-fuels in specific will be discussed. The idea was not to undertake a full blown legal comparative study, but to distil lessons from a country that already have introduced explicit legislation pertaining to bio-fuels. Brazil is seen as one of the countries that successfully introduced a bio-fuels regulatory framework. However, South Africa could learn to avoid some of the mistakes that Brazil made. The author was not able to access sources in Portuguese but materials written by Brazilians on bio-fuels in English were used. Certain legislative and policy documents were also available in English. The study is a survey of the most important literature, policies and legislation pertaining to bio-fuels in South Africa and Brasilia. It is first necessary to define bio-fuels for the purpose of this study.

2. Defining bio-fuels

Bio-fuels seem to be a feasible alternative to the conventional fuels produced from oil, petroleum and synthetic fuels produced from the combustion of coal.⁵⁰ The term bio-fuel is scientifically a very broad or umbrella term for all fuels produced from any sort of biomass.⁵¹ Biomass is the term used to describe any solid biomass; any liquid that can be used or transformed to be used as fuel; and any form of bio-gases.⁵² Bio-fuels are thus any fuels that can be derived from organic material and are renewable in the sense that it cannot be depleted.⁵³

50 See generally Manahan *Fundamentals of Environmental Chemistry* 1107-1109; Saket *Food versus Fuel* 2; Rosamond *et al* 2007 *Environment* 34; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 176-178; Lynd *et al* 2003 *South African Journal of Science* 501; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2389-2392; International Energy Agency *CO2 Emissions* 17.

51 Manahan *Fundamentals of Environmental Chemistry* 1107; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2390; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174.

52 Maier *Climate Change and Energy Insecurity* 39; Manahan *Fundamentals of Environmental Chemistry* 1107; Lynd *et al* 2003 *South African Journal of Science* 501; Von Maltitz and Brent *Assessing the Biofuel Options* 2.

53 Obwaka and Arnold *The limited case for bio-fuels* 1; Manahan *Fundamentals of Environmental Chemistry* 1107; Giampietro, Ulgiati, and Pimentel 1997 *BioScience* 588.

Bio-fuels can be in liquid form, such as bio-ethanol and bio-diesel, which are the most researched types of bio-fuels; or in gaseous form such as bio-gas or hydrogen.⁵⁴ Bio-fuels used for transportation may be derived from various biological sources such as agricultural, commercial, domestic or industrial resources and waste.⁵⁵ Bio-ethanol is an alcohol which can be produced by fermenting the sugar particles present in plant material, such as corn, wheat, sugar cane, sugar beets, molasses or any starch that could be used to produce alcoholic beverages.⁵⁶ The process required for the refining of these sugars into alcohols and eventually bio-ethanol requires in many instances a great deal of energy which could create enough heat for the fermenting process.⁵⁷ These sources for heat energy are natural unsustainable fossil fuels such as wood or coal.⁵⁸ The agricultural practices needed to produce bio-fuel crops for bio-ethanol can also contribute to more GHG emissions due to the extensive use of fertilisers and machinery.⁵⁹ The bagasse which is waste left after the liquid of sugar cane is extracted can also be used for energy but its output is much lower than that of coal or wood, and is therefore not generally used.⁶⁰

54 Manahan *Fundamentals of Environmental Chemistry* 1107; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174; Obwaka and Arnold *The Limited Case for Bio-fuels* 1.

55 Obwaka and Arnold *The Limited Case for Bio-fuels* 1; Manahan *Fundamentals of Environmental Chemistry* 1107; and Maier *Climate Change and Energy Insecurity* 39. For example wheat, sugar cane, sugar beets, molasses or any starch.

56 Manahan *Fundamentals of Environmental Chemistry* 1108; Amigun, Sigamoney and Von Blotnitz *Renewable and Sustainable Energy Reviews* 703; Von Maltitz and Brent *Assessing the Biofuel Options* 1.

57 Demirbas and Demirbas 2007 *Energy Conversion and Management* 2391; Manahan *Fundamentals of Environmental Chemistry* 1108.

58 Manahan *Fundamentals of Environmental Chemistry* 1108; Giampietro, Ulgiati, and Pimentel 1997 *BioScience* 588.

59 Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati, and Pimentel *BioScience* 590; Rosamond *et al Environment* 36; National Biofuels Task Team *National Biofuels Study* 73; and Chakauya, Beyene and Chikwamba *South African Journal of Science* 177.

60 Lynd *et al* 2003 *South African Journal of Science* 503; Manahan *Fundamentals of Environmental Chemistry* 1107; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2390; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174.

Bio-diesel is derived from vegetable oils, animal fats, soy, sunflower, palm oil, jatropha and recycled greases.⁶¹ Bio-diesel can also be used as transportation fuel but is mostly used as an additive to current diesel fuels in order to reduce the emission levels of diesel-powered vehicles.⁶² Bio-diesel is as biodegradable, ecological and eco-friendly as sugar and apparently safe to transport and handled without having to take intense safety measures.⁶³ Bio-ethanol and bio-diesel are called first generation (1stG) bio-fuels due to the fact that they are produced from conventional, established and well researched technology and methods.⁶⁴ The criticism against 1stG bio-fuels is that they prevent certain feedstocks from entering the human food chain, contribute to higher food prices and eventually food insecurity.⁶⁵

This growing disapproval of the sustainability and feasibility of 1stG bio-fuels spiked an increasing focus on the possibilities and potential of second generation (2ndG) bio-fuels.⁶⁶ 2ndG bio-fuels are produced from non-food sources namely solid waste biomass such as the stalks of wheat, wood and maize.⁶⁷ Eventhough 1stG bio-fuels are in a highly developed stage with regard to production, infrastructure and vested markets, research on 2ndG bio-fuels and the use thereof

61 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179; Rosamond *et al* 2003 *Environment* 39; Manahan *Fundamentals of Environmental Chemistry* 1109.

62 Manahan *Fundamentals of Environmental Chemistry* 1108; Rosamond *et al* 2003 *Environment* 39; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179.

63 International Energy Agency *Biofuels for Transport* 172; Larson *Energy for Sustainable Development* 110.

64 Manahan *Fundamentals of Environmental Chemistry* 1108-1111; Lynd *et al* 2003 *South African Journal of Science* 501; Amigun, Sigamoney and Von Blotnitz *Renewable and Sustainable Energy Reviews* 703. These well established technologies and research methods used for the production of 1stG bio-fuels include the fermentation processes of sugars in plant material; the *Fischer-Tropsch* synthesis of hydrocarbons from biomass and various other well established technological processes which will not be discussed in depth due to the nature of this study.

65 Von Maltitz and Brent *Assessing the Biofuel Options* 10; Southern African Biofuels Association *The Impact of Biofuels on Food Security* 10; Saket *Food Versus Fuel* 8. See chapter 3.1 below for the food versus fuel debate.

66 Eisentraut *Sustainable Production of Second-Generation Biofuels* 8; and Rosamond *et al* 2003 *Environment* 34.

67 Rosamond *et al* 2003 *Environment* 34; Manahan *Fundamentals of Environmental Chemistry* 1109; Eisentraut *Sustainable Production of Second-Generation Biofuels* 22.

are still in the demonstration phase but already shows potential benefits such as the consumption of waste residues and the use of discarded land.⁶⁸

2ndG Bio-fuels prove to be a more viable and sustainable solution which would contribute to and promote the main objectives of the South African government, namely to create jobs, develop rural areas and thus alleviate poverty.⁶⁹ 2ndG bio-fuels can also be blended with petroleum based fuels for combustion in existing internal combustion engines or can completely replace petroleum-based fuels by being distributed through the existing infrastructures for use in adapted vehicles with internal combustion engines.⁷⁰ The feasibility and sustainability of a bio-fuels industry would largely depend on the choice of generation of bio-fuels.⁷¹ For example, if a government chooses to use only 1stG bio-fuels and is a developing country with food insecurity the bio-fuels industry would probably be unsustainable.⁷² The concept of sustainability must be incorporated into a bio-fuels industry of a country in order for it to be feasible and positively contribute to the economic growth, the environment and the society as a whole.⁷³

3 Feasibility of bio-fuels

Since the introduction of bio-fuels as a possible alternative to unsustainable fossil fuels there have been numerous publications regarding the impact of bio-fuels on

68 Eisentraut *Sustainable Production of Second-Generation Biofuels* 21; Rosamond *et al 2003 Environment* 34; Von Maltitz and Brent *Assessing the Biofuel Options* 12; Lynd *et al 2003 South African Journal of Science* 506.

69 Eisentraut *Sustainable Production of Second-Generation Biofuels* 22; DEAT *A National Framework for Sustainable Development* 39.

70 Von Maltitz and Brent *Assessing the Biofuel Options* 10; Rosamond *et al 2003 Environment* 34; Manahan *Fundamentals of Environmental Chemistry* 1109; Lynd *et al South African Journal of Science* 506.

71 Eisentraut *Sustainable Production of Second-Generation Biofuels* 55; Rosamond *et al 2003 Environment* 34.

72 Eisentraut *Sustainable Production of Second-Generation Biofuels* 55.

73 Eisentraut *Sustainable Production of Second-Generation Biofuels* 55; Amigun, Sigamoney and Von Blotnitz *Renewable and Sustainable Energy Reviews* 705; Von Maltitz and Brent *Assessing the Biofuel Options* 12. See 4.1 below regarding the discussion of sustainable development incorporated in the bio-fuels industry and planning tools used to determine the sustainability of a bio-fuels policy.

food security especially in developing countries.⁷⁴ In South Africa various government officials and writers have cast a shadow of doubt over the possibility of the feasible utilisation of maize for bio-fuels purposes and argue that it might impact the food security, cause inflation in food prices and possibly increase GHGs through land use change and agricultural activities.⁷⁵ Bio-fuels activists on the other hand argue that bio-fuels could provide South Africa with a fast-track growth option in the agricultural sector, alleviate poverty, promote the development of rural and underutilised areas, sustainably supply the population with modern renewable and environmentally friendly energy, provide poor areas with energy and infrastructure and contribute to economical and political growth.⁷⁶

The complex challenges in the path to sustainable economical development; the need for food and energy security in developing countries; the protection of the natural resources and the environment; the global increase in crude oil prices and import tariffs; the limited capacity for the generation of energy; the need to reduce GHG emissions; the possible development of social and agricultural structures; global economical investments and international competition are all relevant and possible drivers for the establishment of a feasible bio-fuels industry in South Africa.⁷⁷ Bio-fuels seem to be a feasible alternative to current fossil fuels.⁷⁸ However, there seems to be various advantages and disadvantages to the idea of a bio-fuels industry in South Africa which need to be weighed up against each other in order to determine the feasibility of such a bio-fuels

74 See generally Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati and Pimentel 1997 *BioScience* 590; Rosamond *et al* 2003 *Environment* 36; National Biofuels Task Team *National Biofuels Study* 73; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.

75 Southern African Biofuels Association *The Impact of Biofuels on Food Security* 10; Rosamond *et al* 2003 *Environment* 32; Saket *Food versus Fuel* 10; Von Maltitz and Brent *Assessing the Biofuel Options* 11.

76 Ottinger *Biofuels: Potential, Problems and Solutions* 9; Diouf *Climate Change and Energy Insecurity* 107; Winkler *Energy Policies for Sustainable Development* 190.

77 Lynd *et al* 2003 *South African Journal of Science* 499; Giampietro, Ulgiati, and Pimentel 1997 *BioScience* 587; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2386; Ottinger *Biofuels: Potential, Problems and Solutions* 2.

78 Saket *Food versus Fuel* 2; Winkler *Energy Policies for Sustainable Development* 3; Marrison and Larson *Biomass and Energy* 337.

industry.⁷⁹ The various arguments for and against bio-fuels will be referred to briefly in the next paragraphs.⁸⁰

3.1 Food versus fuel debate

The food versus fuel debate raised many concerns regarding the sustainable development of a bio-fuels industry. The production of bio-fuels on commercial level and the impact it might have on the global food security are being questioned.⁸¹ The food versus fuel debate is a constant weighing of the advantages that bio-fuels present and the negative impacts and consequences it might have on the food security.⁸² Maize is the primary crop used for the production of bio-ethanol, but is also the primary staple food in Africa.⁸³ It is doubtful whether Europe and the United States of America (USA) will be able to produce enough crops to meet the demands of their major bio-fuels industries.⁸⁴

Developing nations which are closer to the temperate zone such as South Africa could produce biomass much faster.⁸⁵ For South Africa this might be an opportunity to bridge the gap between first and second economies by producing

79 Ottinger *Biofuels: Potential, Problems and Solutions* 2; Winkler *Energy Policies for Sustainable Development* 20; Lynd *et al* 2003 *South African Journal of Science* 506.

80 Due to the content of this dissertation, the debates could only be discussed in general terms.

81 See Chapter 2 above. Saket *Food versus Fuel* 5; Ottinger *Biofuels: Potential, Problems and Solutions* 3; Boddiger 2007 *The Lancet* 924. Saket *Food versus Fuel* 2; Winkler *Energy Policies for Sustainable Development* 3; Marrison and Larson *Biomass and Energy* 337.

82 Saket *Food versus Fuel* 5; Ottinger *Biofuels: Potential, Problems and Solutions* 2; Lynd *et al* 2003 *South African Journal of Science* 501.

83 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179. 95% of the maize produced in Africa is destined for human consumption. There are 22 countries in the world where maize is the primary staple food and 16 are on the African continent.

84 Ottinger *Biofuels: Potential, Problems and Solutions* 2; Winkler *Energy Policies for Sustainable Development* 20; Lynd *et al* 2003 *South African Journal of Science* 506

85 Boddiger 2007 *The Lancet* 924; Southern African Development Community *Feasibility Study for the Production and Use of Biofuel* 24; Von Braun and Pachauri *The Promises and Challenges of Biofuels* 6; Von Maltitz and Brent *Assessing the Biofuel Options* 3.

more biomass and exporting it for bio-fuels purposes.⁸⁶ The higher prices of bio-fuels products could provide for larger incomes for poor farmers.⁸⁷

3.2 High food prices

Another argument with regard to bio-fuels is that it contributes to high food prices which could lead to starvation in poor countries.⁸⁸ It is argued that even though an increase in the demand for bio-fuels could help poor farmers to receive larger incomes by increasing the prices of their crops, those higher prices could also be to the disadvantage of the same farmers for they need to spend their income on more expensive food for the following season.⁸⁹ Due to the research in technologies currently used for bio-fuels production, it is argued that for at least the next 10 years, bio-fuels production will depend on the use of feed crops.⁹⁰ Currently South Africa produces about 9 million tonnes of maize each year which is also the amount demanded for human consumption.⁹¹ It is argued that production can be increased up to between 12 million and 14 million tonnes.⁹² It seems that South Africa may have the technical and agricultural potential to produce a surplus of maize for bio-fuels purposes, but what would the impact be on the economy?⁹³

86 Boddiger 2007 *The Lancet* 924.

87 Saket *Food versus Fuel* 9; Boddiger 2007 *The Lancet* 924; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 178. As global bio-fuel industries grow, significant economic and financial investment opportunities could emerge for small-scale farmers and developing countries.

88 Von Maltitz and Brent *Assessing the Biofuel Options* 10; Southern African Biofuels Association *The Impact of Biofuels on Food Security* 10; Saket *Food versus Fuel* 8.

89 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179; Rosamond *et al* 2003 *Environment* 33. Food inflation increased by about 22% in South Africa alone.

90 Rosamond *et al* 2003 *Environment* 33; Saket *Food versus Fuel* 5; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179.

91 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 180; Von Maltitz and Brent *Assessing the Biofuel Options* 3; DEAT *Emerging Issues: Biofuels* 5.

92 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 180; Von Maltitz and Brent *Assessing the Biofuel Options* 3.

93 DEAT *Emerging Issues: Biofuels* 5; Von Maltitz and Brent *Assessing the Biofuel Options* 3; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 180.

3.3 *Economic benefits*

For the current year South African farmers have produced about 6 million tonnes in surplus maize which lead to low demand for maize and even lower food prices.⁹⁴ The income that farmers received was therefore much less than their input costs.⁹⁵ However, if the demand for bio-fuels increases, the price for crops (for food and bio-fuels purposes) may increase, meaning a larger income for farmers but more expensive food prices.⁹⁶ If farmers commence commercial production of maize for bio-fuels purposes only a small portion will benefit in an economical and financial way.⁹⁷

The majority of the South African population is not active in large commercial farming and are thus vulnerable to increased food prices.⁹⁸ The high food prices could contribute to hunger and food insecurity in South Africa.⁹⁹ There are however, various reasons for the rise of food prices and food inflation that excludes bio-fuels production.¹⁰⁰ A complex set of factors may contribute to higher food prices and food inflation such as droughts and poor rainfall; an increase in food demand and market competition; an increase of agricultural input costs for machinery and fertilizers; an increase in the price of crude oil; market inefficiencies and competition for land.¹⁰¹

94 Von Maltitz and Brent *Assessing the Biofuel Options* 3; DEAT *Emerging Issues: Biofuels* 5; Saket *Food versus Fuel* 8.

95 Von Maltitz and Brent *Assessing the Biofuel Options* 3; DEAT *Emerging Issues: Biofuels* 5; Rosamond *et al Environment* 32.

96 Saket *Food versus Fuel* 8; Von Maltitz and Brent *Assessing the Biofuel Options* 3.

97 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 180; Von Maltitz and Brent *Assessing the Biofuel Options* 3.

98 Von Maltitz and Brent *Assessing the Biofuel Options* 3.

99 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 180; Von Maltitz and Brent *Assessing the Biofuel Options* 3. Large commercial farmers will increase the prices of their maize in order to export it for bio-fuels purposes. The potential for farmers' wages to increase in developing countries is real, but the possibility also exist that food prices will increase and create even more hardships on poor consumers.

100 Southern African Biofuels Association *The Impact of Biofuels on Food Security* 10; Rosamond *et al 2003 Environment* 32.

101 Saket *Food versus Fuel* 10; Von Maltitz and Brent *Assessing the Biofuel Options* 11; Southern African Biofuels Association *The Impact of Biofuels on Food security* 10.

3.4 Competition for land

Bio-fuels, it seems, will for the coming years primarily depend on agricultural goods and products¹⁰² and will be constrained by the competition for land between food crops and crops for bio-fuels purposes.¹⁰³ If crops are grown on a large scale for bio-fuel purposes it will also be limited by the competition with food crops for various agricultural inputs such as land use; financial investments; adequate infrastructure; necessary labour and agricultural machinery; water resources and agricultural fertilisers.¹⁰⁴ Although the South African agriculture may currently be able to increase the production of maize without putting a strain on natural resources and current food supplies, a growth in the demand for bio-fuels may lead to a limitation in land availability.¹⁰⁵

Land could be diverted for bio-fuel cultivation if the demand for bio-fuels increases, but this may cause detrimental environmental impacts, such as deforestation, land degradation and the conversion of grasslands for crops cultivation.¹⁰⁶ This eventually may contribute to scarce resources, food insecurity and possibly even more CO₂ emissions due to deforestation.¹⁰⁷ To establish a feasible and sustainable bio-fuels industry in South Africa the government must determine which land will be most suitable and in which way it must be used.¹⁰⁸ South Africa stretches over an area of about 122 million hectares and between

102 See chapter 2 above.

103 Rosamond *et al* 2003 *Environment* 34; Amigun, Sigamoney and Von Blottnitz 2008 *Renewable and Sustainable Energy Reviews* 704. See chapter 2 above. Research on 2nd G bio-fuels and the use thereof are still in the demonstration phase but already show potential benefits.

104 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 182; Rosamond *et al* 2003 *Environment* 38; Von Maltitz and Brent *Assessing the Biofuel Options* 11.

105 DEAT *Emerging Issues: Biofuels* 5; Von Maltitz and Brent *Assessing the Biofuel Options* 9; Saket *Food versus Fuel* 10.

106 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 180; Von Maltitz and Brent *Assessing the Biofuel Options* 3; DEAT *Emerging Issues: Biofuels* 5.

107 Morris *Strong Land Use Policy* 1; Saket *Food versus Fuel* 11; Von Maltitz and Brent *Assessing the Biofuel Options* 3; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.

108 Morris *Strong Land Use Policy* 1.

11% and 13% of that is arable land.¹⁰⁹ However, only 3% of this arable land acquires rich conditions and high agricultural potential.¹¹⁰ The degraded land could be cultivated and improved for bio-fuels purposes, which could help restore the nutrient contents of the land, contribute to rural development and the improvement of agricultural practices, and provide poor areas with infrastructure and new investments.¹¹¹ It may still, however, lead to virgin land being exploited for bio-fuel purposes.

