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Biofuels in South Africa:

Factors influencing production and consumption

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A research report submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Masters of Business Administration

November 2006

Abstract

Interest in the biofuels industry in South Africa is driven largely by high oil prices and a strain on energy resources and logistics. This report considers the development of the biofuels industry in its infancy in South Africa and the factors that need to be taken into account by the potential entrants into the market. It also considers the factors which will continue to affect the sustainability of the biofuels industry.

A total of fifteen experts across the biofuels value chain as well as stakeholders, who are considered experts in their field, were approached directly to provide input into this research. Further information was gathered from three focus groups involving thirty five people, all of whom are involved in the evolving biofuels sector.

The research has shown that out of a number of production factors and consumption factors identified, there a few key factors that can be seen to be largely influencing the further development of the biofuels industry. Similarly a few key factors which will influence the sustainability of the biofuels industry have been identified.

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Declaration

I declare that this research project is my own, unaided work. It is submitted in partial fulfillment of the requirements of the degree of Master of Business Administration for the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University.

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David Leonard Chambers

14 November 2006

Acknowledgement

I would like to thank my wife, Karen Chambers, and children Timothy and Kirsten for their forebearance and patience extended until completion of this report.

Many thanks to my supervisor for her patience.

I would like to mention my appreciation of the time made available by a number of key individuals in an industry which has much to offer over the coming years.

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List of Abbreviations

BEE	**Black economic empowerment**
CDM	**Clean Development Mechanism**
CER	**Certified Emission Reduction**
DME	**Department of Minerals and Energy**
DST	**Department of Science and Technology**
DTI	**Department of Trade and Industry**
GDP	**Gross Domestic Product**
NDA	**National Department of Agriculture**
SA	**South Africa**
SMME	**Small, medium and micro enterprises**

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CHAPTER 1

1 INTRODUCTION

1.1 INTRODUCTION

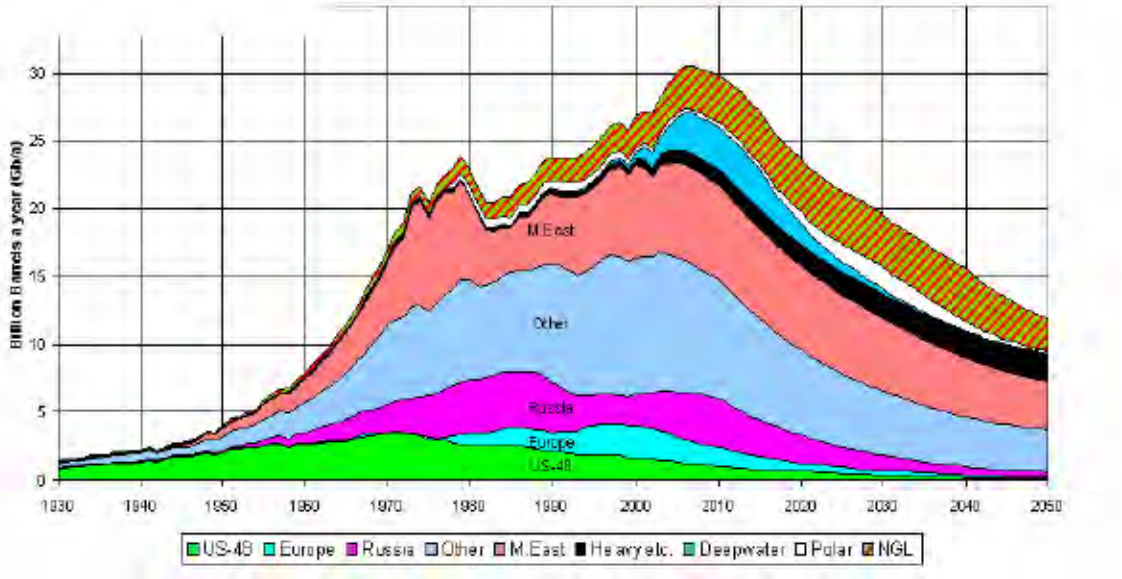
The global economy is in a growth phase lead by China. Together with this growing global economy comes various supply constraints in terms of infrastructure, oils supplies, energy demand in the form of electricity and fuel and the resultant consideration of alternative sources of supply. Alternative energies are high on the agenda across the globe in a search for answers to the aforementioned problem in order to meet rising demand and also looking to the future to develop sustainable alternatives to fossil based resources.

Whereas in the 20th century the businesses of energy supply, agriculture and fuel supply were largely separate sectors with little integration the 21st century brings new challenges and asks for the unlocking of the potential of global resources to reach a sustainable global model of utilisation (Henderson, 2006). The result is likely to be far more integrated energy, agriculture and fuel sectors or the creation of a completely different sector related to agri-energies & fuels.

An assessment of global oil resources paints a picture of diminishing identified or known resources. The forecast for 2010 onwards is a shortage of oil reserves with an inability of the existing fuel suppliers to meet rising demand globally as is

presently forecast. This is depicted in figure 1 below.

Figure 1: Oil resources - 2010 to 2050 (OECD)



A major hurdle that is to be overcome is that of a looming shortage of energy related capacity in South Africa, an ever increasing need for importation of fuel compounded by a pipeline of projects in infrastructure required to be completed by the year 2010.

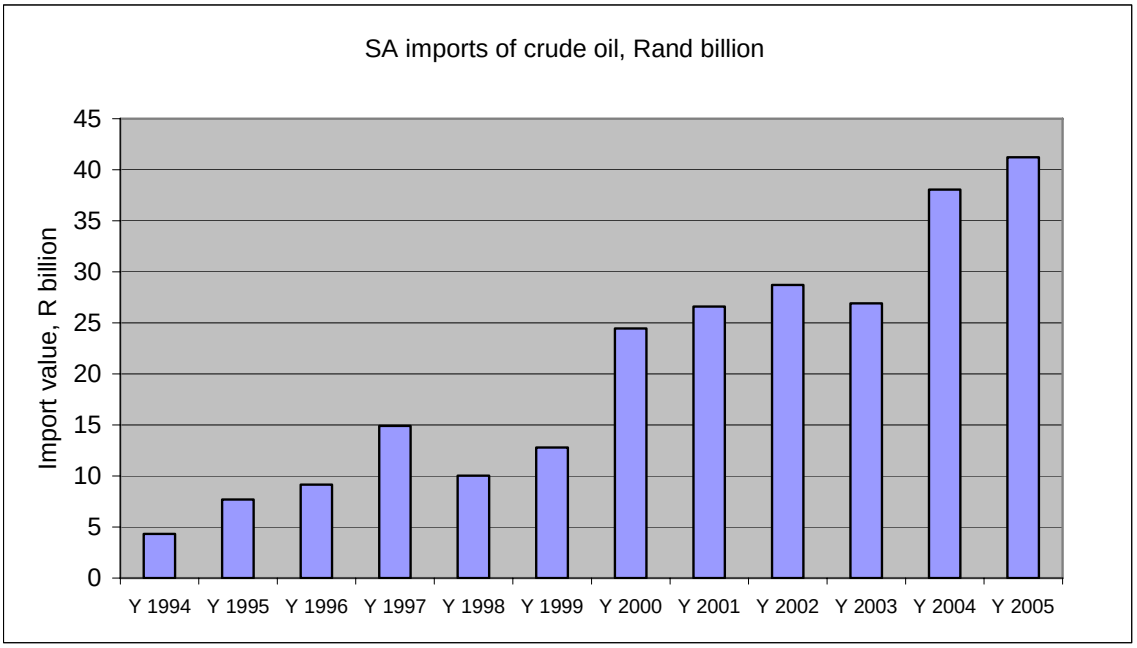
1.2 BACKGROUND

One has to consider where South Africa is positioned relative to demand for as well as capacity to meet increasing demands based upon a 4 to 5% growth rate being experienced at present. South Africa is presently in a renewed phase of development following a period of near stagnation in terms of infrastructure growth

and low GDP growth. The country has in the past ten years relied on excess electrical capacity and oil refining capacity as well as infrastructure and road systems that in 1995 were considered adequate. The government has put forward plans to expend in the order of R370 billion over five years on infrastructure, (Madlala, 2006) starting immediately, with this figure very recently increased to R470 billion.

Factors influencing entry into or involvement in either the production environment or the consumption of biofuels are many and varied. These factors influence different sectors of the market to different extents. At present South Africa is dependant upon imports for approximately 50% of its petroleum needs and this is steadily increasing as can be seen in figure 2.

Figure 2: South African imports of crude oil 1994 to 2005 (SARS)



The world is presently in a demand driven cycle resulting in a high cost of crude oil which has increased from a trading range of $15 to $30 in the early 21st century to in and around $70 in April 2006. More recently this crude oil has been trading in and around $60 per barrel. In conjunction with a doubling in global gas and coal prices over the same period, with China growth driving global demand, this has opened up opportunities for subsitution of energy and fuel derived from a fossil based source to one derived from a renewable source.

