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Markets for biofuel producers in southern Africa

Do recent changes to legislation in the region and EU bring new opportunities?

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Contents

Abbreviations

EBA	Everything but Arms
EC	European Commission
EIA	US Energy Information Administration
EPA	Economic Partnership Agreement
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FQD	Fuel Quality Directive
GEZ	Grown Energy Zambeze Ltda
GSP	Generalised Systems of Preferences
HDSA	Historically Disadvantaged South African
IEEP	Institute for European Environmental Policy
ILO	International Labour Organization
ILUC	Indirect Land Use Change
MFN	Most Favoured Nation
OECD	Organisation for Economic Cooperation and Development
RED	Renewable Energy Directive
SADC	Southern African Development Community
SEI	Stockholm Environment Institute
USDA	United States Department of Agriculture
ZANU-PF	Zimbabwe African National Union – Patriotic Front

Executive summary

This report discusses opportunities for biofuel producers in southern African countries to supply markets in the region and in the EU. It looks at what is the existing policy framework for selected countries in southern Africa, what are current trends in production, consumption and trade and what opportunities exist. It focuses most attention on fuel ethanol, looking at what policies exist in both regions to promote production and trade. It also explores nascent EU markets for advanced biofuels and whether new rules for the EU market present new opportunities for production in southern African countries.

The discussions in this report provide the following observations:

Southern African countries produce and consume little fuel ethanol. Although policies for production and consumption exist in Zambia and Mozambique neither country seems to actually produce or consume fuel ethanol. In South Africa, production of ethanol has risen in recent years but most goes to potable alcohol and industrial uses and little, if any, has gone into fuel use at home or abroad. Fuel ethanol production and consumption in Malawi is around 10% of domestic fuel consumption, but this is low in absolute terms. Only Zimbabwe appears to have substantial production capacity, following large investments in recent years. However, it is unclear by how much production and consumption has actually risen because no reliable information in available.

Meeting new mandates for blending fuel ethanol with gasoline in South Africa will require a large increase in domestic production, which may not take place. At present, it is unclear if South African producers will produce enough fuel ethanol to meet a minimum 2% mandate,[1] as they have yet to commit to upgrade existing manufacturing facilities. Meeting the maximum 10% mandate will require substantial increases in production, and could be partly met through imports from neighbouring countries, based on existing investment plans in those countries. However, recently announced regulations appear to strongly favour domestic production: to receive a manufacturing license, suppliers must use local feedstock and can use imports only in exceptional circumstances.

Trade opportunities in the region exist but appear unlikely to materialise in the near future.
. Despite its ambitious targets, Zimbabwe seems entirely focused on expanding national production and the prospect of either Mozambique or Malawi importing or exporting any fuel ethanol appears slim at present. Zambia appears to be the only country willing to import fuel ethanol from neighbouring countries, although this is likely to be a short-term measure.

Prospects for exports of fuel ethanol to Europe are uncertain. At present, it seems that southern African countries do not export to the EU fuel ethanol market. Given time constraints, we were unable explore the economics behind this. Although EU imports from major fuel ethanol producers are falling, it is unclear if this trend will favour southern African producers. This deserves more research.

EU markets for advanced biofuels[2] appear to offer few opportunities for southern African producers. Rapid analysis of EU advanced biofuels markets suggests demand for most feedstocks will be met mainly from local supply. However, further research is needed to confirm this, and to explore if southern African countries produce eligible feedstocks in substantial quantities, and if it makes economic sense to export these to the EU.

[1] I.e. fuel ethanol makes up 2% of all petrol use in the transport sector.

[2] Advanced biofuels "provide high greenhouse gas savings with low risk of causing indirect land use change and do not compete directly for agricultural land for the food and feed markets" (EU 2012).

1 Introduction

1.1 Background

There is good potential for biofuels production in southern African countries. Crops used as feedstock for biofuels grow well in the region's climate, and in some cases perform better than in parts of the world that are major biofuel producers. (E4tech (2006); Malitz, Haywood et al. (2009)). Several commentators suggest southern African producers would be well-positioned to supply the large and growing markets of developed economies as well as any new markets in emerging economies (Johnson and Matsika (2006); Shumba, Carlson et al. (2009)). While the EU market—which imports 20% of consumption—has offered the most concrete opportunities for international exporters so far, southern African governments have also taken steps to create markets at home by introducing policies to stimulate supply and demand. A driving motive for this is the possibility to reduce spending on fuel imports and, in the longer term, earn foreign currency through exports.

So far, however, southern African producers have produced very little biofuel for either international or domestic markets. The inability of individual projects and markets to get off the ground in most countries reflects both unfavourable international conditions and a lack of enabling policies at home. The global financial crisis made it difficult to attract investment for any production, and for manufacturers using sugarcane feedstock, higher margins in sugar markets meant attention turned away from fuel ethanol to sugar production. (Locke and Henley 2013). Growing global concern of conflicts between food and fuel may also have discouraged some investors (ibid). At home, weaknesses in the domestic investment climate or counteracting policies undermined biofuels policies. For example, while the Zambian government promoted biofuels, its policy of subsidising fossil fuels discouraged potential biofuel investors (Chu 2012). In several countries, complicated and risky processes for acquiring land threatened to stall projects from the outset (Locke and Henley 2013).

Two recent policy changes may improve prospects for biofuels producers. In South Africa, the government has recently announced new guidance on biofuels rules to enter into force in 2015, including details of producer subsidies and blending mandates. Because South Africa's gasoline market represents around 80% of the total consumption of southern Africa (E4tech 2006), this could create substantial demand for fuel ethanol. In Europe, EU policy makers have reacted to mounting concern over risks to food security from biofuels by raising the percentage of the bloc's mandate that can be met using food crops, and promoting so-called "advanced biofuels", which are associated with lower social and environmental risks than conventional biofuels.

1.2 Aim of report

The primary aim of this report is to assess if these recent changes in South Africa and the EU offer opportunities for regional producers in five countries – Malawi, Mozambique, South Africa, Zambia and Zimbabwe. A second aim is to review opportunities in other southern African countries created by policies there. We restrict analysis to fuel ethanol production and markets because ethanol is generally thought to be more promising for the region than biodiesel, and because of limited resources for this study.

1.3 Methodology

To assess opportunities for increasing production we do the following:

- Briefly review the existing policy frameworks in selected southern African countries and the EU to understand what opportunities policies present for fuel ethanol production, and how open potential their markets are to imports.

- Review existing production, consumption and trade in each country to gauge the likelihood of producers expanding production to meet targets.

We do this through a review of publicly available, secondary literature on biofuels policies and markets. Information from published reports and statistical databases provide a reliable overview of important long-term trends in production and longstanding policies in the region.[3] However, because the biofuels policy framework in selected countries has evolved, we have also relied on media articles to analyse recent developments.

Because of limited time and resources, this report does not analyse the economics of fuel ethanol production in any of the countries, or opportunities for trade presented by the difference between production costs and market prices. As a result, findings related to market opportunities are necessarily partial. Nor do we attempt to analyse the important issue of social and environmental risks and benefits from expanding feedstock production. Better assessment of these issues is needed for a fuller understanding of the potential of biofuel expansion in the region.

1.4 Structure of report

The report looks first at opportunities in southern African markets, and then in the EU. Chapter 2 presents details on existing policies aimed at incentivising biofuel production and consumption in each of the five countries. Chapter 3 presents the state of production, consumption and trade for each country. Chapter 4 discusses features of EU fuel ethanol markets and new markets for advanced biofuels relevant to southern African exporters. Chapter 5 summarises findings and presents gaps in the analysis for further research.

[3] A high level of interest in opportunities for southern African production in the mid to late 2000s led a number of in-depth studies which include useful information on prospects that are still relevant today (e.g. (E4tech 2006; Johnson and Jumbe 2013))

2 Biofuels legislation in Southern African countries

2.1 Overview of regional biofuel legislation

The countries covered in this report have all taken steps within the last decade towards developing an enabling environment for biofuels production and consumption. New biofuel policies in Europe in the mid-2000s followed by commodity price hikes in 2007–2008 led to a marked increase in interest in establishing biofuel production and underscored the need for governments to revisit existing policy frameworks. (Cotula 2010).

Countries used different policy tools and institutions to guide and support development of the biofuels sector (see Table 1). By 2010, most of the countries had completed or were finalising their own domestic quality standards, and several (Mozambique, South Africa) had developed a national biofuels policy (Lerner and Motlhatlhedi 2010). Zambia, Mozambique and South Africa had also completed agricultural zoning to determine where biofuel crops should be grown. Since then, Zimbabwe and South Africa have introduced domestic quality standards in 2013. Otherwise, the situation presented in Table 1 remains unchanged.[4]

Table 1: The existing biofuels framework in selected southern African countries

Items	Member States											
	Malawi	Zambia	Tanzania	Mozambique	Botswana	Swaziland	Zimbabwe	South Africa	Angola	Madagascar	DR Congo	Namibia
Agricultural Zoning	No	Food crop mapping	Food crop mapping	Yes	Yes	No	No	Yes	No	No	No	No
Quality Standards	Yes ethanol	Yes	In process	No	In process	In process	No	In process	No	No	In process	No
National B/F Policy	No	No	In process	Yes	No	In process	No	Yes	In process	No	In process	No
Investment Centre for B/F	No	No	Yes	Yes	No	No	No	No	Yes	No	No	No

Source: Lerner and Motlhatlhedi (2010). Note: the last row indicates if the country has an agricultural promotion centre that promotes biofuels (among other crops) rather than investment centres specifically targeting biofuels

On the consumption side, all countries apart from Zambia currently have mandates in place that require distributors to add fuel ethanol to gasoline. (Table 2).