The issue in South Africa is that the current form of land tenure needs to be addressed and contemplated while taking into account the planning and preparation for the initial stages of the bio-fuels industry before further research and investments are done with regard to bio-fuels.¹¹² The social, political and economical deliberations of a society are reflected in the form of land tenure.¹¹³ Landholding in South Africa during the *Apartheid* era was dominated by the white minority and the landholding system was a racially discriminatory one.¹¹⁴ Certain areas in South Africa where designated for occupation by blacks and the elite or developed areas with infrastructure were designated for white ownership.¹¹⁵

109 Morris *Strong Land Use Policy* 1; DEAT *Emerging Issues: Biofuels* 4. About 13% of South Africa's land surface is arable and not all of it is in use.

110 Morris *Strong Land Use Policy* 1; DEAT *Emerging Issues: Biofuels* Issues 4.

111 Saket *Food versus Fuel* 11; Rosamond *et al* 2003 *Environment* 34; Amigun, Sigamoney and Von Blottnitz 2008 *Renewable and Sustainable Energy Reviews* 704; DEAT *Emerging Issues: Biofuels* Issues 4. Rosamond *et al* 2003 *Environment* 34; Amigun, Sigamoney and Von Blottnitz 2008 *Renewable and Sustainable Energy Reviews* 704; DEAT *Emerging Issues: Biofuels* Issues 4.

112 Boddiger 2007 *The Lancet* 924; Carey Miller and Pope *Land Title in South Africa* 457.

113 Carey Miller and Pope *Land Title in South Africa* 457; Bernstein *Land Reform in South Africa* 5.

114 Carey Miller and Pope *Land Title in South Africa* 457; Lahiff *Land Reform in South Africa* 1.

115 The *Natives Land Act* 27 of 1913 provided for the territorial segregation of natives (blacks) and persons that were not natives (whites). The *Native Trust and Land Act* 18 of 1936 went further and provided that the areas designated for blacks will be held in trust by the state for blacks. Blacks held land under a trust tenure system while whites had the luxury of an individual tenure system of landholding. Other acts that provided for the racially based segregation during the *Apartheid* era were the *Group Areas Act* 41 of 1950.

The South African government announced in 2001 that it will distribute at least 30% of agricultural land to blacks by the end of 2004.¹¹⁶ By the end of 2004 only 3.5 million hectares has been delivered under the land reform programme.¹¹⁷ Only 4.3% of agricultural land has been transferred.¹¹⁸ Another 20.6 million hectares of agricultural land need to be delivered before the goal of 30% will be reached.¹¹⁹

This could be problematic for a bio-fuels industry for the owner of land designated for the production of bio-fuel crops will have to conclude some sort of an agreement with bio-fuel companies and (if provided for) apply for governmental support or subsidies. If the person that occupies the land designated for the production of bio-fuel crops is deprived of his or her rights and then given for instance to a communal property association under the *Communal Property Associations Act*¹²⁰ it may affect the production of crops for bio-fuel companies. Most of these lands transferred to previous disadvantaged communities are large commercial agricultural farms.¹²¹

Where degraded land could be improved and diverted for bio-fuel crops the possibility exist that it may require extensive governmental support in the form of financial assistance and education of farmers in the new and effective agricultural practices.¹²² One must also note that it is a costly process to improve land,

116 Bernstein *Land Reform in South Africa* 13. Carey Miller and Pope *Land Title in South Africa* 457. The primary objective of the land tenure reform process in South Africa is to facilitate and reallocate the rights in land within the framework of substantive principles and rules of property law. After 1994 the legal forms of land holding that were racially discriminatory based in the past began the land tenure reform process in order to bring all persons that occupies land under one unitary and legal system of landholding; to promote the security of tenure; to make provision for the redress of those persons that were dispossessed of their property after 19 June 1913 under the discriminatory laws and practices of the past.

117 Bernstein *Land Reform in South Africa* 13; DRDLR *Annual Report* 29. This includes the redistribution, restitution, and tenure reform programmes.

118 Bernstein *Land Reform in South Africa* 13; DRDLR *Annual Report* 29.

119 Lahiff *Land Reform in South Africa* 3; Bernstein *Land Reform in South Africa* 13.

120 28 of 1996.

121 Lahiff *Land Reform in South Africa* 3; Bernstein *Land Reform in South Africa* 13.

122 Lahiff *Land Reform in South Africa* 3; Bernstein *Land Reform in South Africa* 13; Boddiger 2007 *The Lancet* 926. Due to South Africa's complex system of land tenure it is more likely for a person with a legal right to allocate the concerned land for bio-fuel crops

purchase fertilisers and other chemicals which might have negative impacts on the environment.¹²³

3.5 Emissions, alleviation of poverty, oil and developing countries

The improvement and cultivation of potential arable land for bio-fuel crops would require extensive agricultural input costs and products such as irrigation and fertilizers.¹²⁴ Bio-fuels may therefore not be as carbon neutral as it is made out to be.¹²⁵ A large percentage of GHGs are the result of agricultural practices and specifically fertilisers which cause the release of carbons.¹²⁶ Bio-fuels may also create a carbon debt due deforestation.¹²⁷ Natural forests are the largest contribution to global environmental health.¹²⁸

Some argue that bio-fuels production would be a win-win situation for developing countries.¹²⁹ By producing bio-fuels a country would be able to reduce their energy costs by using their own bio-fuels and reduce or even end the overdependence on oil imports from unstable Middle East economies.¹³⁰ This would save billions of import costs which could rather be invested in job creation,

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- and will benefit from the bio-fuel crop production on the land. The person with an informal right or no right will lose his benefits from the current use of the land.
- 123 Saket *Food versus Fuel* 10; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2395.
- 124 Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati, and Pimentel 1997 *BioScience* 590; National Biofuels Task Team *National Biofuels Study* 73; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.
- 125 See generally Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati and Pimentel 1997 *BioScience* 590; Rosamond *et al* 2003 *Environment* 36; National Biofuels Task Team *National Biofuels Study* 73; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.
- 126 See generally Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati and Pimentel 1997 *BioScience* 590; Rosamond *et al* 2003 *Environment* 36; National Biofuels Task Team *National Biofuels Study* 73; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.
- 127 Searchinger *et al* 2008 *Science* 1238; Fargione *et al* 2008 *Science* 1236.
- 128 Rosamond *et al Environment* 36; Searchinger *et al* 2008 *Science* 1238; Fargione *et al* 2008 *Science* 1236.
- 129 Saket *Food versus Fuel* 10; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 178; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2395.
- 130 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 178; Von Maltitz and Brent *Assessing the Biofuel Options* 9.

rural development, developing and improving the economy, alleviate poverty, modernise and develop agricultural land and practices which might result in an increased food production.¹³¹

With this in mind, in 2000 the Millennium Declaration¹³² was adopted and introduced eight Millennium Development Goals (MDGs) which would drive the developing world to face its challenges.¹³³ These goals are the alleviation and eradication of poverty and hunger; to achieve a level of at least primary education in all countries; to reduce child mortality; to improve maternal health; to fight acquired immune deficiency (AIDS) and human immunodeficiency virus (HIV); to ensure environmental sustainability; and to establish a global alliance for the promotion of development in all sectors.¹³⁴

To alleviate and reduce poverty and world hunger is at the centre of most countries' initiative, national goals and strategies.¹³⁵ In South Africa the primary driver for a bio-fuels industry is to develop the economy and to provide for more jobs in order to alleviate poverty and promote rural development.¹³⁶ However, it is way too early to determine whether a bio-fuels industry in South Africa would move the country closer or further from achieving its MDGs. What is of primary importance is that a bio-fuels industry must be carefully planned and should incorporate sustainability in the sense that it must provide for the promotion and development of the bio-fuels industry within the boundaries of the social, economical and environmental resources.¹³⁷

131 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 178; DEAT *Emerging Issues* 4.

132 United Nations Millennium Summit September 2000.

133 Anon 2010 www.sustainabilitysa.org/SAGovernmentsresponsetoClimateChange/SAandtheMDGs.aspx.

134 Anon 2010 www.sustainabilitysa.org/SAGovernmentsresponsetoClimateChange/SAandtheMDGs.aspx.

135 Rosamond *et al* 2003 *Environment* 1; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2387.

136 Von Maltitz and Brent *Assessing the Biofuel Options* 12.

137 Richardson and Wood *Environmental Law* 14; Baker *Sustainable Development* 7; Von Maltitz and Brent *Assessing the Biofuel Options* 12.

3.6 Conclusion

Prima facie it seems that bio-fuels can provide a solution to the issues regarding energy security and efficiency in a developing country; and provide for an adaptation measure to the effects of climate change.¹³⁸ One cannot ignore the fact that these issues and impacts of a bio-fuels industry can have detrimental impact on the environment which may contribute to biodiversity loss. The entire life-cycle of bio-fuels production must be regulated and monitored in order for bio-fuels to present a solution to energy efficiency and security and the effects of climate change.

This implies that there should be some sort of a regulatory framework for the implementation of a bio-fuels industry on large scale. The question to ask is if there exist any policies that provide a framework within which bio-fuels can be sustainably developed? Further, is there legislation that can or already does deal with bio-fuels? An explanation regarding the concept of sustainable development will first follow after which certain policies will be identified that could possibly provide for a regulatory framework for a bio-fuels industry in South Africa.

4 Sustainable development

To determine whether a bio-fuels industry is viable it can be measured against the principles of sustainable development. The principle of sustainable development is universally accepted and formulated in the *Brundlandt Report*¹³⁹ as development which "meets the needs of the present without compromising the ability of future generations to meet their own needs."¹⁴⁰ This seems to be a difficult task for a developing country. How can a country develop to its full potential without compromising the needs of its future generations? The South

138 See discussion in 3 above.

139 World Commission on Environment and Development (WCED) was convened by the United Nations in 1983.

140 Our Common Future (Brundtland Report) was published in 1987 by the United Nations World Commission on Environment and Development (WCED).

African government developed its own definition of sustainable development in the *National Environmental Management Act*¹⁴¹ (NEMA).¹⁴²

NEMA states that sustainable development is the "integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations."¹⁴³ This definition of sustainable development in NEMA provides that the integrity of the natural resources, financial assets and human well being be promoted and protected to ensure that economical and social development is achieved within the environmental limits.¹⁴⁴ Sustainable development has three components which require equal attention and are imbedded within one another.¹⁴⁵ The first is the social component which relates to the moral values, norms, relationships and political institutions such as organs of state and structures of government and influential organisations of humans.¹⁴⁶ Secondly is the economic component which deals with the provision and distribution of needed resources between the supply and demand sides.¹⁴⁷ Finally the ecological component is part of sustainable development in order to manage the impacts and contributions of the economic and social sectors on the environment and the natural resources.¹⁴⁸

All three these components are underpinned by *governance* which is responsible for the sustainable management of all three components by way of policy, plans, strategies and legislation containing principles of sustainable development and

141 107 of 1998.

142 DEAT *A National Framework for Sustainable Development* 14.

143 S 1 of NEMA.

144 Glazewski *Environmental Law* 14-15; Richardson and Wood *Environmental Law* 14; Bethlehem and Goldblatt *The Bottom Line* 4-5. In other words, the environment and natural resources needs to be conserved and protected for future generations while at the same time the economical, social, political and human well being of present generations are developed and improved.

145 Baker *Sustainable Development* 7; Richardson and Wood *Environmental Law* 15.

146 Dresner *The Principles of Sustainability* 1-3; Baker *Sustainable Development* 7; Richardson and Wood *Environmental Law* 13.

147 Baker *Sustainable Development* 7; DEAT *A National Framework for Sustainable Development* 15.

148 Richardson and Wood *Environmental Law* 15; Glazewski *Environmental Law* 14-15; Dresner *The Principles of Sustainability* 1-3; Baker *Sustainable Development* 7.

other management and regulatory tools.¹⁴⁹ Governance consists of public environmental governance and private environmental governance.¹⁵⁰ Public environmental governance refers to the state's responsibilities with regard to the implementation and regulation of activities detrimental to the environment by way of legislative and statutory measures, implementing strategies and policies that will promote sustainable development.¹⁵¹ The private sector has a duty to comply with legislation and therefore need to implement and integrate sustainable development into their corporate responsibilities.¹⁵² Corporate (or private) environmental management is mostly driven by the need to comply with statutory duties.¹⁵³

Sustainable development focuses on the improvement of the society and economy while taking into consideration the limits and boundaries of the environment.¹⁵⁴ The principles of sustainable development could be used to achieve a balance between social, economical and environmental sectors.¹⁵⁵ Due to the impacts a bio-fuels industry may have on the environment, sustainable development needs to be incorporated into the regulatory framework provided for the energy, renewable energy and ultimately a bio-fuels industry.

Before continuing, one must recognise that there is a difference between the concept of sustainability and the concept of sustainable development.¹⁵⁶ Mostly

149 DEAT *A National Framework for Sustainable Development* 14. The South African government argues that sustainable development within the country is the constant and equally integration of these three mentioned sectors and thus would provide that these sectors stay equally compatible and nurtured while the primary development challenges in the country are met through specific actions taken by government.

150 Kotzé *Environmental Compliance and Enforcement* 115.

151 Kotzé *Environmental Compliance and Enforcement* 120.

152 Kotzé *Environmental Compliance and Enforcement* 118.

153 Kotzé *Environmental Compliance and Enforcement* 116.

154 Dresner *The Principles of Sustainability* 63; Baker *Sustainable Development* 7; Reboratti *Sustainability and the Social Sciences*; Hodas 1998 *Widener Law Symposium Journal* 6.

155 Dresner *The Principles of Sustainability* 3; Richardson and Wood *Environmental Law* 15; Glazewski *Environmental Law* 14-15.

156 Baker *Sustainable Development* 7; Reboratti *Sustainability and the Social Sciences*; Dresner *The Principles of Sustainability* 3; Richardson and Wood *Environmental Law* 15; Glazewski *Environmental Law* 14-15. Sustainability of a project or object primarily refers to the ability to manage and regulate the concerned project or object in such a way to

these two concepts are used interchangeable. However, sustainable development can be seen as one of the pathways to achieve sustainability.¹⁵⁷ For the purpose of this dissertation the two concepts are used as synonyms except where otherwise indicated.

For the purpose of this study and the development of a bio-fuels industry in a developing world, sustainable development can be interpreted as to mean that the primary aim of sustainable development is to prevent biodiversity loss.¹⁵⁸ Proximately biodiversity loss is brought about through the overexploitation of natural resources, pollution, climate change and habitat alteration and loss which is brought about through ultimate causes such as market failures and policy distortions, wealth and poverty and inequity, consumer attitudes and preferences and human population dynamics.¹⁵⁹

achieve a perfect balance between the impacts of the project or object on the social, economical and environmental sectors.

157 Du Plessis and Rautenbach 2010 *Potchefstroom Electronic Law Journal* 43.

158 Turpie *Fuggle and Rabie's Environmental Management* 39. Biodiversity is defined in S 1 of the *National Environmental Management: Biodiversity Act* 10 of 2004 as the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.

159 Turpie *Fuggle and Rabie's Environmental Management* 39.

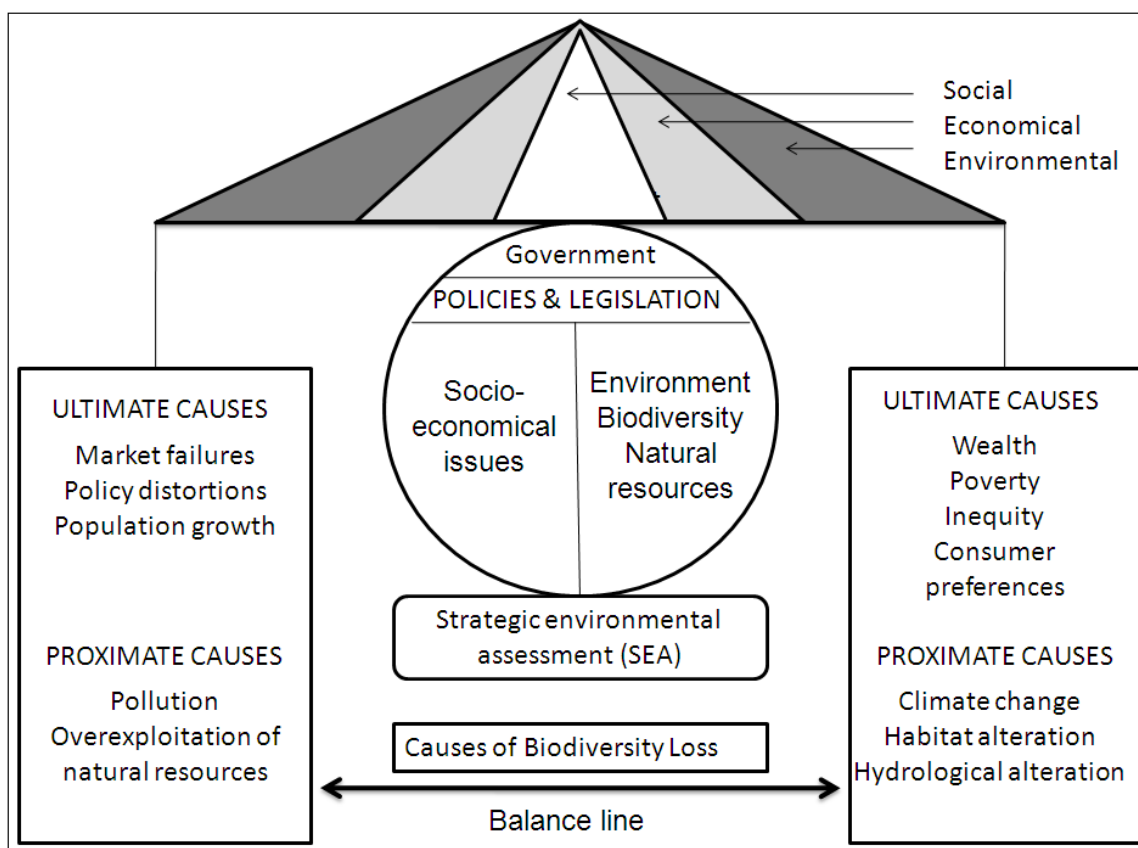


Figure 1: A schematically explanation of the definition of sustainable development with regard to biodiversity loss and strategically environmental assessment at decision making level for the implementation of a bio-fuels industry.¹⁶⁰

Sustainable development planning and conservation is required in this regard to identify the balance line and provide for a maximum of constraints on the biodiversity and its natural resources. With regard to bio-fuels this would entail sustainable development planning to determine the constraints that a bio-fuels industry would place on the environment and then identify the balance line that should be kept in order for the bio-fuels industry to be sustainable.

4.1 Sustainable development for the purpose of an bio-fuels industry

Sustainable development can further be defined within a set of normative environmental principles rather than being just a single recipe for environmental

160 Own model adapted from Turpie *Fuggle and Rabie's Environmental Management* 39.

policies and environmental protection.¹⁶¹ However, these principles must be built into a policy or programme in order for that policy or programme to promote sustainable development.¹⁶² In this part of the study some of the principles of sustainable development will be referred to in relation to the bio-fuels industry as well as with reference to environmental management tools that could be applied in order to give effect to these principles.

One of these principles that form the basis of sustainable development and planning is the precautionary principle.¹⁶³ The precautionary principle requires that preventative steps or solutions be made before the anticipated risks can even take place or occur.¹⁶⁴ To take a precautionary step means to anticipate a scenario or situation that could negatively affect the environment and then implement measures to prevent the anticipated affects from taking place.¹⁶⁵ For example, as the BFIS states, the use of maize for bio-fuel purposes shall be excluded from the initial phases of the bio-fuels industry due to the possible negative impact it might have on food supply securities in South Africa.¹⁶⁶

The management and regulation of a bio-fuels industry must be done within the limits of a specific framework. This framework must provide certain precautionary or preventive measures to prevent the negative effects of the bio-fuels industry from occurring, such as water resource management and food crops that will be used.¹⁶⁷ The government introduced various policies, plans and programs¹⁶⁸, as discussed above, to provide answers to the questions

161 Glazewski *Environmental Law* 14-15; Richardson and Wood *Environmental Law* 14.

162 Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85; Fischer *Strategic Environmental Assessment* 10

163 Richardson and Wood *Environmental law* 15; Glazewski *Environmental Law* 14-15; Dresner *The Principles of Sustainability* 1-3.

164 Glazewski *Environmental Law* 14-15; Dresner *The Principles of Sustainability* 1-3.

165 *Eagles Landing Body Corporate v Molewa NO and Others* 2003 1 SA 412 (T).