Coupled with the above mentioned scenario in Southern Africa, productivity of commercial farming has increased, production has shifted out of marginal areas and total crop volumes have been maintained eventhough less land has been planted (NDA, 2004). This has initially resulted in surpluses of in particular maize of in the order of 2 billion tons in each of the past three seasons namely 2003, 2004 and 2005 (FEWSNET, 2005). On a continued basis this converts into land capacity surpluses.

The maize industry for one is therefore looking to diversify into downstream manufacturing opportunities in order to spread their risk (Maize Forum, 2004). This industry is an example of one looking at the potential of biofuels. A strategic assessment carried out on the maize industry has identified biofuels production (Barnett, 2004) and particularly ethanol production as one of a number of potential opportunities. Similar assessments in the sugar industry have also identified ethanol as a fuel with the potential for growth in South Africa.

The Southern African agricultural industry is in the process of transformation. This is the result of firstly the implementation of a new Agricultural Marketing Act in 1997 (NDA, 2004) and secondly the more recent potential development of the renewable energy industry with a large biofuels component which is agricultural based. This is presently on the starting blocks and looking at ways to overcome barriers of entry into the fuel and energy sectors.

In conjunction with this many of the land claims which were tabled pre 1999 have now been resolved and considerable land has been returned to communities and tribes alike. A large portion of this land presently is either underutilised or presently fallow. The opportunity is available for certain of this land to be developed and utilised for biofuels. In addition to this the government has earmarked additional targets for land to be sourced for potential new entrants.

Starting earnestly in 2002 the South African government has earmarked the biofuels industry as one of the key sectors to develop due to the potential of a significant impact on GDP as well as job creation through development of this new sector. A White Paper on Renewable Energy Policy (DME, 2003) was drawn up to lay down a vision and policy moving forward. This has been highlighted in key speeches by the president, deputy president as well as the finance minister in January and February 2006.

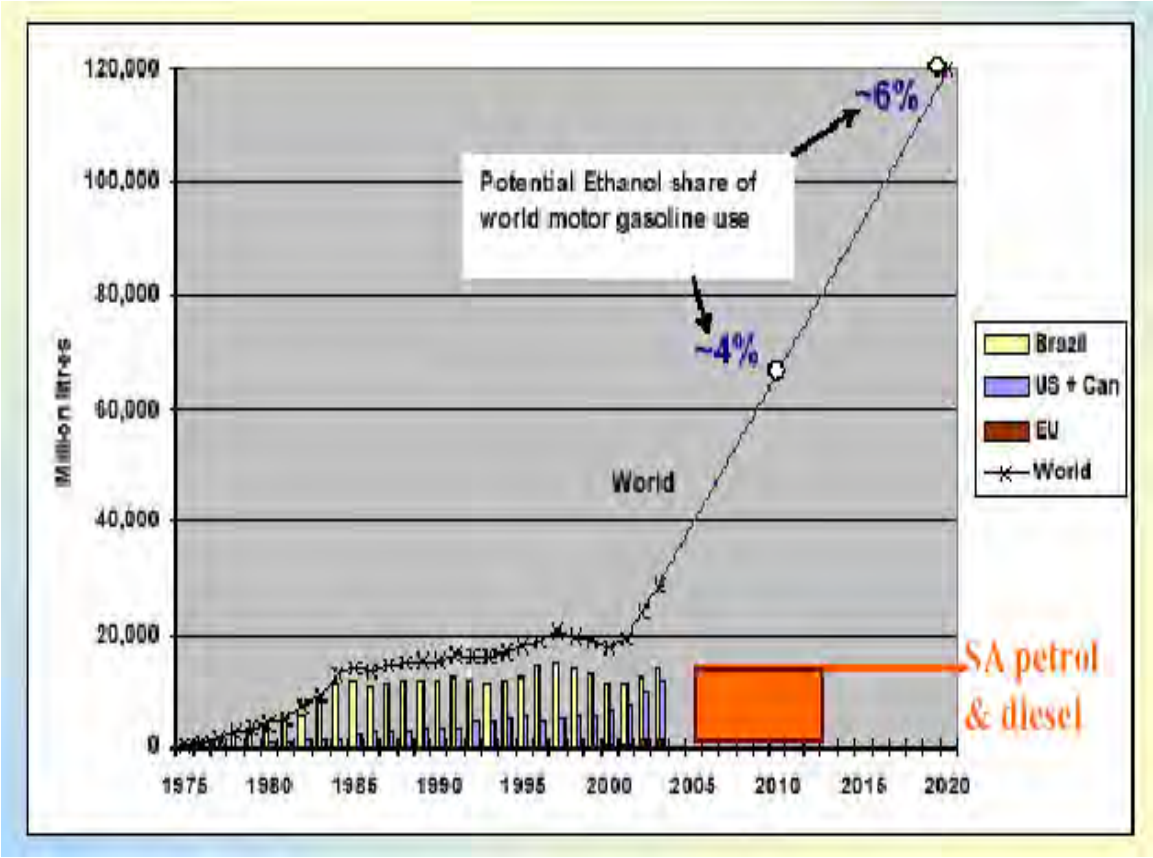
1.3 MOTIVATION FOR THE RESEARCH

The biofuels industry is in its infancy in South Africa. The barriers to entry are significant and the energy market is presently monopolised by a single provider of electricity and the petroleum market by seven refiners who are well entrenched. A number of factors however are assisting the implementation of a biofuels industry and include:

- an imbalance in petrol and diesel usage versus production.
- a high and increasing percentage of GDP expended on crude oil imports.
- the potential of increased inflation with high oil prices.
- high carbon dioxide emissions in South Africa due to high coal and fossil fuel utilisation.
- an increasing dependancy on fossil fuel as the market is now demand driven and existing oil refineries reach their full life span, with no new oil refinery having been built in over twenty years in South Africa.
- significant potential to reduce imports.
- significant potential for job creation.

South Africa is entering a new phase of energy consumption and is able to learn from markets such as Brazil, Germany and the USA where significant strides have been taken over the past fifteen years. Various learnings can be gained from these markets in order to reduce the learning curve for the local biofuels sector.

Figure 3 : Potential global ethanol market (IEA & OECD global data)



Changes to regulations with respect to blending of biofuels in petrol and diesel are presently under development with certain regulatory amendments out for discussion. The government is soon to table a combined short/long term strategy for the biofuels sector.

No specific information is available on the extent of penetration of SMMEs into the industry presently as it has really been the past year during which significant strides have been made in the biofuels industry locally. Numerous factors are influencing choices for participants as well as potential participants in the

production and consumption of biofuels.

In order to achieve this a better understanding of the biofuels business environment is required to inform the potential participant in this growing sector of the economy. The barriers to entry in the biofuels sector are significant as well as the various forces of change in the fuel sector, agri sector and their related industries.

1.4 RESEARCH PROPOSITIONS

South Africa in its own unique way will envelop this new sector and bring to it variations from global markets. The opportunity presents itself to:

- Identify key factors which are either assisting or holding back production and/or consumption within the biofuels sector.
- Idenify and discuss the issues of sustainability of the industry and what factors will most affect this.
- Develop an understanding of the role small and medium business have to play in this commodity driven environment.
- Compare the South African biofuels sector with those of more developed global markets and consider what role government should provide and the type of regulatory environement required.

- Consider potential areas for further development and possibly lead innovation driven from the South African biofuels industry.

1.5 SUMMARY RESEARCH OBJECTIVES

The biofuels industry in South Africa is in its infancy and requires an understanding to be developed on the key factors impacting on the various areas of the industry.

The researcher has set out to identify the factors that play a role in assisting as well as those holding back the biofuels industry both as it is evolving and in the longer term in creating a sustainable business environment.

The research wishes to seek out the factors which are considered as assisting and those which are hindering the development and sustainability of the biofuels industry in order to assist all stakeholders, present and future, in decisions which would be contributing to the development of the biofuels industry. Based upon this basic research various further research would be able to be developed along different core themes identified during the course of this research.

The researcher limits the scope only to an identification of factors and highlighting of key factors. Further to this these factors are grouped and their influences discussed relative to the phases of development of the biofuels industry.

CHAPTER 2

2 THEORY & LITERATURE REVIEW

2.1 CLARIFICATION OF CONCEPTS

National competitiveness

Porter (1990) contends that a nation's competitivenss depends on the capacity of its industry to innovate and upgrade. He further declares that nations ultimately succeed in particular industries because their home environment is the most forward looking, dynamic and challenging.

The question of why companies are able to overcome barriers to change lies in the four attributes which constitute a national advantage. These four attributes are:

1. *Factor conditions*: - The nation's position in factors of production, such as skilled labour or infrastructure, necessary to compete in a given industry.

2. *Demand conditions*: - The nature of home market demand for the industry's products or services.

3. *Related and supporting industries*: - The presence or absence of supplier industries and other related industries.

4. *Firm strategy, structure and rivalry*: - The conditions governing how companies are created, organised and managed as well as the nature of domestic rivalry.

Barriers to entry

The strongest competitive forces determine the profitability of an industry. Every industry has an underlying structure or a set of fundamental economic and technical characteristics (Porter, 1997). New entrants to an industry bring new capacity, the desire for market share and significant resources. The threat of entry depends on the extent of barriers of entry as well as reply from existing members.