4 As of July 2014, neither Malawi, Zambia nor Zimbabwe has a national level biofuels policy.

Table 2: The state of biofuel mandates in selected southern African countries[5]

Country	Existing target and status
Malawi	Mandate for E10 exists and met since 1982.
Mozambique	Mandate for E10 exists since 2012 but not enforced.
South Africa	Mandate for between E2 and E10 will come into force from October 2015.
Zambia	Target for E10 planned but not entered into force.
Zimbabwe	Mandate for E10 exists (enforced since October 2013), planned targets for E15/E20.

Source: Global Renewable Fuels Alliance http://globalrfa.org/biofuels-map/

2.2 Southern African Development Community (SADC)

In addition to steps at the national level, countries have tried to align policies to promote biofuels at the regional level through the Southern Africa Development Community (SADC). The 2009 Meeting of SADC Energy Ministers called on member countries *"to accelerate their initiatives in developing biofuels as a source of alternative and cheap environmentally friendly fuel but also for rural development and poverty reduction"*(SADC 2009) and mandated a Biofuels Taskforce to carry this forward. The taskforce noted the need to work on the following areas:

- The policy, legal and regulatory framework necessary for the sustainable production and use of biofuels, and institutional capacity to develop this.
- Sustainability of biofuels production and use, including pro-poor and rural development.
- Strengthened capacity of national and regional organisations for enhancing regional cooperation and information-sharing on biofuels, including on sustainable development models.

The Biofuels Taskforce also developed the following set of principles for sustainability (Box 1) which member countries could use as a starting point to develop their own, more detailed sustainability criteria (SADC 2009). So far, only Mozambique and South Africa appear to have developed detailed sustainability criteria specifically aimed at biofuels. More details are presented in individual country summaries below.

Box 1: SADC Specific Principles for the Development of Sustainable Biofuels

1. Biofuel production shall follow relevant national law and policies and, where applicable, international law.
2. Biofuel production shall be guided by free prior and informed consent by relevant stakeholders.
3. Biofuel production shall contribute positively to rural development through:
   Non-violation of human and labour rights, promotion of decent work and the well-being of workers
   Social and economic development of indigenous, local and rural people and

[5] Information correct as of July 2014.

communities
Decentralized value-added processing and local participation in the entire value chain.
4. Biofuel production shall contribute positively to local and national food security.
5. Biofuel production shall respect formal and customary land rights and land use rights.
6. Biofuel production shall contribute positively to national energy security.
7. Biofuel production shall contribute positively to protect natural resources, ecosystems that provide essential services and biodiversity.
8. Biofuel production shall contribute positively to availability and quality of water and air.
9. Biofuel production shall not lead to deforestation or forest degradation and where possible contribute to rehabilitation of degraded land.
10. Biofuel production shall contribute positively to climate change adaptation and mitigation.
11. Biofuel production shall contribute positively in reduction of greenhouse gas emissions.
12. Agro-ecological zoning should provide guidance on what feedstock to use and where to plant them.

Source: SADC (2009).

2.3 South Africa

Biofuel policies

South Africa's policy framework for biofuels was first developed in the mid-2000s, but has undergone substantial revision since. In 2005, South Africa's cabinet approved a biofuels development strategy and tasked an inter-department Biofuels Task Team to develop a Biofuels Industrial Strategy. Central to this strategy were the dual aims of job creation and value chain development that aimed to bridge the 'first' and 'second' economies.[6] The strategy set a five-year pilot phase from 2008 to 2013, after which it was envisaged that biofuels would make up 2%[7] of South Africa's liquid fuel consumption, equal to slightly more than 1.1 million litres per day by the end of 2013 (Department of Energy 2014).[8]

Financial incentives to promote biofuels in the pilot phase included the following:

- Full tax exemption for bio-ethanol production[9] and a 50% rebate on fuel tax for biodiesel.
- An accelerated depreciation allowance of 50%:30%:20% over three years for all biofuel projects.

In addition, to stimulate expansion by fuel ethanol producers specifically, government agencies were encouraged to participate in investment, ensure market access and work to include "emerging farmers" in project development.

However, despite these measures, no large-scale producer of either fuel ethanol or biodiesel emerged during this period (Department of Energy 2014). The available literature identifies several reasons for this:

6 The division of the South African economy into "first" and "second" categories is a common way for South African policy initiatives recognise and deal with existing socio-economic marginalisation. The second economy refers to the one-third of the population that does "not directly benefit from the advanced sectors of the South African economy" (Presidency 2006).
7 An ambitious initial target of 4.5% was revised downwards in light of challenges in setting up the industry. The 2% figure was deemed more practical, and was supported by a 2011 study that suggested 2% was optimal from a cost-benefit perspective.
8 Based on an envisaged national fuel pool of 20 billion litres per annum (Department of Energy (2014).
9 Fuel ethanol falls outside the fuel tax net and is therefore 100% exempt from fuel tax.

- *Lack of financial viability:* The Department of Energy's position paper states that biofuels development was not financially attractive for investors given the high capital requirements needed to upgrade existing facilities and low prevailing prices(Department of Energy 2014).[10] For oilcrop producers and processors, higher margins for the production of cooking oil meant producers were unwilling to switch to producing biodiesel.

- *Incomplete policies:* However, others put more emphasis on the lack of key policies or the government's reluctance to implement these — especially the blending mandates — as the main cause of failure (USDA 2013). In addition to the lack of enforcement of blending mandates, a licencing mechanism and an appropriate pricing framework were missing components of the policy framework.

- *Conflicting policy aims:* Another interpretation is that the government's attempt to use biofuels policy as a means to achieve more equitable growth was challenging to, if not incompatible with, swift industry growth (Koesteer 2012). The government's aim to privilege poor parts of country that were poorly served by infrastructure and promote strategies that maximised job creation inevitably made attracting private investment difficult. It also led to prolonged discussions over which crops the government's policies should include and promote through targeted support. The Biofuels Industrial Strategy ruled out the use of maize due to concerns that this would raise maize prices and reduce availability on domestic and regional markets, especially at times of shortages. Both sorghum and sugarcane are eligible feedstocks for fuel ethanol, but which of these should be prioritised for support continues to be debated (see Box 2 below).

Recent adjustments to biofuels policy

Between 2011 and 2013, the government of South Africa revised its policies releasing a new position paper in late 2013 that addresses some gaps in the existing policy framework (Department of Energy 2014). These policies attempt to overcome financial barriers by introducing a subsidy programme and offer more clarity on rules and pricing. Important features of the current policy framework include the following:

- A Mandatory Blending Regulation that compels licenced fuel manufacturers (and their wholesaling arms) to buy and blend biofuels from licenced biofuel manufacturers. The Mandatory Blending Regulation is the main legal tool to incentivise blending of biofuels with fuel. Blending targets are set at between E2 and E10 for bio-ethanol and B5 for biodiesel.[11]

- A set of criteria that determines if a company proposing to manufacture biofuels is eligible to receive a manufacturing license;

- A biofuels pricing framework that sets out how subsidies for manufacturing biofuels are determined and paid;

- A second set of criteria for determining if a biofuel project is eligible to receive government support through the subsidy scheme.

Important features of the new framework include the following:

- As per the original framework, no maize can be used for fuel ethanol production — eligible feedstocks include sugarcane, sugar beet and sorghum for fuel ethanol; and canola (rapeseed), sunflower and soya beans for biodiesel.

10 Converting sugar mills to manufacture ethanol involves substantial investment, estimated at R20 billion (Business Day Live 2014).

11 In other words, the targeted blending ratio for fuel ethanol in petrol is between 2% and 10%. The targeted blending ratio for biodiesel in diesel is 5%.

- The subsidy system is calculated to pay producers an amount that should provide a return on assets of 15%. This is paid per litre of biofuel produced. This is expected to be R195 cents per litre for fuel ethanol and R253 cents per litre for biodiesel but will change monthly in line with prevailing commodity prices.

- To accelerate the first implementation phase, the position paper uses only grain sorghum (for bio-ethanol) and soya beans (for biodiesel) as reference crops for calculating subsidies (Department of Energy (2014). Even though sugarcane is not targeted, the position paper notes that sugarcane producers are nonetheless eligible for subsidies. Options for calculating subsidies will be reconsidered in subsequent phases.

- To encourage competition, the amount of subsidy each producer can receive will be capped at the level equivalent to the maximum capacity of the most efficient existing plant. This is 158,000 m^3/year for bio-ethanol and 113,600 m^3 year for biodiesel.

- The subsidy will be financed through a general levy on domestic consumption of diesel and petrol set at between 4.4 cents and 6.5 cents per litre.

At present, some parts of the policy require further elaboration[12] and investors are still analysing if incentives are sufficient to merit further investment. This is especially so for fuel ethanol manufacturers using sugarcane, who in 2012 had signalled reluctance to invest if subsidies were not calculated based on prices in sugar markets (Department of Energy 2014).

Box 2: The merits of sorghum vis-à-vis sugarcane for fuel ethanol production in South Africa

The Department of Energy's position paper presents a preference for using sorghum as a reference crop over sugarcane on economic, social and environmental grounds.13 In the short term, foreseen high sorghum prices mean the government will have to provide relatively little subsidy to producers to achieve target returns on investment of 15%. Government analysis suggests sorghum production offers better prospects than sugarcane for job creation and small business development in former homelands. Finally, it requires less water and can be produced in dryland areas.