166 See 5.5 below.

167 See 3 above for the various affects bio-fuels might have and which preventive steps must be taken.

168 See 3 and 5.

regarding the energy, sustainable development, renewable energy as possible solutions and adaptation measures to climate change.¹⁶⁹

These policies are, however, fragmented and if not correlated and integrated with one another it could have serious impacts on the social, environmental and economic sectors when implementing a bio-fuels industry within this fragmented framework.¹⁷⁰ With regard to a sustainable policy regulatory framework for a bio-fuels industry a SEA could be the appropriate process to anticipate the possible negative effects of bio-fuels policy documents and provide for a framework within which preventive and precautionary steps can be taken at implementation level.¹⁷¹ SEA is a process whereby new policies, plans and programmes are evaluated and analysed before the commencement of a project.¹⁷²

The objective of a SEA is to identify the most desired principles of sustainable development and incorporate and integrated the various identified policy measures and principles to promote and develop the ultimate policy framework that will promote sustainable development.¹⁷³ Even though no universally accepted definition of SEA exists, SEA is a globally accepted process that can be used by governments to recognise environmental impacts of, and to minimise the environmental impacts of policies, plans, programmes and strategies.¹⁷⁴ In other words SEA is a process that can be used at the highest level of decision-making

169 Fischer *Strategic Environmental Assessment* 10.

170 See 3 above.

171 Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85; and Fischer *Strategic Environmental Assessment* 2.

172 Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85; and Fischer *Strategic Environmental Assessment* 10.

173 Kidd and Retief *Fuggle and Rabie's Environmental Management* 982; Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85. The SEA ensure that a decision will be taken in a more structured decision making framework which will reflect and support characteristics such as effective decision making processes; sustainable development; effective governance; and the consideration of all issues and alternatives.

174 Fischer *Strategic Environmental Assessment* 6; Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85; Kidd and Retief *Fuggle and Rabie's Environmental Management* 982.

and governmental policy making to take preventive steps, incorporate it into the policy, plan or programme for long-term sustainable development.¹⁷⁵

In the case of *Fuel Retailers Association of SA (Pty) Ltd v Director-General Environmental Management Mpumalanga and Other*¹⁷⁶ (*Fuel Retailers-case*) the court quoted the Brundtland Report that stated that:¹⁷⁷

Environmental stresses and patterns of economic development are linked to one another. Thus agricultural policies may lie at the root of land, water, and forest degradation. Energy policies are associated with the global greenhouse effect, with acidification, and with deforestation for fuel wood in many developing nations. These stresses all threaten economic development. Thus *economics and ecology must be completely integrated in decision making and lawmaking processes not just to protect the environment, but also to protect and promote development*. Economy is not just about the production of wealth, and ecology is not just about the protection of nature; they are both equally relevant for improving the lot of humankind.

The court identified certain aspects that energy policies deal with, or should deal with such as the regulation of GHGs, water resource management and deforestation for fuel wood in many developing nations.¹⁷⁸ All these stresses identified in energy policies relate and impact on the social, economical and environmental sectors.¹⁷⁹ An SEA could be the appropriate tool to integrate the management and regulation of all these stresses identified into one regulatory system.

The second principle of sustainable development is the principle of integration, which correlates with and forms part of the SEA process as well.¹⁸⁰ The integration principle requires that all decisions regarding developments must

175 Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85.

176 2007 10 BCLR 1059 (CC) (*Fuel Retailers-case*).

177 *Fuel Retailers-case* par 44 (Own emphasis).

178 *Fuel Retailers-case* Par 44.

179 *Fuel Retailers-case* Par 44.

180 Baker *Sustainable Development* 8; Richardson and Wood *Environmental Law* 14; Glazewski *Environmental Law* 14-15.

recognise the overall outcome thereof and its total impact on the environment.¹⁸¹ In other words the cost to the environment that could be caused by a proposed development must be integrated in all decision-making processes.¹⁸²

The integration of environmental impacts is normally done by conducting an environmental impact assessment (EIA).¹⁸³ The principle of integration within the ideal of sustainable development, which is to prevent biodiversity loss, provides for the reconciliation of socio-economic development with environmental protection.¹⁸⁴ In the *Fuel Retailers*-case Ngcobo J stated that:¹⁸⁵

...development cannot subsist upon a deteriorating environmental base. Unlimited development is detrimental to the environment and the destruction of the environment is detrimental to development. Promotion of development requires the protection of the environment. Yet the environment cannot be protected if development does not pay attention to the costs of environmental destruction. The environment and development are thus inexorably linked. The integration of economic development, social development and environmental protection implies the need to reconcile and accommodate these three pillars of sustainable development. Sustainable development provides a framework for reconciling socio-economic development and environmental protection.

The tool used and provided for by NEMA to integrate the consideration of the socio-economic developments and the costs of environmental destruction is the EIA process.¹⁸⁶ EIA is the process whereby data and information is collected, organised, analysed and communicated in order to identify possible impacts of a proposed project on the environment.¹⁸⁷ During this EIA process socio-economic development considerations are integrated with environmental considerations.¹⁸⁸

181 Richardson and Wood *Environmental Law* 14; Glazewski *Environmental Law* 14-15.

182 Hodas 1998 *Widener Law Symposium Journal* 6; Baker *Sustainable Development* 8; Reboratti *Sustainability and the Social Sciences*.

183 Bradbrook and Ottinger *Energy Law and Sustainable Development* xi; Haywood and De Wet *Sustainability Assessment* 2. However, EIA is not often performed for energy infrastructure developments.

184 This is also the aim on NEMA by making provision for EIAs.

185 *Fuel Retailers*-case Par 44 and 55.

186 Kidd and Retief *Fuggle and Rabie's Environmental Management* 982.

187 Kidd and Retief *Fuggle and Rabie's Environmental Management* 982; Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 42.

188 Kidd and Retief *Fuggle and Rabie's Environmental Management* 982.

An EIA must also take into consideration the guidelines and precautionary and preventive measures of a SEA when performed and in existence.¹⁸⁹

EIA, as a project related tool, identifies the impacts, risk and advantages that the proposed project might have on the environment, society and the economy within the sustainable policy framework provided for by SEA.¹⁹⁰ For example, with regard to the bio-fuels industry this would mean that before agricultural land could be cultivated for the production of bio-fuel crops a complete EIA would have to be conducted in order to determine the impacts on the land use changes, water resources and deforestation if applicable.¹⁹¹ The same would go for when a bio-fuels plant is constructed.

The third principle of sustainable development is that of equity.¹⁹² Intergenerational equity requires of the present generation to protect and promote the health, well being and productivity of humans and maintain the natural ecosystems in order to promote and eventually achieve the goal of

189 Fischer *Strategic Environmental Assessment* 6; Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85. SEA's objective is to prevent a policy from causing negative impacts and proactively promote positive developments.

190 Fischer *Strategic Environmental Assessment* 6; Abaza, Bisset and Sadler *Environmental Impact Assessment and Strategic Environmental Assessment* 85. EIA is a project or activity related planning tool and not situated for policy or strategy planning at a higher level of decision making. NEMA lacks to mention the SEA as a planning tool for policies. The SEA can be applied to a wider range of situation than the EIA. The SEA process provides for the consideration of environmental impacts and alternatives of a proposed policy at a higher level of decision making. The SEA process provides a policy framework within which EIAs must be conducted and take the findings of the SEA process into account and must therefore be implemented before an EIA can be performed.

191 With regard to the development of a bio-fuels policy, SEA at government level is a necessity due to the wide spread issues and cumulative affects a bio-fuels project might have in the future. As said, EIA is designed to address the issues of a certain project or activity. For example an EIA for the establishment of a bio-fuels plant would have to take into consideration issues such as the location or proposed site for the plant; the distance of the plant from the nearest land used for bio-fuel crops and what the impact of the transport thereof to the processing plant would be; or the total CO₂ emissions due to the transport of the bio-fuel crops and whether it would be worthwhile to establish the plant to reduce CO₂ emissions.

192 Richardson and Wood *Environmental law* 14; Dresner *The Principles of Sustainability* 1-3; Glazewski *Environmental Law* 13.

prosperity for all people.¹⁹³ With regard to bio-fuels, intergenerational equity would for example mean that a bio-fuels policy and bio-fuels industry would have to consider all the possibilities that would be most beneficial to the entire population.¹⁹⁴

The following question arises. How will one know when a policy, legislative document would accommodate equity? To determine the equity of a legislative document, policy or project an evaluation, monitoring and reporting process need be followed. On policy and decision making level, this evaluation, monitoring and reporting process could be performed by way of an SEA. On project and implementation level, such as a fully functioning bio-fuels industry, a Life Cycle Assessment (LCA) should be conducted.¹⁹⁵ In other words, to determine the equity of a policy, legislative document or project, it should be evaluated and measured against the principle of equity and also the balance line identified by sustainable development planning.¹⁹⁶

Efficient environmental management should cover the entire life cycle of a project.¹⁹⁷ The LCA is an assessment of the pressure placed upon the carrying ability of the environment or concerned ecosystem by the bio-fuels industry.¹⁹⁸ The LCA is a global and prominent method for the evaluation of the total environmental performance of a product, process or pathway during its entire life cycle.¹⁹⁹ The entire LCA is done by calculating and measuring the processes

193 Richardson and Wood *Environmental Law* 13; Dresner *The Principles of Sustainability* 1-3. The requirement of intra-generational equity deals with the injustices between nations and communities, for example the protection of human rights is one way to support intra-generational equity. A discussion of intra-generational equity is not of importance to this study for the study deals with the implementation of a bioOfuelos industry in South Africa only.

194 Hodas 1998 *Widener Law Symposium Journal* 9; Richardson and Wood *Environmental Law* 14.

195 See figure 2 below.

196 See figure 1.

197 Nel and Kotzé *Fuggle and Rabie's Environmental Management* 14-15.

198 André, Delisle and Revèret *Environmental Assessment* 32; Gnansounou 2009 *Bioresource Technology* 4921; Kaltschmitt, Reinhardt and Stelzer *Biomass and Bioenergy* 121.

199 Gnansounou 2009 *Bioresource Technology* 4921.

used to produce energy; and the material used and released into the environment.²⁰⁰

The first stage of the LCA is the quantitative and objective analysis of the total energy and material used and released into the environment during a process.²⁰¹ With regard to a bio-fuels industry this first stage analysis would include a analysis of the type of organic material or crops (such as maize or sugarcane for example) used; the amount of energy required to produce these crops or material, and process them into bio-fuel products (agricultural input costs such as machinery and fertilisers); the amount of emissions let out by the process (through transportation emissions; carbon debt through deforestation and land use change impacts); and the impact on water resources.²⁰²

The second stage of the LCA is a quantitative or a qualitative assessment of the negative and positive impacts of the use of the produced product on the environment.²⁰³ This would be one of the arguments in favour of bio-fuels. The use of bio-fuels contributes to the environmental health due to low emissions when used in transportation.²⁰⁴ The final stage would be the qualitative and quantitative analysis of the needs and possible alterations to the process to alleviate the pressure on the environment.²⁰⁵ With regard to a bio-fuels industry the last stage of the LCA would, for example, recommend the use of sugarcane for bio-ethanol instead of the use of maize in order to alleviate the pressure on water resources used for extra maize and food security.²⁰⁶

200 André, Delisle and Revèret *Environmental Assessment* 32; Gnansounou 2009 *Bioresource Technology* 4921.

201 André, Delisle and Revèret *Environmental Assessment* 32.

202 Makhubele *A water resource compliance monitoring and enforcement* 12; Gnansounou 2009 *Bioresource Technology* 4921.

203 André, Delisle and Revèret *Environmental Assessment* 32.

204 Gnansounou 2009 *Bioresource Technology* 4921; Kaltschmitt, Reinhardt and Stelzer 1997 *Biomass and Bioenergy* 121.

205 André, Delisle and Revèret *Environmental Assessment* 32; Gnansounou 2009 *Bioresource Technology* 4921.

206 Gnansounou 2009 *Bioresource Technology* 4921; Kaltschmitt, Reinhardt and Stelzer 1997 *Biomass and Bioenergy* 121.

With regard to the process of developing and establishing a bio-fuels industry the LCA could be the final tool used to improve the industry and alleviate the pressure on the environment caused by the bio-fuels industry in the initial stages. The social, economical and environmental components are embedded within each other, interdependent of each other and the patterns of production and consumption within the bio-fuels industry must be ecologically sustainable.²⁰⁷ The discussion above provides a pathway to build sustainability into the bio-fuels industry from decision-making, policy and planning level to implementation and project management.

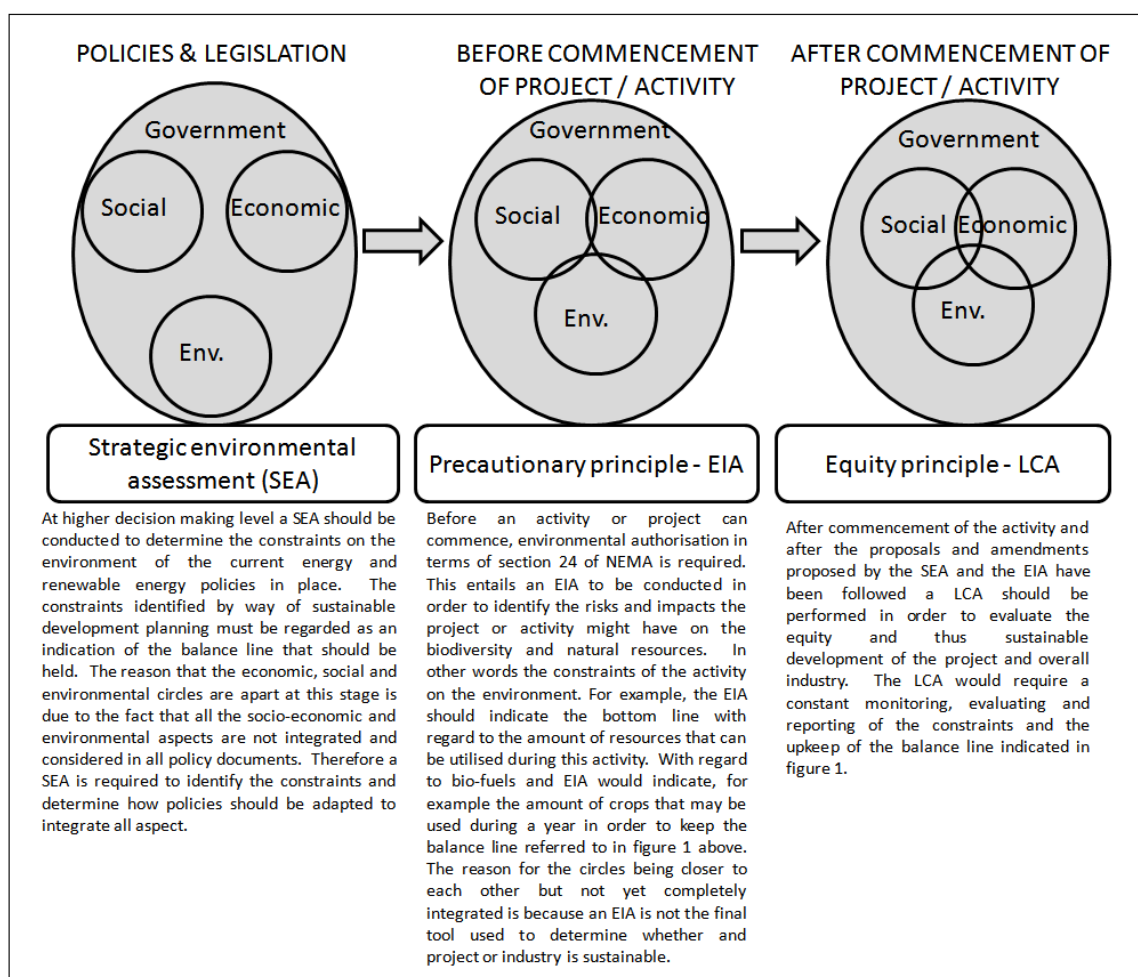


Figure 2: Building sustainability principles into a bio-fuels industry from decision-making and policy level to implementation and project management level.²⁰⁸

207 Richardson and Wood *Environmental Law* 13.

208 Own model adapted from Brent 2008 *Science Scope* 71.

Figure 2 above is a graphical explanation of the above discussion regarding the incorporation of sustainable development planning principles such as precautionary steps by way of an EIA, and integration and equity by way of an SEA on decision making level and an LCA on project and implementation level into a bio-fuels industry. There is a policy framework for renewable energy and bio-fuels in specific. The principles of sustainable development are not integrated and are found in various policy documents.

A bio-fuels industry cannot be promoted by reading the BFIS in isolation from the WPoEP, WPoRE, NFSD, JPOI or the National Climate Change Response White Paper. The policy documents mentioned above only provides a framework for a bio-fuels industry and do not regulate the bio-fuels industry. For a bio-fuels industry to be regulated, legislative measures are needed. To determine whether South Africa's policy framework for bio-fuels include sustainable development principles the South African policy framework will now be discussed.

5 South African policy framework

Bio-fuels and other forms of bio-energy have been promoted by governments and legislators as the golden solution to the effects and mitigation of climate change.²⁰⁹ Very few questions regarding the actual impact and true effects of a large scale bio-fuels industry was asked.²¹⁰ Gradually the debate shifted to the consequences of the production of bio-fuels and in no time bio-fuels became the single largest threat to food security, biodiversity, water resources, land availability and the environment in general.²¹¹ During this shift from golden solution to environmental threat, certain strategies and principles surrounding bio-fuels, such as the *Bio-fuels Industrial Strategy* and the *Bio-fuels Licensing*

209 Maier *Climate Change and Energy Insecurity* 36.

210 Maier *Climate Change and Energy Insecurity* 36.

211 See 3 above.

Criteria of the DE, has been developed but with no compliance measures or penalties for non-compliance.²¹²

A discussion regarding sustainable development policies and energy related policies in South Africa will now follow. There are various policies in South Africa containing sustainable development goals.²¹³ However, environmental issues are emerging faster than policy responses and new policies are continually required.²¹⁴ The Bio-fuels Industrial Strategy is, for example, based upon a chronologically development of government policies regarding energy and renewable energy which are found upon the principles of sustainable development and which provide for the development of a bio-fuels industry in the country.²¹⁵ The first of these policies which will be discussed is the Johannesburg Plan of Implementation (JPOI) which relates to sustainable development and can provide for the implementation of renewable energy.

5.1 The Johannesburg Plan of Implementation (JPOI)

The JPOI was adopted in 2003 and is regarded South Africa's answer to global concerns and challenges developing countries face discussed at the *World Summit of Sustainable Development*²¹⁶ (WSSD) in 1992.²¹⁷ According to the JPOI poverty alleviation; cleaner and more environmentally friendly production and consumption patterns and the protection and conservation of South Africa's natural resources for economical and social benefits within the limits of sustainable development are the keys to improve and overcome the development challenges South Africa faces.²¹⁸ The JPOI provides for certain areas that would

212 See 6 below.

213 See generally JPOI *Response Strategy*; DME *White Paper on Renewable Energy*; DEAT *A National Framework for Sustainable Development*; DEAT *National Cleaner Production Strategy*; DEAT *National Climate Change Response Strategy*.

214 Govere *From the Periphery to the Core of Decision Making* 461.

215 DME *Biofuels Industrial Strategy* 5. Due to the nature of this study only selected policies that lead the way for the drafting of the BFIS will briefly be referred to before the BFIS will be discussed.

216 *World Summit of Sustainable Development: Rio Summit 1992*.

217 JPOI *Response Strategy* 5.

218 JPOI *Response Strategy* 3.

require attention in order to promote the main purpose of the JPOI.²¹⁹ These areas include the improvement of basic social requirements such as adequate access to clean water and sanitation; safe and adequate human settlements; energy security and rural access to affordable energy and the protection of ecosystems.²²⁰

The JPOI provides that the improvement of these issues can be done by way of allocating financial resources for development projects; efficient governmental practices and cooperation; expanding economical capacity by accessing new global markets; to transfer and research new technologies; and provide better education and training.²²¹ If planned carefully and researched and implemented with sustainable development as basis a bio-fuels industry could provide for most of these goals.²²² For example, if South Africa were to enter the global market for bio-fuels products and export bio-fuels, South African farmers, including communities, could receive a larger income and contribute to economic growth and expansion and automatically energy security.²²³

5.2 White Paper on Energy Policy (WPOEP)

The second policy relating to energy is the WPOEP. In December, 1998 the government introduced the WPOEP which preceded the *National Energy Act*²²⁴ (NEA).²²⁵ After 1994 nearly all policies were re-examined by the new democratic government that set out on a path of reconstruction, development, transparency and abolishing the *Apartheid* policies and practices.²²⁶ The reconstruction and

219 JPOI *Response Strategy* 3.

220 JPOI *Response Strategy* 3.

221 JPOI *Response Strategy* 3.

222 JPOI *Response Strategy* 3; Richardson and Wood *Environmental Law* 14; Baker *Sustainable Development* 7; Von Maltitz and Brent *Assessing the Biofuel Options* 12.

223 JPOI *Response Strategy* 3; Richardson and Wood *Environmental Law* 14; Baker *Sustainable Development* 7; Von Maltitz and Brent *Assessing the Biofuel Options* 12.

224 34 of 2008.

