MINISTRY OF ENEGY AND POWER DEVELOPMENT

Biofuels Policy of Zimbabwe

A policy framework for the production and use of liquid biofuels in the transport sector

MINISTERIAL FOREWORD

The National Energy Policy (2012) promotes the optimal supply and utilisation of energy in a safe, sustainable and environmentally friendly manner. The Energy Policy (2012) also promotes the provision of modern energy solutions and utilisation of Renewable Energy in the country. The National Energy Policy has guided in the development of the Biofuels Policy which is in line with the Ministry's vision, "To achieve universal access to sustainable and modern energy in Zimbabwe by 2030". The policy mainly focuses on liquid biofuels in the transport sector during the period leading to year 2030. This is in line with the Sustainable Development Goal 7, "Ensure access to affordable, reliable, sustainable and modern energy for all" and the Sustainable Energy for All initiative objective to ensure universal access to modern energy services by year 2030.

The Biofuels Policy has been developed to guide the biofuels sector and to create an enabling environment for viable biofuels projects to be implemented in the country. The Biofuels Policy assists in bridging a supply gap in the country and thereby increase biofuels production which in turn results in the security of supply for the nation. The import bill is significantly reduced and there is employment creation and subsequently, poverty is reduced. The Policy promotes investment in the Biofuels sector and allows for a level playing field for all players who would want to venture into the Biofuels value chain. The Policy also addresses issues of market inefficiencies by opening up the market for competition and also looks at a decentralized model of implementation for biofuels projects.

Having noted that 68% of the Zimbabwean population lives in the rural areas and high levels of energy poverty exist there, the Policy promotes rural development and improved livelihoods for the rural populace. There are great opportunities for rural communities to participate in the biofuel feedstock value chain. This is in line with the National goals of the Transitional Stabilisation Programme (2018 - 2020) and Vision 2030. This Vision is anchored on re-engagement with the Global Community, private sector-led rapid growth and development as well as enhanced domestic and foreign investment as encapsulated by the mantra "Zimbabwe is open for business".

Investment in the sector drives the successful implementation of the Policy as clean energy projects are capital intensive. The Policy addresses investment issues and provides a policy framework that guides for incentives in the sector.

Nationally Determined Contributions (NDCs) identify the energy sector as the major GHG contributor accounting for 49% of national emissions. Petrol-ethanol blending has been identified as one of the projects for Low Carbon Development pathway and mitigation contribution. Ethanol blending alone is expected to substantially reduce GHG emissions by year 2030 at 20% level of blending which is expected to attract millions of United States Dollars (USD) investment. This in turn shows that the policy will assist in addressing emissions from the energy sector.

Capacity building is essential for appropriate knowledge and expertise to be continuously applied during projects implementation thus enabling the projects to expand internationally. Once the projects are on a regional and international scale foreign currency is generated for the nation.

I am in no doubt that the Biofuels Policy will be a valuable policy that will bring positive results for all sectors of the economy.

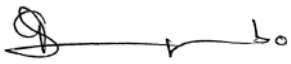
Fortune Chasi (MP)
MINISTER OF ENERGY AND POWER DEVELOPMENT

ACKNOWLEDGMENTS

The National Biofuels Policy was developed with a wide range of consultations from stakeholders in the Biofuels value chain in the country. Stakeholder consultative workshops were held in the Mashonaland region, Matabeleland region and in the Masvingo region.

Firstly I would like to thank the European Union who played an invaluable role by providing funding for the development process of the Policy. I would also like to acknowledge the inter-ministerial Biofuels oversight committee, technical stakeholders, regional stakeholders, members of the media fraternity and the general public. Sincere gratitude goes to WWF Zimbabwe for their coordination role and to the team of Policy experts who provided their expertise and guidance in the development process of the Biofuels Policy. Last but not least, I would like to thank everyone who contributed to the development process of the Policy either as a participant or as a resource person for their invaluable contributions throughout the process.

The Ministry values the input of all players as they ensured the production of a Biofuels Policy that will benefit the nation at large. The Ministry looks forward to full participation in the implementation process of the Policy to ensure that Zimbabwe has sustainable energy solutions that will improve the livelihood of the nation whilst addressing the climate change issues.



Dr. G. S. Magombo
SECRETARY FOR ENERGY AND POWER DEVELOPMENT

CONTENTS

ACRONYMS

DRSS	Department of Research and Specialist Services
EMA	Environmental Management Agency
NBPZ	National Biofuel Policy of Zimbabwe
NEP	National Energy Policy
NEPIS	National Energy Policy Implementation Strategy
NSSA	National Social Security Authority
MoEPD	Ministry of Energy and Power Development
MLRR	Ministry of Land and Rural Resettlement
SAZ	Standards Association of Zimbabwe
SIRDC	Scientific and Industrial Research and Development Centre
ZERA	Zimbabwe Energy Regularity Agency
WWF	World Wide Fund

EXECUTIVE SUMMARY

Introduction

The National Biofuels Policy has been developed to guide long term sustainable development of the bio fuel sector in Zimbabwe through provision of an enabling environment. The Policy ensures that biofuel production; processing, distribution and marketing in Zimbabwe will remain within the parameters of economic, environmental and social sustainability. Lack of a Biofuels Policy can result in inconsistent and fragmented activities that do not deliver the desired outcomes.

Benefits of a domestic biofuel sector

Zimbabwe's energy demand is rising with a current national requirement of three million three hundred thousand (3 300 000) and four million three hundred thousand (4 300 000) litres of petrol and diesel per day respectively. The policy recognises that the widespread adoption of bio-fuels could reduce the country's dependence on imported petroleum products; stabilize fuel prices; ensure energy security; promote rural development and investment; reduce poverty; and create employment.

Fuel import substitution from biofuels has several benefits which include:

- Enhanced energy security, especially in the transport sector;
- Creation of a large market for agricultural products, representing significant economic opportunities in the rural areas;
- Improvement of the country's trade balance;
- Additional employment across the biofuel value chain;
- Supporting the development of a "Green Economy".

Policy Scope and Objectives

- The Policy covers the period up to year 2030 and focuses on liquid biofuels in the transport sector, initially ethanol from sugar cane and biodiesel from Jatropha, while exploring the possibility of using other feed stocks for bio fuel production.
- The Policy is structured around four interrelated ***pillars***, namely the economic; agricultural; environmental; and social and institutional which identify and respond to the key issues that need to be addressed for successful sector development.

The Policy proposes that the country:

- achieves a consistent and sustainable ethanol blending ratio of up to 20% by 2030
- introduces biodiesel at a blending ratio of up to 2% by 2030
- increases the number of players in the biofuels sector

The Policy articulates specific strategies and key actions under each of its ***five policy objectives*** which are:

a. To improve the viability and long term growth and sustainability of the bio-fuels sector;
b. To ensure the maintenance of bio-fuel product quality and standards;
c. To improve the productivity and economic viability of bio-fuel feedstock production;
d. To implement development trajectories that balance bio-fuel investments with biodiversity maintenance and water and air pollution; and,
e. To implement production models that increase community benefits from bio-fuel investments and foster institutional cooperation and coordination.

Stakeholder engagement

A wide range of consultations was carried out in preparation of this document from a large number of stakeholders along the biofuel value chain in Zimbabwe. The stakeholders provided invaluable insights into the

Policy development process and their views are integrated in the guidelines and strategies laid out in this Policy.

Implementation road map

1. Institutional coordination on bio fuels Policy implementation

Given the cross sectoral nature of the bio-fuel business, the successful implementation of the Policy will largely depend on close cooperation and coordination among key government institutions. As such the Policy forwards an Inter-Ministerial Bio-fuels Development Coordination Committee to superintend over the policy implementation with representation from the private sector, academia, and civil society for collaboration and coordination among various government and non government actors along the value chain.

2. Policy harmonization

Biofuel production falls under the domain of a number of Policies, to ensure comprehensive implementation of the Policy, efforts will be made to harmonise the Policy to eliminate any conflicts and contradictions.