Table 3: Comparison of sorghum and sugarcane within the government's position paper

Parameter	Sorghum	Sugarcane
Material requirements per m^3 ethanol	2.40 t	12.5 t
Water requirements for cultivation	Dry land	Both dry land and irrigation. Brownfields expansion on dry land is possible. New sugarcane (Greenfields) is likely to be irrigated.
Cultivation	Planted and harvested every year	Sugarcane harvested every year, growth cycle average 12 to 18 months; ratoon for 8 to 10 years
By-products	Medium protein distiller's grains, which can replace maize in animal feeds	Some additional renewable energy outputs if greenfield sugar mill such as renewable electricity.
Agricultural job creation potential @ 2% ethanol blending[3]	2,400 without multiplier effects	2,000 to 12,500 without multiplier effects depending on how the industry grows more sugarcane
Land area for 2% ethanol[4]	200,000 ha	30,000 to 50,000 ha
Global price volatility	Relatively stable, subject to global supply-demand dynamics	Relatively volatile, driven by export supply from Brazil

Assumptions: 1 job per 250 tonnes grain sorghum; 1 job per 240 tonnes additional sugar cane; yields for sorghum are 3t/ha and for sugarcane 60 t/ha (dryland) and 100t/ha (irrigated).

12 For example, transportation and tax issues need to be resolved.
13 The merits of sorghum over sugarcane are debated within the industry (Locke, personal communication). While sorghum requires more labour, yields are lower than for sugarcane. It can also require significant irrigation to reach high yields.

The underlying assumptions for calculating the subsidies to fuel ethanol producers are presented calculations for sorghum processing are presented in Table A1 in the annex.

Sources: Department of Energy (2014); Business Day Live (2014)

Social inclusion and sustainability criteria

South Africa established a set of criteria using the SADC regional principles (see above) as a starting point. While the government recognises the need to mitigate social and environment risks related to biofuel feedstock expansion, it advocates a cautionary approach towards introducing sustainability criteria due to the high potential cost to investors (Department of Energy 2014). Table A2 in the annex set out the areas that investors need to comply with in order to receive a biofuel manufacturing license and be eligible to receive government subsidies.

Producers need to provide important social benefits including a minimum 25% stake of plant ownership by historically disadvantaged South Africans, and 70% of employees must be South African. In addition, a minimum of 10% of all feedstock needs to come from smallholder producers once a project is up and running (within four years). It is unclear from Table A2 how onerous environmental criteria are. The main requirements concern water extraction and avoiding deforestation, which requires certification by line ministries. The regulations set no criteria related to greenhouse gas emissions.

Do opportunities for trade exist?

So far, the analysis has focused on policy areas relevant for domestic production. Features of South Africa's biofuel policy that impact prospects for regional trade include the following:

Imports

Biofuel shipments to South Africa are not subject to duties (Cartwright 2007). However, importing biofuels is impeded by non-tariff barriers in legislation, namely the Petroleum Products Act 1997 (Act no. 120 of 1997) and guidelines issued by the Department of Minerals and Energy (Department of Minerals and Energy 2006). These documents state that imports of fuel and blending components (including biofuels) is limited to applicants with a manufacturing licence and Historically Disadvantaged South African (HDSA) wholesalers that have letters of recommendation from the Department of Minerals and Energy.

In addition, according to the "Criteria for Licenses to Manufacture Biofuels" (Department of Energy 2014), to acquire a biofuels manufacturers license, producers must source all their feedstock from South Africa.[14] Feedstock imports are permitted only in two exceptional circumstances:

1 "…at times of adverse agricultural production and when local producers cannot meet the investors (sic) demand." In this event, "the investor must apply in writing to the Petroleum Controller to decide that a period of adverse agricultural production has commenced."

2 "Due to the difficulties in the availability of certain feedstocks domestically, importation could be allowed for projects at inception stages under certain conditions."

Although these circumstances are likely to occur frequently, the following requirements attach conditions to importing that appear difficult to fulfil, especially without further guidance:

14 The criteria do not provide details on whether imports of liquid biofuels are permitted.

a. Only those crops where generally there is no adequate domestic capacity, or are not grown in South Africa.

b. Carbon footprints for these crops must be negative in the country of origin.

c. A detailed phase-in period for replacing imports with local production must be provided. This domestic sourcing must be from emerging farmers in "underutilised areas".

d. Detailed accounts of types of by-products, quantities and potential markets must be provided to prevent market dominance in local markets.

Exports

There are no domestic restrictions preventing South African manufacturers from exporting biofuels internationally. As neighbouring countries import fuel from or through South Africa, these may be attractive export markets for South African biofuel producers that can blend fuels on transit routes. However, Cartwright (2007) notes that high costs of transport, especially port costs, makes exports of ethanol attractive only for those producers sited near ports.

2.4 Zimbabwe

Biofuel policies

Zimbabwe ran a fuel ethanol blending programme for E10 from 1980 until 1992. Government support ended after the drought of the early 1990s reduced sugarcane production almost completely, and new markets for potable ethanol in Europe became more a more attractive option to supplying domestic fuel markets (Cartwright 2007).

In response to increasing scarcity of foreign currency and rising costs of importing fuel in 2007, the government introduced a white paper on 'Principles of Biofuels Development and Use' guiding the government's support to production, distribution and marketing activities for jatropha for biodiesel and sugarcane for bioethanol (USDA 2011). In 2011, the government followed this with a new draft biofuels policy that permitted the use of sorghum for fuel ethanol and soybeans, sunflower and cottonseed for biodiesel (USDA 2011). A mandate for E10 was introduced and has been enforced since October 2013.

Despite the existence of these official policies, the government has on several occasions attempted to increase the blending ratio through issuing statements and intervening in fuel ethanol production (USDA 2011). In late 2013, government officials announced mandatory blending at E15. Although this was downgraded to E10 amid public protest over high prices and poor harvests, senior political figures have recently announced the government's intention to raise it again to E15 or E20 in the near future (Daily News 2014).

Because raising fuel ethanol production and reducing dependence on fuel imports is a strategic priority for the Zimbabwean government, the sector has become heavily politicised and contested. In 2013, the government gave the sole licence to produce fuel ethanol to a company called Green Fuels.15 The privileged position of Green Fuels as a monopoly ethanol supplier has attracted criticism from other sugar producers, whose profits from supplying domestic sugar markets have been increasingly squeezed by cheaper Brazilian imports. The status of the company has since become a subject of

[15] Green Fuels sources feedstock from land owned by the Agricultural Rural Development Agency, who in turn had taken this land from local communities (Mashininga 2014).

major political debate within the ruling party and the government has recently taken over a large stake of the company's assets (Mashininga 2014).[16]

Ongoing campaigns on land reform and indigenisation of businesses are an ongoing source of concern for domestic and foreign producers in Zimbabwe. Sugar-processing plants and estates run by South African firm Tongaat-Hulett have been targeted for further nationalisation in the recent past, although this has not been followed up recently (Reuters 2014).

Opportunities for trade

Zimbabwean policy appears to neither restrict nor promote trade. On the face of it, the ambitious blending target suggests Zimbabwe would welcome imports, but given the current emphasis on encouraging domestic production from a single domestic monopoly supplier and the scarcity of foreign currency, this is unlikely. Indeed, Zimbabwe could potentially access ethanol production from a second domestic producer (Triangle) before resorting to imports from foreign producers but has done so on only one occasion.

In the current political and economic situation and the focus on the domestic market, prospects for exports from Zimbabwe also seem unlikely.[17]

2.5 Zambia

Biofuel policies

In 2008, the Zambian government issued the National Energy Policy and created national standards for biofuels. Blending ratios followed in 2011 (5% for biodiesel and 10% for bioethanol). However, these ratios have yet to be translated into formal policy (Biofuels Digest Website 2013) and the government continues to provide subsidies for fuel, thereby hampering the price competitiveness of biofuels (Chu 2012). The Zambian Development Authority, the agency responsible for promoting inward investment, continues to promote investments in the biofuel sector but does not treat it as a priority sector (ibid).

However, recent government announcements suggest there is still interest in developing the ethanol sector in the near future. In January 2014, the government announced its intention to invest in blending facilities at Ndola (the site of the main petroleum refinery) and Lusaka (the capital), with plans for additional future blending at fuel depots across the country. In addition, the government continues to hold talks with the main sugar producer, Zambia Sugar, to encourage the latter to invest in ethanol manufacturing (Kunda 2014).

Opportunities for trade

At the same time as it announced intentions to raise domestic investment, the government indicated its interest in importing ethanol through a competitive bidding process in the short term due to the lack of domestic capacity (Kunda 2014). Previously, the government signalled its interest to import ethanol from Zimbabwe and this would be a likely source for future imports. Whether this goes ahead in the face of opposition from domestic producers remains to be seen (Namutowe 2013). As domestic production has not yet started, no provisions exist for exporting fuel ethanol to neighbouring countries.

16 The owner of Green Fuels, Billy Rautenbach, has a controversial background having been involved in suspect arms deals in the DR Congo. His close relationship to senior members of the ruling ZANU-PF party led him to being banned from travelling to the US http://nehandaradio.com/2014/04/26/us-envoy-wont-say-billy-rautenbach-hook/

17 Although Green Fuels has reported that neighbouring countries are interested in buying fuel ethanol, no sales have been announced and it appears unlikely exports would be sanctioned by the Zimbabwean government, given its ambitions to increase domestic blending.