The barriers to entry are:

a. *economies of scale:* - these economies deter entry by forcing aspirants either to come in on a large scale or to accept a cost disadvantage.

b. *product differentiation:* - brand differentiation creates a barrier by forcing entrants to spend heavily to overcome customer loyalty.

c. *capital requirements:* - the need to invest large financial resources in order to compete creates a barrier to entry.

d. *cost disadvantages:* - entrenched companies may have cost advantages not available to potential rivals.

e. *access to distribution channels:* - the newcomer must secure distribution of its product or service.

f. *government policy:* - the government can limit or foreclose entry to industries with controls such as licence requirements or limits on access to raw materials.

Strategic competition

The basic elements of strategic competition need to be considered in the light of Henderson's (1989) additions to Porter's diamond. He considers there to be five basic elements in:

i) the ability to understand competitive behaviour as a system in which there is continual interaction between competitors, customers, money, people and resources;

ii) the ability to use this understanding to predict how a given strategic move will rebalance the competitive equilibrium;

iii) identifying resources that can be permanently committed to new uses even though benefits will be deferred;

iv) the ability to predict risk and return with enough accuracy and confidence to justify that commitment ;

v) the willingness to act on convictions.

2.2 THE SOUTH AFRICAN BIOFUELS BUSINESS ENVIRONMENT

2.2.1 Factor conditions

Consideration will be given in this study to various aspects influencing the production and consumer environments for biofuels and includes monopolistic tendencies of the fuel and energy sectors; a pull towards larger economies of

scale to make projects viable; a requirement from government to incorporate BEE and SMMEs into projects and a market for agricultural products which creates a tug-of-war with the food sector to create a sustainable energy sector assisted by the newly created carbon credit mechanisms.

Kesper (2000) states that the small firm discussion is being taken up again in South Africa and that SMMEs can be considered as major employment creators. The implementation of this option could be followed in developing the biofuels industry, taking into account the high unempolyment rate in South Africa at present.

2.2.2 Demand conditions

Renewable Energy is presently seriously being considered as an alternative in various aspects of energy production and consumption to meet present growing global demands. It is entirely possible that more than half the present global energy requirements could be met by non fossil fuel means. It has been postulated that by the year 2050 the present known global oil reserves will have been mostly depleted and that a large portion of the global energy requirements will be produced from renewable energy sources. In this light the South African Government (DME, 2003) took note of this eventuality and has set out policy principles relating to the possible promoting and implementing of renewable energy including for biofuels.

Presently South Africa relies heavily on coal with in excess of 95% of its energy requirements drawn from coal or fossil based fuels. This is in comparison with many other countries which have a larger spread of energy sources which include nuclear, hydropower and renewable energies.

2.2.3 Related and supporting industries

The biofuels industry is linked in part to the poultry industry, feed manufacturers, food industry and feedlot industries. The poultry industry has become the single largest agricultural industry in terms of gross value (Nkuna, 2004) now in excess of R8.6 billion.

Any increase in the biofuels industry value chain will impact on the four above mentioned industries in one way or another. This could positively influence pricing through a greater availability of feed products to each industry or could in times of shortage result in higher input costs (Vink & Kirsten, 2002).

There is a need for efficient distribution networks to support biofuels. Traditional routes to biofuels are inefficient, leading to low energy yields and questionable sustainability (Towler, Oraskar and Smith, 2004). The advantage of biofuels is the production close to source of use.

2.2.4 Firm strategy, structure and rivalry

The biofuels industry forms a subsector of the energy and renewable energy sectors and is interlinked with the electrical energy sector and petroleum sectors. The electrical energy sector is dominated by one company providing over 95% of South Africa's electrical power. In turn the petroleum sector consists of seven companies providing all local fuel requirements. A measure of these sectors using the Herfindahl-Hirschman Index (HHI) (Nellis and Parker, 2002) would demonstrate the extent of their monopolistic tendencies which by their nature can result in inflated prices.

Traditionally the oil industry in South Africa has seven key players who have been entrenched for the past twenty years and more. Due to high barriers of entry including high capital costs, regulations and high risk the industry has been monopolised by six large companies with typically in the order of 8% to 12% market share each and one company with in the order of 40% market share.

2.3 BARRIERS TO ENTRY

2.3.1 Government policy

Presently the South African government is in the process of establishig a biofuels strategy (Le Roux, 2006). This strategy has been considered over the period

March 2006 to November 2006 and has incorporated all relevant government departments and institutions. This policy will set the guidelines for intial entry conditions and sustainable involvement in the biofuels industry.

2.3.2 Economies of scale

Typically in a commodity type environment such as the renewable energy sector the tendency is to move towards economies of scale to reduce costs and reach a competitive advantage. Similarly firms that are expanding are likely to benefit from economies of scale which are internal to their operation (Nellis and Parker, 2002).

With the barriers to entry significantly lower in the biofuels industry than the fossil fuel/petroleum industry there is potential for new as well as smaller companies to become involved. The effectiveness of this strategy is to be considered in the light of commodity based markets.

Over time technology has developed to allow economies of scale to be achieved such that the bioethanol market can be more closely cost competitive with the petroleum sector. This has been demonstrated in Brazil (Goldemberg & Coelho, 2004) where fifteen years of development has provided a distinct advantage in the biofuels sector. Stucley and Schuch (2001) confirm this finding based on experience in Australia.

A comparison of facility required for biodiesel production to that for bioethanol production reveals that production of biodiesel can be achieved on a smaller scale, or by batch means with the potential of significantly smaller economies of scale.

2.3.3 Capital requirements

The scale of production facility globally is increasing as technology develops, distribution channels and markets are streamlined and availability of feedstock and products are increased. The capital cost of entry into the market can be prohibitive as is demonstrated by the cost of a large scale bioethanol plant (Hill, 2006) envisaged for South Africa at R700 million.

The capital requirements for a biodiesel facility however can vary with the potential of low capital requirements on less sophisticated technology on a small scale.

2.3.4 Cost disadvantages

Developed and developing world countries reached agreement in 1997 (Kyoto Protocol), to reduce developed world emissions to 5% below 1990 levels by the year 2012 (Schreiner, 2004). The result of this agreement has been the creation of a Clean Development Mechanism (CDM) and Certified Emission Reduction (CER) trading market which trades credits in carbon dioxide emissions.

This has resulted in a basis being created for longer term solutions to climatic

change and assisted in the reduction of barriers and costs (Grubb, 2000) throughout the renewable energy sector. How this impacts on the biofuels sector is still to be determined.

2.3.5 Access to distribution channels

It is critical in any assessment of the economics of biofuels supply that the whole value chain be considered. With a low bulk density of biomass this creates a logistical problem of handling, storing and transporting (Allen and Browne, 1998). Management and planning of the fuel supply chain is required to ensure access to available distribution channels or development of new channels of offtake and distribution.

2.4 SUSTAINABILITY

Considerable debate is presently being generated as to the capability of the world to meet a high production of renewable energy based upon grown feedstocks. In this case there will become a point where the requirements as laid down by Maslow (Grobler et al, 2002) are not being met. In times of drought and once a critical quantity of land and produce has been earmarked for biofuel production a “needs pull” will be created towards food production to the detriment of the biofuels sector.

The view is that with the additional requirements of supply to a renewable energy

sector the prices (Food Pricing Monitor, 2003) of foodstuffs will increase significantly more during periods of shortages (Vink & Kirsten, 2002). The concern in this regards is also the potential detrimental effect of a global catastrophe or specific regional climatic problems which could put a strain on global prices.

2.5 REGULATORY ENVIRONMENT, SMMEs & BEE

Through the land claims mechanism considerable land is being or has been returned to communities across South Africa. Various avenues are presently being considered for community involvement on more than just satisfying the basic physical needs. A policy of SMME development and incentivisation is supporting the consideration of a number of projects in the biofuels sector.

Through employment equity legislation contained in the Employment Equity Act No 55 of 1998 (Republic of South africa, 1998) organisations have been incentivised to implement affirmative action measures to redress previous disadvantaged groups. This policy is driving incentives as well as partnerships in the biofuels arena.

2.6 PURPOSE OF THE RESEARCH

The purpose of the literature study was to build a foundation upon which further research studies will build. This study sets out to identify the key elements and

critical factors influencing the production and utilisation of biofuels in South Africa.

The research will:

- Identify factors which assist the entry into and sustain involvement in the production environment of biofuels.
- Identify factors which retard or hinder the consumer environment of biofuels.
- Pin point critical factors which influence production and consumption of biofuels.
- Identify factors which contribute to a sustainable biofuels sector.
- Consider the changing environment between the entry into biofuels and a phase when a sustainable sector has been developed.
- Develop and group factors to provide a better overall understanding of the relative importance of these factors.

CHAPTER 3

3 RESEARCH PROPOSITIONS

3.1 RESEARCH TITLE

Biofuels in South Africa: Factors influencing production and consumption.

3.2 RESEARCH PROBLEM

To identify the factors influencing the production and consumption environments in the biofuels sector as it evolves from a fledgling to sustainable industry.