3. Financial resources mobilisation for the biofuels sector

Significant investment is required to develop a thriving domestic biofuel sector, considering the constraints of the national fiscus, other financial resources will need to be mobilised. Options under consideration are:

- Investments by state owned companies;
- Development banks providing loans, private equity investments and technical assistance;
- Bilateral development financing and foreign investment loans;
- Foreign private investors.

4. Capacity building in the biofuels sector

All institutions involved in biofuel feedstock production must be capacitated to play their roles. In addition, effective institutional framework must be set up to coordinate all the activities and give clear leadership and direction.

5. Communication for greater awareness on biofuels

The Ministry will develop a communication strategy on biofuels to deal with the deficit of information and awareness among producers and authorities concerning the importance of biofuels in the national economy, as well as inform them of the potential opportunities it offers to the rural community.

6. Monitoring and Evaluation (M&E)

The Ministry should establish an independent body for M&E of the Policy. A Monitoring and Evaluation framework should be developed to fairly monitor the sector.

Conclusion

The Policy which resulted from the National Energy Policy (2012) will help the Government to achieve its objectives. The Policy also supports the intention of the Vision 2030 to enhance domestic and foreign investment, re-engagement with the Global community as well as Private sector led rapid growth and development.

1. Introduction to the National Biofuel Policy for Zimbabwe

1.1 Benefits of a domestic biofuel sector

The Zimbabwean economy is slowly re-emerging from a protracted period of economic decline. With positive economic growth, energy demand is picking up. Zimbabwe is a net importer of fossil fuel energy. Its current requirements are three million three hundred thousand (3 300 000) and four million three hundred thousand (4 300 000) litres of petrol and diesel per day, respectively.

To meet part of this demand with domestically produced fuels rather than imported fuels, Zimbabwe is revitalising its once vibrant biofuel sector. In addition to fuel import substitution, other benefits that can materialise from a successful and well-managed domestic biofuel sector are:

- Enhanced energy security, especially in the transport sector;
- Creation of a large market for agricultural products, representing significant economic opportunities in the rural areas;
- Improvement of the country's trade balance;
- Contribution to a cleaner environment through reducing greenhouse gas emissions and other vehicular emissions.

By increasing the use of renewable fuel, Zimbabwe is also aligning its development trajectory towards a Green Economy, the new developmental paradigm that sees "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP 2010). In a Green Economy, "growth in income and employment are driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services" (UNEP 2010). This policy applies these principles to biofuels development in Zimbabwe, aiming to achieve the triple dividend of economic development, improved environmental sustainability of the transport sector, and providing employment and other socio-economic opportunities to the population, especially in the rural areas.

1.2 Biofuel use around the world and in Zimbabwe

Over the last decade and a half, global biofuel production has increased dramatically. Most of it has been driven by government interventions, which can take many forms. In the United States of America, biofuel manufacturers enjoy strong financial incentives. In the European Union (EU) and a number of emerging economies, biofuel consumption is mostly driven by blending mandates.

Biofuels can be blended with fossil fuels in low blends (typically of two percent (2%), five percent (5%), ten percent (10%) on a per volume basis in what is known as E2, E5, E10 for ethanol or B2, B5, B10 for biodiesel) or high blends [typically eighty five percent (85%) for ethanol in what is known as E85, and ninety percent (90%) for biodiesel in B90]. Blends of E10 or less are used in more than twenty (20) countries around the world, including Argentina, EU, Canada, Australia, New Zealand, Mexico, China, India, Colombia, Philippines, South Africa etc. Blends from E20 to E25 have been used in Brazil since the late 1970s, and more recently in Thailand and Malawi. E85 and E100 are commonly used in the U.S. and Brazil in flexible-fuel vehicles, and to some extent in Europe.

The production and use of biofuels in Zimbabwe has been taking place since the 70s, albeit with interruptions. In the 1980s, Zimbabwe started producing bioethanol using molasses as feedstock at the

Triangle Ethanol Plant, which was the first production facility of its kind in Africa. Petroleum blending was done at a rate of twelve to fifteen percent (12–15%) with ethanol. The production plant ceased operation in the year 1992 due to severe drought conditions which led to failure to access the feedstock, while at the same time unblended fuel also became cheaper.

In the year 2005, the country re-looked into the prospect of using the jatropha plant for biodiesel production and launched the National Bio-Diesel Feedstock Production Programme with the aim of establishing jatropha plantations right across the country and a jatropha processing plant was set up in Mount Hampden. However, the project was later abandoned due to lack of coordination and the inability to pay an attractive price to the farmers for jatropha, which eventually led to lack of constant and reliable supply of the feedstock.

In February 2008, a memorandum was presented to Cabinet that proposed the development and use of biofuels in order to mitigate the impact on the economy of the rise in fuel prices. In May 2008, Triangle had started to produce hydrous ethanol. In addition, Finealt, a state-owned company tasked with the development of a biodiesel value chain, had entered into a joint venture with an Italian corporation to cultivate ten thousand (10 000) hectares of Jatropha. In the year 2009, there was an introduction of the multi-currency system and companies were allowed to import fuel independently. This led to fuel becoming available in the market and hence biodiesel production was no longer seen as a priority.

However, in the year 2011 a large bioethanol plant project was resuscitated at Chisumbanje in the Chipinge District. The plant was set up on a joint venture partnership between the governmental Agricultural Rural Development Agency (ARDA) and a private investor, Green Fuels. It was set to be the largest of its kind in sub-Saharan Africa. In the year 2011 Green Fuel did start producing anhydrous ethanol and was selling it on the market until in February 2012, when it was forced to shut operations.

In the year 2013, the government has introduced Mandatory Blending of Anhydrous Ethanol with Unleaded Petrol. Initially, the blend was set at ten percent (10%), meaning that all licensed procurers and wholesalers of unleaded fuel must ensure it has been blended with a minimum ten percent (10%) of ethanol produced by a licensed producer. This mandate has subsequently been varying between ten percent (10%) and twenty percent (20%), depending on ethanol supply.

Experience in Zimbabwe and around the world has shown that a national policy is needed to guide the long-term development of the biofuel sector and ensure its sustainability, and lack of one can result in inconsistent and fragmented activities that do not deliver the desired outcomes. The National Biofuel Policy has been developed to fill the biofuel policy vacuum in Zimbabwe and deliver specific objectives, as identified below.

1.3 Policy objectives

A sustainable domestic biofuel sector would support the intention of the Vision 2030 Economic Development Thrust to enhance domestic and foreign investment, re-engagement with the Global community as well as Private sector led rapid growth and development. This is in sync with the land reform programme that has made more land resources available to many more citizens of Zimbabwe, who can avail themselves of the opportunity posed by biofuels as an alternative form of energy. To formalise sector development, MoEPD has included the development of a National Biofuels Policy in its Five Year Development Plan.

The National Biofuel Policy for Zimbabwe (NBPZ) presented in this document represents the MoEPD's fulfilment of this requirement. The aim of this policy is two-fold:

- To provide an enabling environment for the development of a biofuel sector in Zimbabwe; and
- To ensure the biofuel production, processing, distribution and marketing in Zimbabwe will remain within the parameters of economic, environmental and social sustainability.

1.4 Policy scope

The NBPZ covers the following time horizon, sectors and value chains:

- The period up to year 2030;
- The focus is on liquid biofuels in the transport sector;
- It focuses on ethanol from sugarcane and biodiesel from jatropha, while exploring the possibility of using other possible feedstocks for biofuel production.

The policy has been structured around four key pillars, namely the economic, agricultural, environmental and social and institutional, each of which covers a number of issues that need to be addressed for successful sector development. In addition, an implementation roadmap is included, to provide clarity on the next steps and stakeholder responsibilities.