2.6 Mozambique

Biofuel policies

Mozambique's biofuel policy framework is also relatively recent. The biofuels policy was drafted in 2007-2008 in parallel with zoning exercises to find suitable areas for biofuel production. The biofuels policy and strategy were released in 2009, followed by the regulation for ethanol in 2011 and the launch of an interministeral task team. In addition, in 2009, Mozambique started to develop a sustainability framework — the Mozambican Biofuel Sustainability Framework — to reduce environmental and social impacts when developing and implementing projects. This was piloted during 2013 with three companies (NIQeL, GEZ and CleanStar) and is currently undergoing further study by the government (Vissers and Chidamoio 2013).

Although Mozambique has introduced a blending mandate of E10, this does not appear to be enforced at present, and none of Mozambique's sugarcane production is used for ethanol production (USDA 2014).

2.7 Malawi

Although Malawi has run a blending programme since 1982, it does not have a biofuels policy. This lack of policy constrains investment, especially for encouraging the use of co-products of sugar production, including cane trash and bagasse (SEI, 2012). [18] Malawi has neither imported nor exported any fuel ethanol.

18 Cane trash is the field residue that remains after harvesting the cane stalk. Bagasse is the milling by-product that remains after extracting sugar from the stalk http://www.bioenergyconsult.com/tag/cane-trash/

3 Fuel ethanol production in southern African countries

This chapter discusses current fuel ethanol production and consumption in southern Africa. It starts with an overview of production and consumption statistics for the region, followed by more details for each country.

3.1 Overview of regional fuel ethanol markets

Table 4 presents production and consumption figures for the selected countries in 2011 — the latest year when statistics are available.[19] Figure 1 shows historical production in each country. Figures for fuel ethanol trade are not freely available but country level analysis (below) suggests fuel ethanol is not traded in the region.

Table 4: Fuel ethanol production and consumption figures[20] for selected countries in 2011

Country	Production (litres/ day)		Consumption (litres/ day)	
	Fuel ethanol production **(Global ranking in brackets)**	Ethanol production from biomass	Fuel ethanol consumption	Biofuel use
Malawi	31,700 **(42)**	NA	15,900	NA
Mozambique	0	0	0	0
South Africa	15,900 **(49)**	0	15,900	0
Zambia	0	0	0	0
Zimbabwe	3,200 **(52)**	NA	200	NA
Source	EIA International Energy Statistics	OECD-FAO Agricultural Outlook—Biofuels data	EIA International Energy Statistics	OECD-FAO Agricultural Outlook

Source: EIA International Energy Statistics Renewable Database; OECD; OECD FAO Agricultural Outlook database. NB figures from EIA are originally presented barrels per day and have been converted by the author to litres per day and rounded to the nearest hundred. NA denotes not available.

Production

According to EIA data, Malawi was the region's largest producer of fuel ethanol in 2011 (producing 31,700 litres per day), followed by South Africa (15,900 litres per day) and Zimbabwe (3200 litres per day).[21] Neither Mozambique nor Zambia produced any fuel

19 Production in 2011 was above any year since 2000 for all reported variables.

20 The databases do not report trade data, so it is unclear what

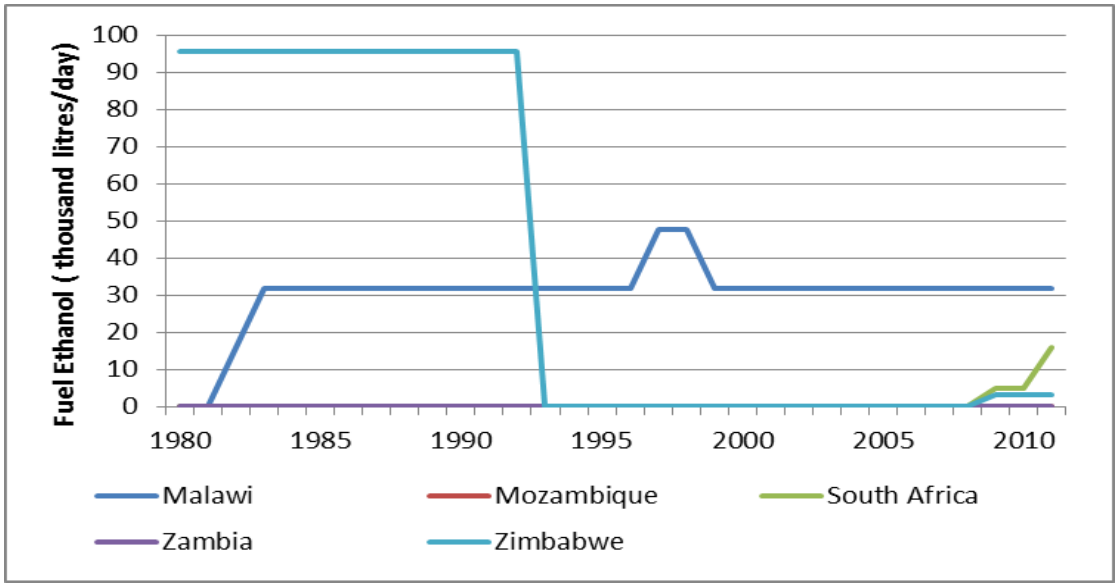
21 However according to other reports, Zimbabwe's production was much higher—see section 3.3.

ethanol according to EIA.[22] By national production, Malawi ranked 42nd in 2011, South Africa 49th, and Zimbabwe 52nd.

OECD-FAO reports that no biomass was used to produce fuel ethanol in Mozambique, South Africa and Zambia (see second column of Table 4). Country-level analysis appears to validate this (see below). Malawi and Zimbabwe both produce fuel ethanol mostly using sugarcane, which likely accounts for most of the volumes reported in first column of Table 4.

Figure 1 puts current fuel ethanol production in a historical context. Malawi has consistently produced around 32,000 litres per day since the mid 1980s. Zimbabwe also produced large volumes of fuel ethanol in the 1980s (around 95,000 litres per day) but a drought in the early 1990s brought production almost to a halt.

Figure 1: Fuel ethanol production in Southern African countries, 1980-2011



Source: EIA International Energy Statistics database.

Consumption

Figures from the two databases suggests selected countries consume very little or no fuel ethanol (Table 4). South Africa's consumption appears to balance its domestic production.[23] The reason for the difference between EIA figures for production and consumption in Zimbabwe and Malawi is puzzling since country-level analysis below suggests neither country exports fuel ethanol (discussed below).

South Africa

Current ethanol production and exports

As is evident from Table 4, no or insignificant volumes of fuel ethanol is consumed in South Africa and most ethanol production goes into non-fuel uses in the industrial, and beverage sector (OECD 2013). Although nearly 200 million litres is exported, all of this goes to non-fuel uses in the pharmaceutical, paint and potable alcohol industries (Cartwright 2007).

22 Figures should be interpreted with caution—comparable figures from industry consultants present different figures suggesting differences in methodologies used to aggregate data.
23 The reason for the difference between EIA and OECD-FAO reported consumption figures for South Africa is not known.

Projected increase in demand and supply

As of February 2014, four South African bio-ethanol manufacturers had received licences so could theoretically start production. The total production capacity for the four proposed fuel projects is equivalent to 1.08 million litres per day (Table 5). Should these projects come on-stream and produce at full capacity, fuel ethanol is expected to reach 2% of total fuel consumption, exceeding the minimum target for blending of 2% of petroleum (currently equivalent to 240 million litres per year). However, none of the licenced manufacturers has started to build plants (Department of Energy 2014).

Feedstocks for future fuel ethanol supply

As discussed in Section 2.3, the fuel ethanol mandate is expected to be met through a combination of sorghum and sugarcane. The facilities expected to begin operations in the near future will use sorghum (see Table 6) and as a result production of sorghum will need to rise sharply in coming years to meet the 2% mandate: if using sorghum alone, an additional 620,000 tonnes will be needed: see Table 7 (Grynberg (2013). This will require expanding land under use by 210,000 has. This seems to be the most feasible option, as there is very limited scope to expand sugarcane production because of scarcity of existing irrigated land and sustainability issues surrounding increasing irrigated land (E4tech (2006), USDA 2013).

It is uncertain if blending mandates will lead to further processing of sugarcane waste, greater use of sugarcane for ethanol production instead of sugar, or an expansion of sugarcane area or yields. As Figure A1 in the annex shows, there is a complex relationship between the sugar, oil and ethanol price which is not possible to explore here.

Table 5: Details of fuel ethanol manufacturing facilities with manufacturing licences.

Company Name	Crop / Feedstock	Capacity (million litres per annum)	Location	License status
BIO-ETHANOL				
Mabele Fuels	Sorghum	158	Bothaville, Free State	Issued[1]
Ubuhle Renewable Energy	Sugarcane	50	Jozini, KwaZulu Natal	Issued
E10 Petroleum Africa CC	Sugarcane and other crops	4.2	Gauteng , Germiston	Granted[2]
ARENGO 316 (PTY) LTD	Sorghum and sugar beet	180 (in 2 phases of 90 each)	Cradock, Eastern Cape	Granted
TOTAL BIO-ETHANOL CAPACITY		**392.2**		

Source: (Department of Energy 2014). NB: Granted means the applicant has not met all the requirements but is now in possession of a conditional manufacturing license. Issued means the applicant has met all the requirements and is now in possession of a manufacturing license.