Propositions

Proposition 1:

To identify the factors that influence the production environment through consideration of these influences across the biofuels value chain as well as those influences impacting on key stakeholder groups.

Proposition 2:

To identify the factors that influence the consumption environment through consideration of these influences across the biofuels value chain as well as those influences impacting on key stakeholder groups.

Proposition 3:

To identify the factors considered most likely to have a stronger influence on the evolving biofuels sector in its infancy.

Proposition 4:

To identify the factors considered most likely to have a continual influence on a sustainable biofuels sector.

Proposition 5:

To discuss and develop an understanding of the role of government, the role for CERs, SMMEs and the extent of structures required for a buoyant biofuels sector.

Considering there are a considerable number of factors which presently influence the early development of the biofuels sector and could influence a sustainable biofuels sector this study identifies those factors to be seen as having greater influence in both the intial phase of start-up and in the later sustainable phase.

CHAPTER 4

4 RESEARCH METHODOLOGY

4.1 RESEARCH METHODOLOGY

This research has been undertaken to provide insight into the key elements and critical factors influencing the production and consumption of biofuels in South Africa. The findings will provide input into a benchmarking of South African conditions relative to global conditions, gives insight into specific local business environment differentials and help identify factors which will be of continued significance as the industry develops.

The research explores five propositions as listed in chapter 3. The research makes use of a qualitative research methodology. The research strategy utilised is that of an exploratory study and according to (Welman and Kruger, 2003) is utilised to gain familiarity with a paricular phenomena confirming in what form it exists. This type of study allows for an understanding of a problem to be clarified. The interviews carried out were face to face with interviewees and of a semi-structured nature. The interviews were held with a cross section of experts across the biofuels value chain. The results are supported by three focus group sessions, the first with a group of eighteen members of the South African Biofuels Association and the other two with smaller groups of small and medium producers

and potential producers.

The study starts with a broad focus on the global renewable energy and biofuels industries. A literature review was conducted to identify the main influences on the global biofuels industry and considers a number of areas including technology innovation, carbon credits, monopolies, scales of economy for businesses and barriers to entry amongst other influences.

The literature review is followed by interviews with various stakeholders and experts on a purposive basis. The aforementioned people hold key positions in companies or associations in the biofuels value chain and are considered experts in their fields. Interviews were also held with four key stakeholders on the basis of pre selection and two opportunistic interviews were carried out due to unavailability of experts. This interview process and assimilation of information provides a further understanding of the South African biofuels market and its potential, with consideration given to key elements and critical factors that influence the production and consumption of biofuels.

4.2 POPULATION OF RELEVANCE

The population of relevance is the biofuels industry supply chain in South Africa as well as relevant stakeholder interest groups. The biofuels supply chain consists of nine different groups. These are depicted in figure 3 (see section 6). A most

senior person, considered an expert, from each of the nine groups was approached with one however declining. This includes the agricultural industry (seed suppliers and producers), millers, oil extractors, animal feed manufacturers, biofuels refiners, distributors and two consumer groups. The relevant stakeholder groups include the government, consultants, technology and equipment suppliers, vehicle manufacturers, engineering companies, the petroleum industry, biofuel user groups and potential new entrants, financial institutions and development organisations.

4.3 SAMPLING METHOD AND SIZE

The research strategy utilised is one of an exploratory study. This is appropriate as the industry being considered is one in its infancy in Southern Africa. Initially purposeful sampling uncovered various phenomena drawn from individuals with expert knowledge of the industry. Welman et al (2003) confirms that through the methodology utilised the sample obtained may be regarded as representative of the relevant population.

As no public records are available reflecting the full extent of the industry to date the researcher has to rely on an interpretation of reality through the perspectives of the people intimately involved in this fledgling industry. The sampling size being considered was one of nine experts who are representatives of the biofuels supply chain associations and six experts who are in key positions within the various stakeholder groups. Out of this sample eight experts from the biofuels supply

chain associations made themselves available for an interview, four experts from stakeholder groups and a further two opportunistic interviews were held.The two interviews which could be considered opportunistic interviews were carried out with key stakeholders during the course of the study as these stakeholders were identified.

Two types of focus groups were held. The first type was for small and medium producers and service providers in the biofuels industry where two focus group sessions consisting of seven and ten people resepctively were held in different areas of the country.

The third focus group, with a broader scope, consised of eighteen registered members of the South African Biofuels Association. This focus group session was with a group representing their specific organisations, called together to discuss the present situation within the biofuels industry, the development of a national strategy and possible interventions required in order to stimulate the evolving industry. Various information has been drawn from this session held over four hours, although with a broader scope.

4.4 DATA ANALYSIS

The results of the various interviews was obtained initially through means of content analysis. This was followed up by both qualitative and quantitative analysis. Interviews were initially summarised based upon notes taken and

recordings of each interview. Consideration in the analysis is given to the relative incidence (Welman et al, 2003) of themes at the same time giving consideration to the possible differences in perception and focus between different role players in the industry.

4.5 POTENTIAL LIMITATIONS OF THIS STUDY

This study is limited to identifying the key elements and critical factors influencing the production and consumption of biofuels in the evolving biofuels industry in South Africa, considering each and comparing the influence of each.

The biofuels industry is in its infancy/start-up phase and the relevant experts approached have limited first hand experience of biofuels production or consumption. The results of this study are based largely upon the views of these experts and stakeholders.

This study does not take into account time factors relating to the initial development of the industry and potential maturation. There is only reference made to a start-up phase and a stage reached where there is sustainability. Results should be seen as phase related and not time related.

The results from this study should not be taken as indicative of the results that could be obtained from a similar study of the renewable energy sector eventhough

the biofuel sector forms a subsector of the renewable energy sector. Similarly in the case of the fuel industry no indicative results will be suggested.

This study is also limited to identifying, considering and comparing the various factors, and differentiating between factors which hinder and support the development of the biofuels industry. The information developed here will be available for utilisation in strategic assessments but this does not form part of this study.

CHAPTER 5

5 RESEARCH RESULTS

5.1 INTRODUCTION

Results were obtained from individual direct interviews and from three focus group sessions. The results from the individual interviews were assessed qualitatively using content analysis followed by a quantitative assessment or frequency analysis to determine themes, subsectors and weightings. The interviewee group had been pre selected and consisted of a senior person or expert from each of the predetermined nine different biofuel value chain groups. A further seven interviews were considered with senior personnel from stakeholder groups in regular contact with the nine value chain groups. The breakdown of interviewees in table 1 shows a widespread sample across the full biofuels value chain.

The results of interviews are reported upon in five different ways. These are firstly in the form of factors which influence the production environment, secondly factors influencing the consumption environment, thirdly as factors influencing sustainability, fourthly as frequency and subsectors relating to production, consumption and sustainability and fifthly content analysis of the roles of carbon credits (CERs), SMMEs and government regulatory environment around biofuels.

The interviews included separate but similar questions for both biodiesel and

bioethanol as biofuels. The reason is due to the large differences that are encountered from feedstocks types to blending methods, quality and ultimately different usages. The presentation of results of interviews keep these two fuels separate but also combine results in certain areas such as sustainability .

Table 1 : Interviewee list

Stakeholder Group	Institution/Organisation	Interviewee	Priority
		Position	
Biofuels supply chain representative associations			5 off
Seed & Research	ARC - Agricultural Research Council	Senior Manager	
Feedstock	Grain SA	General Manager	
Milling	National Chamber of Milling	Managing Director	
Refining	SABA - SA Biofuels Association	CEO	
Distributors	SA Petroleum Retailers Association	National Director	
Byproducts	Animal Feed Manufacturers Association	General Manager	
Stakeholders			
Government	Department of Minerals and Energy	Deputy Director Energy	2 off
	Department of Science and Technology	Deputy Director Energy	
	Department of Trade and Industry	Director Projects	
Consumers	National Automobile Manufacturers Ass	Director	2 off
	SA Heavy Vehicles Association	Deputy Chairman	
	Automobile Association of SA	Manager	
Petroleum Companies	PetroSA	Chairman	1 off
	SASOL	Director Technology	
	One of Shell, Total, BP, Engen or Caltex	Director Strategic Projects	
Consultants	Independent Fuels Consultant	Director	1 off
Financial Institutions	FNB/SBSA Bank Agri	Managing Directors	1 off
	Industrial Development Corporation - Agri	Senior Manager	
	CEF - Central Energy Fund	Managing Director	
Producers	Independent Producer 1	CEO	1 off
	Independent Producer 2	Director	
			13 off
Opportunistic			
Seed supplier	Monsanto	Product Manager	1 off
Investors	Capital Fund	Member	1 off
			15 off
Focus Group 1	South African Biofuels Ass Members	Range of positions	18 off
Focus Group 2	Potential SME producers, investors & servs	Range of positions	17off
			50 off

5.2 INTERVIEWS COMPLETED

A total of fifteen individual interviews were carried out and three focus groups sessions were held. A further four individual interviews were planned but these were declined on the basis of availability of the participants, not considered appropriate by the prospective interviewee or deferred to another party in the organisation.