1.5 Policy values

The NBPZ has been drafted based on the following specific values:

- **Transparency** of all processes related to biofuel activity in the country.
- **Accountability** of all stakeholders involved in the biofuel value chain, including Government, farmers, biofuel producers, oil companies, fuel distributors and users.
- **Respect** for all stakeholders and their views.
- **Humility** by applying the precautionary principle when unsure of the impacts that biofuels might have, especially on the environment and the rural poor.
- **Team Spirit** for effective coordination and avoiding of competition between the various stakeholders involved in the biofuel value chain.
- **Sustainability** for ensuring that biofuels produced and consumed in Zimbabwe are economically, environmentally and socially beneficial to the nation.

1.6 Stakeholder engagement

Wide stakeholder consultations have been carried out in preparation of this policy document. The NBPZ draws heavily on inputs from a large number of stakeholders involved in the biofuel value chain in Zimbabwe, including:

- Farmers and farmer's organisations,
- Biofuel producers,
- Several government ministries, agencies and parastatals,
- Research organisations and Universities,
- Biofuel users (motorists association),
- Oil companies and fuel retailers.

All of the above groups have provided invaluable insights into the policy development process. Their inputs are interlinked with additional research conducted on each of the key issues addressed in this document and their views and recommendations are often integrated in the guidelines and strategies laid out by this policy.

2 Economic pillar

2.1 Introduction

A successful biofuel sector offers a number of economic benefits to the country:

- Enhanced energy security, especially in the transport sector;
- Creation of a large market for agricultural products, representing significant economic opportunities in the rural areas;
- Improvement of the country's trade balance;
- Additional employment across the biofuel value chain;
- Supporting the development of a "Green Economy".

For these benefits to materialise, the country's biofuel sector needs to be efficient, equitable and sustainable. This entails providing the sector with right incentives and growth opportunities. The economic pillar aims to strike a balance between the various objectives of the policy: fuel import substitution, rural development opportunities, trade balance improvement with the realities of the nation's constrained fiscal position and (relatively) high cost of biofuel production and provides guidance on how to improve the efficiency of biofuels produced in Zimbabwe.

2.2 Challenges

2.2.1 Improving biofuel economics

The economics of biofuel production are determined by their production costs and market price. Production costs of biofuels depend on a number of variables, the most important of which are:

Feedstock production costs. They account for approximately half of the cost of ethanol from sugarcane and eighty to ninety percent (80-90%) of total production costs for biodiesel. Feedstock production costs in turn depend on input costs (namely land, labour, water, energy, capital, seeds and fertilizer) and plant yield, which determines the cost per unit (usually ton) of feedstock. In Zimbabwe, several of the cost components mentioned above are high (especially energy and water costs (high prices coupled with erratic supply), but also capital costs, fertiliser cost etc), while yields are low-to-medium compared to best possible yields. This translates into relatively high prices for feedstock. In Zimbabwe, average sugarcane production cost is almost twice as high as in Brazil, the world's largest sugarcane producer, but also significantly higher than in the Southern African Development Community (SADC) region. The cost of jatropha production is also relatively high, but may come down as further Research and Development (R&D) is carried out.

Feedstock conversion efficiency. Zimbabwe is achieving internationally comparable conversion efficiencies in its existing biofuel plants, so this is not the reason for the comparatively high cost of biofuel produced in the country.

Cost of biofuel processing. The two major cost components of biofuel processing are energy inputs, which can account for as much as twenty percent (20%) of operating costs of biofuel plants, and capital costs. Both are relatively high in Zimbabwe, raising the total production costs.

The scale of the plant. Biofuel processing plants can be small (in the order of few thousand litres per day), medium (in the order of tens of thousands of litres per day) and large (in the order of million litres per day). Economies of scale are important to reduce average costs so the trend has been towards larger plants with capacities in the order of two hundred million (200 000 000) litres per year. Zimbabwe has biofuel plants falling in all three scale groups. Medium to large plants operate on a centralized processing model that also sources feedstock from smallholder out-growers. Small plants, owned and operated by

communities, might be a good solution for niche markets, such as straight biodiesel to be used in farm machinery etc, and should be supported as well.

The sale or productive use of by-products. The valorisation of by-products can have a significant impact on the biofuel plant's profitability. Existing ethanol producers in Zimbabwe are already using bagasse to generate electricity, with potential for expansion.

The relatively high input costs discussed above translate to relatively high prices for biofuels produced in Zimbabwe. A litre of ethanol in Zimbabwe is sold at between seventy eight cents (0.78 USD) and ninety five cents (0.95 USD) at farm gate, compared with thirty cents (0.3 USD) in Brazil and an average international price of sixty cents (0.6 USD) per litre (in year 2015). Biodiesel produced from jatropha sourced from smallholders at one hundred and fifty (150) USD per tonne costs about ninety cents (0.9 USD) per litre to produce.

As neither ethanol nor biodiesel sold in Zimbabwe are traded as open market commodities, it is not possible to talk about market prices for biofuels. Rather, they are both determined by the state. These state-determined prices are substantially higher than both international prices for biofuels and those of imported fossil fuels and will have to be reduced to allow substantial increase in the use of domestically produced biofuel without causing significant financial strain either on the national budget or the motorists.

2.2.1.1 Policy guidelines

- Work with actors across the biofuel value chain to reduce costs associated with the production and marketing of biofuels.
- Actively encourage valorisation of biofuel by-products.
- Target general industrial development support to biofuel producing regions.

2.2.1.2 Strategies

- Revise existing charges and levies imposed on biofuel production and lower them where possible.
- Reduce import duties on faming inputs such as fertiliser, improved seed varieties, faming equipment.
- Allow biofuel producers to use the electricity they generate through bagasse combustion for own needs first, and offer a cost-reflective feed-in-tariff for any surplus power exported to the national grid.
- Support the development of a market for jatropha press-cake as organic fertiliser.
- Support R&D on improving yields of biofuel feedstocks.
- Target investments in public infrastructure, energy and water supplies to biofuel producing regions.
- Investigate innovative financing models to reduce the capital costs of biofuel projects.

2.2.2 Linking reduction in fuel economy of biofuel blends to their pricing

It is well-established that the fuel economy of biofuel blends is lower compared to unblended fossil fuels. Ethanol's average energy density is only some sixty six percent (66%) that of petrol, while for biodiesel this figure is ninety three percent (93%). This means that the fuel economy decreases as the amount of biofuel (by volume basis) increases in the fuel blend.

Research conducted by the SIRDC in Zimbabwe shows that when compared with unleaded petrol, the average fuel economy loss is four point eight-four percent (4.84%) with E10, seven point two-four percent (7.24%) with E15 and eleven point zero-six percent (11.06%) with E20 for local travel. For highway travel the fuel economy reductions were four point three-three percent (4.33%), seven point six-zero percent (7.60%) and nineteen point nine-eight percent (19.98%) for E10, E15 and E20, respectively.

While higher blends have not been tested in the local context, as a general rule, E85 has a fuel economy that is about fifteen to twenty percent (15-20%) lower compared to pure unleaded petrol.

2.2.2.1 *Policy guidelines*

- Include consideration on fuel economy reduction in the pricing of the blend to ensure fairness to motorists. The price of the blend should in principle be commensurate with the reduction in fuel economy compared to unblended mineral fuel.

2.2.2.2 *Strategies*

- The maximum blend price in relation to the theoretical price of unblended mineral fuel, including all duties and levies:
- Price for E10 should not exceed ninety five percent (95%) of the theoretical price of unblended petrol at the pump (if it was allowed to be sold);
- Price for E20 should not exceed ninety percent (90%) of theoretical price of petrol at the pump;
- Price for E85 should not exceed eighty to eighty five percent (80-85%) of theoretical price of petrol at the pump.
- Commission research on fuel economy of biodiesel blends and set price ceilings accordingly.