Table 6: Fuel ethanol and sorghum needed under proposed mandate levels in South Africa

	Current production	*Production needed to meet E2 mandate*	*Shortfall under 2% target (E2)*	*Shortfall under10% mandate (E10)*
Fuel ethanol total	5.8 million litres per year (EIA data)	*250 million litres per year to meet E2*	N/A	N/A
Ethanol feedstock (sorghum)	*Between 150,000 to 170,000 tonnes per year)*	*780,000 tonnes*	*620,000 tonnes (eq. to 210 000 has of land)*	*3.3 million tonnes (eq. to 1.1 million has of land)*

Source: analysis cited in Grynberg (2013)

Zimbabwe

Media reports suggest Zimbabwean fuel ethanol production is now much higher than the 2011 figures reported in Table 4. As discussed in section 2.4, one company — Green Fuels —has manufactured fuel ethanol since 2011 (USDA 2011). This has a capacity to produce 100 million litres per year of ethanol from 9,500 hectares (has) of sugarcane. A recent media report suggests production came close to an equivalent of 200,000 litres per day at one point in 2010 but subsequently fell due to poor weather (Financial Gazette 2014).[24] The company does not disclose up to date production data.

According to the Green Fuels website, the company intends to expand to four manufacturing plants to an annual capacity of 1.5 billion litres to meet Zimbabwe's domestic requirements in full (Green Fuel Website, Chiketo (2014)). To this end, the company is trying to establish a second plant in Mwenezi, Mashvingo and expand production on to 46,000 has but has encountered problems in negotiating land acquisition and resettlement (Chiketo 2014).

There are two other large-scale sugar companies operating in Zimbabwe – Triangle Estate and Hippo Valley.[25] These produce around 3 million tonnes of sugarcane that accounts for approximately 80% of Zimbabwe's sugar output (USDA 2014). In 2009, Triangle installed a new de-hydration plant for producing fuel-grade ethanol, which has the capacity to produce 124,000 litres per day. All ethanol production is currently exported to Europe (apparently for non-fuel use), although during a domestic fuel ethanol shortage in 2013/14, Triangle supplied around 30 million litres of fuel ethanol (Tongaat-Hulett website, Daily News Live 2014).

This discussion highlights considerable uncertainty surrounding current and potential production in Zimbabwe. According to the EIA figure of 3000 litres per day, Zimbabwe is the 52nd largest producer in the world. However, if production is closer to 200,000 litres per day cited above, this would put it in 27th place.

On the consumption side, a 2011 report stated that Zimbabwe consumed no fuel ethanol in that year (USDA 2011) but media and industry reports since suggest consumption is now substantial. As discussed in section 2.4, Zimbabwe is now considering E15 and E20 targets, which suggests it is already in a position to meet 10% of road fuel consumption.

24 Note this is well above the EIA estimate of 3000 litres per day presented in Table 4.
25 South African company Tongaat-Hulett has full ownership of Triangle and has a controlling stake of 50.3% in Hippo Valley.

Zambia

At present, Zambian manufacturers produce ethanol only on an experimental basis. However, the government is keen to increase domestic production on the back of the large sugar industry that produces ethanol for non-fuel uses. In January 2014, it signed a Memorandum of Understanding with Zambia Sugar (owned by South African firm Illovo), the biggest national producer, to encourage exploring investments in ethanol production in return for government commitment to purchase a portion of the offtake. Zambia Sugar is set to decide if it will invest by next year (2015), with production potentially starting in 2017 (Mulikelela 2014). As mentioned above, the government of Zambia has also signalled its interest in importing an unspecified amount of bioethanol for fuel use in the short term, but has yet to do so (Kunda 2014).

Malawi

Malawi has produced fuel ethanol since 1982, meeting around at least 10% of its transport gasoline consumption (Johnson and Jumbe 2013) although with significant fluctuations in volume between years. Fuel ethanol is manufactured at two distilleries using molasses extracted from nearby sugar refineries attached to the Dwangwa and Nchalo estates.[26] The two distilleries have a combined capacity of 99,000 litres per day (Hart Energy website) but currently operate at around one third of capacity. Malawi neither imports nor exports ethanol at present.

Mozambique

The lack of fuel ethanol production and consumption suggested in Table 4 is supported by available media articles, which report no recent activity in the sector. [27] Five projects were reportedly aiming to establish production using a mix of sugarcane, sorghum and cassava and if brought online at full capacity could produce an equivalent of 293,600 litres per day,[28] greatly exceeding an E10 blending target (see Table 5) (Locke and Henley 2013). However, none of these has started production yet.

3.2 Future demand, supply and regional trade

Projected future demand

Based on the available information above, we present back-of-the-envelope estimates for potential fuel ethanol market sizes for each country, assuming E10 mandates are fully introduced by 2022[29] (Column 1 of Table 4). Although the assumption that markets will expand so much is probably unrealistic, this allows us to gauge how much production would need to expand by in order to fulfil demand. Requiring around two million litres per day, the South African market would dwarf markets in other countries, which would need between 30and 40 thousand litres per day. At present levels of production, supply would meet only a tiny portion of demand (see third column).

If planned investments reported above go ahead in each country, Mozambique and Zimbabwe would easily exceed their domestic blending targets and could conceivably export the equivalent of 380,000 litres per day. On the other hand, if all announced investment goes ahead in South Africa, it would still face a shortfall of around 920 thousand litres per day.

26 Both distilleries are owned by the Press Corporation. Dwanga and Nchalo are owned by South African company Illovo. (Illovo 2013)
27 Although FAO-OECD reported fuel ethanol consumption of 2 million litres per year between 2010 and 2012 (OECD 2013), this figure has been revised to zero in the current online database. Similarly, although OECD (2013) projected fuel ethanol consumption to rise to 15 million litres per year in 2022, the online database projects fuel ethanol consumption levels to stay at zero.
28 Figure calculated from background figures used in Locke and Henley (2013).
29 2022 is chosen because it represents a plausible, albeit ambitious, timeframe within which to establish a mandate.

Table 7: Hypothesised fuel ethanol consumption in 2022, assuming an E10 mandate is fully enforced (litres/day)

Country[30]	Hypothetical fuel ethanol demand in 2022	Current level of production (figures from Table 4)	Supply gap (high estimate)	Plausible level of production with planned investment	Supply gap (low estimate)
Mozambique	40,141	0	**40,141**	293,600	**-253,459**
South Africa	2,000,324	15,900	**1,984,424**	1,080,000	**920,324**
Zambia	38,763	0	**38,763**	?	**?**
Zimbabwe	33,609	3,200	**30,409**	200,000	**-132,782**

Source: Author's calculation based on WDI and EIA statistics[31], and information in this report.

Conclusions

The discussion above suggests that to meet blending mandates of 10%, South Africa, Zambia and Mozambique need additional fuel ethanol supply. Although current production volumes are unknown, it is reasonable to assume that Zimbabwe is already able to – or will soon – meet a domestic 10% mandate. The government is setting higher targets that it plans to reach through increased domestic production. Fuel ethanol production in Malawi is also already near 10% of its fuel consumption and there is little indication that production would raise without significant changes in policy or economics (Johnson and Jumbe 2013).

For those countries which currently do not produce fuel ethanol:

- Mozambique's targets could be met easily if existing planned projects got underway and the economics favoured fuel ethanol production (over other options).
- Zambia produces significant volumes of sugar and is currently exploring opportunities to produce fuel ethanol by upgrading existing manufacturing plants. It is likely blending targets could be met using domestic production, if this made economic sense.
- For South Africa, the size of the gasoline market and lack of current production and investment plans raises questions whether it will meet a lower blending target of 2%, let alone an upper target of 10%

A simple calculation suggests that if producers in Mozambique and Zimbabwe were to implement current investment plans, they could meet domestic mandates and still have large surpluses to export. Even if South Africa imported this entire surplus, the gap between supply and its E10 mandate would be around 535 thousand litres per day.[32]

However, as discussed in section 2.3 current South African policies appear to rule out significant opportunities for imports. Biofuel manufacturers can receive licences only if they demonstrate that they will source from domestic producers, preferably emergent farmers. Imports of fuel ethanol are permitted only in exceptional circumstances, and even then, plans must be in place to substitute imports with domestic production, ruling

30 Data are not available for Malawi.
31 Calculated using Road sector gasoline fuel consumption values for each country (reported on WDI) and assuming the gasoline market grows at the projected average for Africa of 0.8% p.a. (EIA 2013).
32 Calculated from Table 7.

out the possibility for local manufacturers to rely on imports as a core part of their business model.

The discussion above also suggests that there is limited scope for regional trade between other countries in the immediate future. Although Zimbabwe has set ambitious fuel targets, its focus is squarely on domestic production and is unlikely to be in a position to afford significant imports of fuel ethanol. Zambia has signalled an interest to buy some fuel ethanol in the short term, but is more likely to encourage domestic production over the longer term.

4 Markets in the EU

The EU is currently the most promising market for global fuel ethanol exporters due to the structural deficit created by biofuel mandates which European countries cannot fill using local production (USDA 2013).[33] Opportunities for exporting countries (including those in southern Africa) to supply fuel ethanol (and other biofuels) to the EU are determined by the following factors:

- The current set of EU energy and environment policies that aim to increase markets for biofuels and other forms of renewable energy, and any prospective changes to these policies in the near future;
- How far EU demand is met by international imports, and expectations of how suppliers' markets will evolve;
- Treatment of potential EU imports from southern African exporters under the current EU trade regime;
- Current and future treatment by the EU of exporters that account for a major share of EU imports, and the production, consumption and export policies in those countries.