In total of fifty people of whom thirty five are directly associated with the biofuels industry value chain and the remainder only stakeholders associated with the biofuels industry had input into either direct interviews or focus group sessions.

5.3 ANALYSIS OF INTERVIEWS

5.3.1 PROPOSITION 1

Proposition 1 is to identify the factors that influence the production environment through consideration of these influences across the biofuels value chain as well as those influences impacting on key stakeholder groups.

The full details of respondents replies relating to proposition 1 are contained in Appendix C and Appendix D. The core responses have been summarised in table 2 and table 3. Table 2 provides the most frequent responses relating to the

production of bioethanol and table 3 responses relate to the production of biodiesel. The responses are grouped together and presented in table 4 and table 5 respectively for bioethanol and biodiesel.

Table 2 : Factors influencing the production environment – bioethanol

Group	Stakeholder Group	Feedstock availablty	Land availablty	Impact on markets	Market for products	Incentives	Economics	Market volatility	Govmt Policies	Logistical aspects	National Interest	Technology	Technical	Quality
1	**Research & development**		x			x	x				x			
2	**Seed**	x					x		x	x		x		
3	**Feedstock**		x	x			x	x	x					x
4	**Milling**													
5	**Refining**		x		x	x	x			x			x	x
6	**Distributors**				x		x					x		
7	**Byproducts**	x		x	x		x		x		x			
8	**Government**	x		x	x	x		x	x			x	x	
9	**Consumers**						x				x		x	x
10	**Petroleum Companies**	x				x	x	x	x	x			x	
11	**Consultants**	x				x	x		x	x		x		
12	**Financial Institutions**	x			x	x	x		x					x
	Discrete basis total	6	3	3	5	6	10	3	7	4	3	4	4	4
	Ranking	**3**	**10**	**10**	**5**	**3**	**1**	**10**	**2**	**6**	**10**	**6**	**6**	**6**

Table 3 : Factors influencing the production environment – biodiesel

Group	Stakeholder Group	Feedstock availablty	Feedstock Imports	Impact on markets	Market for products	Incentives	Economics	Govmt Policies	Distribution costs	Technology	Technical	Quality
1	**Research & development**	x	x	x	x	x	x					
2	**Seed**						x			x	x	
3	**Feedstock**	x				x	x	x	x			
4	**Milling**											
5	**Refining**		x		x	x	x	x	x	x		x
6	**Distributors**				x		x		x	x	x	
7	**Byproducts**	x	x	x		x	x	x				
8	**Government**	x		x		x						
9	**Consumers**	x	x	x				x			x	x
10	**Petroleum Companies**	x		x		x	x	x		x		
11	**Consultants**	x		x	x	x	x	x		x		
12	**Financial Institutions**	x		x	x			x				x
	Discrete basis total	8	4	7	5	7	8	7	3	5	3	3
	Ranking	**1**	**8**	**3**	**6**	**3**	**1**	**3**	**9**	**6**	**9**	**9**

Table 4 : Group factors influencing the production environment – bioethanol

Group	Stakeholder Group	Total no	Factors of production	Financial factors	Legislation	Factors of logistics	Business Environment	Other
1	Research & development	7	2	3	0	0	1	1
2	Seed	9	2	2	2	1	1	1
3	Feedstock	9	1	3	2	0	1	2
4	Milling							
5	Refining	9	2	3	0	1	1	2
6	Distributors	3	0	2	0	0	0	1
7	Byproducts	7	1	4	1	0	0	1
8	Government	8	1	4	1	0	0	2
9	Consumers	5	0	1	0	1	0	3
10	Petroleum Companies	8	1	3	1	2	0	1
11	Consultants	6	1	2	1	1	0	1
12	Financial Institutions	6	1	3	1	0	0	1
	Area basis total		12	30	9	6	4	16
	Ranking		3	1	4	5		2
	Area average basis		3	4.3	4.5	1	1	3.2
	Ranking		4	2	1			3

Table 5 : Group factors influencing the production environment – biodiesel

Group	Stakeholder Group	Total no	Factors of production	Financial factors	Legislation	Factors of logistics	Business Environment	Other
1	Research & development	6	2	5	0	0	0	0
2	Seed	6	2	1	0	0	1	2
3	Feedstock	7	2	2	1	1	1	0
4	Milling							
5	Refining	10	3	3	1	1	0	2
6	Distributors	6	0	2	0	2	0	2
7	Byproducts	6	2	3	1	0	0	0
8	Government	6	1	4	0	0	0	1
9	Consumers	6	2	1	1	0	0	2
10	Petroleum Companies	7	1	4	1	0	0	1
11	Consultants	7	1	4	1	0	0	1
12	Financial Institutions	5	1	2	1	0	0	1
	Area basis total		17	31	7	4	2	12
	Ranking		2	1	4			3
	Area average basis		2.7	4	3.5	2	1	2.4
	Ranking		3	1	2			4

5.3.2 PROPOSITION 2

Proposition 2 is to identify the factors that influence the consumption environment through consideration of these influences across the biofuels value chain as well as those influences impacting on key stakeholder groups.

The full details of respondents replies relating to proposition 2 are contained in

Appendix E and Appendix F. The core responses have been summarised in Table 6 and table 7. Table 6 provides the most frequent responses relating to the production of bioethanol and table 7 responses relate to the production of biodiesel. The responses are grouped together and presented in table 8 and table 9 respectively for bioethanol and biodiesel.

Table 6 : Factors influencing the consumption environment – bioethanol

Group	Stakeholder Group	Bioethanol Availability	Guarantees & warantees	Problems in usage	Price of fuel	Economics	Govmt Policies	Additional requirements	Technical aspects	Quality
1	**Research & development**		x	x					x	
2	**Seed**	x				x			x	x
3	**Feedstock**			x				x		
4	**Milling**									
5	**Refining**			x				x	x	
6	**Distributors**		x		x					x
7	**Byproducts**				x	x	x			x
8	**Government**					x	x		x	x
9	**Consumers**	x			x				x	x
10	**Petroleum Companies**							x	x	
11	**Consultants**	x	x			x	x		x	
12	**Financial Institutions**	x	x		x					x
	Discrete basis total	4	4	3	4	4	3	3	7	6
	Ranking	**3**	**3**	**7**	**3**	**3**	**7**	**7**	**1**	**2**

Table 7 : Factors influencing the consumption environment – biodiesel

Group	Stakeholder Group	Biodiesel Availability	Guarantees & warantees	Price of fuel	Economics	Govmt Policies	Additional requirements	Public knowledge	Technical aspects	Quality
1	**Research & development**		x			x	x		x	x
2	**Seed**	x		x						
3	**Feedstock**	x					x	x		x
4	**Milling**									
5	**Refining**			x	x		x			x
6	**Distributors**		x	x	x		x	x		x
7	**Byproducts**			x	x	x				x
8	**Government**			x					x	
9	**Consumers**			x						x
10	**Petroleum Companies**				x	x			x	
11	**Consultants**	x			x	x			x	
12	**Financial Institutions**	x	x	x				x		x
	Discrete basis total	4	3	7	5	4	4	3	4	7
	Ranking	**4**	**8**	**1**	**3**	**4**	**4**	**8**	**4**	**1**

Table 8 : Group factors influencing the consumption environment – bioethanol

Group	Stakeholder Group	Total no	Factors of consumption	Financial factors	Legislation	Factors of logistics	Business environment	Other
1	Research & development	5	3	0	0	0	1	1
2	Seed	5	1	2	0	0	0	2
3	Feedstock	6	1	0	2	1	2	0
4	Milling							
5	Refining	4	1	0	0	1	1	1
6	Distributors	5	1	1	0	0	0	3
7	Byproducts	4	0	2	1	0	0	1
8	Government	5	0	1	1	0	0	3
9	Consumers	4	1	1	0	0	0	2
10	Petroleum Companies	4	1	1	0	0	2	1
11	Consultants	7	2	2	1	1	0	1
12	Financial Institutions	5	2	1	0	0	0	2
	Area basis total		13	10	5	3	6	17
	Ranking		2	3			4	1
	Area average basis		3.3	2.5	1.3	1	1.5	3.4
	Ranking		2	3			4	1

Table 9 : Group factors influencing the consumption environment – biodiesel

Group	Stakeholder Group	Total no	Factors of consumption	Financial factors	Legislation	Factors of logistics	Business environment	Other
1	**Research & development**	7	1	0	1	1	2	2
2	**Seed**	3	1	1	0	1	0	0
3	**Feedstock**	4	1	0	0	0	1	2
4	**Milling**							
5	**Refining**	4	0	2	0	0	1	1
6	**Distributors**	6	1	2	0	0	1	2
7	**Byproducts**	4	0	2	1	0	0	1
8	**Government**	2	0	1	0	0	0	1
9	**Consumers**	2	0	1	0	0	0	1
10	**Petroleum Companies**	4	0	1	2	0	0	1
11	**Consultants**	5	1	2	1	0	0	1
12	**Financial Institutions**	5	2	1	0	0	0	2
	Area basis total		7	13	5	2	5	14
	Ranking		**3**	**2**	**4**		**4**	**1**
	Area average basis		1.8	3.3	1.3	0.7	1.3	3.4
	Ranking		**3**	2	**4**		4	1

5.3.3 PROPOSITION 3

Proposition 3 is to identify the factors considered most likely to have a stronger influence on the evolving biofuels sector in its infancy.