2.2.3 Removing market inefficiencies

One of the reasons for the relatively high cost of ethanol in the country is the currently inefficient market structure relying on a single ethanol producer to supply the blending market. This is causing cheaper ethanol, which is already being produced in the country, to be exported or used in other sectors, forcing the transport sector to rely on the more expensive producer.

Opening the biofuel (specifically, the ethanol) market to competition, should in principle also open the possibility of having a decentralised model of small-scale biofuel plants located in the immediate vicinity of the feedstock, and possibly (co)owned by feedstock producers that would benefit from the value added of the biofuel as opposed to the limited value of selling raw material. In addition, opening the market to more biofuel producers should – in the long-term - provide feedstock growers with a wider choice of off-takers. In the short-term of course, constraints on credit availability, logistical and contractual issues and of course the necessary economies of scale might still favour a highly concentrated sector, so the development of a decentralised biofuel market will require active government support.

2.2.3.1 *Policy guidelines*

- Relax the indigenisation requirement in light of the capital intensity of the energy sector to attract other biofuel producers to the sector, thereby stimulating competition for the benefit of both feedstock producers and biofuel users.
- Support development of community-owned small-scale plants for niche markets.

2.2.3.2 *Strategies*

- Revise the following ethanol licensing conditions that stifle competition:
- General Condition (i) conditions requiring that major shareholding [fifty one percent (51%)] should be held by Zimbabweans; and
- Special Condition (ii) that grants exclusive rights to produce anhydrous ethanol for sale under the national blending mandate to a single producer.
- Negotiate supply to the mandatory blending market with other existing and potential ethanol producers in the country.

2.2.4 Providing the right incentives

Every country with a successful biofuel sector has provided significant policy support to it, either at the onset of sector development or continuously. Incentives can be targeted as interventions along the whole value chain. This policy foresees a combination of economic incentives and other "sustainability" incentives that stimulate the delivery of environmental and social benefits by the biofuel sector, in line with the Green Economy objectives.

Economic incentives include budgetary support measures, regulatory measures and trade restrictions to support the development of a domestic biofuel sector. In terms of "sustainability" incentives, in its indigenisation and economic empowerment policy, Zimbabwe already has incentives for responsible investments inclined towards community social good and environmental responsibility. These need to be consistently applied to the biofuel sector, as well as incentives from other relevant policies that will promote production and consumption of biofuels that will result in increased farm incomes and improvements in air, water and land resources.

2.2.4.1 Policy guidelines

- Provide appropriate incentives to promote wider adoption of biofuels subject to national fiscal capacity.
- Apply incentives to biofuel investments in line with other policies.
- Reward biofuel investments that deliver greater social and environmental benefits as opposed to just production volumes.
- Define the timing of incentives provision in such a way that it will allow investors to accumulate resources that they can deploy for environmental management.

2.2.4.2 Strategies

- Continuation of mandatory ethanol blending to ensure market for ethanol producers.
- Introduction of mandatory blending for biodiesel based on feasibility of supply.
- Continued lower taxation of biofuels insofar as the national fiscus allows.
- Prohibition of biofuel importation, subject to conformity with existing trade agreements.
- Reward soil and water conservation on farms where feedstocks are produced.

2.2.5 Setting the correct biofuel target

As long as biofuels are not cost-competitive with mineral fuels, the amount of biofuels that enter a country's transport fuel mix is politically determined. This determination needs to be informed by the amount of biofuels that can be tolerated by the national vehicle fleet, the amount that can be sustainably produced, and the level of support that can be offered.

To date, Zimbabwe has used biofuels in its transport fuel mix mainly in the form of a low-blend of ethanol and petrol. There seems to be no consensus on what is the maximum level of blending in low-blends that can be used in conventional vehicles, with car manufacturers and oil companies generally in favour of a ten percent (10%) blending wall, while biofuel producers and farming lobbies argue in favour of a higher blending wall. The vast majority of countries have set blending targets for ethanol at ten percent (10%) or less on a volume basis, with only a few blending at twenty percent (20%) or higher. In countries where blends above ten percent (10%) have been introduced, car manufacturers were typically given a period of time to comply with the new fuel regulations and adapt the engines of the cars that were sold on the local market. In Zimbabwe, most vehicles are currently only warranted to run on biofuels blends of up to ten percent (10%). Flex-fuel vehicles that can run on any combination of petrol and ethanol are still very few.

In terms of biofuel supply, the situation has improved for ethanol, which is now produced in quantities sufficient to allow blending higher than ten percent (10%). The situation is different for biodiesel, with jatropha production in the country still very modest. The determination of necessary biofuel supply is complicated by gaps in fuel usage data per sector, especially for diesel.

Finally, in terms of support for the developing biofuel industry, it has to be recognised that biofuels are currently supported by a generous tax break of fifty eight (58) cents per litre (the duty on ethanol is only five (5) cents per litre as opposed to cents per litre for petrol, with a similar tax regime likely to be needed for biodiesel to support its uptake). If such support continues, this will result in a loss of twenty to thirty percent (20-30%) of fuel levies and duties to the national fiscus, which could seriously compromise its ability to meet its obligations. At the same time, a successful domestic biofuel sector will also generate revenues for the national budget, through corporate taxes paid by biofuel producers, various levies on land use etc in addition to generating income in the agriculture sector.

There is a clear trade-off in setting the blending ratio lower or higher: A lower ratio [i.e. ten percent (10%)] will result in less substitution of imported fuels (and hence less trade balance improvement), less income and employment generation in the agricultural sector, but also in a lower reduction in fuel economy of the blend, a lower loss of duties and levies to the national fiscus and less resistance from motorists with cars warrantied to run on ten percent (10%) blends only. On the other hand, a higher ratio [i.e. twenty percent (20%)] will result in more substitution of imported fuels (and hence more trade balance improvement), more income and employment generation in the agricultural sector, but also in a higher reduction in fuel economy of the blend, a higher loss of duties and levies to the national fiscus and likely more resistance from motorists with cars warrantied to run on ten percent (10%) blends only.

2.2.5.1 Policy guidelines

- Improve understanding of all aspects of increased used of biofuels on the nation, including macroeconomic impacts, environmental impacts and consumer protection issues.
- Adopt the precautionary principle until such time that all necessary information becomes available.

2.2.5.2 Strategies

- Improve data collection on fuel usage in the transport sector, especially for diesel.
- Carry out a comprehensive analysis of macroeconomic impacts of different levels of biofuels in Zimbabwe's transport fuel mix.
- Carry out a comprehensive study on the composition of the Zimbabwean vehicle fleet to gain full understanding of the impact of a blending ratio above ten percent (10%) on motorists.
- Increase the number of players in the biofuel sector
- Based on currently available information, set blending mandate as follows:
  - i. For ethanol: ten percent (10%) until year 2020, and twenty percent (20%) by year 2030 if deemed feasible after additional information has been collected.
  - ii. Engage with car manufacturers and importers to prepare the market for ethanol blends beyond ten percent (10%).
  - iii. For biodiesel: two percent 2% blend from year 2020, provided supply can be assured.

2.2.6 Ensuring long-term sector development

Limiting the development of the domestic biofuel market to low-blends would quickly pose a constraint on sector development (mainly ethanol), as the amount of biofuel required to meet a low-blend obligation could be reached quite quickly. A high-blend market (for ethanol) must therefore be actively developed to allow for sector expansion and to ensure that the maximum rural employment and import substitution benefits are achieved. In addition, Zimbabwe is ideally positioned to become a regional biofuel hub, which will provide further scope for sector expansion. Finally, the emerging approach to blending diesel

with low volumes of ethanol [up to five percent (5%)] should be explored and encouraged, if found to be feasible in the local context.

2.2.6.1 Policy guidelines

- Support ethanol market growth by pursuing development of a high-blend market (E85).
- Position Zimbabwe as the regional biofuel hub.
- Track and encourage technological developments that may allow for other uses of biofuels.