225 DME *White Paper on the Energy Policy* 1.

226 See Bond *Unsustainable South Africa* 3-8; Currie and De Waal *The Bill of Rights Handbook* 526-527. See also the Reconstruction and Development Programme (RDP)

redevelopment of the energy sector in South Africa came to be one of the most urgent transformation challenges.²²⁷ One of the reasons for the revision of the energy policy was due to acknowledgment of the government that the energy sector is one of the largest contributors to economic growth in the country and promotes job opportunities.²²⁸

The WPoEP simultaneously recognised that coal-based energy is also one of the largest contributors to GHGs.²²⁹ The WPoEP aims to promote and improve affordable access to energy and better the governance with regard to energy by way of coordinating government departments and aligning government policies.²³⁰ The WPoEP further aims to stimulate economical growth by managing the energy sector and environmental and health related issues; secure a supply of energy by providing for more diverse energy sources; and to address energy policy issues.²³¹

By aiming to provide for a more diverse energy supply the WPoEP recognises the development of renewable energy sources and states that South Africa must monitor and research the development of renewable energy in other countries in order to adapt to the global growing trend and to compete internationally in the energy sector and economical level.²³² The WPoEP recognises that the energy sector should promote the development of new cleaner development technologies in order to compete with the global market. Even though bio-fuels are not mentioned explicitly, it does not mean that the research and development

and the government's macro-economic strategy: Growth, Employment and Redistribution (GEAR).

227 DME *White Paper on the Energy Policy* 3; Bethlehem and Goldblatt *The Bottom Line* 30; Van Schalkwyk *Climate Change and Energy Insecurity* 3.

228 Bethlehem and Goldblatt *The Bottom Line* 30; Van Schalkwyk *Climate Change and Energy Insecurity* 3; Winkler *Energy Policies for Sustainable Development* 23-30; International Energy Agency *CO2 Emissions* 10; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2387; Saket *Food versus Fuel* 6.

229 DME *White Paper on the Energy Policy* 23.

230 DME *White Paper on the Energy Policy* 28.

231 DME *White Paper on the Energy Policy* 28.

232 DME *White Paper on the Energy Policy* 79.

of bio-fuel technologies are excluded.²³³ The global production and use of bio-fuels grew with at least 40% in the past 7 years, indicating that bio-fuels technologies have become more widely available in the recent years.²³⁴ To give effect to the mitigation goals of the WPoEP, the White Paper on Renewable Energy was published in 2003.²³⁵

5.3 White Paper on Renewable Energy (WPoRE)

In 2003 South Africa introduced the WPoRE in which the government acknowledged that research and development of alternative renewable energy sources were of immediate concern and would promote the goals of the JPOI.²³⁶ South Africa agreed that emissions of GHGs from the use of fossil fuels such as coal and petroleum products had led to international concerns about global warming and thus the government promised to develop a framework within which a renewable energy industry could operate, grow, and contribute positively to the South Africa's economy and the global environment.²³⁷

The WPoRE proposed the development of renewable energy technologies and renewable energy sources such as solar power; wind power; biomass; hydro; tidal and wave energy; and geothermal to produce electricity, gaseous and liquid fuels within the energy sector.²³⁸ The WPoRE acknowledged that various obstacles existed with regard to the implementation of renewable energy in South

233 DME *White Paper on the Energy Policy* 23. Some technologies might be developed and adapted for use in South Africa. If the South African government monitors the development of bio-fuels as a renewable energy in other countries, the South African government would come to realise that there has been an increase in the use of bio-fuels and that certain technologies are well established and could be implemented in South Africa on a advantageous and profitable basis.

234 International Energy Agency *Biofuels for Transport* 33-46; Eisentraut *Sustainable Production of Second-Generation Biofuels* 32; International Energy Agency *CO2 Emissions* 17. One of the main arguments of the South-African government against bio-fuels is that it would not be profitable in the initial stages.

235 See 5.4 below.

236 DME *White Paper on Renewable Energy* 1.

237 DME *White Paper on Renewable Energy* 1.

238 DME *White Paper on Renewable Energy* 1.

Africa.²³⁹ These obstacles include expensive renewable energy technologies (RETs) which would require extensive investments and introduction of other financial support during the initiative period before it will become profitable.²⁴⁰ Most consumers and investors were unaware of the potential benefits and opportunities renewable energy could bring.²⁴¹ This could change if effective legislation were enacted and backed by carefully planned and strategically developed policies and research programmes to illustrate the feasibility and sustainability of renewable energy projects such as bio-fuels in South Africa.²⁴²

The WPoRE set goals in respect of these obstacles and proposed to implement a proper legislative framework to promote the development, research and implementation of renewable energy and RETs.²⁴³ The WPoRE intended to establish a regulatory framework within which pricing and tax tariffs could be imposed and regulated with regard to renewable energies and provide local producers of liquid fuels from renewable resources such as bio-fuels to enter their respective fuel infrastructures, markets and systems.²⁴⁴

The WPoRE set a renewable energy goal which requires that the total energy supply by the end of 2013 should consist of at least 10 000 Gigawatt per hour (GWh).²⁴⁵ The WPoRE acknowledged that the transport sector in South Africa provided for 30% of the total energy consumption and was therefore a target sector for the implementation of RETs and renewable energy sources such as bio-fuels.²⁴⁶ The WPoRE proved to be an important driver for renewable energies in general and could provide a necessary framework for a bio-fuels industry. However, up to date no progress has been made with regard to the goals set out

239 DME *White Paper on Renewable Energy* 1.

240 DME *White Paper on Renewable Energy* 3.

241 DME *White Paper on Renewable Energy* 5.

242 DME *White Paper on Renewable Energy* 3.

243 DME *White Paper on Renewable Energy* 5.

244 DME *White Paper on Renewable Energy* 7.

245 DME *White Paper on Renewable Energy* 7. An energy unit whereby electricity consumption is measured.

246 Mathiesen, Lund and Norgaard 2007 *Utilities Policy* 108; International Energy Agency CO2 Emissions 14; DME *White Paper on Renewable Energy* 8.

in the WPoRE and seems to lack the required governmental cooperation and political will.

5.4 National Framework for Sustainable Development in South Africa

In 2008 the government introduced a *National Framework for Sustainable Development* (NFSD) with the idea to provide decision-makers with a framework within which they could recognise the necessary policies that were aimed at economical growth, conserving and sustaining our ecosystems; that would meet the basic social needs and overall promote sustainable development.²⁴⁷ The NFSD recognised the three important components of sustainable development which are imbedded within each other and underpinned by effective governance.²⁴⁸

The NFSD provides for a framework with guidelines within which policies could be formed to reflect the characteristics of sustainable development, achieve the goals set out in the JPOI and wherein already adopted policies can be acted upon in order to provide for sustainable development within South Africa.²⁴⁹ The NFSD introduced certain focus areas which should be addressed in order to give effect to the goals of sustainable development, the MDGs and the goals set out in the JPOI.²⁵⁰ Various programmes have already been introduced to give effect to the NFSD such as Eskom's South African Bulk Renewable Energy Generation (SABREG) project which aim is to explore the renewable energy options for South Africa.²⁵¹

247 DEAT *A National Framework for Sustainable Development* 4.

248 DEAT *A National Framework for Sustainable Development* 6.

249 DEAT *A National Framework for Sustainable Development* 8. See 5.1 above.

250 DEAT *A National Framework for Sustainable Development* 25.

251 DEAT *A National Framework for Sustainable Development* 28. The types of renewable technologies currently under investigation are wind energy, solar energy, biomass and tidal energy.

Various cleaner production initiatives were introduced under the *Cleaner Production Strategy*²⁵² (CPS) of 2004 and are now implemented under the framework of the NFSD.²⁵³ The purpose of the CPS is to promote cleaner production systems and processes which will eventually result in products and product processes that are more cost effective and less harmful to the environment.²⁵⁴

With regard to the CPS and renewable energy, bio-fuels could provide a way to achieve the goals of the NFSD and the CPS which include the reduction of environmental degradation; improve the economy; improve quality of life; create jobs; to enhance the framework for integrated planning; to use natural resources efficiently; and to help the government to effectively respond to emerging human development, economic and environmental challenges.²⁵⁵ A bio-fuels industry may provide an answer to the question as to how to reach the goals of the JPOI.

5.5 Bio-fuels Industrial Strategy of the Republic of South Africa

The South African government recognised that carefully planned policies, regulations and incentives are preconditions for the development of a sustainable and feasible bio-fuels industry.²⁵⁶ As recognised by the WPoRE, the BFIS also states that the most difficult obstacle to overcome is the expense of RETs and the lack of investments and other financial support for bio-fuels.²⁵⁷ Bio-fuels must compete with the unpredictable nature of crude oil prices with and would require extensive investments.²⁵⁸

252 DEAT *National Cleaner Production Strategy*.

253 DEAT *A National Framework for Sustainable Development* 28.

254 DEAT *National Cleaner Production Strategy* 9.

255 DEAT *National Cleaner Production Strategy* 28.

256 DME *Biofuels Industrial Strategy* 5.

257 DME *Biofuels Industrial Strategy* 6.

258 International Energy Agency *Biofuels for Transport* 33-46; Eisentraut *Sustainable Production of Second-Generation Biofuels* 32; International Energy Agency *CO2 Emissions* 17.

Government and or investors would most probably support something that is going to be profitable and sustainable in the future.²⁵⁹ It is for this reason that a BFIS needs to be developed in order to convince investors of the possibilities and sustainability of a bio-fuels industry in South Africa.²⁶⁰ However the South African BFIS is primarily driven by the requirement that it must serve as a link between first and second economies and thereby alleviate poverty, uplift agricultural practices and contribute to the development of the rural areas, which would also require the industry to be sustainable.²⁶¹

5.5.1 Purpose of the BFIS

The primary focus of the South African BFIS is therefore to address poverty and economical development issues.²⁶² The BFIS intends to promote agricultural practices and technologies in areas that were previously neglected and not cared for under the *Apartheid* system and a fragmented legislative regime.²⁶³ Most of these target areas are in former homelands that in the past had no infrastructure, governmental support or market access for their produced agricultural products.²⁶⁴

The BFIS states that the development of a bio-fuels industry will promote the creation of viable commercial agricultural areas in former homelands which will ensure the sustainability of the industry and provide emerging farmers with sustainable income opportunities.²⁶⁵ Land in the homelands is underutilised land but has agricultural potential.²⁶⁶ The dislocation of people to create space for agricultural land in the former homeland areas would be inescapable and the

259 DME *Biofuels Industrial Strategy* 5.

260 DME *Biofuels Industrial Strategy* 5.

261 DME *Biofuels Industrial Strategy* 6.

262 DME *Biofuels Industrial Strategy* 7.

263 DME *Biofuels Industrial Strategy* 6.

264 DME *Biofuels Industrial Strategy* 7.

265 DME *Biofuels Industrial Strategy* 8.

266 Gnansounou 2009 *Bioresource Technology* 4921; Kaltschmitt, Reinhardt and Stelzer 1997 *Biomass and Bioenergy* 121

impact of this on the already insecure, unstable and complex land tenure system has not in depth been considered by the BFIS.²⁶⁷

The only findings of the BFIS regarding land is that the price of land might be higher due to the production of bio-fuels and that the production of crops for bio-fuel purposes could contribute to the objectives of land reform and land restitution programmes by providing emerging farmers who were previously disadvantaged with market access and sustainable incomes.²⁶⁸ The production of crops for bio-fuels purposes could also undermine the objectives of land reform programmes by requiring the dislocation of previously disadvantaged people from their land acquired under the land reform programmes.²⁶⁹

5.5.2 Feasibility findings of the BFIS

Regarding food security which is the primary debate with regard to bio-fuels, the BFIS states that due to the fact that underutilised land in former homelands with no commercial market access is targeted for bio-fuel crops production, it will have a minimal impact on food security and food prices.²⁷⁰ The BFIS proposes a 2% level penetration of bio-fuels into the fuels industry.²⁷¹ Even though South Africa over produce between 3 million and 4 million tonnes of maize each year, the use of maize for bio-fuels purposes is still a great concern.²⁷² Therefore the BFIS specified that the use of maize for bio-fuel purposes shall be excluded from the initial phases of the bio-fuels industry.²⁷³ Maize will only be considered for the use of bio-fuel purposes once a stable market for bio-fuels has been established and the degraded land in former homelands are sustainably productive and infrastructure is provided for.²⁷⁴

267 DME *Biofuels Industrial Strategy* 8; Boddiger 2007 *The Lancet* 926. See also 3 above.

268 DME *Biofuels Industrial Strategy* 10.

269 DME *Biofuels Industrial Strategy* 11.

270 DME *Biofuels Industrial Strategy* 14.

271 DME *Biofuels Industrial Strategy* 14.

272 DME *Biofuels Industrial Strategy* 14.

273 DME *Biofuels Industrial Strategy* 14.

274 DME *Biofuels Industrial Strategy* 14.

For the initial investments and development of the bio-fuels industry only sugar cane and sugar beet will be used for bio-ethanol and soya bean, canola and sunflower for bio-diesel.²⁷⁵ Once again the BFIS has not anticipated and projected all the possible consequences of the proposed strategy. It is anticipated that the total population in Africa will grow with 2.5 times the 1990 level.²⁷⁶ South-Africa's population grew from 36,745 million in 1990 to about 50,429 million in 2010.²⁷⁷ There is doubt whether the country's water resources could accommodate this agricultural venture.²⁷⁸

Already established agricultural practices for food crop purposes uses at least 60% of the available water resources and crop lands for bio-fuel purposes would have to find its water resources from existing allocations, or compete for scarce new water resources.²⁷⁹ With regard to the issue of bio-fuels not being profitable in the initial stages due to competition with oil prices and a strong fuel industry, the BFIS proposes an incentive dispensation scheme.²⁸⁰ According to the BFIS this incentive scheme will guarantee the investors and farmers a profitable return on their assets equal to the risks involved.²⁸¹ In other words, the incentives provided for by the government will make it worthwhile to invest in the bio-fuels industry in the initial years.²⁸² This can only be achieved if a balance line is identified by way of sustainable development planning within the bio-fuels industry.

275 DME *Biofuels Industrial Strategy* 21.

276 Marrison and Larson 1996 *Biomass and Energy* 339; and United Nations 2010 <http://esa.un.org/UNPP/p2k0data.asp>.

277 World Economic Forum *The Africa Competitiveness Report* 226; and United Nations 2010 <http://esa.un.org/UNPP/p2k0data.asp>. To achieve the MDG of alleviating poverty and undernourishment food security must increase at a much higher level to prevent levels of undernourishment to fall. In other words, these degraded lands in former homelands would have to be cultivated, improved, and provided with necessary infrastructure and market access for food crop production instead of bio-fuels crop production to improve the level of undernourishment and alleviate poverty.

278 Morris *Strong Land Use Policy*; Funke, Strauss and Meyer 2009 *Agrekon* 240. The improvement, cultivation and development of this degraded land could be a costly expedition.

279 DME *Biofuels Industrial Strategy* 16.

280 DME *Biofuels Industrial Strategy* 21.

281 DME *Biofuels Industrial Strategy* 21.

282 DME *Biofuels Industrial Strategy* 21. For bio-ethanol a 100% fuel levy exemption will be imposed and for bio-diesel a 50% fuel levy exemption will be awarded.

5.6 *National Climate Change Response White Paper*

The *National Climate Change Response White Paper*²⁸³ (the White Paper) recognises that South Africa as a developing country faces various challenges such as water shortages, the challenge of poverty, unemployment and low levels of education.²⁸⁴ South Africa struggles to deliver basic services to all and on top of that, South Africa is also a contributor to global climate change given that it has an energy intensive, fossil-fuel powered economy and is extremely vulnerable to the impacts of climate change.²⁸⁵ The White Paper identified a variety of key adaptation sectors, or rather focus areas which must be attended to in order to adapt to the effects of climate change.²⁸⁶ These key adaptation sectors include water, agriculture, biodiversity and forestry which all relate to the environmental pillar of sustainable development.²⁸⁷ Then the White Paper went further and identified industries and the energy sector and two key adaptation sectors. The industry and energy sectors resort under the economical and social pillars of the sustainable development structure.²⁸⁸

The reason therefore is that the White Paper acknowledges that energy and industry sectors contribute to economical growth and thus improved human settlements, human health and wealth.²⁸⁹ Finally the White Paper acknowledged that all these sectors and the regulation and sustainable development thereof is underpinned by government.²⁹⁰ Government performs its duties by way of governance.²⁹¹ Governance must be understood as the management of human

283 DEA *National Climate Change Response White Paper* 2010 was published in GN 757 in GG 34695 of 19 October 2011.

284 DEA *National Climate Change Response White Paper* 8.

285 DEA *National Climate Change Response White Paper* 10.

286 DEA *National Climate Change Response White Paper* 9-24.

287 See 4 above.

288 DEA *National Climate Change Response White Paper* 25.

289 DEA *National Climate Change Response White Paper* 12.

290 DEA *National Climate Change Response White Paper* 30.

291 See Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Barrow *Environmental Management and Development* 15.

activities.²⁹² Governance is done through management and regulatory tools and measures.²⁹³

The White Paper identified all the above mentioned sectors as key adaptation sectors in accordance with the principles of sustainable development and aims to improve these sectors by using various management tools and regulatory measures.²⁹⁴ The White Paper's purposes to use a combination of civil based tools and command and control based tools.²⁹⁵ These sort of tools include public awareness programmes; public participation processes; monitoring and reporting committees; inspections; compliance with norms and standards; improved access to information and the review, monitor and evaluation of management systems.²⁹⁶

The White Paper is more focused in the sense that it sets out specific goals and time periods within which the set goals must be achieved.²⁹⁷ For example the White Paper promises to develop and commission a web-based GHG emission monitoring and reporting system as part of the National Atmospheric Emission Inventory (NAEI) component of the South African Air Quality Information System by 2012 and enforce the mandatory submission of GHG emission data and information to the NAEI by all large industrial emitters and compilers of GHG emissions by 2013.²⁹⁸

5.7 Conclusion

From the above discussion it is clear that there exist various policy documents with different goals and different management tools and regulatory measures.

292 Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Barrow *Environmental Management and Development* 15.

293 Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Barrow *Environmental Management and Development* 15.

294 DEA *National Climate Change Response White Paper* 31-37.

295 DEA *National Climate Change Response White Paper* 35-37.

296 DEA *National Climate Change Response White Paper* 35-37.

297 DEA *National Climate Change Response White Paper* 35-37.

298 DEA *National Climate Change Response White Paper* 35-37.

Policies such as the WPoEP and the WPoRE provide for a general framework within which the energy sector and renewable energy can be regulated. The JPOI and the NFSD provide for introduction, research and implementation programmes which promote the incorporation of sustainable development principles into policy frameworks such as those provided for under the WPoEP and the WPoRE.²⁹⁹

The BFIS specifically then provides for a regulatory framework for the initial stages of a bio-fuels industry. It proposes to use and implement various research and exploration programmes with regard to the implementation of bio-fuels. The BFIS also provides for certain restrictions which can be said to be a form of demand and control tool, but also largely proposes fiscal instruments such as state subsidies, tax incentives and pricing policies.³⁰⁰ What should be understood is that the BFIS must be incorporated with the principles and frameworks provided for in the WPoEP, the WPoRE, the NFSD and the White Paper.

The only way of determining whether policies that relate to the regulation of similar aspects of a certain sector is by way of a SEA. At higher decision making level a SEA should be conducted to determine the constraints on the environment of the current energy and renewable energy policies in place. The constraints identified by way of sustainable development planning must be regarded as an indication of the balance line that should be held. The reason that the economic, social and environmental circles are apart at this stage is due to the fact that all the socio-economic and environmental aspects are not integrated and considered in all policy documents. Therefore a SEA is required to identify the constraints and determine how policies should be adapted to

299 See 5.4 above.

300 The BFIS provides guidance with regard to financial and tax tariffs, licensing of bio-fuels producers, crops selection, crops substitution and norms and standards for the bio-fuels industry, but none of this is enforceable. Winkler *Energy Policies for Sustainable Development* 137. Another obstacle in the path of a sustainable bio-fuels industry, which the BFIS provides no guidance for, is investment and constant research. In order to promote and grow the industry and attract investors for newly researched technologies some type of guarantee will be needed in the form of legislation.

integrate all aspect to incorporate the environmental and socio-economic sectors to uphold the balance line of sustainable development. Up to date no such SEA have been performed by the government with regard to energy and renewable energy policies.

Even though the discussed policies propose certain management tools and regulatory measures, it is the intention of this study to identify key tools and measures that will incorporate sustainable development planning into a bio-fuels industry. One of these key tools identified is the EIA. Before an activity or project can commence an EIA need to be conducted in order to identify the risks and impacts the project or activity might have on the biodiversity and natural resources. In other words, the constraints which the concerned activity, project or industry might have on the environment need be identified. For example, the EIA should indicate the bottom line with regard to the amount of resources that can be utilised during this activity. With regard to bio-fuels an EIA would indicate, for example the amount of crops that may be used during a year in order to keep the balance line referred to in figure 1 above. In this regard the BFIS provided a guideline by stating that only sugar cane and sugar beet will be used for bio-ethanol and soya bean, canola and sunflower for bio-diesel for the initial stages.