Based upon a frequency analysis the key influences were identified for the full value chain and stakeholder groups. The responses for bioethanol and for biodiesel were combined to obtain the results in tables 10 and 11. Table 10 relates to the production environment with results drawn from tables 2 & 3 while table 11 is based upon responses for the consumption environment with results drawn from Tables 6 & 7.

Table 10 : Key factors influencing the production environment – biofuels

Group	Stakeholder Group	Feedstock availablty	Market for products	Impact on markets	Incen tives	Econo mics	Govmt Policies	Logistical aspects	Techno logy	Technical	Quality
	Discrete basis total	6	5	7	6	10	7	4	5	4	4
	Ranking	**4**	**6**	**2**	**4**	**1**	**2**	**7**	**6**	**7**	**7**

Table 11 : Key factors influencing the consumption environment – biofuels

Group	Stakeholder Group	Biofuel Availabilit y	Guarantee s & warantees	Problems in usage	Price of fuel	Econo mics	Technical aspects	Govmt Policies	Additional require ments	Quality
	Discrete basis total	4	4	3	4	4	7	4	4	7
	Ranking	**3**	**3**	**9**	**3**	**3**	**1**	**3**	**3**	**1**

5.3.4 PROPOSITION 4

Proposition 4 is to identify the factors considered most likely to have a continual influence on a sustainable biofuels sector.

Key factors are identified in Table 12 and potential other influences to be considered are reflected in Table 13.

Table 12 : Key factors influencing the sustainability of the biofuels industry

Group	Stakeholder Group	Feedstock availablty	Land availablty	Market for products	Incentives	Economics	Oil prices	Govmt Policies	Technology
1	**Research & development**		x	x		x		x	x
2	**Seed**		x	x		x			
3	**Feedstock**				x			x	
4	**Milling**								
5	**Refining**								x
6	**Distributors**				x	x		x	
7	**Byproducts**				x	x		x	
8	**Government**		x	x				x	
9	**Consumers**	x							x
10	**Petroleum Companies**	x				x	x		
11	**Consultants**	x		x	x	x	x	x	x
12	**Financial Institutions**	x			x	x	x		x
	Discrete basis total	4	3	3	5	7	3	6	5
	Ranking	**5**	**6**	**6**	**3**	**1**	**6**	**2**	**3**

Table 13 : Factors with some influence on the sustainability of the biofuels industry

Group	Stakeholder Group	Impact on markets	Price of fuel	Distribution aspects	Blending aspects	Logistical aspects	Corporations	Public knowledge
1	**Research & development**			x		x		
2	**Seed**		x					
3	**Feedstock**				x			
4	**Milling**							
5	**Refining**							
6	**Distributors**		x					x
7	**Byproducts**	x						x
8	**Government**	x					x	
9	**Consumers**						x	
10	**Petroleum Companies**				x	x		
11	**Consultants**							
12	**Financial Institutions**			x				
	Discrete basis total	2	2	2	2	2	2	2
	Ranking	**9**	**9**	**9**	**9**	**9**	**9**	**9**

Table 14 : Group factors influencing the sustainability of the biofuels industry

Group	Stakeholder Group	Total no	Factors of production	Factors of consumption	Financial factors	Legislation	Factors of logistics	Businss environment	Other
1	Research & development	10	3	0	2	1	2	0	2
2	Seed	6	1	0	4	1	0	0	0
3	Feedstock	4	0	1	1	1	1	0	0
4	Milling								
5	Refining	3	1	0	0	0	0	0	2
6	Distributors	5	0	0	3	1	0	0	1
7	Byproducts	6	0	0	3	1	0	0	2
8	Government	6	2	0	2	1	0	1	0
9	Consumers	4	1	0	1	0	0	1	1
10	Petroleum Companies	7	2	0	2	0	2	0	1
11	Consultants	7	1	0	4	1	0	0	1
12	Financial Institutions	7	1	0	3	0	1	0	2
	Area basis total		12	1	24	7	6	2	12
	Ranking		2		1	4	5		2
	Area average basis		2	1	2.7	3.5	2	1	1.7
	Ranking		3		2	1	3		5

5.3.5 PROPOSITION 5

To discuss and develop an understanding of the role of government, the role for CERs, SMMEs and the extent of structures required for a buoyant biofuels sector.

SMMEs – The extent of involvement envisaged in each of four stages in the biofuels value chain is included in table 15.

Table 15 : The role of SMMEs

Group	Stakeholder Group		Feedstock Production			Agri Processing			Refining			Distribution		
		Limited	Some	Large	Limited	Some	Large	Limited	Some	Large	Limited	Some	Large
1	Research & development			x	x			x			x		
2	Seed			x	x				x		x		
3	Feedstock		x			x			x			x	
4	Milling												
5	Refining		x			x			x			x	
6	Distributors		x		x			x				x	
7	Byproducts		x			x		x			x		
8	Government			x	x			x			x		
9	Consumers		x		x			x				x	
10	Petroleum Companies		x		x			x				x	
11	Consultants		x		x				x		x		
12	Financial Institutions		x		x			x				x	
	Discrete basis total	0	8	3	8	3	0	7	4	0	5	6	0

CERs – out of a total of fifteen interviewees only two had any view on the role expected to be played by CERs.

Government role and regulations – The extent of involvement suggested in each of bioethanol and biodiesel value chain is included in table 16.

Table 16: The extent of government regulation

Group	Stakeholder Group	Bioethanol			Biodiesel	
		Low	High		Low	High
	Discrete basis total	3	8		8	3

5.4 SUMMARY

Fifteen direct personal interviews were carried out . The results of these fifteen personal interviews are reported on in section 5.3 and related to the five original propositions. The specific original data is contained in Appendix C through to Appendix H. Manipulation of data is reported in section 5.3 in the form of a frequency analysis where themes, subsectors and weightings are reported for the various propositions set at outset of the research study.

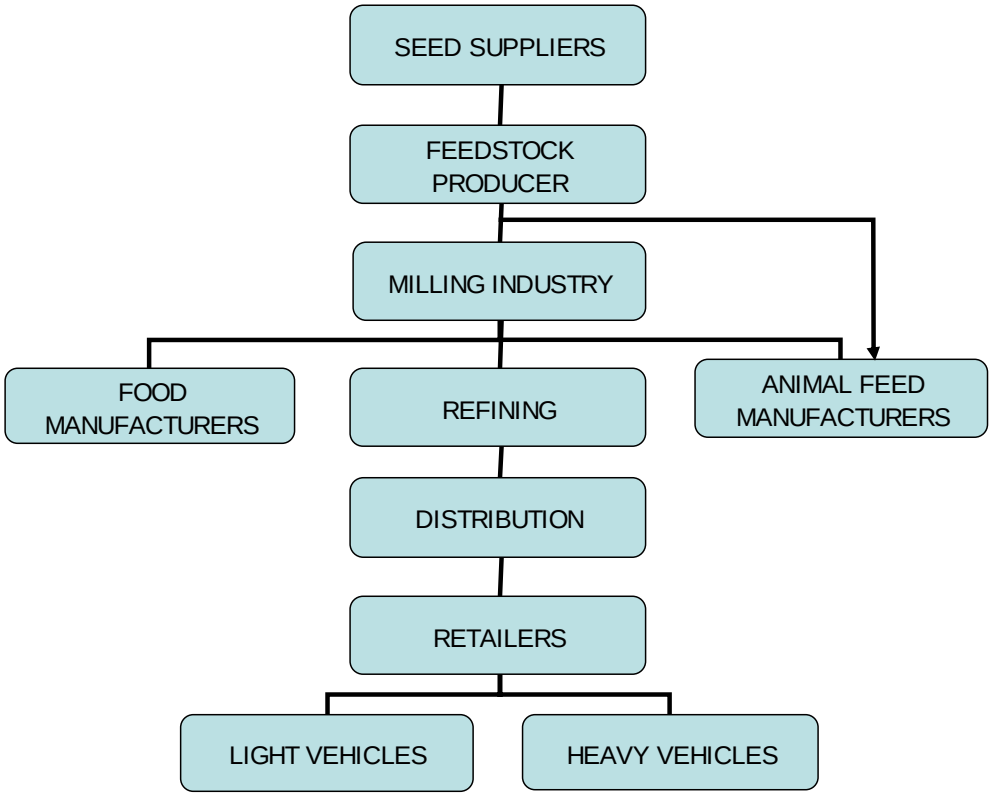
CHAPTER 6

6 DISCUSSION OF RESEARCH RESULTS

6.1 INTRODUCTION

Specific senior personnel in each of the nine biofuels value chain groups were identified and approached for direct personal interviews. A total of seven of the original interviewees responded positively and a further one suggested a substitute. The result was that experts from eight of the groupings in the value chain were interviewed. The biofuels value chain groups are as depicted in figure 4 but excludes the food manufacturers.