2.2.6.2 Strategies

- Duty-free/reduced duty importation of flex-fuel cars.
- Support for distribution and installation of flex-fuel converter kits.
- Shifting of government vehicle fleets to E85 as a demonstration tool.
- Raising awareness among motorists on the benefits of flex-fuel vehicles and E85.
- Explore interventions in support of biofuel exports.
- Explore the feasibility of the emerging ethanol-diesel blend [up to ten percent (5%)] for use in Zimbabwe.

3 Agricultural pillar

3.1 Introduction

The country's climate and soils have been established through a land suitability analysis to be capable of supporting the cultivation of a wide range of biofuel feedstock e.g. sugarcane, jatropha, cassava, sweet sorghum etc. The production of biofuels feedstock must be achieved at highest possible yields and lowest possible cost to be competitive.

3.2 Challenges

3.2.1 Identify suitable feedstocks for biofuel production

Currently, sugarcane is the main ethanol feedstock produced, mainly grown in the Lowveld in Masvingo and Manicaland. There was marginal growth in the land area under sugarcane cultivation in the last twenty (20) years. Cassava is expected to soon become another ethanol feedstock used in the country. Jatropha is the only feedstock for biodiesel currently grown, mainly in the provinces of Mashonaland East, West and Central and many smaller pockets in the country. It is largely grown as live fence by small-holder farmers and is still at research and development phase. Sweet sorghum is another potential feed stock for ethanol production. The stem of sweet sorghum is rich in sugar, and is crushed and fermented to produce bioethanol. Currently sweet sorghum is being widely grown in the country by small-scale farmers, for human consumption.

Cassava, sweet sorghum and jatropha are far less demanding on inputs (e.g. fertilizers and irrigation water) compared to sugarcane and can be grown by small-holder farmers who lack resources and access to finance. These crops could play a key role in rural development and poverty reduction if a market for them is assured.

3.2.1.1 Policy guidelines

- Improve organization of new potential feedstocks producers (mainly small-scale farmers).
- Ensure market for alternative feedstocks.

3.2.1.2 Strategies

- Establish clean, virus-free planting material for cassava.
- Organise cassava small-holder farmers to use their collective force.
- Replicate the tobacco contract system for biofuel feedstocks.
- Develop demand-driven research and development on new feedstock with support from the private sector.

3.2.2 Identifying suitable land for feedstock production

Currently, Zimbabwe has approximately fifty four thousand (54 000) hectares (ha) under sugarcane cultivation, with expansion plans that will almost double this hectarage by year 2030. This is more than sufficient to meet the approximately thirty five thousand to forty five thousand (35 000 - 45 000) ha that would need to be planted by sugarcane to provide sufficient ethanol by year 2030 and maintain current levels of sugar production, even if ambitious ethanol use targets are set and if yields do not improve. Achieving even a modest target for biodiesel would require significantly more land, up to one hundred thousand (100 000) ha to be planted with jatropha (at current yield levels).

Land suitability studies have identified vast amounts of land where biofuel feedstocks can be grown. Zimbabwe has nearly three million hectares suitable for sugarcane production in the south-eastern parts of the country in Masvingo and Manicaland provinces. An even larger amount of land is suitable for cassava production, in the northern, eastern and south-eastern parts of the country. All the provinces have parts suitable for jatropha curcas production with a third of the country's land identified as suitable.

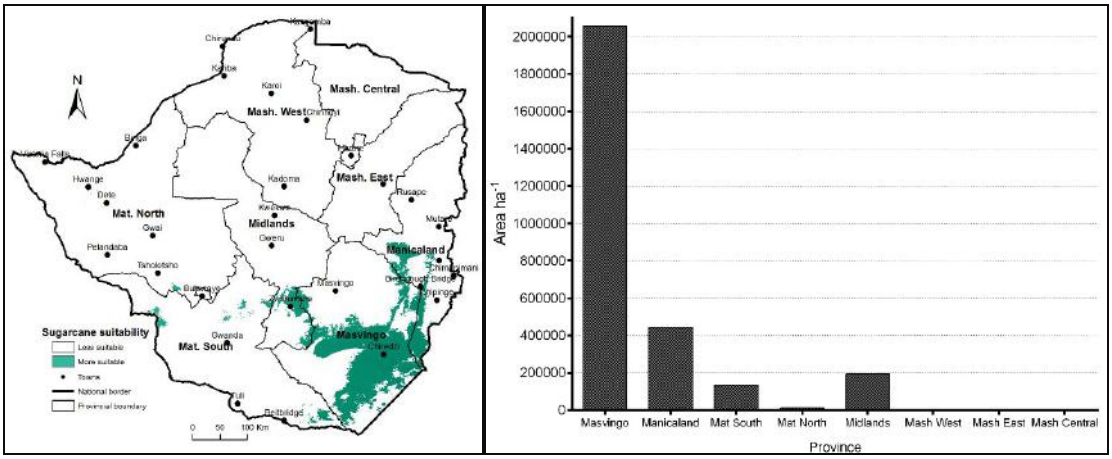


Fig: Modelled suitability of sugarcane in Zimbabwe: Fig above shows the spatial distribution of suitable areas for sugarcane production. Fig 1b shows the areas in each province that are suitable for sugarcane production.

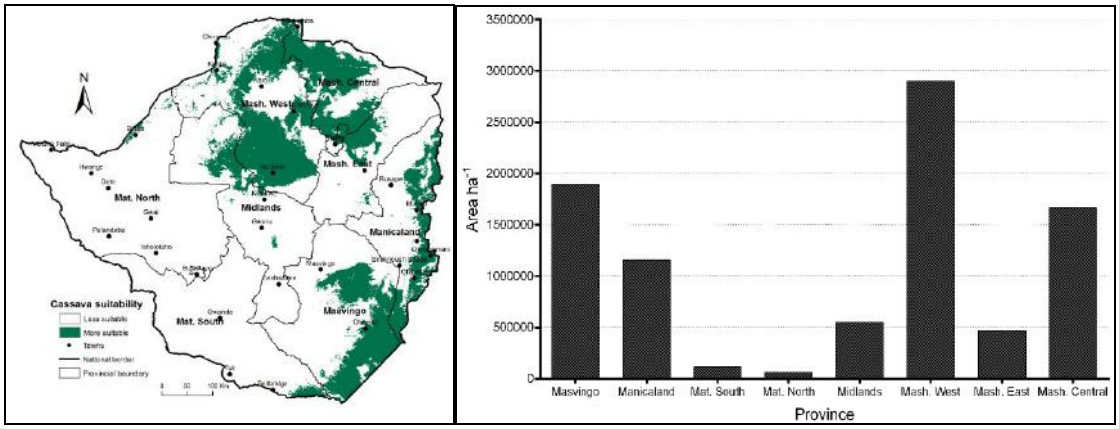


Fig: Modelled suitability of cassava in Zimbabwe: Fig above shows the areas in each province that are suitable for cassava.

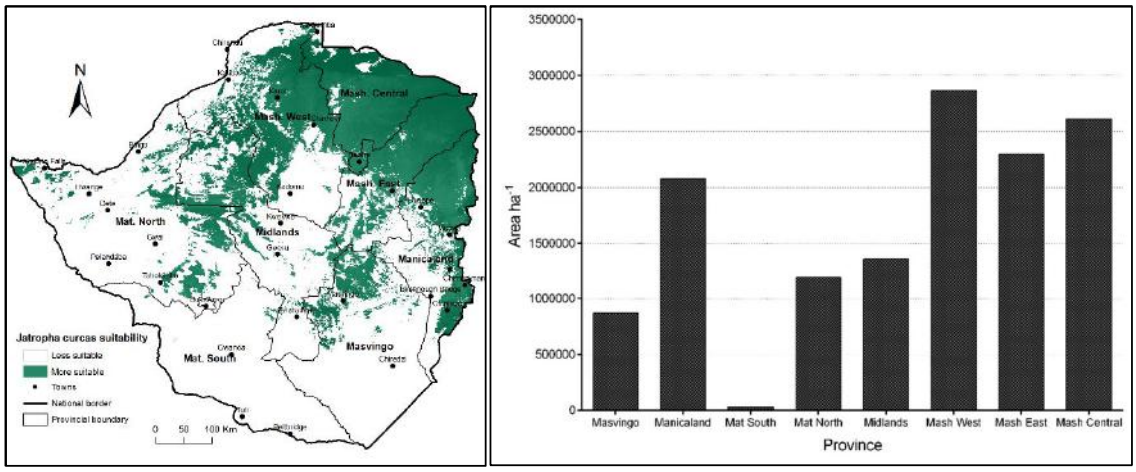


Fig: Modelled suitability of cassava in Zimbabwe: Fig above shows the areas in each province that are suitable for Jatropha.