After commencement of the activity and after the proposals, amendments and alterations indicated by the SEA and the EIA have been followed a LCA should be performed in order to evaluate the equity and thus sustainable development of the project and overall industry. The LCA would require constant monitoring, evaluating and reporting of the constraints and the upkeep of the balance line indicated in figure 1. The idea being that after the initial stages the entire sustainable development planning process as indicated in figure 2 be followed again to determine the variables in the constraints and, for example, if the proposed 2% level penetration of bio-fuels into the fuels industry by the BFIS is achievable while upholding the balance line.

South Africa's energy policy framework does provide for the basic principles of sustainable development, however, the initial integration of these fragmented principles set out in an incongruent set of policies is lacking. A SEA of South Africa's energy policy framework is required to fully incorporate sustainable development planning into the renewable energy industry. The policies discussed only provide for a framework and do not regulate the bio-fuels industry. These policies must be converted into legislation or already existing legislation need to be adapted in order to provide for the regulation of a bio-fuels industry. A discussion of South Africa's energy and renewable energy regulatory legislative regime will now follow.

6 South Africa

This part of the study investigates South African energy legislation and legislation that could possibly provide for the regulation of a bio-fuels industry. In this section the South African Constitution and legislation such as NEMA, the NEA and the PPA will be referred to before reference will be made to Brazilian legislation. This section will determine whether these legislative documents provide for a framework for renewable energy and possibly bio-fuels.

6.1 Constitution

As stated above, the incorporation of sustainable development is essential to the feasibility of a bio-fuels industry and to attract investors.³⁰¹ Section 24³⁰² of the Constitution is threefold in the sense that it provides everyone with a right to an

301 Von Maltitz and Brent *Assessing the Biofuel Options* 12; Lynd *et al* 2003 *South African Journal of Science* 506; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.

302 Everyone has the right-

- (a) to an environment that is not harmful to their health or well-being; (b) and to have the environment protected, for the benefit of the present and the future generations, through reasonable legislative or other measures that-
- (i) prevents pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development.

environment which is not harmful to their health or well-being; secondly it provides for the concept of sustainable development and lastly it provides for state duties with regard to environmental protection.³⁰³ Section 24 is negatively phrased and implies that only an assured minimum standard needs to be complied with in order to assure an environment that is "not harmful" instead of providing a positive right to a healthy and clean environment.³⁰⁴ Section 24 has an anthropocentric approach, focusing on the greater good of the human well being.³⁰⁵

This anthropocentric approach³⁰⁶ together with the protection of the environment for the advantage of the "present and the future generations" provided for by section 24 recognises and makes provision for the concept of sustainable development.³⁰⁷ The Apartheids-era's industrialisation plans and projects; urban development; rural dispossession; and the poor economic growth due to the lack of market access did damage to the ecological resources of the South African society and imposed challenging transformation and development tasks upon the first democratic government of South Africa.³⁰⁸

To restore these inequities, socio-economic imbalances and provide all with better standards of living, it was of utmost necessity that the Constitution introduced the concept of sustainable development to the South African government.³⁰⁹ Section 24 of the Constitution ensures that all policies and plans with regard to development and improvement in South Africa must be measured against the principles of sustainable development and underpinned by the

303 Currie and De Waal *The Bill of Rights Handbook* 527; Glazewski *Environmental Law* 72.

304 Currie and De Waal *The Bill of Rights Handbook* 525.

305 See generally Currie and De Waal *The Bill of Rights Handbook* 525; Hunter, Salzman and Zaelke *International Environmental Law* 632; Glazewski *Environmental Law* 45.

306 A detailed explanation of the concept of an anthropocentric approach does not fall within the scope of this study.

307 See generally S 24 of the Constitution; Kyoto Protocol; Rio Declaration. S 24 of the Constitution will not be discussed in full due to the nature of this dissertation.

308 Currie and De Waal *The Bill of Rights Handbook* 526; Bond *Unsustainable South Africa* 25.

309 Currie and De Waal *The Bill of Rights Handbook* 525; Bond *Unsustainable South Africa* 201.

government.³¹⁰ Government would therefore for example, have to develop a legislative regulatory framework for renewable energy, in specific bio-fuels, and complete a strategic environmental assessment within the confines of sustainable development planning.³¹¹

In order to effectively protect the environment the social and economical impacts of the bio-fuels industry on the environment should be considered, such as extra land use; specified food crops for the use of bio-fuels; the impact on water use and food security; job creation; economical benefits; and environmental impacts such as the loss of bio-diversity due to deforestation for extra land should be addressed in policies that require sustainable planning.³¹² In the end, section 24 must be incorporated in a regulatory framework for a bio-fuels industry in order to secure the protection of the ecology while ensuring socio-economic development.

6.2 NEMA

NEMA gives effect to section 24 of the Constitution by serving as a legislative vehicle for nationals to exercise their constitutional environmental right while at the same time NEMA ensure that constitutional environmental protection is promoted.³¹³ NEMA provides for certain principles which must be adhered to

310 Dresner *The Principles of Sustainability* 1-3; Baker *Sustainable Development* 7; Richardson and Wood *Environmental Law* 13; Sexton 2009 *California Agriculture* 193; Demirbas 2008 *Energy Conversion and Management* 2114.

311 Sexton 2009 *California Agriculture* 193; Demirbas 2008 *Energy Conversion and Management* 2114; Currie and De Waal *The Bill of Rights Handbook* 527. It is the responsibility of the state to introduce and policy measures and legislation which aim must be to protect the environment.

312 Ackom, Mabee and Saddler *Major Environmental Criteria of Biofuel Sustainability* 23; Sexton 2009 *California Agriculture* 193; Demirbas 2008 *Energy Conversion and Management* 2114; Von Maltitz and Brent *Assessing the Biofuel Options* 12; Lynd *et al South African Journal of Science* 506; Winkler *Energy Policies for Sustainable Development* 47; Sexton 2009 *California Agriculture* 193; Demirbas 2008 *Energy Conversion and Management* 2114; Ackom, Mabee and Saddler *Major Environmental Criteria of Biofuel Sustainability* 3.

313 Van der Linde *Fuggle and Rabie's Environmental Management* 194; Bray 1999 *South African Journal of Environmental Law and Policy* 7; *Fuel Retailers Association of Southern Africa v Director-General Environmental Management, Department of Agriculture, Conservation and Environment, Mpumalanga Province, and Others* 2007 6 SA 4 (CC); s 1 of NEMA.

during sustainable development planning.³¹⁴ These principles provide the government with a framework and guidelines which government departments must consider to perform effective environmental management³¹⁵ and implement plans with regard to the management or protection of the environment.³¹⁶

NEMA provides that development projects must be socially, economically and environmentally sustainable.³¹⁷ With regard to sustainable development NEMA incorporates the three basic international environmental principles discussed above³¹⁸ and provides for further guidelines that must be considered in order to promote the sustainable development of the country.³¹⁹ These sustainable development principles include guidelines such as the avoidance of the degradation of ecosystems and the loss of biodiversity; the avoidance of pollution and waste; and the protection of the nation's cultural heritage sites and not to disturb these sites.³²⁰ The principles that are of relevance for this study are those principles that relate to the use of South Africa's natural resources.

314 Bray 1999 *South African Journal of Environmental Law and Policy* 8; Van der Linde *Fuggle and Rabie's Environmental Management* 198.

315 See generally Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Barrow *Environmental Management and Development* 15. Environmental management is the maintenance of the balance between the surroundings within which humans and other living organisms exist and the use of natural resources that leads to the improvement of quality of life and the amount of income people generate through utilising these resources for production and development purposes. Environmental management should not be seen as the management of the environment itself but rather as the management and regulation of human activities that might have a detrimental effect on the environment. One can understand from the complex definition of environmental management that it is a process which will require various management tools which must be used simultaneously in order to maintain the said balance. These environmental management tools are divided into four categories by the Deming Management Cycle (DMC). The DMC provides that environmental management tools must be divided into planning, doing, checking and acting tools due to the complexity of environmental management.

316 Van der Linde *Fuggle and Rabie's Environmental Management* 194; Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Bray 1999 *South African Journal of Environmental Law and Policy* 8.

317 Lawrence 1999 *South African Journal of Environmental Law and Policy* 61-62.

318 See 6 above.

319 Bray 1999 *South African Journal of Environmental Law and Policy* 8; Van der Linde *Fuggle and Rabie's Environmental Management* 198.

320 Van der Linde *Fuggle and Rabie's Environmental Management* 194; Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13; Bray 1999 *South African Journal of Environmental Law and Policy* 8. Where it can all together not be avoided measures must be implemented to minimise the disturbance or degradation.

The principles contained in NEMA are based upon the internationally recognised environmental principles such as adopted in the 1972 Stockholm Declaration.³²¹ All of these principles relate to the sustainable development planning discussed in chapter 4 above, such as the precautionary and preventive action principle, equity principle, and the principle of sustainable development which requires integration principles.³²² All of these principles are of equal importance but for this part of the study focus will be placed upon the principles of sustainable development such as equity and integration.

When considering and anticipating sustainable development in a energy sector one realises that the rate of depletion, when exploiting and utilising our non-renewable natural resources such as oil must be regulated and controlled.³²³ The realisation that non-renewable resources will not last forever is one of the many drivers for the development and implementation of alternative energy sources such as bio-fuels.³²⁴ NEMA prescribes sustainable development principles and provides government and private organisations such as mining companies with tools and measures to implement these principles and to

321 The 1972 United Nations Conference on the Human Environment adopted 26 principles and an Action Plan for governments and organisations to provide as guidelines for environmental management and conservation.

322 Due to the nature of this study the detail regarding international environmental management principles will not be discussed in full. See Soto 1996 *ILSA Journal of International and Comparative Law* 194-207.

323 Bray 1999 *South African Journal of Environmental Law and Policy* 8; Van der Linde *Fuggle and Rabie's Environmental Management* 194; S 2(4)(a)(v) of NEMA.

324 Lynd *et al* 2003 *South African Journal of Science* 503; Manahan *Fundamentals of Environmental Chemistry* 1107; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2390; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174; Winkler *Energy Policies for Sustainable Development* 4; International Energy Agency *CO2 Emissions* 10; Dlamini *Bio-fuels and Energy* 14. The South African energy industry is dominated by coal, which contributes 70% of the country's primary energy supply, fuels and 93% of electricity production. Currently 33% of the coal mined in South Africa is exported. At the present production rate, there should be more than 50 years of coal supply left. It is anticipated that the global oil resources would be depleted by 2070 if continued on the current rate of exploitation and utilisation and this a consideration which must be incorporated into South Africa's planning and energy policies for the future.

implementation the use of renewable energy sources in a sustainable manner.³²⁵ NEMA is thus a general legislative framework based upon international environmental principles which government must take into account at decision making level to integrate management efforts and promote sustainable development and to adapt to the effects of climate change.³²⁶

Applied to bio-fuels, sources should be used for the generation of renewable energy and must not surpass the level of reliability of the ecosystem the source belongs to; or endanger or disturb the concerned ecosystems.³²⁷ The impact of bio-fuels on land use change and water resources must further be considered before a piece of land is designated for the production of bio-fuel crops.³²⁸ The principles also provide the state and private entities with guidelines on how to perform integrated environmental management (IEM) which entails the recognition of all the elements of the environment that are interrelated and all the aspects relating to the social and economical context in order to decide and chose the best practical option for all during development projects.³²⁹ A bio-fuels

325 S 2(4)(a)(vi) of NEMA; Van der Linde *Fuggle and Rabie's Environmental Management* 199.

326 Van der Linde *Fuggle and Rabie's Environmental Management* 194; Nel and Kotzé *Fuggle and Rabie's Environmental Management* 7-13.

327 S 2(4)(a)(vi) of NEMA; Van der Linde *Fuggle and Rabie's Environmental Management* 199.

328 Von Maltitz and Brent *Assessing the Biofuel Options* 7; Giampietro, Ulgiati, and Pimentel 1999 *BioScience* 590; Rosamond *et al* 2003 *Environment* 36; National Bio-fuels Task Team *National Biofuels Study* 73; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177. See section 28 of NEMA which refers to the duty of care and remediation of environmental damage:

(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

(1A) Subsection (1) also applies to a significant pollution or degradation that-

(a) occurred before the commencement of this Act;

(b) arises or is likely to arise at a different time from the actual activity that caused the contamination; or

(c) arises through an act or activity of a person that results in a change to pre-existing contamination.

329 S 2(4)(b) of NEMA. See Nel and Kotzé *Fuggle and Rabie's Environmental Management* 31. IEM can be seen as the integration of all aspect of the environmental; socio-economical-; cultural-; political sectors; governmental resources; governance tools; and spheres of government that must be utilised and attended to during a decision making process of a proposed project.

industry can affect an enormous amount of issues relating to the environmental, social and economical sectors such as food security, competition for land, water resources, and degradation of land due to deforestation for extra land only to name a few issues.³³⁰

Due to the wide ranging impact bio-fuels might have, IEM is a necessity for the development of a sustainable bio-fuels policy and would require the consideration of all the issues and the cooperation between all the affected government departments that deals with social, environmental and economical issues.³³¹ These principles of NEMA are basic sustainable management principles and guidelines that could be used and adopted for a bio-fuels policy or legislation.

NEMA makes provision for cooperative environmental governance (CEG) by requesting as a principle that all actions, policies or legislation taken with regard to the environment must be coordinated and harmonised between the governmental departments.³³² Each bio-fuel project will differ and aspects such as sufficient water supply and surrounding infrastructure will play a role during the planning and consideration of the bio-fuels industry.³³³ Environmental planning requires extensive inputs from various social and economical sectors and information from various government departments.³³⁴ To help identify,

330 Ottinger *Biofuels: Potential, Problems and Solutions* 2; Winkler *Energy Policies for Sustainable Development* 20; Lynd *et al* 2003 *South African Journal of Science* 506. See 3.1 above regarding the feasibility debate around bio-fuels.

331 Lynd *et al* 2003 *South African Journal of Science* 506; Amigun, Sigamoney and Von Blottnitz 2008 *Renewable and Sustainable Energy Reviews* 705; Ottinger *Biofuels: Potential, Problems and Solutions* 7. See also 3.2 above. For Example the Department of Energy (DE), of Science and Technology (DST), of Agriculture (DA), of Water Affairs (DWA), and of Social Development (DSD) only to name a few departments that will be involved.

332 Ss 11-16 of NEMA; Kotzé *Environmental Compliance and Enforcement* 123. See section 24L of NEMA below.

333 Ottinger *Biofuels: Potential, Problems and Solutions* 2; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179.

334 Lynd *et al* 2003 *South African Journal of Science* 506; Winkler *Energy Policies for Sustainable Development* 2; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 177.

analyse, consider and implement the most practical acceptable decision for all, NEMA provides for CEG by way of EIA.³³⁵

NEMA provides for various environmental management and regulatory tools based upon the internationally recognised environmental principles to perform IEM.³³⁶ To give effect to the principles of sustainable development NEMA has listed certain activities that, before commencement of the activity, certain precautionary and preventative steps are required in the form of various environmental regulatory and management tools.³³⁷ NEMA provides that responsibility must be taken for the environmental impacts of a "policy, programme, project, product, process, service or activity" all throughout the life cycle thereof.³³⁸ NEMA does not only recognise environmental responsibility for

335 Ss 23-24 of NEMA. See generally Kotzé *Environmental Compliance and Enforcement* 121-125; Nel and Kotzé *Fuggle and Rabie's Environmental Management* 31. See also section 24L of NEMA which provides for the alignment of environmental authorisations and automatically makes provision for CEG:

(1) If the carrying out of a listed activity or specified activity contemplated in section 24 is also regulated in terms of another law or a specific environmental management Act, the authority empowered under that other law or specific environmental management Act to authorise that activity and the competent authority empowered under Chapter 5 to issue an environmental authorisation in respect of that activity may exercise their respective powers jointly by issuing-

- (a) separate authorisations; or
- (b) an integrated environmental authorisation.

(2) An integrated environmental authorisation contemplated in subsection (1) (b) may be issued only if-

- (a) the relevant provisions of this Act and the other law or specific environmental management Act have been complied with; and
- (b) the environmental authorisation specifies the-
 - (i) provisions in terms of which it has been issued; and
 - (ii) relevant authority or authorities that have issued it.

336 For example the command and control based tools and incentive based tools. See chapter 5.2 and 3.6 above.

337 These identified activities are listed in the following regulations: GN R543, GN R544 (Listing Notice 1), GN R545 (Listing Notice 2), GN R546 (Listing Notice 3) and GN R547 in GG 33306 of 18 June 2010. These new EIA regulations replace the EIA regulations of 2006 and provides for new provisions regarding EIAs and environmental management frameworks. Listing Notice 1 contains the list of activities for which a Basic Assessment process needs to be conducted, Listing Notice 2 contains the activities for which a Scoping and an Environmental Impact Report process must be conducted while Listing Notice 3 contains activities and sensitive areas of each province for which a Basic Assessment process must be conducted.

338 S 2(4)(e) of NEMA. See Nel and Kotzé *Fuggle and Rabie's Environmental Management* 15. Nel and Kotze introduced the cyclical process called the project life cycle of environmental management. When done correctly this project life cycle assessment helps one to take responsibility for the entire life cycle of the proposed project. The three

an activity during its life cycle, but also mentions environmental responsibility for the policy or policy framework within which the concerned activity is performed. Thus NEMA indirectly states that environmental responsibility must be taken for the impacts and effects of policy documents and so, even though not expressly stated, recognises SEA as an environmental management tool to promote sustainable development planning.³³⁹

It is noteworthy to knowledge that NEMA barely refers to economic based- and market based incentives to achieve sustainable and integrated environmental management. Market based incentives or fiscal incentives as it is better known are a range of market processes and market based instruments used to affect and sway economic behaviour so as to achieve a certain desired goal.³⁴⁰ It is further necessary to consider the South African energy legislation.

6.3 National Energy Act

Based upon the WPoEP³⁴¹ the NEA was partially enacted in 2008 to give effect to the objectives set out in the WPoEP as well as the WPoRE.³⁴² The NEA provides for a framework for other energy laws and aims to provide the availability of diverse energy sources in a sustainable and affordable manner.³⁴³

basic processes in the project life cycle are the project, product and the management cycle, all with its own sub-processes. The cyclical process of environmental management provides for three main phases namely the planning and design phase, the acquiring and contractual phase and the implementation and operational phase. The operational phase consists of various sub-divided phases such as the construction, commissioning, operations, expansion, decommissioning, rehabilitation and termination.

339 See Kidd and Retief *Fuggle and Rabie's Environmental Management* 981. The definition of EA is wide enough to incorporate SEA.

340 Kotzé *Environmental Compliance and Enforcement* 298. This is important to note for the BFIS is largely based upon economic and market based incentives such as tax subsidies, price control measures, state subsidies and trade restrictions.

341 See 5.2 above.

342 Glazewski *Environmental Law* 9. Only Chapter 1, Chapter 4 and sections 17, 18 and 19 of the NEA was commenced and enacted. See Proclamation N28, GG34175 of 1 April 2011.

343 Other energy law within the framework provided for by the NEA includes the *Nuclear Energy Act* 46 of 1999; *National Nuclear Regulator Act* 47 of 1999; *Electricity Regulation Act* 4 of 2006; *Petroleum Products Act* 120 of 1977; *Petroleum Pipelines Act* 60 of 2003; *Gas Act* 48 of 2001; and the *National Energy Regulator Act* 20 of 2004.

The NEA aims to alleviate poverty by enhancing economical growth through sustainable energy planning and governmental cooperation.³⁴⁴ The NEA makes provision for research, development and implementation of renewable energy sources to ensure a secure and increased supply of energy.³⁴⁵

The NEA defines "renewable energy" as any "energy generated from natural non-depleting resources including solar energy, wind energy, biomass energy, biological waste energy, hydro energy, geothermal energy and ocean and tidal energy."³⁴⁶ The words *biomass energy* indicates that the NEA recognises bio-fuels as a possibility and provides a framework for a possible bio-fuels industry and legislation to be developed.³⁴⁷ The integrated energy planning (IEP) initiative which was adopted and enacted by the NEA takes into consideration issues such as secure energy supply; the transformation of the energy sector; the demand for energy; the economical viability and affordability of current and newly researched energy sources; issues relating to sustainability in the energy sector such as social equity, job creation and the environment.³⁴⁸

IEP is a vehicle used to determine the amount of energy various consumers such as industries and households will need in the future in order to plan, anticipate, prepare and provide for certain services and implementation measures to sustainably manage the development of the energy sector.³⁴⁹ The IEP will assist the government in identifying the necessary and correct mix of implementation

344 Preamble of the NEA.

345 S 2(d) of NEA.

346 S 1 of NEA.

347 Maier *Climate Change and Energy Insecurity* 39; Manahan *Fundamentals of Environmental Chemistry* 1107; Lynd *et al* 2003 *South African Journal of Science* 501; Von Maltitz and Brent *Assessing the Biofuel Options* 2. Biomass is the term used to describe any solid biomass; any liquid that can be used or transformed to be used as fuel; and any form of biogases.