4.1 EU biofuel policies

The EU's Renewable Energy Directive and Fuel Quality Directive are the main pieces of legislation that determine the policy framework and opportunities for third countries to export fuel ethanol imports to the EU.

The Renewable Energy Directive (RED) requires 10% of energy used in transport to come from renewables by 2020. Although sources of fuel are not specified, most of this is expected to come from biofuels. Biofuels must meet sustainability criteria linked to greenhouse gas emissions, land use, environmental and labour standards. Both domestically produced and imported biofuels must meet sustainability criteria. The Fuel Quality Directive (FQD) requires that greenhouse gases from transport fuel fall by 6% by 2020.

In addition, in October 2012, the EC published a proposal to address concerns over Indirect Land Use Change (ILUC). This proposed placing a cap on biofuels coming from first generation biofuels, and instead put in place measures to encourage the uptake of advanced biofuels. In June 2014, EU energy ministers agreed to a 7% cap for biofuels produced from food crops, and to a non-binding 0.5% target for advanced biofuels (Reuters 2014). This agreement is now with the EU parliament for their consideration.

4.2 Fuel ethanol markets

EU ethanol imports

At present, the European market consumes around 1.21 billion litres of ethanol per year (2011 figures), around 28% of the bloc's total biofuel consumption (USDA GAIN 2013). In 2013, the EU imported around 1.2 billion litres for transport fuels. However, imports of fuel ethanol have decreased in recent years (see Figure 2) as the EU has restricted imports from some countries by introducing new trade measures. Ethanol imports were expected to drop to 850 million litres in 2014, with 500 million litres going into transport fuels (USDA GAIN 2013).

Recent changes and future trends in EU fuel ethanol markets

The following events in 2013/14 affected EU fuel ethanol markets (OECD-FAO 2014):

- The imposition of anti-dumping duties against Indonesia, Argentina and the USA, which limited imports from these countries. Anti-dumping and countervailing duties on US bioethanol imports were expected to cut off exports to Europe (USDA 2013). As a result, a gap of around 500 million litres was created in 2012, which was filled with imports from Guatemala, Peru and Pakistan, all countries who enjoy duty-free access.

- Proposals were made to reduce first generation biofuel targets for 2020 under the Renewable Energy Directive. The EU has also hardened rhetoric on eliminating support to conventional (food-based) biofuels after 2020 (IEEP 2014).

- Ethanol prices continued their downward trend, indicating ample supplies.

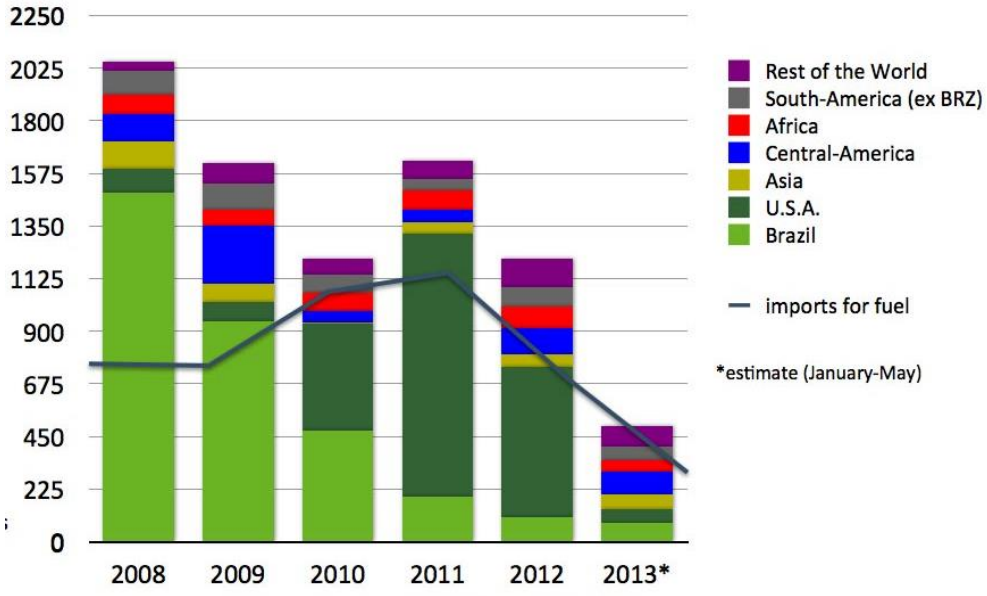
The following trends are expected in the near future:

- The EU is expected to meet 8.5% of its RED target from biofuel by 2020. The EU will need to rely on imports to meet its RED targets if they remain at 10%.

- Ethanol prices are expected to rise. At the minimum, the price rise follow the crude oil price and inflation however if exporting countries consume more of their own production prices could rise further.

- EU imports are expected to reach 1.26 billion litres per year in 2015 and rise to over 2 billion litres in 2020.

Figure 2: Ethanol imports into the EU by region, 2008-2013



Source: Epure 2013

Access to European fuel ethanol markets for southern African producers

All the southern African countries reviewed here, with the exception of South Africa, have unlimited duty-free access to the EU market for their ethanol exports.[34] This access is provided through the Everything by Arms agreement or, in the case of Zimbabwe, an Economic Partnership Agreement (Dimaran and Laborde 2012; USDA 2014).

A new trade pact between southern African countries and the EU agreed in July 2014 allows South Africa to export 80,000 tonnes of ethanol duty-free to the EU (Reuters 2014). Beyond this, the Most Favoured Nation (MFN) rates apply.[35]

Sustainability criteria

To contribute towards RED targets, EU imports of biofuels have to meet social and environmental sustainability criteria. Producers need to demonstrate that:

- Biofuels consumption reduces greenhouse gas emissions by 35%, increasing to 50% by 2017;
- Biofuels are not produced on land that has either an important habitat for biodiversity or has large carbon stocks (e.g. peatlands, wetlands);
- The use of labour conforms to important International Labour Organization (ILO) standards.

[34] These countries would be able to export fuel ethanol and other biofuels to European markets in unlimited quantities, as long as the volume exported does not exceed 15% of the total amount that all GSP beneficiaries export to the EU (EU 2012).

[35] MFN rates are €19.2/hectolitre for undenatured ethanol and €10.2/hectolitre for denatured ethanol. Undenatured ethanol is suitable for human consumption. Denatured ethanol is not. With the exceptions of the UK, Netherlands, Finland, Denmark, the Czech Republic and Slovakia no EU governments permit fuel blending with denatured ethanol.

Producers either can demonstrate compliance by submitting documentation through national schemes, or make use of approved voluntary certification schemes. The EU has recognised 17 certification schemes (see Table A.4 in the annex) that provide a sufficient level of detail to comply with RED requirements, and it is expected that the vast majority of biofuel importers will use these (CIFOR 2013).

Conclusions

It is unclear if the combination of reduced imports into the EU from traditional exporters and zero or low tariffs for southern African countries are sufficient to stimulate extra production and exports to the EU.

On the one hand, tightening trade rules that reduce imports from traditional exporters may create opportunities. Figure 2 shows that Brazil and the US have accounted for the lion' share of the EU's imports, but as imports from these regions shrink amid a growing EU in coming years, there may be more opportunities for African exporters. However, other suppliers with preferential access and lower prices may continue to fill this shortfall. No existing analysis was found on this issue, suggesting it deserves further attention, including analysis of costs and competitiveness.

It is unclear if sustainability criteria and certification presents a major obstacle to trade. While fuel ethanol feedstocks produced in southern Africa are likely to meet sustainability criteria especially on greenhouse gas savings, the costs of certification, although low overall, may be high especially for smaller producers (van Meijl, 2012). So far, no southern African producers appear to have been accredited by any of the voluntary schemes.

4.3 Advanced biofuels

In 2012 and 2013, the European Commission revised key biofuels policies in order to incentivise greater use of so-called "advanced biofuels". Unlike conventional biofuels which are manufactured using crops that are either used for food or carry a high risk of causing indirect land use change (ILUC), advanced biofuels "*provide high greenhouse gas savings with low risk of causing indirect land use change and do not compete directly for agricultural land for the food and feed markets*"(EC 2012). To incentivise uptake, the EC proposed to allow countries using these crops to count their contribution towards meeting renewable energy targets at a level double or four times their energy content.[36]

[36] In 2012, a proposal was made towards amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

Table 8: Feedstocks eligible for double and quadruple accounting

Eligible for double counting	Eligible for quadruple counting
(a) Used cooking oil. (b) Category I and II animal fats (complying with health rules and not intended for human consumption. (c) Non-food cellulosic material. (d) Ligno-cellulosic material except saw logs and veneer logs.	Algae, Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under Article 11(2) (a) of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. (c) Biomass fraction of industrial waste. (d) Straw. (e) Animal manure and sewage sludge. (f) Palm oil mill effluent and empty palm fruit bunches. (g) Tall oil pitch. (h) Crude glycerine. (i) Bagasse. (j) Grape marcs and wine lees. (k) Nut shells. (l) Husks. (m) Cobs (n) Bark, branches, leaves, saw dust and cutter shavings.

Source: IEEP (2013)

Opportunities for southern African producers?