Figure 4: The biofuels value chain



A further five senior personnel in stakeholder groups were also interviewed directly as well as two stakeholders associated with SMMEs on an opportunistic basis.

The results of these interviews and analysis thereof are provided in chapter 5 under each proposition put forward at the outset of the research study. Each of these propositions and their results are now discussed in detail in chapter 6.

6.2 PROPOSITION 1

Proposition 1 is to identify the factors that influence the production environment through consideration of these influences across the biofuels value chain as well as those influences impacting on key stakeholder groups.

6.2.1 Specific factors

From table 2 and table 3 we are able to identify the ten most frequent specific factors influencing the production environment related to biofuels. These have been reduced from the original factors detailed in Appendix C and Appendix D.

A total of thirteen factors identified by more than three interviewees are listed in table 2 and table 3. The most significant factors are the economics of biofuels production, the lack of legislation or government strategy and the availability of feedstocks for production.

Economics of biofuels production

The economics relating to entry into biofuels have been identified by all except one interviewee as a stumbling block to entering into production. This relates to three areas as defined in section 2.3, namely a cost disadvantage for a total new participant to the sector, the high cost of capital and the requirement as identified globally for economies of scale (Goldemberg et al, 2004) to ensure viability.

Government policies

The actions of government are in progress and a biofuels strategy is being developed (Le Roux, 2006). The expectation is that the strategy will be finalised during November 2006 after which there will be time for public debate. The implementation of this strategy will provide confirmation of governments position and allow would be entrants to the biofuels sector to be comfortable with a given strategy, set of regulations and indication of the type and extent of incentives available.

Feedstock availability

The production of biofuels involves a lengthy value chain the initial part of it which has traditionally been handled exclusively by the food sector in the form of the food industry, feed manufacturers and feed lot industries and the latter part by the petroleum companies. The biofuels value chain will have to be developed to meet any demand from the biofuels sector. The biofuels consumer or demand sector

alone cannot achieve this due to the interlinking with existing channels of production and distribution in both the food sector and fuel sector controlled by existing players (Allen et al, 1998) in the industry.

6.2.2 Group Factors

From table 4 and table 5 we are able to identify the group factors influencing the production environment related to biofuels. These have been reduced from the original factors detailed in Appendix E and Appendix F.

Financial factors

These include the economics of biofuels production but also relate to incentives and subsidies that governments globally have put in place to assist with initial capital costs. The volatility of the feedstock markets, exchange rate and oil prices provide a risky 'playground' for new entrants into the biofuels market.

Demand conditions

In order to stimulate demand conditions the government is in the process of setting out policy principles (DME, 2003) which will entice producers into biofuels production. These are necessary in order to stimulate the biofuels industry in the short term and sustain the industry in the long term.

6.3 PROPOSITION 2

Proposition 2 is to identify the factors that influence the consumption environment through consideration of these influences across the biofuels value chain as well as those influences impacting on key stakeholder groups.

The full details of respondents replies relating to proposition 2 are contained in Appendix E and Appendix F. The core responses have been summarised in Table 6 and table 7. Table 6 provides the more frequent responses relating to the consumption of bioethanol and table 7 responses relate to the consumption of biodiesel. The responses are grouped together and presented in table 8 and table 9 respectively for bioethanol and biodiesel.

6.3.1 Specific factors

From table 6 and table 7 we are able to identify the ten most frequent specific factors influencing the consumption environment related to biofuels. These have been reduced from the original factors detailed in Appendix E and Appendix F.

The most significant factors are the economics of biofuels consumption i.e. the biofuels price, biofuels availability, technical aspects relating to the differences that use of biofuels will bring about and consistent quality of the biofuels.

Pricing of biofuels

The consumer sees the price of biofuels as a given and that it should be lower than fossil fuels. He is more concerned about the quality and technical aspects relating to the use of biofuels and the impact on consumption and any guarantees associated with the engines or vehicles in use.

Biofuels availability

Confirming the argument put forward re feedstock availabity in section 6.2.1. the biofuels market is only evolving at present. The consumer would like to know that there is a consistent supply of biofuels. Production of biofuels involves a lengthy value chain the initial part of it which has traditionally been handled exclusively by the food sector in the form of the food industry, feed manufacturers and feed lot industries and the latter part of the value chain by the petroleum companies. The biofuels value chain will have to be developed to meet any demand from the biofuels sector. The biofuels consumer sector alone cannot achieve this due to the interlinking with existing channels of production and distribution in both the food sector and fuel sector controlled by existing players (Allen et al, 1998) in the industry.

6.3.2 Group Factors

From table 8 and table 9 we are able to identify the group factors influencing the consumption environment related to biofuels. The number of factors have been

reduced from the original list of factors provided in Appendix E and Appendix F.

Quality and technical factors

The difference between the consumer and the producer is that the consumer is worried about the possible repercussions due to utilisation of a new product. The producer typically knows that the right quality of product can be produced but needs to still experience any problems. The government has in its turn provided standards for biofuels, more specifically biodiesel and laid down best practice re licensing and distribution of biofuels.

Financial factors

These include the economics of biofuels supply but also relate back to whether there would be incentives and subsidies that governments globally have put in place to assist with initial capital costs or to assist when the price of oil is low. The volatility of the feedstock markets, exchange rate and oil prices provide a risky playground for new entrants into the biofuels market. On the one hand the price on a particular feedstock has been known to rise significantly due to shortages but the option is there to utilise a different feedstock.

Demand conditions

In order to stimulate demand conditions the government is in the process of setting out policy principles (DME, 2003) which will entice producers into biofuels production. These are necessary in order to stimulate the biofuels industry in the

short term and sustain the industry in the long term. The availability of biofuels at a competitive price will stimulate demand.

6.4 PROPOSITION 3

Proposition 3 is to identify the factors considered most likely to have a stronger influence on the evolving biofuels sector in its infancy.

6.4.1 Specific factors

Based upon a frequency analysis the key influences were identified for the full value chain and stakeholder groups. The responses for bioethanol and for biodiesel were combined to obtain the results in tables 10 and 11. Table 10 relates to the production environment with results drawn from tables 2 & 3 while table 11 is based upon responses for the consumption environment with results drawn from Tables 6 & 7. The most significant factors are the economics of biofuels production, the lack of legislation or government strategy and the availability of feedstocks for production.

Economics of biofuels production

The economics relating to entry into biofuels have been identified by all except one interviewee as a stumbling block to entering into production. This relates to three

areas as defined in section 2.3, namely a cost disadvantage for a total new participant to the sector, the high cost of capital and the requirement as identified globally for economies of scale (Goldemberg et al, 2004) to ensure viability.

Government policies

All except two respondent have identified the lack of a confirmed direction provided by government to date as a significant barrier to moving forward. The actions of government are in progress and a biofuels strategy is being developed (Le Roux, 2006). The expectation is that the strategy will be finalised during November 2006 after which there will be time for public debate. The implementation of this strategy will provide confirmation of governments standpoint and allow would be entrants to the biofuels sector to be comfortable with a given strategy, set of regulations and indication of the type and extent of incentives available.

Feedstock availability

The production of biofuels involves a lengthy value chain the initial part of it which has traditionally been handled exclusively by the food sector in the form of the food industry, feed manufacturers and feed lot industries and the later part by the petroleum companies. The biofuels value chain will have to be developed to meet any demand from the biofuel sector. The biofuel consumption sector alone cannot achieve this due to the interlinking with existing channels of production and

distribution in both the food sector and fuel sector controlled by existing players (Allen et al, 1998) in the industry.

6.4.2 Group Factors

From table 4 and table 5 we are able to identify the group factors influencing the production environment related to biofuels. These have been reduced from the original factors detailed in Appendix E and Appendix F.

Financial factors

These include the economics of biofuels production but also relate to incentives and subsidies that governments globally have put in place to assist with initial capital costs. The volatility of the feedstock markets, exchange rate and oil prices provide a risky 'playground' for new entrants into the biofuels market.

Demand conditions

In order to stimulate demand conditions the government is in the process of setting out policy principles (DME, 2003) which will entice producers into biofuels production. These are necessary in order to stimulate the biofuels industry in the short term and sustain the industry in the long term through reaching of critical mass.

6.5 PROPOSITION 4

Proposition 4 is to identify the factors considered most likely to have a continual influence on a sustainable biofuels sector.

Key factors are identified in Table 12 and potential other influences to be considered are reflected in Table 13.

6.5.1 Specific factors

From table 12 and table 13 we are able to identify the eight most frequent specific factors considered as influencing the sustainability of a biofuels sector. These have been reduced from the original factors detailed in Appendix G. The most significant factors are the economics of the biofuels sector, government policies, technology dependancy and development, incentives for alternate fuels and feedstock availability. Also mentioned were land availability, market for product and relative oil prices.

Economics of biofuels

The presence of incentives have assisted entrants into the biofuels sector to achieve economies much sooner than expected as normal returns would not have allowed them to do so. The biggest hurdle here is reaching economies of scale as quickly as possible where the value chain has to be established over a period of

time. The new entrant is at a cost disadvantage, has high cost of capital and has the requirement, as identified globally, to strive for economies of scale (Goldemberg et al, 2004) to ensure viability.