348 S 6(2) of NEA. DME *White Paper on the Energy Policy* 19; and S 6 of NEA. The WPoEP recognised that after 1994 in South-Africa there was a lack in capacity to obtain a sufficient level of information to support policy developments in the energy sector. To correct this, the WPoEP proposed a process of integrated energy planning (IEP).

349 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>; Brent 2008 *Science Scope* 70.

measures and forms and sources of energy to accommodate the anticipated services for the future, such as bio-fuel production.³⁵⁰

An Integrated energy plan³⁵¹ (IE-plan) must acknowledge plans relating to and address issues relating to transport; electricity; petroleum; water; trade; energy infrastructure; housing, air quality management; greenhouse gas mitigation by the energy sector; and any other integrated development plans of local and provincial authorities.³⁵² Previously energy planning was done by companies to boost their shares in the market and provide for better future profits.³⁵³ This type of energy planning only focussed on economical benefits and did not address issues regarding the environment and social needs.³⁵⁴

An IEP is designed to include issues regarding the environment, social and economical needs such as the needs of the energy sector and the supply side; environmental, social and economical costs and future goals based upon the most practical solutions.³⁵⁵ The South African IE-Plan³⁵⁶ of 2003 states that as its objectives is to diversify and increase the energy supply in the country by using gas and renewable energies; and to develop policies, legislation and regulations for the promotion and development of renewable energy sources in the country.³⁵⁷

The IE-Plan recognises that renewable energy sources must be developed and could provide another policy driver for the development and introduction of

350 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>; Brent 2008 *Science Scope* 70.

351 See S 6(3)-(6) of NEA. The IE-Plan must serve as a guide for energy infrastructure investments and developments; take into account all viable energy supply options; and guide the selection of the appropriate technology to meet energy demand.

352 S 6(4) of NEA.

353 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>.

354 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>

355 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>; Brent 2008 *Science Scope* 70.

356 DME *Integrated Energy Plan*.

357 Department of Minerals and Energy *Integrated Energy Plan* 2 and 28.

measures, policies and legislation for a bio-fuels industry in South Africa.³⁵⁸ The IE-Plan, however, fails to consider the possibility and impacts of legislation that could accommodate and promote the expansion and regulation of renewable energy sources such as bio-fuels.³⁵⁹ The government thus recognised the importance of renewable energies but conducted very little integrated planning in this regard.³⁶⁰ The IEP, however, can be used as a tool to incorporate the statistics and findings of monitoring, research and evaluation committees. The IEP is for private and public awareness and can function as a guideline for government and private entities in the energy sector with regard to environmental management and sustainable development. The IE-Plan does not refer to environmental externalities, impacts and costs but only to statistics surrounding energy planning, economical growth and benefits.³⁶¹

6.4 Petroleum Products Act

The PPA defines a petroleum product as "any petroleum fuel or any lubricant including *other substances* that could be used for the same purpose which petroleum fuel is being used".³⁶² Bio-fuels can be used for the same purpose as petroleum products and could be regarded as *other substances* under the PPA and as a petroleum product for purposes of the PPA.³⁶³ The objectives of the PPA relates to the regulation of the entire petroleum product industry.³⁶⁴ The PPA provides for measures to regulate petroleum products and the use thereof

358 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>; Brent 2008 *Science Scope* 70.

359 Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>.

360 Brent 2008 *Science Scope* 70.

361 DME *Integrated Energy Plan* 28; Sustainable Energy and Climate Change Project 2005 <http://www.seccp@earthlife.org.za>. For example the IE-Plan did not address the effects of governmental interventions such as environmental funding for renewable energy sources in the initial stages. The excuse for this mishap is because policy regarding national environmental taxing and funding is not yet resolved.

362 S 1 of the PPA. Own emphasis added.

363 See S 1 of the PPA and 2 above. Obwaka and Arnold *The limited case for bio-fuels* 1; Manahan *Fundamentals of Environmental Chemistry* 1107; Maier *Climate Change and Energy Insecurity* 39. See for example wheat, sugar cane, sugar beets, molasses or any starch. As explained above bio-fuels can be used in liquid form, such as bio-ethanol or biodiesel as fuels that could be used for transportation and act as a feasible replacement for petroleum products.

364 Preamble of the PPA.

and to establish an economy which generates cost from the distribution of petroleum products.³⁶⁵ It seems as if the PPA provides a regulatory structure for an industry such as bio-fuels seeing that the regulation and legislation framework for a fuel industry is already in place.

Measures, standards and criteria for the licensing of persons that are involved with the manufacture, production and sale of petroleum products are provided for under the PPA.³⁶⁶ The PPA makes provision for a Controller of the Petroleum Products (CPP) who is responsible for the issuing and granting of these licences.³⁶⁷ The PPA requires that no person may manufacture a petroleum product without a manufacturing licence; wholesale a prescribed petroleum product without a wholesale licence; develop a site for the purpose of petroleum manufacturing without there being a site license for that site; or sell petroleum products without an applicable licence to sell.³⁶⁸ Any person that is the owner of property, site or manufacturing business that relates to the manufacturing, wholesale or retail of petroleum products must apply for a licence at the CPP, whether it is for manufacturing, wholesaling or the retailing of petroleum products.³⁶⁹

The CPP may only issue license in terms of the PPA.³⁷⁰ Section 2B of the PPA provides that the CPP must, before issuing a license, consider whether the issuing of the license applied for will promote an efficient manufacturing, wholesaling and retailing petroleum industry; facilitate an environment that will promote efficient and commercial investments; employment opportunities and promote the development of small businesses in the petroleum sector; ensure the countrywide availability of petroleum products at competitive prices and

365 Preamble of the PPA.

366 Preamble of the PPA.

367 S 2A(1) of the PPA.

368 S 2A(1)(a)-(d) of the PPA. Regulations Regarding Petroleum Products Manufacturing Licences (GN R288 in GG 28665 of 27 March 2006).

369 S 2A(4) of the PPA.

370 S 2B(1) of the PPA.

promote access to affordable petroleum products.³⁷¹ If bio-fuels were to be regulated under the PPA, and licenses for the manufacturing, retailing and wholesaling of bio-fuels were to be applied for under the PPA, section 2B would create an enormous challenge for the CPP. It may be a challenge for the CPP to determine whether the issuing of a bio-fuels license would promote commercial investments; create job opportunities; and create or promote an efficient manufacturing, wholesaling and retailing bio-fuels industry.

The PPA provides the Minister of Energy with the power to make regulations regarding the manufacturing of and the wholesale, site or retail licences for petroleum products.³⁷² The Minister also has the power to issue regulations regarding the purchase or sale of petroleum products manufactured from coal, natural gas or *vegetable matter* by an already licensed wholesaler or manufacturer.³⁷³ Vegetable matter is any substance, essence or material produced by plants or any object growing in the manner of a plant,³⁷⁴ which will include materials used for bio-fuels.³⁷⁵ By using the words *vegetable matter* the PPA recognises the manufacturing of fuels from biomass and thus provides for the promotion of a bio-fuels industry under the PPA.³⁷⁶

371 S 2B of the PPA.

372 S 12C(1) of the PPA. See generally the Regulations Regarding Petroleum Products Manufacturing Licences (GN R288 in GG 28665 of 27 March 2006); Regulations Regarding Petroleum Products Site and Retail Licences (GN R286 in GG 28665 of 27 March 2006); and the Regulations Regarding Petroleum Products Wholesale Licences (GN R287 in GG 28665 of 27 March 2006) issued in terms of the PPA.

373 S 12C(1)(aA) of the PPA.

374 Free Dictionary 2010 <http://www.thefreedictionary.com/vegetable+matter>.

375 Maier *Climate Change and Energy Insecurity* 39; Manahan *Fundamentals of Environmental Chemistry* 1107; Lynd *et al* 2003 *South African Journal of Science* 501; Von Maltitz and Brent *Assessing the Biofuel Options* 2; Manahan *Fundamentals of Environmental Chemistry* 1107; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2390; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 174. Bio-fuels are thus any fuels that can be derived from organic matter (plant matter) and is renewable in the sense that it cannot be depleted.

376 The PPA states that no person may manufacture a petroleum product without a manufacturing licence; wholesale a prescribed petroleum product without a wholesale licence; develop a site for the purpose of petroleum manufacturing without there being a site licence for that site; or sell petroleum products without an applicable licence to sell. According to S 12(1) of the PPA it is an offence to manufacture a petroleum product without a license and a person shall 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.

With regard to the initial stages of the bio-fuels industry and the economical viability thereof, the PPA provides the Minister of Energy with the power to regulate the price of petroleum products and which could issue regulations regarding petroleum products manufactured from vegetable matter in order to make the bio-fuels industry more competitive with existing and well established petroleum industries such as the petroleum, coal and natural gas manufacturers.³⁷⁷

Further, section 2E of the PPA provides that the Minister of Energy may prescribe a system for the allocation of site and the corresponding retail licences.³⁷⁸ The CPP shall be bound by this prescribed system.³⁷⁹ Such a system must be aimed at the transformation of the retail sector into one that has the most favourable number of efficient sites; must intend to achieve a balance between all participants in the petroleum products industry; and must be based on the principles of section 2B.³⁸⁰ Section 2E provides for a tool by which the Minister under the PPA could prescribe a system for the allocation of bio-fuel licenses. The development of such a system needs however to be based upon a sustainable bio-fuels policy. At this stage the BFIS could provide some guidance.

6.5 Bio-fuels licensing criteria

To give guidance to the process of applying for a license to produce or manufacture bio-fuels under the PPA, the DE issued a set of guidelines and

377 To date no such regulations have been promulgated. However the National Treasury approved the increase of the Fuel Levy exemption for bio-diesel from 30% to 40%. The exemption was introduced in 2003 and SARS allows for a 100% exemption for small biodiesel producers (less than 300m annually) to make the bio-fuels industry more competitive and profitable. The National Treasury also approved a Renewable Energy Capital Subsidy Scheme (RECSS) which is administered by the DME. The Subsidy provides for 16.7 c/l subsidy for bio-ethanol and 27.3 c/l for bio-diesel, up to a maximum of R20 million.

378 S 2E of the PPA.

379 S 2E of the PPA.

380 S 2E of the PPA.

criteria with regard to bio-fuels manufacturing.³⁸¹ These guidelines are not law. These guidelines only provide for certain measures and criteria which must be met before a person or company can obtain a license under the PPA³⁸² to manufacture bio-fuels.³⁸³ According to the criteria all manufacturers, including pilot projects, need to apply for a manufacturing licence.³⁸⁴

If a person manufactures bio-fuels for own use that person will have to register with the CPP and provide annual statistics on which crops they use, the production capacity and what the bio-fuels products are used for.³⁸⁵ Research projects regarding bio-fuels production must provide written proof from their relevant research institutions to the CPP.³⁸⁶ Bio-fuels products produced from research projects will be limited in quantities and may not be used for commercial purposes.³⁸⁷ This should encourage persons to research and develop bio-fuels technologies in order to find which would be most sustainable and feasible for South Africa.

The DE requires that the crops which will be used for the production of bio-fuels must not cause negative impacts on the environment during the manufacturing, processing, transport and storage processes, thus addressing the entire life cycle of bio-fuels.³⁸⁸ For example, it was discussed earlier that the growing of feedstocks for the production of bio-fuels would require extra water resources and if not regulated water scarcity might occur.³⁸⁹ The criteria for bio-fuels licensing states that the production of bio-fuel crops under already water licensed

381 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

382 See S 2B(1) of the PPA.

383 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

384 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

385 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

386 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

387 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

388 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

389 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 182; Rosamond *et al* 2003 *Environment* 38; Von Maltitz and Brent *Assessing the Biofuel Options* 11. See 3.1 above.

irrigation³⁹⁰ shall only be allowed in "exceptional circumstances" and a detailed motivation must be provided to the CPP.³⁹¹ The guidelines fail to provide examples or any further details as to what is meant with exceptional circumstances.³⁹²

If, however, the manufacturer intends to use water which is already licensed and being used for gainful irrigation of crops for food stocks then that person would not be required to apply for a new water use license for the irrigation of bio-fuel crops.³⁹³ In South Africa water scarcity is an issue and the management of water resources is a development priority.³⁹⁴ Total water requirements for bio-fuel feedstock production and other water demands for the bio-fuel industry could become a major management issue if not planned, researched and regulated correctly from the start.³⁹⁵

It is thus of primary importance to implement management measures for water regulation in the bio-fuels life cycle and specifically crop production for bio-

390 According to section 21 of the *National Water Act* 36 of 1998 water use includes the taking water from a water resource; storing water; impeding or diverting the flow of water in a watercourse; engaging in a stream flow reduction activity contemplated in section 36; engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; disposing of waste in a manner which may detrimentally impact on a water resource; disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; altering the bed, banks, course or characteristics of a watercourse; removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and using water for recreational purposes.

391 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

392 In the case of *Vanqa v S* 2000 JOL 7501 (Tk) the court stated that exceptional circumstances can be regarded as *unusual factors*. Thus any circumstances that are unusual or exceptionally different from those circumstances normally found during the irrigation of crops and or normal available water resources would be exceptional circumstances. For example when there has been an exceptionally good or more than normal rainfall in a specific year and that would encourage the irrigation of crops for bio-fuel purposes under an already water licensed irrigation system.

393 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

394 Makhubele *A water resource compliance monitoring and enforcement* 16.

395 Makhubele *A water resource compliance monitoring and enforcement* 16. It is said that the use of water in the biodiesel production can be as much as three times that of the petroleum diesel industry, which is mainly in the culture of seeds and washing at different stages of the biodiesel industry.

fuels.³⁹⁶ An applicant for a license to manufacture bio-fuels must ensure that the crops he or she intends to use for the production of bio-fuels are mainly sugar cane, sugar beet, soya beans, sunflower and canola.³⁹⁷ Maize and jatropha may not be used for the production of bio-fuels according to the bio-fuels licensing criteria.³⁹⁸ This is an important notion due to the fact that maize and jatropha are primary staple foods in Africa and if used for bio-fuel purposes they could lead to higher food prices and food insecurity.³⁹⁹

The import of feedstocks for the production of bio-fuels shall not be allowed except in times of poor and unfavourable agricultural production and when the local producers cannot meet the demand set by the investors of the bio-fuels industry.⁴⁰⁰ The importation of feedstocks would also be allowed only for bio-fuels projects that are in the inception stage and only under certain prescribed conditions.⁴⁰¹ For example, only crops that are not generally grown in South Africa and wherefore a domestic capacity does not exist may be imported. Importation shall only be allowed if provision was made for a phase-in period for import replacements (or substitution) for domestic sources.⁴⁰² Substitution for domestic sources must be linked to the sources that are provided for by emerging farmers from underutilised areas.⁴⁰³ In other words, if emerging farmers cannot meet the crop source demand for bio-fuel manufacturers, substitution sources may be imported under the conditions of a phase-in and a phase-out plan.⁴⁰⁴

396 Makhubele *A water resource compliance monitoring and enforcement* 16.

397 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

398 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

399 See 3.1 above. Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179.

400 DME 2007 http://www.energy.gov.za/files/renewables_frame.html. A bio-fuels manufacturer must submit a written application to the CPP to announce that a period of poor and adverse agricultural production has commenced.

401 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

402 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

403 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

404 However, the carbon footprint of the production of that imported crops may not have a negative impact on the environment of the country of origin. For example, the expansion of sugarcane land in Brazil and the expansion of land for maize in the US might have a detrimental effect on the Amazon rain forest. It is anticipated that the expansion of Brazil's sugarcane for bio-ethanol will reduce the amount of forest in the Amazon with

With regard to importation and substitution a detailed report regarding the types of by-products; quantities and potential markets need be provided by manufacturers to the CPP.⁴⁰⁵ The reason therefore is to ensure that trade takes place under fair conditions and to manage and avoid market dominance by manufactures in the local market which rely on imported feedstocks and products only.⁴⁰⁶ The licensing guidelines require that a written contract be drawn up to ensure that mainly feedstocks sourced from underutilised areas are used for bio-fuels production. The licensing criteria however take recognition of the fact that it is going to take a while for these underutilised areas to produce continually and sustainably feedstocks for the production of bio-fuels and therefore require that a detailed phase-in plan be constructed for the period of during which feedstocks from large commercial farmers will be used and how it will be phased-out to accommodate the feedstocks produced from underutilised areas.

The licensing criteria require that greater priority will be given to the commercially proven technologies during the BFIS 5 year pilot project initiative⁴⁰⁷ and that priority will be given to the promotion and production of 1stG bio-fuels.⁴⁰⁸ In order to secure the supply of bio-fuels and to promote the introduction of bio-fuels into the fuel industry and market the licensing criteria require that proof be provided for an off-take agreement with a local oil company, operator, large commercial undertaking or dedicated operator such as a municipality which will use the bio-

40% by 2050. The production of crops for bio-fuels in Brazil proves to have a detrimental effect of the biodiversity through deforestation.

405 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

406 DME 2007 http://www.energy.gov.za/files/renewables_frame.html. The licensing criteria and the BFIS aim to establish a bio-fuels industry that will be sourced from underutilised land in the former homelands in order to develop infrastructure and agricultural practices in the rural areas and alleviate poverty and therefore importation and substitution must be regulated.

407 DME *Biofuels Industrial Strategy*. The BFIS which introduced a short term focus or a 5 year pilot project to achieve a 2% penetration level of bio-fuels into the national liquid fuels supply within the period of 2008 to 2013.

408 The use of 2ndG bio-fuels during these initial phases will only be supported if it is for research purposes. Further all bio-fuels manufacturers must adhere to the prescribed SANS specifications and standards for bio-fuel products.

diesel of bio-ethanol as required.⁴⁰⁹ Through providing for the off-take agreement the promotion and accommodation of bio-fuels in the already established structure of the oil industry is ensured.⁴¹⁰ With regard to the bio-fuels manufacturing facility (or the plant) the manufacturer must provide proof that it has obtained the necessary approval for the construction of the manufacturing facility from other authorities.⁴¹¹

The guidelines states that in addition to the mentioned criteria, all the other provisions pertaining to the production of petroleum products in the PPA, will still apply.⁴¹² The PPA, however, does not refer to the guidelines for bio-fuels licences. These criteria guidelines together with the BFIS will likely provide the framework which the Minister of Energy under the PPA will use to develop a system in terms of section 2E for the allocation of bio-fuels licenses. The stimulation of a bio-fuels industry is in line with the government's sustainable development objectives.⁴¹³

6.6 Conclusion

Mention is made of bio-fuels in the PPA⁴¹⁴ but it is safe to conclude that an established energy and fuels industry infrastructure with legislative regulatory measures that relate to renewable energy or bio-fuels in specific and provide for the incorporation of sustainability can be found in an incongruent set of statutes which can not be read in isolation from one another.⁴¹⁵ The regulation of the bio-

409 DME *Biofuels Industrial Strategy*.

410 DME *Biofuels Industrial Strategy*

411 DME *Biofuels Industrial Strategy*

412 DME *Biofuels Industrial Strategy*

413 DME 2007 http://www.energy.gov.za/files/renewables_frame.html.

414 S 12 C(1)(aA) of the PPA.

415 Glazewski 2005 <http://www.uct.co.za>; Winkler *Energy Policies for Sustainable Development* 138; Prasad and Visagie *Renewable Energy Technologies* 15; Winkler *Energy Policies for Sustainable Development* 29 and 47. The energy sector in South-Africa consist of various industries that provides for various forms of energy such as the coal-; electricity-; nuclear energy-; oil-; liquid-fuels-; gas-; and renewable energy industries. Each of these sectors has the appropriate legislation in place to regulate these industries and the resources that is used and utilised by them.

fuels industry seems to be still fragmented into as not all the dimensions of the bio-fuels industry are regulated by one specific legislative document.