EU proposals on advanced biofuels do not appear to rule out the use of imported feedstocks so those sourced from international markets would be eligible for the same benefits as those from domestic sources. As with fuel ethanol, the tariff regimes that southern African producers face are determined by their status under trade agreements: most countries have unlimited duty free access (Mozambique, Malawi, and Zambia under Everything but Arms, Zimbabwe under its Economic Partnership Agreement) while South Africa is liable for duties in line with its trade agreement.[37]

Because the new proposed rules for advanced biofuels are not finalised, literature exploring how each prospective feedstock market will develop is still very limited. A report by the Institute for European Environmental Policy (IEEP 2013) provides an overview on opportunities, challenges and likelihood for imports associated with different feedstocks.[38] Table A3 in the annex synthesises this and other limited information to suggest if opportunities exist or not.

Given time constraints, we were unable to conduct further analysis of either existing production of these feedstocks in southern African countries, potential for future supply or likely costs of production and transport to Europe. These would be necessary next steps to determine if it exporting feedstock to the EU is feasible.

The analysis in Table A3 suggests there is little potential for southern African countries to supply advanced biofuels feedstocks to European markets in the near future. Many of the feedstocks are bulky, with low energy-to-weight density and would therefore be expensive to transport. Moreover, although feedstocks are treated as carbon neutral up to the point of collection, their bulkiness may result in relatively high emissions during transport. However, a few feedstocks appear to merit further consideration since they

[37] Research did not reveal special tariffs that apply to advanced biofuel feedstocks.

[38] IEEP (2013) presents analysis each eligible feedstock, but the level of analysis is relatively shallow.

are not immediately ruled out by IEEP's analysis. These include bagasse, nutshells, used cooking oil, non-food cellulosic material, and ligno-cellulosic material.

As criteria and benefits for supplying advanced biofuels are still being debated, there is also a risk that additional safeguards are introduced to prevent feedstocks being perversely diverted from their current use. These safeguards may introduce additional restrictions that raises the cost of exporting (IEEP 2013).

Opportunities for these crops would benefit from further research. Possible questions to guide further research include the following:

- Do southern African countries produce these feedstocks in significant quantities and at low costs?
- Is there capacity to process these feedstocks in current and planned European manufacturing facilities? If not, can local processing facilities exist, or is there sufficient supply to justify investment in one?
- Do prices for advanced biofuels in European markets exceed prices for alternative uses within southern Africa?
- Does European sustainability legislation for these feedstocks make importing such goods into the bloc cumbersome and expensive?

5 Findings and areas for more research

5.1 Findings

The discussions in this report provide the following observations on current trends in production, consumption and trade and what opportunities exist in the near future given the current policy framework:

- **Recent years have seen low production and consumption of fuel ethanol.** Although policies for production and consumption exist in Zambia and Mozambique neither country seems to actually produce or consume fuel ethanol. In South Africa, production of ethanol has risen in recent years but most goes to potable alcohol and industrial uses and little, if any, has gone into fuel use at home or abroad. Fuel ethanol production and consumption in Malawi is around 10% of domestic fuel consumption, but this is low in absolute terms. Only Zimbabwe appears to have substantial production capacity, following large investments in recent years. However, it is unclear by how much production and consumption has actually risen because no reliable information in available.

- **Meeting new blending mandates in South Africa will require a large increase in domestic production, which may not take place.** At present, it is unclear if South African producers will produce enough fuel ethanol to meet a minimum 2% mandate, as they have yet to commit to upgrade existing manufacturing facilities. Meeting the maximum 10% mandate will require substantial increases in production, and could be partly met through imports from neighbouring countries, based on existing investment plans in those countries. However, recently announced regulations appear to strongly favour domestic production: to receive a manufacturing license, suppliers must use local feedstock and can use imports only in exceptional circumstances.

Trade opportunities in the region exist but appear unlikely to materialise in the near future.

- Despite its ambitious targets, Zimbabwe seems entirely focused on expanding national production and the prospect of either Mozambique or Malawi importing or exporting any fuel ethanol appears slim at present. Zambia appears to be the only country willing to import fuel ethanol from neighbouring countries, although this is likely to be a short-term measure.

- **Prospects for exports of fuel ethanol to Europe are uncertain.** At present, it seems that southern African countries do not export to the EU fuel ethanol market. Given time constraints, we were unable explore the economics behind this. Although EU imports from major fuel ethanol producers are falling, it is unclear if this trend will favour southern African producers. This deserves more research.

- **EU markets for advanced biofuels appear to offer few opportunities for southern African producers.** Rapid analysis of EU advanced biofuels markets suggests demand for most feedstocks will be met mainly from local supply. However,

further research is needed to confirm this, and to explore if southern African countries produce eligible feedstocks in substantial quantities, and if it makes economic sense to export these to the EU.

5.2 Gaps and areas for more research

The data used in this review were largely restricted to information from publicly available secondary literature and databases, which although reliable, are often out of date and offer little on recent developments and future trends. More in-depth research involving interviews with government officials, market analysts and investors is needed to provide a fuller picture on both ongoing developments and sentiments that will influence future markets and opportunities.

The following areas would also benefit from further analysis:

- More in-depth research based on economic analysis of fuel ethanol production under present market conditions in oil and sugar markets. Analysis of markets in both southern African countries and the EU would be useful to better understand opportunities in the near future;

- Possible incentives and obstacles to reneging on mandates in the case of South Africa to gauge the likelihood of this happening, or alternatively for the South African market to open up to imports from regional suppliers.

- Costs of complying with EU sustainability criteria for exporters of fuel ethanol and feedstocks eligible under rules for advanced biofuels.

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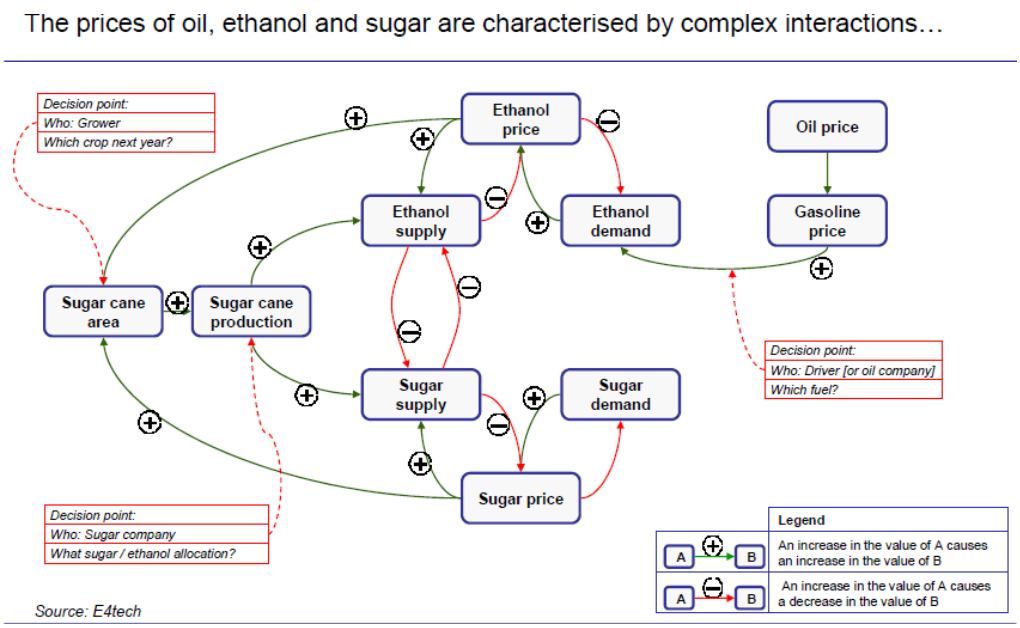
Annex

Figure A1: Relationship between ethanol, sugar and oil markets



Source: E4tech (2006)

Table A1: Assumptions for calculating subsidies for fuel ethanol producers using sugarcane and sorghum as feedstocks

The major assumptions are listed below:

Assumption	Bio-ethanol	Biodiesel
Reference Feedstock	Grain Sorghum	Soya Beans
Efficient Plant Capacity	158,000 m³/a	113,000 m³/a
Capital Investment (2011)	R2,131 million	R1,135 million
Feedstock Consumption	2.40 t/m³	5.40 t/m³
Feedstock Pricing Basis	SAFEX Sorghum	SAFEX Soya
Co-product Credits	0.53 t/m³ DDGS	4.10 t/m³ Soya Meal 0.11 t/m³ Glycerol
Co-product Pricing Basis	DGGS = 80% SAFEX Yellow Maize	Soya Meal = 110% SAFEX soya
Total Variable Costs, excluding Feedstock (2011)	R102 million	R129 million
Total Fixed Costs (2011)	R235 million	R172 million
Annual Cost Escalation (Capex and Opex)	PPI & CPI	PPI & CPI
Working Capital	Stock = 15 days Debtors = 45 days Creditors = 30 Days	Stock = 15 days Debtors = 45 days Creditors = 30 Days
Biofuel Pricing Basis	BFP ULP95 + Zone Differential + Blending Value	BFP ULSD + Zone Differential

Source: Department of Energy (2014)

Table A2: Standards, criteria and indicators for biofuel production in South Africa