3.1.1.1 Policy guidelines

- Identify target areas for biofuel feedstock production based on existing data on land suitability, agro-ecological zones and land use plans.

3.2.2.2 Strategies

- Develop terms of reference for zoning the country indicating available land suitable for each respective feed stock crop.
- Use the identified areas to guide the positioning of marketing systems and small expelling plants.

3.2.3 Improving feedstock productivity

Average crop yields in Zimbabwe are below their potential and need to be improved to improve the economics of biofuel production in the country. Recently, average yield of sugarcane has declined; more so among the out-growers. Cassava yields in the country are ranging from nine (9) tonnes per hectare up to twelve (12) tonnes per hectare under dry land conditions have been obtained in Zimbabwe, whereas yields of forty to eighty (40 - 80) tonnes per hectare have been achieved under high management and irrigation (in South Africa). Jatropha yields are only some three to five (3 – 5) tonnes of oilseeds per

hectare, compared with twelve to sixteen (12 – 16) tonnes per hectare that have been achieved with better management practices (even in Zimbabwe).

Such low yields are due to a number of factors, including inadequate research and development, lack of training in better production practices for farmers, lack of varieties bred specifically for biofuels production, low input and drought tolerance, high cost of inputs such as chemical fertilizers, limited availability of financial resources for farmers to make the necessary investments for better production practices, inadequate water supply in some areas (Lowveld) etc. Low yields will be further exacerbated by climate change.

3.2.3.1 Policy guidelines

- Improve agricultural data collection to improve understanding on issues causing low agricultural productivity.
- Develop a long term plan on improving management practices in agriculture.

3.2.3.2 Strategies

- Establish a model where the Estates provide management and logistical support to out-growers.
- Ensure adequate electricity and water supply.
- Ensure farming methods that maintain adequate organic matter in the soil and maintain soils fertility.
- Research on alternative low cost inputs such as organic matter.
- Consider lower or no duties for essential imported farming inputs (capital goods and other).
- Establish a fund for research, development and training for biofuels crops, from levies on biofuels.
- Formulate breeding programs for high yielding varieties suitable for biofuels production under high and low input systems
- Design R&D programs for water retention, agronomic practices improving soil fertility, and water use, harvesting and conservation practices.
- Introduce the use of renewable energy e.g. solar water pumps to ensure continued water supply during load-shedding periods.
- Zimbabwe National Water Authority (ZINWA) shall be required to install water meters to enable proper records on water use.

3.2.4 Production and marketing models

Many sugarcane out-growers in Zimbabwe are heavily in debt, clearly suggesting that the current model for smallholder farmer participation in sugarcane production may not be sustainable. There are several reasons for this, including limited access to finance and production inefficiencies that are contributing to low yields. Out-growers of sugarcane Estates also feel short-changed by the plantation companies because they are only remunerated for the sugar and not for the by-products resulting from sugarcane processing.

There are plans to expand the land area under sugarcane cultivation, with increasing small-holder participation. This may not be sustainable, unless small-holder sugarcane growers get better returns and are able to pay back loans. With the coming on board of new players in the production of ethanol and biodiesel, fairer and more transparent marketing systems which protect the grower are an imperative. Marketing systems for jatropha seed, cassava and other feedstock need to be developed.

3.2.4.1 Policy guidelines

- Modernise existing feedstock production models which have resulted in reduced industrial efficiency giving low revenue to out-growers

3.2.4.2 Strategies

- Encourage contract farming of feedstock.
- Establish an irrigation fund.
- Establish a Biofuels Marketing Board to ensure marketing regulations and growth of the sector is achieved at high standards similar to the Tobacco Industry Marketing Board.
- Develop innovative mechanisms for mobilizing resources and finance resources.
- Decentralise expelling capacity to enable broad participation of many farmers and avoid transporting less valuable materials and encourage local employment. Smaller ethanol processing plants must also be considered.

4 Environmental pillar

4.1 Introduction

Environmental considerations in the NBPZ relate to the effects (positive and negative) of biofuel production likely to affect the human and natural environment. Some of the key factors influencing environmental effects from producing feedstocks for biofuels are site-specific and depend on the type of feedstocks produced, the management practices used to produce them, prior land use and any land-use changes that their production might infer. A key factor is that traditionally managed small farms often retain ecologically diverse spaces that can provide the same biodiversity and ecosystem service benefits. However, when small farmers grow feedstocks for large processing facilities, economic pressures may cause them to intensify use of fertilisers and chemicals, reduce on-farm diversity and put uncropped areas into production. This may also happen within large-scale production estates, necessitating measures for mitigation, while promoting improved environmental practices within the context of greening production systems from the farm, to the plant and to the distribution sites.

The production and use of biofuels affects greenhouse gas emissions, air quality, water quality, water use, and biodiversity in specific sites, which are key concerns. Therefore, the need for biofuel policies to integrate comprehensive plans for climate, biodiversity protection, food and energy security is a fundamental underpinning of the environmental pillar. However, the measurements of these are often hamstrung by lack of technologies allowing to precisely quantifying the effects. In any case, many factors affect the overall greenhouse gas balance of biofuel production and consumption; some processes result in sequestration of greenhouse gases while others result in greenhouse gas emissions. For example, carbon dioxide is stored in plants as they grow, but emissions are generated by fuel combustion during the process of manufacturing and transporting the biofuel. Conversely, replacing an annual crop with a perennial biofuel crop could increase the amount of carbon dioxide sequestered at the site. The policy therefore addresses conservation within the context of energy provision, in a country desiring a balance of both. The objectives also entail adherence to sustainable environmental practices; adoption of a one hundred percent (100%) compliance approach to existing regulation related to the environment, such as the Environmental Management Act **[Chapter 20:27]**; ensuring sustainable biofuel production that does not damage the environment and the health and safety of the consuming public; and promoting the use of biofuels given their environmental benefits.

4.2 Challenges

4.2.1 Ensuring environmental sustainability of biofuels production

Environmental sustainability of biofuel feedstock production has several aspects, including possible invasive nature of some feedstocks, contamination of soil and water resources by agrochemicals, which in turn impacts on biodiversity etc. While it is often difficult to quantify such effects on natural ecosystems,

these aspects must form key considerations when planning the expansion of production and use of biofuels.

Effects on water resources. Land expansion for production of biofuel feedstock often also means increased demand for water supply through damming of rivers. This helps retain water that can be used for multiple purposes, as long as water pollution is under control[1]. For instance, the dams could be used for irrigating of feedstock, as well as other food and industrial crops, while also promoting fishing and attracting other aquatic life. The holding of water in dams can have a positive effect on ecosystems by providing a basis for regeneration of catchment vegetation. But dams can also have a negative effect on communities, as experienced in the Lowveld, where they caused flooding of homes and displacement of people.

The impact of biofuel production on water resources does not stop when the crop is harvested, as significant amounts of water are also required to turn the crop into fuel. Biofuel production plants can also cause problems for local water resources. Failure of machinery during production can result in effluent discharge that may pollute surrounding water bodies, resulting in livestock and fish deaths and unsuitability for human use.