The PPA does not make provision for cooperative governance between the different departments except by stating that all other authorisations should be in place before a licence will be issued under the PPA.⁴¹⁶ Meaning that before a person or company can, for example apply for a manufacturing licence under the PPA, he or she or the company should first have complied with the relevant environmental legislation. This would mean, for example, that if a bio-fuels manufacturer still needs to construct a manufacturing plant, he or she or the company must first determine which of their activities is listed under NEMA and obtain an environmental authorisation for such an activity. For example, activity number 4 in Listing Notice 2 of the NEMA regulations states that a full EIA should be done if a facility of infrastructure is to be constructed which is meant for the refining, extraction or processing of gas, oil or petroleum products with an installed capacity of 50 cubic metres or more.⁴¹⁷

The fact that these other authorisations are in place would not necessarily mean that all the principles of sustainable development planning have been taken into account. The PPA lacks sustainable development planning on governmental level and should at least be amended to include the consideration and integration of environmental aspects when issuing a license under the PPA. Bio-fuels are to some extent regulated by the PPA. The PPA, however, mostly regulates the socio-economical aspects of the fuel industry. The Brazilian energy legislation will

416 S 2D(3) of the PPA states that any person that apply for a manufacturing, wholesale, site or retail licence, as the case may be, shall be entitled to be issued with a licence for the operation of the activity concerned if the applicant is in compliance with all national, provincial and local government legal requirements, that are in force immediately prior to the commencement of this PPA for the operation of the activity concerned. Regulation 16(1)(f)(ii) of the Petroleum Products Manufacturing Licences (GN R288 in GG 28665 of 27 March 2006) states that the Record of Decision of the environmental authorities in accordance with the *Environmental Conservation Act 73* of 1989 (read now NEMA) permitting manufacturing operations on the property should be submitted to the CCP.

417 GN R545 (Listing Notice 2) in GG 33306 of 18 June 2010.

be discussed to determine if South Africa could learn from this country's experience in regulation of the bio-fuels industry.

7 Brazil

As mentioned before, Brazil is the second largest producer and consumer of bio-ethanol.⁴¹⁸ Also aware of the impacts of climate change and implementing mitigation measures, Brazil has gained valuable and diversified experience with regard to bio-fuels, technologies, management measures and legislation to regulate the bio-fuels industry.⁴¹⁹ During the 1970s the Special Secretariat for the Environment⁴²⁰ (SSE) was introduced mainly to address environmental pollution situations with regard to water resources.⁴²¹ It was first in 1981 that a National Environmental Policy Law (NEPL) was introduced.⁴²² The NEPL was the first Brazilian piece of legislation that provided for a definition of the environment as the set of physical, chemical and or biological conditions, laws, influences and interactions that facilitate shelters and govern life in all of its forms.⁴²³

The NEPL was the first legislative attempt to provide protection for the environment as a whole.⁴²⁴ Previous laws only dealt with specific environmental issues such as forests or water resources under SSE.⁴²⁵ The NEPL was enacted in 1981 but it was only in 1988 that the Brazilian Federal Constitution was

418 See 1 above. Rosamond L *et al* 2003 *Environment* 38; Sales *et al* *Programmatic Biofuel Clean Development Mechanism* 3; Colares 2008 *Syracuse Journal of International Law and Commerce* 102. The United States of America only recently surpassed Brazil as the largest producer of ethanol.

419 Colares 2008 *Syracuse Journal of International law and Commerce* 101; Egler *Improving the Environmental Impact Assessment* 254.

420 *Secretaria Especial do Meio-Ambiente*.

421 Egler *Improving the Environmental Impact Assessment* 241.

422 Law No 6.938 of 31 August of 1981 (*Política Nacional do Meio-Ambiente*).

423 Patriota 2009 *Washington International Law Review* 612.

424 Patriota 2009 *Washington International Law Review* 612.

425 Egler *Improving the Environmental Impact Assessment* 241; Patriota 2009 *Washington International Law Review* 613.

enacted.⁴²⁶ In 1988 Brazil was transformed into a *Nova Republica* (New Republic) and the Brazilian Federal Constitution included a specific chapter with regard to the environment.⁴²⁷ Even though the Brazilian Federal Constitution was enacted after the NEPL it would be more appropriate to discuss the Brazilian Federal Constitution before the NEPL will be discussed.

7.1 Brazilian Federal Constitution

Even though the Brazilian Federal Constitution (1988 Constitution) provides for environmental protection, there are also other provisions in the 1988 Constitution that indirectly or directly deals with environmental issues.⁴²⁸ The 1988 Constitution states that:⁴²⁹

All have the right to an ecologically balanced environment which is an asset of common use and essential to a healthy quality of life, and both the Government and the community shall have the duty to defend and preserve it for present and future generations.

The 1988 Constitution provides for a right to an "ecologically balanced environment".⁴³⁰ This is a social fundamental right which is attached to the individual's duty and the state's responsibility to protect the environment for present and future generations.⁴³¹ The 1988 Constitution recognises that the environment is of essence for a good healthy life, quality life and living standards, which does not translate into a right to a clean and healthy environment.⁴³²

426 Lindenbojm 2001 *Section of Environment, Energy and Resources* 3; Patriota 2009 *Washington International Law Review* 613.

427 Egler *Improving the Environmental Impact Assessment* 241; Patriota 2009 *Washington International Law Review* 613. Under institutions such as SSE; environmental legislation such as the NEPL that provides for protection of the entire environment and the Brazilian Federal Constitution, a comprehensive environmental management and regulatory regime are provided for.

428 Lindenbojm 2001 *Section of Environment, Energy and Resources* 3.

429 S 225 of the 1988 Constitution.

430 S 23 of the 1988 Constitution.

431 Lindenbojm 2001 *Section of Environment, Energy and Resources* 2; Egler *Improving the Environmental Impact Assessment* 258.

432 Lindenbojm 2001 *Section of Environment, Energy and Resources* 2.

The words "ecologically balanced environment" indicates that certain relevant ecological areas must be identified which must be protected by legislation and the use of these identified areas will be subject to limitations imposed by these laws.⁴³³ Further, the 1988 Constitution provides for the concurrent jurisdiction of the federal government, the states, the federal district, and the local governments to protect historical, artistic and cultural value, monuments, natural landscapes and archaeological sites; to protect the environment and prevent or minimise pollution; to conserve and protect the forests, fauna and flora.⁴³⁴ The Brazilian Constitution of 1988, similar to the South African Constitution,⁴³⁵ places more emphasis on the ecology rather than promoting an anthropocentric approach.

7.2 National Environmental Policy Law

The National Environmental Policy Law⁴³⁶ (NEPL) provides for a definition of the environment and protection of the environment.⁴³⁷ With the introduction of the NEPL, environmental law became a crosscutting field of law.⁴³⁸ The NEPL framework also led to the adoption of the Environmental Crimes Law⁴³⁹ (ECL) which made the legal regime for environmental protection all encompassing.⁴⁴⁰

433 Patriota 2009 *Washington International Law Review* 613; Lindenbojm 2001 *Section of Environment, Energy and Resources* 2.

434 Patriota 2009 *Washington International Law Review* 613; Lindenbojm 2001 *Section of Environment, Energy and Resources* 2. The federal government, the states, the federal district, and local governments have concurrent jurisdiction and the competence to make and implement legislation regarding the protection of the environment and control of pollution; the protection of the historic, cultural and artistic heritage; and the liability for damages to the environment. S 24 of the 1988 Constitution establishes the power to adopt laws, decrees, resolutions and ministerial directives.

435 See 6.1 above.

436 Law No 6.938 of 31 August of 1981.

437 The protection of the environment was now regarded as a field of law. Previously the environment was protected by a water law, a forest law or a biodiversity law. In terms of the 1988 Constitution it is still of essence to identify an ecologically area to be protected under law but the NEPL provides the framework and limitations within which lawmakers could implement environmental protection laws for specified ecological areas.

438 Moreira and Goldemberg 1999 *Energy Policy* 232; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Colares 2008 *Syracuse Journal of International Law and Commerce* 102.

439 Colares 2008 *Syracuse Journal of International law and Commerce* 102; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Egler *Improving the Environmental Impact Assessment* 254.

440 Egler *Improving the Environmental Impact Assessment* 256.

Environmental law is enforced through administrative law, civil law and criminal law.⁴⁴¹ The aim of the NEPL is to create a system that would provide for the accumulation of information, the monitoring of compliance with legislative measures, and within which public and private participation could be encouraged.⁴⁴²

To effectively provide for this system the NEPL introduced a National System for the Environment⁴⁴³ (NSE) with four levels, each with administrative responsibility consisting of the federal government, the states, the federal district, and local governments or rather municipalities.⁴⁴⁴ In 1990 the NEPL was amended to incorporate the NSE's important structure namely the National Council for the Environment⁴⁴⁵ (NCE).⁴⁴⁶ The duty of the NCE was to identify the norms and standards for the management of the environment.⁴⁴⁷ The primary objective of the NEPL was:⁴⁴⁸

...the preservation, improvement and recovering of environmental quality necessary for life, in order to assure the country's conditions for the economic and social developments, the national security interests and to the protection of the dignity of human life.

To give effect to this objective the NEPL provided for certain environmental regulatory principles.⁴⁴⁹ These principles required governmental action for the management and maintenance of the ecological balance, meaning that the environment is a common inheritance and must be conserved and protected for

441 Colares 2008 *Syracuse Journal of International Law and Commerce* 102; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

442 Moreira and Goldemberg 1999 *Energy Policy* 232; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Colares 2008 *Syracuse Journal of International Law and Commerce* 102.

443 *Sistema Nacional do Meio-Ambiente*.

444 Egler *Improving the Environmental Impact Assessment* 255.

445 *Conselho Nacional do Meio-Ambiente*.

446 Egler *Improving the Environmental Impact Assessment* 255.

447 Egler *Improving the Environmental Impact Assessment* 254.

448 Colares 2008 *Syracuse Journal of International Law and Commerce* 102; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Egler *Improving the Environmental Impact Assessment* 255.

449 Egler *Improving the Environmental Impact Assessment* 254.

collective use.⁴⁵⁰ The first principle or demand requires that the ecological balance must be maintained through governmental action and protected for collective use for present and future generations.⁴⁵¹

The following principles are based upon this first demand which requires that the use of soil, water resources, mineral resources and air must be done in a wise and sensible manner; the use of natural resources must be planned and monitored; activities that could potentially pollute or cause negative impacts to the environment must be subjected to control and zoning measures; new research and technologies must be promoted and developed in order to improve the rational use of natural resources; the quality and status of the environment must be constantly monitored and degraded areas or ecosystems must be improved and conserved; and environmental education and participation must also be promoted in communities.⁴⁵²

7.3 Brazil's ethanol industry

It is within this framework provided for by the 1988 Constitution, NEPL, NSE and the NCE that Brazil's long history and experience with bio-fuels have attracted global interest.⁴⁵³ The bio-fuel industry gained attention in Brazil due to the potential it have to reduce CO₂ emissions, to add to a country's energy mix and supply and to improve agricultural practices and development.⁴⁵⁴ The Brazilian ethanol programme was an initiative implemented by the military government from 1964 to 1985, in order to become more independent of Middle Eastern oil supply.⁴⁵⁵ The ethanol production industry was based on government subsidies and tax refunds for sugar cane producers in order to make it a profitable and

450 Colares 2008 *Syracuse Journal of International law and Commerce* 102; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

451 Egler *Improving the Environmental Impact Assessment* 254.

452 Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Colares 2008 *Syracuse Journal of International Law and Commerce* 102.

453 Egler *Improving the Environmental Impact Assessment* 254.

454 Colares 2008 *Syracuse Journal of International law and Commerce* 101.

455 Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

competing industry in its initial stages.⁴⁵⁶ During the 1970s the oil price impaled due to the oil crisis of 1973.⁴⁵⁷ Brazil's response to this crisis was the National Alcohol Program⁴⁵⁸ (*Proálcool*) which was the first bio-fuels programme in Brazil.⁴⁵⁹

The *Proálcool* was an inventive and effective programme despite cheaper energy sources such as coal and oil.⁴⁶⁰ In 1975 the *Proálcool* was enacted as law and a nationwide ethanol production chain was developed.⁴⁶¹ The primary aim of the *Proálcool* was to produce 3.5 billion litres of ethanol from sugar cane by 1980 and in addition achieve national socio-economic goals such as savings from foreign exchange; to reduce inequalities of the regional and personal income; a larger utilisation and cultivation of redundant and or degraded land; to increase labour resources; and to develop the production of monetary goods in Brazil.⁴⁶²

Article 2 of the *Proálcool* specifies a selection of crops that may be used for the production of ethanol namely such as sugar cane and manioc roots.⁴⁶³ The *Proálcool* requires an increase in the production of these crops which would automatically increases the agricultural sector's practices and productivity and promotes the modernisation of sugar distilleries.⁴⁶⁴ The main objectives of the *Proálcool* are to diminish the regional inconsistencies in ethanol production and bring all regions to a competitive level; to augment the accessibility of basic

456 Moreira and Goldemberg 1999 *Energy Policy* 232; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Colares 2008 *Syracuse Journal of International Law and Commerce* 102.

457 Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Moreira and Goldemberg 1999 *Energy Policy* 232; Colares 2008 *Syracuse Journal of International law and Commerce* 102.

458 Law No 78,593 of 14 November 1975 (the *Proálcool*).

459 Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Moreira and Goldemberg 1999 *Energy Policy* 232; Colares 2008 *Syracuse Journal of International law and Commerce* 102.

460 Colares 2008 *Syracuse Journal of International law and Commerce* 102.

461 Colares 2008 *Syracuse Journal of International law and Commerce* 102; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

462 Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

463 Colares 2008 *Syracuse Journal of International law and Commerce* 103.

464 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

technologies, implements and machinery for the agricultural sector and sugar distilleries; and to minimise the transport costs of ethanol products.⁴⁶⁵

The *Proálcool* specifically makes provision for financial incentives by providing that all investments and costs relating to the ethanol programme would be funded by the national bank system.⁴⁶⁶ This provision for financial incentives of the *Proálcool* is incorporated to encourage and augment the ethanol production.⁴⁶⁷ For example, the *Proálcool* states that regions where crops production are not normally cultivated or regions with low cultivation potential would be assisted by the National Monetary Council (NMC) to improve their cultivation potential.⁴⁶⁸

Article 7 states that the National Petroleum Council (NPC) must establish a programme for the distribution of ethanol within the existing petroleum companies at an affixed price determined by the NPC.⁴⁶⁹ It seems that the *Proálcool* initially had a good effect. In 1985 almost 95% of vehicles with internal combustion engines in Brazil were ethanol driven.⁴⁷⁰ However, the percentage of cars using ethanol dropped drastically to about 3% during the 1990s due to the ludicrous low price of oil that made the ethanol industry an expensive one.⁴⁷¹ Various factors contributed to the fall of the Brazilian ethanol industry.⁴⁷² Sugar prices

465 Article 3(b) of the *Proálcool*.

466 Article 4 of the *Proálcool*. For example article 5(a) states that investments aimed at the installation, modernisation or expansion of distilleries or agricultural practices would be provided for by the *Banco Nacional do Desenvolvimento Economico*; the *Banco do Brasil*; the *Banco do Nordeste do Brasil*; and the *Banco da Amazonia*.

467 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

468 Article 5(b) of the *Proálcool*.

469 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

470 Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290.

471 Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 179; Colares 2008 *Syracuse Journal of International law and Commerce* 103; Paiva and Wolde-Georgis 2010 <http://ssrn.com/abstract=1593658>.

472 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2232.

increased, oil became more affordable and governments supported the new civilian ruling governments of the Middle East.⁴⁷³

Only one argument in favour of the ethanol programme remained. Ethanol was free of pollutants and helped reduced CO₂ emissions, thus being more environmentally friendly.⁴⁷⁴ This is still the main argument in favour of bio-fuels today and is one of the possible alternative energy options to adapt to climate change.⁴⁷⁵ To restore the ethanol industry to its previous glory the Brazilian government legislated a 22% increase in ethanol content in gasoline driven vehicles in 1993.⁴⁷⁶ Brazil accordingly survived international oil price swings through innovative legislation for bio-fuels. At the end of the 1990s the oil price increased drastically again and the Brazilian motor industry turned to ethanol once again.⁴⁷⁷ The high and unstable oil prices and Brazil's initiative taken with its ethanol industry and the state owned oil company *Petrobras's* offshore oilfields discovery enabled the country to be a *self oil capability* country.⁴⁷⁸

The aim of the *Proálcool* was to produce 3.5 billion litres of ethanol by 1980.⁴⁷⁹ By the time the *Proálcool* was implemented in 1974, Brazil already had 130 ethanol distilleries which produced 625 million litres of ethanol and had a well established ethanol regime.⁴⁸⁰ The aim of the bio-fuels industry of Brazil differs

473 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2232.

474 Colares 2008 *Syracuse Journal of International law and Commerce* 102; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290.

475 International Energy Agency *CO2 Emissions* 14; Van Drunen, Lasage and Dorland *Climate Change* 144; Low *Climate Change and Africa* 124-126; Manahan *Fundamentals of Environmental Chemistry* 1107-1109; Saket *Food versus Fuel* 2; Rosamond *et al* 2003 *Environment* 34; Chakauya, Beyene and Chikwamba 2009 *South African Journal of Science* 176-178; Lynd *et al* 2003 *South African Journal of Science* 501; Demirbas and Demirbas 2007 *Energy Conversion and Management* 2389-2392.

476 Law No 8,723 of 28 October 1993. See Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232.

477 Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

478 Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

479 Nass, Pereira and Ellis 2007 *Crop Science* 2231-2232; Colares 2008 *Syracuse Journal of International law and Commerce* 103

480 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290.

completely from that of South Africa. Even though South Africa acknowledges that the bio-fuels industry could act as a bridge between first and second economies, South Africa primary reason for implementing a bio-fuels industry is to adapt to the effects of climate change.⁴⁸¹ Brazil's primary reason for the implementation of a bio-fuels industry was mainly to become independent and provide its own fuel and simultaneously uplift the socio-economical standings.⁴⁸²

7.4 Brazil's bio-diesel programme

After the success the Brazilian government had with its ethanol programme, the government considered the use of bio-diesel and implemented various research and pilot projects for bio-diesel.⁴⁸³ In 2002 the Ministry of Science and Technology (MCT) introduced the *Pro-Bio-diesel* programme.⁴⁸⁴ The programme proposed a B5 (5% bio-diesel with 95% diesel) blend with diesel in Brazil with a target of B20 (20% bio-diesel and 80% diesel) blend within 15 years from the date of implementation of the *Pro-Bio-diesel* programme.⁴⁸⁵

The MCT noted that the use of bio-diesel and bio-fuels in general is not only economically beneficial but also a guaranteed alternative for fossil fuels.⁴⁸⁶ The MCT reported that the environment and social sector would also benefit from the use of bio-fuels in Brazil.⁴⁸⁷ Bio-fuels were biodegradable; were produced from renewable sources; emitted about the equal amount of CO₂ that was absorbed during the cultivation of oilseed; and was not hazardous material.⁴⁸⁸ After considering these benefits the government constructed a ministerial commission

481 See 5.4 and 5.5 above.

482 Colares 2008 *Syracuse Journal of International law and Commerce* 103.

483 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

484 Pousa 2007 *Energy Policy* 5394. The Pro-Bio-diesel programme was introduced by the Decree No 702 of 30 October 2002.

485 Pousa 2007 *Energy Policy* 5394; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148.

486 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148.

487 Pousa 2007 *Energy Policy* 5394; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148.

488 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148; Joint Transport Research Centre *The Performance of Brazilian Biofuels* 77.

to discuss and lay down the basis for the National Programme for the Production and Use of Bio-diesel (NPPUB).⁴⁸⁹ The ministerial commission reported in 2003 that the NPPUB must be based upon the three legs of sustainability namely social, economical and environmental.⁴⁹⁰ The reason was that the NPPUB must serve as a tool to promote social inclusion and social integration through social and economical development in the country.⁴⁹¹ The ministerial commission identified the less developed regions of Brazil to benefit from the social and economic development of the NPPUB.⁴⁹²

The report further advised that bio-diesel should immediately be introduced into the Brazilian fuel matrix but should not be regarded as compulsory.⁴⁹³ The commission argued that the introduction of bio-diesel should be optional so that the NPPUB would not institute established routes of technologies or raw material for bio-diesel production in the country.⁴⁹⁴ This way the bio-diesel industry would prove itself by reflecting what worked best and which routes or material would be more sustainable.

In 2005 the Brazilian government introduced the commission's findings and reports on bio-diesel by way of legislation into the Brazilian fuels industry.⁴⁹⁵ The NPPUB for bio-diesel proposed the optional use a B2 (2% bio-diesel and 98% diesel) blend until 2008 where after the use of B2 will become compulsory.⁴⁹⁶ The law on bio-diesel states that between 2008 and 2013 the use of B5 (5% bio-

489 Pousa 2007 *Energy Policy* 5394; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148

490 Pousa 2007 *Energy Policy* 5394.

491 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148; Joint Transport Research Centre *The Performance of Brazilian Biofuels* 77; Pousa 2007 *Energy Policy* 5394.

492 Pousa 2007 *Energy Policy* 5394; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148

493 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148.

494 Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2234; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290.