STANDARDS	CRITERIA	INDICATORS
Contribution to liquid fuels industry transformation	Mandatory part ownership by historically disadvantaged South Africans (HDSAs)	A minimum of 25% ownership and control of biofuels manufacturing plants by HDSAs. All other matters related to transformation will be informed by BBBEE Act and other specific sectorial laws
Facilitation of social inclusion	Mandatory part sourcing of biofuels feedstock from small holder farmers, emerging farmers and other farming historically disadvantaged South Africans (HDSAs)	A combined minimum of 10% biofuels feedstock sourced from small holder farmers, emerging farmers and HDSAs within 4 years of start-up plant operations.
Protection of agricultural land rights	Prior written consent from land owners to participate in the biofuels programme	A legally sound consent form signed by the land owner
Positive contribution to rural development	Appointment of labour	Bio fuels manufacturer's feedstock supply contract must contain a clause stating that a minimum of 70% labour procured from the South African citizens (if available) appointed in agricultural activities
		A combined minimum of 10% unskilled, semi- and skilled labour procured from the South African citizens (if available) appointed in manufacturing plant
	Mandatory spend on rural SMMEs, Co-operatives and contribution to community initiatives	Percentage of the annual procurement spend of the manufacturing plant on local SMMEs, Co-operatives and community initiatives
		Type and quality of training afforded local SMMEs, Co-operatives and community members
Avoidance of food security threats	Prohibition of diverting commercial farmlands to biofuels feedstock production	Letter from the Department of Agriculture Forestry and Fisheries (DAFF) confirming the feedstock has been / will be planted in "Designated Areas" and not in currently productive commercial farmlands (save for land acquired through the land restitution and other redress programmes)

STANDARDS	CRITERIA	INDICATORS
Protection of scarce natural resources	Avoidance of deforestation	The supply contract shall contain a clause that stipulates a prohibition of clearing of trees (and indigenous trees in particular) for feedstock production unless agreed to in writing by relevant authorities e.g. the Department of Water Affairs (DWA) & DAFF, etc.
	Controlled biofuel feedstock irrigation	Letter from DWA approving the use of irrigation water for biofuel feedstock production
		Detailed motivation for irrigating biofuel feedstock without negatively impacting the country's constrained water resources
Ability to produce sustainably	Demonstrate the commitment to establish a biofuels plant and be financially sustainable (continue as a going concern)	A EIA Record of Decision must be in place
		Letters of intent/MOUs from debt and equity funders to be provided covering the full investment
		Summary business plan to be provided

Table 4: Standards, Criteria and Indicators

Source: Department of Energy (2014)

Table A3: Potential for imports of advanced biofuel feedstocks

Feedstock	Likelihood of being imported into the EU (IEEP (2013) assessment)	Are more safeguards likely to be needed that may further raise barriers to supplying markets?	*A-priori* opportunity for southern African producers?
Feedstocks potentially eligible for quadruple accounting			
Algae Algae from both marine and fresh-water environments; may be harvested from wild stocks or cultivated.	**Low.** Algae are a high moisture content, low density feedstock which can biodegrade rapidly and, as such, are not suitable for transport over longer distances without drying. Artificial drying of algae is economically and environmentally costly, thus unless algal biomass can be dried naturally, processing it is likely to be constrained to the immediate vicinity of biomass production facilities.	Unclear at present but likely needed to promote most sustainable algae feedstocks.	Unclear.
Biomass fraction of mixed municipal waste Food waste and garden waste.	**Low.** Significant imports are highly unlikely given the low energy density.	Safeguards are likely needed to prevent burning of materials that could otherwise be re-used or recycled.	Unlikely due to cost.
Biomass fraction of industrial waste Waste paper, cardboard and wood and food waste from food processing.	**Low.** Significant imports are highly unlikely given the low energy density.	Safeguards are potentially needed to prevent burning of materials that could otherwise be re-used or recycled.	Unlikely due to cost.
Straw	**Low.** Although there is trade between European countries, significant extra-EU trade is unlikely given the low density of straw.	Safeguards are potentially likely needed to ensure straw is sourced from sustainable areas and soil carbon is accounted for. Specific measures may be needed for imports if CAP measures are used to regulate this in Europe.	**Unclear.**
Animal manure and sewage sludge	**Low** as mainly a wet material.	Safeguards are potentially needed to prevent a decline in availability of organic fertiliser.	Unlikely due to cost.
Palm oil mill effluent and empty palm fruit bunches	**Low-unknown.** As a wet material, palm oil mill effluent is a wet material likely to be too bulky to import. No information exists on quantities of empty fruit bunches are imported into the EU.	Safeguards potentially needed if palm oil bunches are diverted from use as fertilisers in home countries.	Unlikely due to low production in selected countries.

Tall oil pitch A highly viscous residue from the distillation of crude tall oil. Crude tall oil stems from crude sulphate soap, which is (along with black liquor) a by-product of the conifer based paper pulp making process.	**High.** Tall oil and its resulting products are being traded.	Unclear.	Unclear.
Crude glycerine A by-product of biodiesel production and the processing of animal and vegetable fats and oils.	**Unclear** but given the large-scale biodiesel production in the EU, a domestic oversupply is anticipated, making imports unlikely.	Likely to be covered under ILUC proposals for biodiesel production.	Unlikely due to availability within Europe.
Bagasse Fibrous residue from the sugarcane crushing process	**Low.** Bulky feedstock therefore imports highly unlikely.	Unclear.	Unlikely if bagasse can be used to generate energy in exporting countries.
Grape marcs and wine lees: Grape marc is the residue that remains after the pressing of fresh grapes. 'Wine lees' is the sediment remaining in the vessels used in wine production, consisting of dead yeasts and other solid particles.	**Low**. Large volumes of marc and lees are available within the EU. The EU produces 65 per cent of the world's wine, equating to roughly 175m Hl per annum. Wine is imported but in liquid form.	Not likely.	Unlikely due to high existing availability within Europe.
Nut shells	**Low.** Nuts are imported into the EU, though predominantly shelled. Significant volumes of almond, walnut and hazelnut shells are available within the EU.	Unclear.	Unlikely due to cost and if nut shells can be used to generate energy in exporting countries.
Husks Protective outer coating of seeds, nuts, grains or fruit.	**Low.** Unlikely to be imported as a biofuel feedstock given low energy density. Furthermore, imported grains (eg rice) tend to be imported without husks.	Unclear.	Unlikely due to cost and if husks can be used in other uses in exporting countries.
Cobs Central, fibrous core of a maize ear.	**Low.** Due to relatively low cob yields per hectare and low energy density of cobs, it is unlikely that such a feedstock will be imported to the EU on any scale.	Safeguards are potentially needed to prevent a decline in organic fertiliser.	Unlikely due to cost
Bark, branches, leaves, saw dust and cutter shavings	**Unlikely/ unclear.** Primary imports usually would be of timber or higher density pellets.	Safeguards are potentially needed to prevent decline in forest soil quality.	Unlikely due to cost
Feedstocks potentially eligible for double accounting			

Used cooking oil	**High.** Used cooking oil can be imported into the EU easily, with low-level controls in place controlling its import. Anecdotal evidence suggests that there may be issues with either virgin oils being burned or being contaminated with small quantities of used cooking oil so that the oil feedstock can be classified as used cooking oil.	Safeguards potentially needed to prevent use of virgin oils.	Potentially yes, depending on economics.
Animal fats classified as category I and II in accordance with EC/1774/2002 laying down health rules concerning animal by-products not intended for human consumption.	The import and export of Cat 1 and 2 tallow to and from the EU are subject to very strict requirements, eg sterilisation under pressure, marking, and are only allowed for certain safe purposes. However, there are proposals to allow the import of non-sterilised Cat 1 tallow from third countries (mainly Brazil, Canada, US, Uruguay and Argentina) for the oleochemicals industry. There are no plans to lift the export restriction for EU produced Cat 1 tallow. Cat 3 tallow is widely traded throughout the world.	IEEP (2013) suggest environmental safeguards are needed to ensure Cat III tallows are not used in biofuels or downgraded to Cat I for biofuels. If this does occur, feed and olechemical use of (unsustainable) palm oil is likely to increase.	Unlikely due to sanitary restrictions.
Non-food cellulosic material (Crops include *Miscanthus*, other energy grasses, certain varieties of sorghum and industrial hemp but exclude crops with high lignin content, such as wood products).	There is potential for this feedstock to be imported, however cultivation within the EU is more likely.	IEEP (2013) suggests the following safeguards as necessary: Ceilings on land dedicated to energy crop production to avoid ILUC risks; Energy crops should be included within the proposed 5% cap.	Potentially yes, depending on economics.
Ligno-cellulosic material except saw logs and veneer logs. This includes woody energy crops including willow and poplar grown in short rotation coppice (SRC) and short rotation forestry (SRF)	There is potential for this feedstock to be imported, but it is more likely, due to economic reasons, that dedicated lingo-cellulosic crops would be grown within the EU and close to refineries.		Potentially yes, depending on economics.

Table A4: EC-recognised Voluntary Schemes that verify compliance with sustainability criteria

1. ISCC (International Sustainability and Carbon Certification)
2. Bonsucro EU
3. RTRS EU RED (Round Table on Responsible Soy EU RED)
4. RSB EU RED (Roundtable of Sustainable Biofuels EU RED)
5. 2BSvs (Biomass Biofuels voluntary scheme)
6**. RBSA** (Abengoa RED Bioenergy Sustainability Assurance)
7. Greenergy (Greenergy Brazilian Bioethanol verification programme)
8. Ensus voluntary scheme under RED for Ensus bioethanol production
9. Red Tractor (Red Tractor Farm Assurance Combinable Crops & Sugar Beet Scheme)
10. SQC (Scottish Quality Farm Assured Combinable Crops (SQC) scheme)
11. Red Cert
12. NTA 8080
13. RSPO RED (Roundtable on Sustainable Palm Oil RED)
14. Biograce GHG calculation tool
15. HVO Renewable Diesel Scheme for Verification of Compliance with the RED sustainability criteria for biofuels
16. Gafta Trade Assurance Scheme
17. KZR INIG System