Wetlands ecosystems and biofuel feedstock production. Zimbabwe has several lakes and wetland systems that are conidered sites of conservation significance, as mapped by the Environmental Management Agency (EMA). Wetlands are an important source of freshwater and food for hundreds of communities, and provide a host of important ecosystem services, such as water purification and retention, storing organic carbon in the soil, reducing the impact of storm surges and flooding, regulation of soil salinity, provide habitats critical to maintaining viable populations of species with commercial and conservation value etc. Wetlands are also biodiversity hot-spots, hosting a variety of tree, grass and animal species. The conversion of wetlands to biofuel feedstock production areas would mean creating an ecosystems imbalance and foregoing all these important services, with an impact on the environment and the people.

Invasive alien species. While some biofuel feedstocks are not prone to invasiveness, others are. Therefore standard management of controlling invasive feedstock must apply. A major concern on invasive species is that several plant varieties used to produce feedstock are hybrids and their invasiveness is not well understood.

Soil management and nutrient conservation. Soil is an important component of feedstock production and its quality over time is essential to ensure production sustainability. This policy argues for soil health, understood as the continuing ability of the soil to function as a living system in natural balance with the environment and land use. With large-scale biofuels feedstock production expansion, there is a risk of soil degradation leading to a loss of nutrients, acidification, erosion, compaction and contamination. The loss of soil causes higher runoff risks, which may cause flooding, and degradation of land. Therefore, appropriate soil management needs to be undertaken to ensure continuous productivity of the soil, even after feedstock production stops. As some analysis show, some monocultures and use of fertilisers over a longer period of time can destroys large land areas (soil texture) to the extent that it becomes difficult to rehabilitate the land, and this must be avoided.

4.2.1.1 Policy guidelines

On water pollution:

[1] EMA has a statutory regulation on the discharge of effluent water: Effluent license in terms of section 60 of the Environmental Management Act (CAP 20:27) of 2002: Completed application forms (ESWD1); Laboratory analysis report of effluent within One (1) calendar year with submission of quarterly reports

- Promote the adoption of conservation measures for water resources, e.g. recycling water from processing plants for re-use in irrigation where appropriate (by considering the water quality requirements for the crops being produced).
- Water treatment at plant site should be a prerequisite before discharge to local water bodies, especially in sugarcane producing areas, which means that investors in biofuels work within the parameters of EMA regulations. The protection of biodiversity in rivers and sub-catchments that provides livelihoods to local people should be prioritized above the biofuels investment that discharges effluent.

On wetlands:

- The protection of wetlands and biodiversity should be a priority, so sensitive ecosystems like wetlands as identified by EMA should be avoided in biofuel production. Categorical exclusion of wetlands areas for biofuel development is warranted.
- Regular monitoring of all biofuel developments *adjacent* to wetland areas for possible impact spill-overs.

On invasive alien species:

- Comprehensive research on the characteristics of all feedstock varieties is required - particularly improved varieties imported into the country. Full information on the production cycle of each variety must be collected and related to impact on the environment.
- The behavior of the feedstock within a particular biodiversity area - e.g. pests likely to affect the crop and other plant species.

On soil management:

- Allow for appropriate land recuperation times between production activities.
- Support reforestation programmes where needed.
- Promote consideration of environmental compensation through planting of indigenous species in suitable areas at feedstock production sites and in surrounding communities.
- Help small-holders increase landscape diversity and restore ecosystem services by planting perennial oil trees.

4.2.1.2 Strategies

- Prohibit expansion of biofuels feedstock cultivation into the margins of rivers, streams, lakes and ponds and promote vegetation buffer zones around water bodies which prevent contamination by agrochemicals from drift and runoff.
- Account for the full range of existing ecosystem services and livelihood support in an area when considering its conversion to biofuel feedstock production, through a comprehensive cost-benefit analysis.
- The investor in biofuel feedstock production should be mindful of potential invasiveness of feedstock, and regular checks and piloting should be done and monitored by the DRSS, as well as commissioning independent research in universities and other appropriate research institutions.
- Implement rational management of biofuel feedstock to prevent the generation of resistant weeds or pests, avoiding unnecessary applications of agro-chemicals.
- Promoting good farming practices that will not damage the land e.g. avoid stream bank cultivation, avoiding sensitive ecosystems, managing cultivation for land and soils to recover nutrients and use of contours and other conservation works to preserve the land and soil quality, wetlands, forests and other biodiversity resources be implemented.
- Ensure optimal management of organic waste, e.g. return of vinasse to the farm, as source of nutrients.

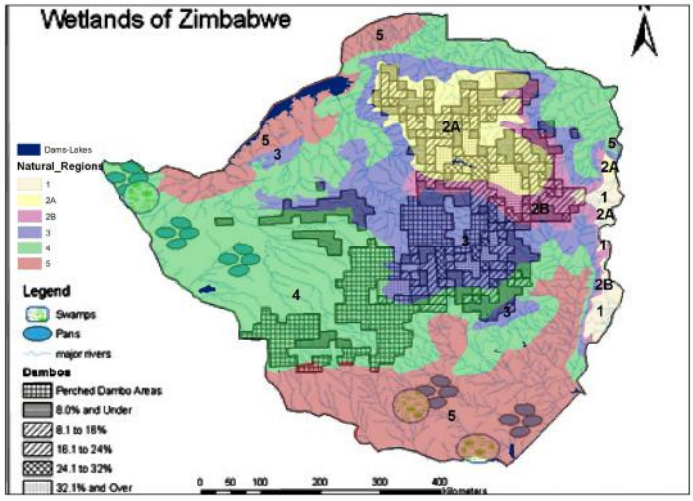
- Ensure lining of the canals that transport the effluent from biofuel processing plants to the fields in order to prevent land and water pollution.

4.2.2 Land use planning and biofuels

Land use zoning will not only inform production but also strategies for markets and supplying areas in need of specific crops besides biofuel feedstocks. Biofuel production may infer clearance of land for both the fields and biofuel plant. Such land use change may impact on carbon sinks and loss of agro-biodiversity. Although the feedstock is expected to aid carbon sequestration, the volumes are much lower than those of natural forests, which neccessitates identifcation of such forest areas through land use planning. Clearing virgin land or practising monoculture for biofuel feedstock production are among possible shifts in land use caused by biofuels that will have implications on the local habitat. Land use changes for biofuel production limits environmental services, which requires appropriate regulations and monitoring systems.

In order to ensure sustainable feedstock production in all areas at all times, it is essential that policy on land use considers sensitive ecosystems, such as wetlands, and excludes them from areas available for biofuel feedstock production. Planned land expansion should also not threaten food crop production and high biodiversity value areas. Comprehensive land use guidelines are needed that promote biofuel production on appropriate forms of land, including land that in the past was regarded as marginal and degraded. This will not compromise food production for local communities. Case studies in the North East of Zimbabwe, in Mashonaland East province, are proving that with good land management, biodiversity and forestry can be preserved and enriched while communities benefit from small-scale jatropha production and processing without harming the environment. Designating land for food crops, forestry, settlements/infrastructure and nature conservation will avoid unintended negative environmental and socio-economic consequences or misplaced land developments.

Map 4.1: Wetlands zoned based on Zimabbwe's agro-ecological zones



4.2.2.1 *Policy guidelines*

- Zoning as a land use-planning tool should be used and framed around the agro-ecological regions as well as human developed infrastructure.
- Environmental sensitivities on sloppiness, fragile soils, and wetlands should be considered in land use planning to avoid wide scale erosion of land, particularly in sensitive areas where farmers may be attracted to biofuels feedstock production.

- Consider land consolidation, exchanges or other voluntary approaches for the readjustment of parcels or holdings to assist investors and current users to improve the layout and use of their parcels or holdings for the production of biofuels.