495 Law No 11097 of 13 January 2005. See Colares 2008 *Syracuse Journal of International law and Commerce* 103.

496 Nass, Pereira and Ellis 2007 *Crop Science* 2234; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

diesel and 95% diesel) blend will be optional and after the period has lapsed the use of B5 blends will be compulsory as well.⁴⁹⁷ This way the law provides the industry and technologies to settle into the use of bio-diesel and prevents non compliance issues by providing for optional periods and thereafter it becomes mandatory, once it settled in.

With regard to the report of the ministerial commission on the issue that the NPPUB must not provide for established routes of technologies or raw material for bio-diesel production the new law defined bio-diesel as any "bio-fuel derived from renewable biomass for the use in engines of internal combustion with ignition by compression or for generation of another type of energy, that can partially or totally substitute fossil fuels."⁴⁹⁸ This definition of bio-diesel imputes no restrictions with regard to the technologies that could be used or the choice of raw material that could possibly be used to produce bio-diesel.⁴⁹⁹

The natural sequestration of carbon in the vast rain forest, namely the Amazon, remains one of the most valuable contributions to global environmental health.⁵⁰⁰ Brazil's bio-fuels industry largely depends on soybean and sugarcane crops.⁵⁰¹ The cultivation of these crops for food and bio-fuel purposes poses a threat to the Amazon forests in Brazil.⁵⁰² It is anticipated by Brazilian researchers that if soybean and sugarcane expansions continue on current trend it could reduce the Amazon rainforests with 40% by 2050.⁵⁰³

497 Colares 2008 *Syracuse Journal of International law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2234.

498 Article 4 of Law No 11097 of 13 January 2005. See Colares 2008 *Syracuse Journal of International law and Commerce* 103.

499 Nass, Pereira and Ellis 2007 *Crop Science* 2234; Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 290.

500 Rosamond *et al* 2003 *Environment* 38.

501 Rosamond *et al* 2003 *Environment* 38.

502 Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 304; Rosamond *et al* 2003 *Environment* 38; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1149; Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

503 Rosamond *et al* 2003 *Environment* 38; Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

The Brazilian government took the initiative with the NPPUB to provide a framework for the chain of production, credit finance and basic technologies in the initial stages but with its focus on supporting family farms instead of large established researchers or fuel companies.⁵⁰⁴ For example, the Brazilian Ministry of Agrarian Development (MDA) instituted the Selo Combustive Social (SCS) which aim was to develop and administer practices and programmes which were socially the best option and most beneficial in order to persuade companies entering the bio-diesel industry to conclude commercial agreements with small scale family farms.⁵⁰⁵

The Brazilian government introduced certain incentive mechanisms to encourage the inclusion of family farmers of the National Programme for the Improvement of Family Agriculture (NPIFA) who produced bio-diesel in the less developed regions of Brazil.⁵⁰⁶ The government introduced the "social fuel seal" which was created to stipulate the efforts aimed at the development of these regions.⁵⁰⁷ In order to obtain the "social fuel seal" companies need to conclude technical cooperation agreements with small producers or directly with family farmers.⁵⁰⁸

Agreements concluded with small scale family farms contain standard clauses which set the duration of the agreement and the price tariffs and terms.⁵⁰⁹ The industry participants must also, under the agreement, provide technical assistance and training to the small scale family farm producers to become "social fuel seal" certified.⁵¹⁰ This certification programme reflects the progress

504 Nass, Pereira and Ellis 2007 *Crop Science* 2234; Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1148.

505 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1149; Pousa 2007 *Energy Policy* 5394.

506 Nass, Pereira and Ellis 2007 *Crop Science* 2230; Pousa 2007 *Energy Policy* 5394; Colares 2008 *Syracuse Journal of International law and Commerce* 103.

507 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1149; Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

508 Nass, Pereira and Ellis 2007 *Crop Science* 2230.

509 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1149; Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

510 Nass, Pereira and Ellis 2007 *Crop Science* 2230.

that bio-fuels policy process has made in Brazil to integrate economic concerns with environmental and social development issues.⁵¹¹

The "social fuel seal" brings endless advantages for these companies.⁵¹² For example, it allows the companies to help them qualify for public bank loans; qualify for tax exemptions and government subsidies; and is regarded as a positive marketing tool for companies.⁵¹³ To be eligible for special tax benefits and financing from the government, these fuel companies or industry participants must conclude raw material supply agreements with family farmers.⁵¹⁴

One can safely assume that Brazilian legislation regulating the bio-fuels industry is largely based upon market-based and incentive-based instruments with primary aim of social upliftment. However, the new trend in Brazilian bio-fuels policy making is to promote the environmental best practices while simultaneously promoting programmes for socio-economic development.⁵¹⁵ By incorporating these three aspects of sustainability into its policies Brazil has driven bio-fuel production from an idea to a corporeal industry that is supported and protected by the public and private sectors in Brazil.⁵¹⁶

7.5 Conclusion

Traditionally Brazil's bio-fuels industry has been driven by an initial reaction to unstable oil prices.⁵¹⁷ The Brazilian government, however, acknowledges that an efficient and well planned bio-fuels policy could result in various positive effects,

511 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1149; Joint Transport Research Centre *The Performance of Brazilian Biofuels* 66.

512 Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

513 Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

514 Da Silva César and Batalha 2010 *African Journal of Agricultural Research* 1149; Pousa 2007 *Energy Policy* 5394; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

515 Cordonnier 2008 *William and Mary Environmental Law and Policy Review* 304; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

516 Nass, Pereira and Ellis 2007 *Crop Science* 2230; Pousa 2007 *Energy Policy* 5394.

517 Colares 2008 *Syracuse Journal of International Law and Commerce* 103; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

economically, socially and environmentally wise.⁵¹⁸ Therefore the Brazilian bio-fuels industry is mainly driven by economic incentives and market based instruments. However, Brazil is not exactly embracing a wider and more sustainable environmental agenda and its bio-fuel strategy may threaten its contribution to climate change adaptation.⁵¹⁹

Brazil's bio-fuels industry poses to be a threat to the vast rain forest surrounding the country. It is clear that Brazil initially introduced its bio-fuels industry for economical growth and industry related reasons. The Brazilian bio-fuels industry was and is still mainly driven by the socio-economic upliftment in the developing country. It is clear that Brazil did implement sustainable development planning before implementing its bio-fuels industry for all the aspects regarding socio-economic and environment was not integrated and considered.

Brazil failed to upkeep the balance line of sustainable development as explained in figure 1 above. What South Africa should take away from Brazil is that the constant monitoring and implementation of sustainable development planning into the bio-fuels industry will help identify the constraints placed upon the environment by the bio-fuels industry. By introducing sustainable development planning, measures will be identified that can be used in order to prevent the bio-fuels industry from surpassing the identified constraints. Brazil did not identify its bottom line and only focussed on the socio-economic development rather than upholding the balance line between socio-economic development and the protection of the environment.

518 Colares 2008 *Syracuse Journal of International law and Commerce* 102; Rosamond et al 2003 *Environment* 38.

519 Rosamond et al 2003 *Environment* 38; Nass, Pereira and Ellis 2007 *Crop Science* 2230.

8 Conclusion and Recommendations

The aim of this study was to determine how the bio-fuels industry should be regulated in South Africa as a developing country by distilling lessons from the Brazilian bio-fuels regulatory experiences. Bio-fuels can be defined as any fuels that can be derived from organic material and are renewable in the sense that it cannot be depleted. Bio-fuels seem to be a feasible alternative to the conventional fuels produced from oil, petroleum and synthetic fuels produced from the combustion of coal. For bio-fuels to be a feasible alternative for South Africa it should mean the development of a bio-fuels industry that can eventually take the place of the fossil fuel industry and ensure that enough food crops be available to feed the nation and provide for food security.

There are several arguments raised for and against bio-fuels such as that the utilisation of maize for bio-fuels purposes might negatively impact the food security, cause inflation in food prices and possibly increase GHGs through land use change and agricultural activities. Then there are the arguments in favour of bio-fuels such as that bio-fuels could provide economical growth in the agricultural sector, alleviate poverty, promote the development of rural and underutilised areas, sustainably supply the population with modern renewable and environmentally friendly energy, provide poor areas with energy and infrastructure and contribute to economical and political development.

To determine whether a bio-fuels industry is feasible and viable it can be measured against the principles of sustainable development. The principle of sustainable development is the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations. All three these components are underpinned by governance by way of policy, plans, strategies and legislation containing principles of sustainable development and other management and regulatory tools.

Sustainable development focuses on the improvement of the society and economy while taking into consideration the limits and boundaries of the environment. Sustainable development planning and conservation is required in this regard to identify the balance line as indicated in figure 1 above and provide for a maximum of constraints on the biodiversity and its natural resources. With regard to bio-fuels this would entail sustainable development planning to determine the constraints that a bio-fuels industry would place on the environment and then identify the balance line that should be kept in order for the bio-fuels industry to be sustainable.

Sustainable development can further be defined within a set of normative environmental principles rather than being just a single recipe for environmental policies and environmental protection. In this study some of the principles of sustainable development was referred to in relation to the bio-fuels industry as well as with reference to environmental management tools that could be applied in order to give effect to these principles. The sustainable development planning principles such as the precautionary principle reflected in an EIA and integration and equity by way of an SEA on decision making level and an LCA on project and implementation level of a bio-fuels industry were discussed.

Figure 2 above proposes the incorporation of sustainable development planning into a bio-fuels industry. At higher decision making level a SEA should be conducted to determine the constraints on the environment of the current energy and renewable energy policies in place. The constraints identified by way of sustainable development planning must be regarded as an indication of the balance line that should be held. Therefore a SEA is required to identify the constraints and determine how policies should be adapted to integrate all aspect.

Before an activity or project can commence, environmental authorisation in terms of section 24 of NEMA is required. This entails an EIA to be conducted in order to identify the risks and impacts the project or activity might have on the biodiversity and natural resources. For example, the EIA should indicate the

bottom line with regard to the amount of resources that can be utilised during this activity. With regard to bio-fuels and EIA would indicate, for example the amount of crops that may be used during a year in order to keep the balance line referred to in figure 1 above.

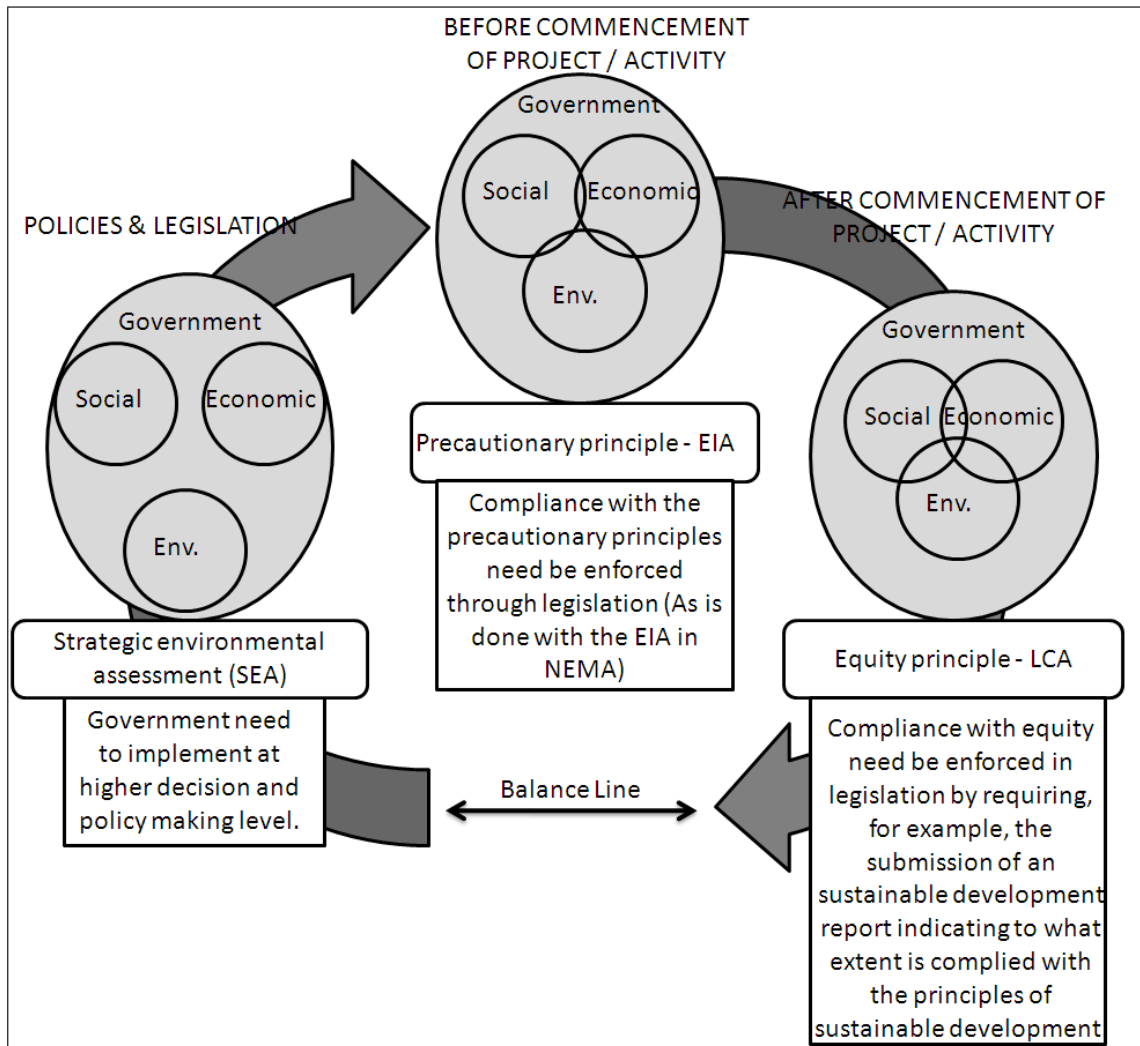


Figure 3: The continual cycle of sustainable development planning, illustrating the pursuit of sustainable development and the upkeep of the biodiversity balance line.

The reason for the circles being closer to each other but not yet completely integrated in the project or activity commencement phase is because an EIA is not the final tool used to determine whether and project or industry is sustainable. After commencement of the activity and after the proposals and amendments proposed by the SEA and the EIA have been followed a LCA should be

performed in order to evaluate the equity and thus sustainable development of the project and overall industry. The LCA would require a constant monitoring, evaluating and reporting of the constraints and the upkeep of the balance line. Figure 3 above indicates the cyclical process of sustainable development planning that should be followed with regard to the bio-fuels industry. In order to upkeep the balance line and prevent the bio-fuels industry from contributing to bio-diversity loss, this process must be continually executed to integrate the economical, social and environmental circles with each other. When striving to keep these sectors integrated with one another, it will keep the balance line from becoming unstable.

South Africa has a policy framework for renewable energy and bio-fuels in specific. The principles of sustainable development planning are, however, not integrated and are found in various policy documents. A bio-fuels industry cannot be promoted by reading the BFIS in isolation from the WPoEP, WPoRE, NFSD, JPOI or the National Climate Change Response White Paper. South Africa's energy policy framework provide for the basic principles of sustainable development, however, the initial integration of these fragmented principles set out in a various different policies is lacking.

There has never a SEA of South Africa's energy policy framework been done, and such a would be required to fully incorporate sustainable development planning into the renewable energy industry. This is also a lesson to be learnt from the Brazilian policy framework. The Brazilian bio-fuels policy framework placed so much emphasis on socio-economic growth and improvement that the conservation of and constraints on the environment was completely forgotten. Therefore the Brazilian bio-fuels policy framework cannot be said to have been subjected to sustainable development planning. Only recently the Brazilian government started to recognise the constraints placed upon the environment by their bio-fuels industry.

The South African Constitution provides every person with a right to an environment which is not harmful to their health or well-being. It also makes provision for the concept of sustainable development and provides for state duties with regard to environmental conservation. The 1988 Constitution of Brazil provides every person with a right to an "ecologically balanced environment" which is a social fundamental right attached to the individual's duty and the state's responsibility to protect the environment for present and future generations. The Brazilian Constitution of 1988 places more emphasis on the ecology rather than promoting an anthropocentric or sustainability approach.

With regard to bio-fuels in South Africa there is no specific legislative document that directly deals with the bio-fuels industry and the specific regulation thereof. South Africa has a general environmental legislative framework provided for under NEMA. Mining, transport and energy are regulated by sectoral specific laws but the government departments are still subject to the section 2 NEMA principles and environmental authorisation prerequisites, where required. The PPA states, for example, that no licence for manufacturing or retailing of petroleum products will be granted if all other permits or authorisations under any other law are not complied with. This includes compliance with environmental legislation before the CCP will issue a manufacturing licence. It therefore seems that there should at least be some administrative cooperation between the different governmental departments dealing with environmental protection and socio-economic development. Biofuels manufacturing must be licenced in terms of the PPA and there are some guidelines in this regard. The guidelines are not binding.

Brazil only has one legal document dealing with bio-fuels, namely Law No 78,593 of 14 November 1975, or the *Proálcool*. Brazil's primary reason for the introduction of the *Proálcool* was to become independent and provide its own fuel and simultaneously uplift the socio-economical standings. Due to the financial and economic incentives the *Proálcool* was successful and in 2003 Brazil introduced its bio-diesel programme which is not yet translated into law.

However, even though Brazil has a National Environmental Policy Law (NEPL) which provides for a legislative regulatory framework for the conservation and protection of the environment, no correlation exists between the *Proálcool* and the NEPL with regard to the regulation of the Brazilian bio-fuels industry. For example the *Proálcool* regulates the bio-fuels industry and all economical and commercial aspect relating thereto and makes no reference to the requirements or principles provided for in the NEPL. The main aim of the Brazilian bio-fuels industry is socio-economical upliftment, for example such as the social-fuel stamp that promotes bio-fuel production only and not taking into consideration the impacts of commercial bio-fuels production on the environment.

In South Africa there is an established energy and fuel industry infrastructure with legislative regulatory measures that relate to renewable energy and bio-fuels in specific and provide for the incorporation of sustainable development planning in an incongruent set of statutes. A regulatory legislative framework for the fuels industry already exists under the PPA.

The reason for figure 3 illustrating sustainable development planning as a continuous process is because of the variable factors in the environmental and socio-economical sectors. For example, the economy will be affected by drought and a poor rainfall. This will mean more food crops need be imported to provide for food security. Then there is the constant effects of climate change that need be adapted to. To upkeep the balance line between socio-economical development and environmental protection, sustainable development planning principles need be constantly applied to an industry. It is recommended, for the bio-fuels industry to be feasible, that the principles of sustainable development planning be incorporated into legislation.

The PPA already regulates the licencing aspect of the bio-fuels industry. It, however, lacks the sustainable principles and therefore sustainable regulation of a fuels industry. Firstly, at governmental level and higher decision making level a

complete SEA of energy policies and legislation need be conducted to identify the possible constraints imposed by the concerned documents and identify measures and taxes to be incorporated into legislation and other regulatory documents that will promote the sustainable development of a bio-fuels industry.

The SEA will also indicate to the private sector what constraints the bio-fuels industry imputes on the environment, biodiversity and South Africa's natural resources. Once these identified constraints are incorporated into legislation and the constant cycle of sustainable development planning as indicated in figure 3 above is implemented, the bio-fuels industry could provide a feasible alternative to fossil fuels in South Africa as a developing country.

It is not recommended that the wheel be reinvented. The PPA is already in place to regulate the South African fuels industry; it only need be amended to incorporate regulatory measures which promote sustainable development of the fuels industry and cooperation between governmental departments. Compliance with the precautionary principles need be enforced through legislation. This is already done through NEMA which provides that an environmental authorisation need be obtained. The PPA also states that if the applicant for a licence under the PPA is in not compliance with all national, provincial and local government legal requirements, a licence shall not be issued. This indicates cooperation between the CCP and other governmental departments. Do we need reference to this in the PPA – what about the guidelines?

Further, compliance with equity need be enforced in legislation by requiring, for example, the submission of a sustainable development report indicating to what extent is complied with the principles of sustainable development. It is recommended that the PPA be amended to incorporated the specifics for a bio-fuels such as indicated crops may be used; the amount of crops that may be used each year for bio-fuel purposes; which land may be used for crops production for bio-fuel purposes, for example only rural land; provide specification with regard to the transport of the crops to the bio-fuel plant, to minimise the

amount of CO₂ emissions emitted through transport and market and incentive based principles need be incorporated to provide for the economic viability of the bio-fuels industry, for example governmental subsidies.

All of the aspects pertaining to a bio-fuels industry need be incorporated into legislation for the sustainable compliance report which will indicate the measure of compliance with equity need be assessed against the legislative regulatory specifications. The PPA need be amended to incorporate regulatory tools for a bio-fuels industry that will provide for socio-economic development, such as job creation, poverty alleviation, economical growth by not depending of fossil fuels that need be imported from the Middle East and promote agricultural technologies. However, and this is the lesson to be learnt from the Brazilian bio-fuels industry, the socio-economical development need be done within the constraints upon the environment, identified through the sustainable development planning principles.

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