Government policies

In all global markets governments have provided subsidies or incentive schemes or both for the development of a biofuels sector. The economics of the biofuels sector has been shown to be requiring assistance relative to the fossil fuel sector. Certainty in the market place will assist decisions by all biofuels sector stakeholders. The implementation of a strategy will provide confirmation of governments standpoint and allow would be entrants to the biofuels sector to be comfortable with a given strategy, set of regulations and indication of the type and extent of incentives available.

Feedstock availability

The production of biofuels involves a lengthy value chain the initial part of it which has traditionally been handled exclusively by the food sector in the form of the food industry, feed manufacturers and feed lot industries and the later part by the petroleum companies. The biofuels value chain will have to be developed to meet any demand from the biofuel sector. The biofuel consumption sector alone cannot achieve this due to the interlinking with existing channels of production and distribution in both the food sector and fuel sector controlled by existing players

(Allen et al, 1998) in the industry.

6.5.2 Group Factors

From table 14 we are able to identify the group factors influencing the production environment related to biofuels. These have been reduced from the original factors detailed in Appendix G.

Financial factors

These include the economics of biofuels production but also relate to incentives and subsidies that governments globally have put in place to assist with initial capital costs. The volatility of the feedstock markets, exchange rate and oil prices provide a risky playground for new entrants into the biofuels market.

Demand conditions

A set strategy with the potential of mandatory blending considered or a less regulated market for in particular biodiesel would allow existing stakeholders and potential new entrants to be able to set their own strategy. A clear understanding of the requirements of regulations and structures would intice more entrants who otherwise have shied away from a sector without clear direction.

6.6 PROPOSITION 5

To discuss and develop an understanding of the role of government, the role for CERs, SMMEs and the extent of structures required for a buoyant biofuels sector.

Factor conditions

South Africa has an abundance of low skilled labour geographically positioned to become involved in the production of feedstocks. The creation of co-ops and such like for smaller enterprise development is seen as a potentially major employment potential (Kesper, 2000) to be realised. The opening up of this sector via quota systems for SMMEs in the form of managed small businesses could create significant employment.

From table 15 it can be seen that the research group participants see significant potential for SMMEs in the provision of feedstocks, some involvement in the distribution of biofuels and refining of biofuels but limited participation in the agri-processing stages of the biofuels value chain.

Government Policy

The existing fuel industry is well regulated. These structures are in place and the easiest way forward is to include biofuels into the mix by regulating the supply and distribution along existing channels. The government is in a position however to open up various of the channels to new entrants or play safe and proceed with all

existing structures. The research reveals in table 16 that participants are of the opinioon that the biodiesel portion of biofuels could be less regulated thereby allowing for greater participation by new entrants and creation of significant opportunities.

CERs – based upon the total group interviewed no concrete information was obtained re the availability nor methodology of securing CER credits and this research in that respect was seen to be limited. A review of this outside of the group reveals a similar lack of understanding on the methodology to be followed. This is a new mechanism for biofuels and is one under development globally.

CHAPTER 7

7 RECOMMENDATIONS AND CONCLUSIONS

7.1 INTRODUCTION

The researcher set out to source information and provide insight into the pool of factors that influence production and consumption in the evolving South African biofuels industry. A total of 15 personal interviews and three focus groups with thirty five participants were carried out. Various research questions were put forward to fifty participants to try and better understand the factors influencing the production and consumption environments of biofuels; to identify key factors of influence and consider the roles of CERs, SMMEs, the government and the format of structures and regulations around the biofuels business environment.

Results of the aforementioned interviews have been analysed and the research study methodology followed has provided certain key findings. Due to the revealed certain key factors which are presently holding back entrants into the biofuels sector but at the same time provided an understanding of the underlying factors which will come to the fore once the government has finalised a strategy for the South African biofuels sector.

7.2 RECOMMENDATIONS

Based upon the research carried out it is clear that there are numerous factors to be taken into account when assessing the way forward in an industry such as the biofuels sector. One has to not make it too complicated but at the same time take note that this sector is a commodity driven sector with a variety of commodities each influencing the overall value chain.

Recommendation 1 – to all stakeholders to note the complexity or interlinking of the markets that are being considered and the implications that something seemingly unrelated could have on the biofuels sector.

Recommendation 2 – the volatility of all markets as experienced over the past five years including those for oil, feedstocks and exchange rates does not allow for short term strategies to succeed easily.

Recommendation 3 – the government needs to close out on the strategy being developed and be clear to all stakeholders what opportunities and incentives are the requirements of legislation and tax regimes, standards and policies.

Recommendation 4 – the government needs to consider the various opportunties available to SMMEs and new market entrants and ensure that regulations and

structures do not compromise the potential of including significant new entrants.

Recommendation 5 – potential new entrants need to understand the full biofuels value chain before considering an entrance in light of the extensive interaction between groups in the value chain.

Recommendation 6 – stakeholders need to note the extensive range of variables that impact both the economics of the sector as well as the availability of feedstocks.

Recommendation 7 – consumers need to be aware of the technical pitfalls associated with the new products as well as the differences in usage patterns and availability of product .

Recommendation 8 - the grouping that could be impacted the most could be the consumer. Issues of quality, availability and price of fuel have been associated with the fuel industry from outset. The consumer needs to be informed and this through his own initiative but more so through the right channels. It remains the responsibility of the producer of biofuels to provide the consumer with the right information about biofuels in terms of inherent qualities, availability, benefits and problems.

7.3 FUTURE RESEARCH

In the process of carrying out the research a number of future research areas were identified. In the processing of results the research has also highlighted further areas where specific research would benefit the evolving biofuels industry. Each of these is listed sequentially and discussed shortly.

The role of CERs or CDMs – it is not clear through discussion with any party in the industry as to the full benefit of the the CER/CDM mechanism, how this will apply to biofuels and what the procedures are to implement this process presently. Is there something meaningful in CERs for the biofuels industry?

The benefits that biofuels provide to a developing country – broken down into a total system energy benefit, direct cost analysis, social gain, job creation and security of supply of fuel.

The role of SMMEs in biofuels in developing countries - it is easy to consider the production of feedstock on the basis of extensive small farmer inclusion but can the remaining three areas of processing, refining and distribution be largely carried out by SMMEs.

Centralised vs decentralised models of production – based upon economies of scale the most likely outcome of any study will be that a large scale production facility is the most cost efficient. Is this the right way of thinking in an industry where subsidies are the norm globally?

A quota system and licensing – much along the lines as is experienced in the fishing industry a request for quotas is received and licences are issued on a selective basis for a given period of time.

Southern Africa and biofuels – could Southern Africa provide a global biofuels industry of scale larger than Brazil?

Biodiesel – should biodiesel be considered a fuel or an additive? Due to the initial low percentage blends predicted of 1 to 5%.

Biofuels, fact or fiction - is there substance behind the debate that biofuels can supply global fuel needs or is it a basket of alternate energies which provide the answer.

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APPENDICES

APPENDIX A

INTERVIEWEE

NAME:		
POSITION:		
INDUSTRY:		
ROLE:		
TEL NO:		
PRESENT EXTENT OF INVOLVEMENT WITH BIOFUELS		
FUTURE INVOLVEMENT		

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

INTERVIEW GUIDE

Questions		
Initiate discussion through a general question on a few key thoughts of the interviewee on the biofuels industry.		
Status?		
Company/Institution sector participation presently?		

Questions		
1.0 What are the key issues facing the production environment for biofuels?		
- Firstly for bio-ethanol?		
- Secondly for bio-diesel?		
1.1 Which do you consider are the five critical factors?		
- Firstly for bio-ethanol?		
- Secondly for bio-diesel?		

1.2 Do you find any of these factors peculiar to the South African business environment?		
Compare to other countries. Examples?		
1.3 Which factor assist and which hinder entry into the sector?		
Sustainability?		
1.4 Which factors are most pertinent to your area of expertise? Rank in order.		
1.5 Which factors will hinder and/or assist in the long term in creating a a sustainable industry?		

INTERVIEW GUIDE

Questions		
2.0 What are the key issues facing the consumption environment for biofuels?		
- Firstly for bio-ethanol?		
- Secondly for bio-diesel?		
2.1 Which are the five critical factors?		
- Firstly for bio-ethanol?		
- Secondly for bio-diesel?		

2.2 Do you find any of these factors peculiar to the South African business environment?		
2.3 Which factor assist and which hinder entry into this sector?		
Sustainability?		
2.4 Which factors are most pertinent to your area of expertise? Rank in order.		
1.5 Which factors will hinder and assist in the long term in creating a a sustainable industry?		

Questions		
3.0 Questions on regulations and structure?		
What do you see as the role of gvmt?		
Should there be a specific structure to the industry?		
As now in the fuel industry or different?		
How will regulations benefit the market?		
Can the industry be totally unregulated? With guidelines?		
What role can & will SMMEs play?		
Farming		
Processing		
Refining		
Distributing		
What role will CDMs/CERs play		
What will drive the industry in the future?		