4.2.2.2 Strategies

- Inter-ministerial collaboration for land use planning and allocation: Ministry of Lands, Ministry of Local Government, Ministry of Agriculture, Water, Climate and Environment and other concerned planning authorities should consider potential areas for feedstock production in their land allocation, balancing it with other industrial crops and food crops land allocation.
- Conduct independent assessments on the potential impacts of land use change and its implications on tenure rights, food security and the progressive realization of good environmental practices.
- Leaving land for prescribed times to recuperate and reforestation programmes are essential for soil improvement and water retention, while facilitating natural habitats to play environmental services roles.
- Consideration of environmental compensation through planting of indigenous species that can attract other animal resources as a mandatory requirement during feedstock production (non-tree species) and leaving areas with sensitive ecosystems as a biodiversity management system.
- Use agro-ecological zones as a basis for planning and making decisions where to grow feedstock; the Lowveld with ideal conditions for sugarcane production for ethanol should be planned better; models of core estates with processing plants integrated with smallholder out-growers schemes to limit expansion of large scale plantations only and leave buffer land for biodiversity.

4.2.3 Infrastructure and transportation of biofuels

Infrastructure in production areas. By their very nature, manufacturing or processing facilities transform raw materials into a value-added product—and in that process, organic and chemical changes take place that result in emissions of some sort. Biofuels production is no different in that regard. Emissions from processing plants may vary slightly depending on the process, design and feedstock. A variety of emission control technologies are used to control potential air pollutants from processing plants. In most cases, chemicals such as methanol and caustic soda that are highly flammable and toxic are used and require appropriate infrastructure and trained personnel that must be in place.

Transport infrastructure and equipment. Biofuels are being distributed by road using motorised road tankers. Although the base infrastructure is there, more can be done to improve the quality of the road networks. A statutory instrument on biofuels transportation is necessary, and ZERA will be central in the implementation of the instrument in collaboration with EMA. There is a need to ensure that the transport and storage infrastructure conforms to the properties of the biofuels since most of it was designed for fossil fuels. Distribution systems for biofuels should conform to the environmental standards to avoid spillage and leaks that can harm the environment. This includes regular maintenance on the distribution infrastructure and equipment. During distribution, the vehicles used should be licensed and noted for fitness of the road. The choice of the mode of transport should be guided by the quantity of product to be distributed.

4.2.3.1 Policy guidelines

- Companies involved in biofuels shall ensure that there is pre-treatment of effluent to EMA prescribed standards before disposal.
- Regular oversight on both processing and transport and distribution infrastructure needs to be carried out.

- During distribution, the vehicles used should be licensed and noted for fitness of the road or other forms of transport. Mode of transport should be guided by the quantity of produce to be distributed.
- Storage facilities for biofuel products should be designed to meet the safety standards stipulated by the regulatory authorities such as ZERA.
- Apply the "polluter pays" principle to offenders causing environmental damage by using inappropriate infrastructure.

4.2.3.2 Strategies

- Companies are to undertake regular voluntary check-ups on processing plants, distribution channels and retail sites and produce reports to be shared with EMA and ZERA. This will be accompanied by spot checks to ensure that standards are being adhered to.
- Construct appropriate infrastructure for waste disposal.
- Storage facilities for biofuel products should be designed to meet the safety standards stipulated by the regulatory authorities such as ZERA. For example use of colour codes to identify harmful substances can be adopted.
- All biofuel storage and distribution centres should have spillage containment/bands in case of accidental spillages as a legal requirement (hazardous substances storage and disposal regulations). All these containments should be lined with membranes and built with corrosion proof concrete.
- Impose penalties on any investor, distributor or retailer flouting set regulations for each node of the value chain.

5 Social pillar

5.1 Introduction

The development of biofuels can be accompanied by several negative social impacts which have to be avoided or at least mitigated for sustainable socio-economic development. The major policy issues revolve around community rights and food security; product quality and acceptability of biofuels, as well as health and safety for workers and communities in general.

5.2 Challenges

5.2.1 Ensuring the well-being of people in biofuel production areas

The need for land to grow biofuel feedstocks can have negative impacts on people in the affected areas. People can be displaced to make way for biofuel feedstock estates. Or when land used for growing food crops is converted to growing biofuel feedstocks, the food security of the area and the communities living in it can be compromised.

A popular model for feedstock production involves a central estate surrounded by small-holder out-growers. Estates require large tracts of land. Most of the land required for large scale estates is often land already occupied by local people. The people derive their livelihood from the land – food production, grazing land for their animals and often firewood from nearby forests for their energy needs. Sometimes, the people are forcibly moved from their land to make way for biofuels crop estates, without consultation or adequate compensation and are relocated to new sites where there is no social infrastructure like schools, clinics and shopping facilities nearby.

Food security is threatened whenever land that is normally used to produce food is converted to growing biofuel feedstock. Biofuel crops can also compromise food production by competing for land, water, inputs and labour in a specific area.

Women tend to be the majority in rural areas which are targeted for the growing of biofuel crops. Men and women in the same household as well as male and female headed households face different risks with respect to their access and control of land and other productive assets, their level of participation in decision making and socio-economic activities, employment opportunities and conditions. Women face bigger risks from biofuel developments than men.

5.2.1.1 Policy guidelines

- Prioritise biofuel feedstock production on land not occupied by people.
- Ensure transparent and comprehensive consultation with affected communities at the planning stage of a biofuel project, and fair compensation, if required.
- Offer affected people the opportunity to participate in new projects either as feedstock growers or as community shareowners.
- Require implementation of social responsibility programs acceptable to the people and Government to be carried out by feedstock estates.
- Prohibit the use of staple food crops such as maize as feedstock for biofuel production.
- Encourage intercropping food crops with biofuel crops. Sugar cane has been successfully intercropped with maize, cabbage and beans, benefitting its yields.
- Land currently used for food production will not be converted to growing energy crops except under compelling circumstances.
- Promoting biofuel feedstock production on marginal land to minimise competition for land.
- Programs on biofuel production in rural areas must take cognisance of gender differentiated roles.
- Increase participation of small-holder farmers in biofuel developments, male or female.

5.2.1.2 Strategies

- Identify land utilisation patterns to facilitate targeting unoccupied land and marginal land for biofuels investments.
- Formulate guidelines on:
- mandatory transparent community consultation for prospective investors,
- assessing and implementing fair and adequate compensation for affected communities,
- community shareholding, social responsibility projects and other community participation in new biofuel investments.
- Train farmers on successful intercropping practices of food crops and biofuel crops.
- More deliberate efforts will be made to protect women and increase their access to land, capital and technology.
- Research to identify gender differentiated socio-economic risks and benefits to men and women at the policy formulation level so that these are incorporated in the policy and programs.

5.2.2 Ensuring consistent product quality

Consistent quality is a critical prerequisite for consumer confidence and acceptance. The quality of the biofuels produced in Zimbabwe will also determine if they can be accepted for trade on the international market and for carbon financing.

SAZ has already produced quality stands for both ethanol and biodiesel that are deemed appropriate and are in line with international standards, allowing for Zimbabwean ethanol to be exported to international markets. ZERA carries out regular independent quality control checks to ensure that the quality standards

are complied with. So far, ethanol produced in Zimbabwe has been found compliant with the applicable quality standards.

5.2.2.1 Policy guidelines

- Ensure consistent product quality by enforcing biofuel standards developed by SAZ.
- All biofuel producers, biofuel blending facilities and fuel retailers are to be licensed by ZERA and will not be allowed to operate without license.

5.2.2.2 Strategies

- ZERA will continue to monitor and enforce the biofuel quality standards that have been developed by the SAZ.
- Ministry of Agriculture will draw up regulations for feedstock production and development;
- Government will mount public awareness and consumer education for biofuels in order to counter any negative perceptions on biofuels.
- The MoEPD will develop an Energy Management Act which shall include legal provisions to empower the Minister of Energy and Power Development to have oversight over all energy resources and energy related cross-cutting issues such as energy pricing, product and service quality.

5.2.3 Safeguarding health and safety of workers and communities

The manufacture and handling of biofuels can be dangerous if suitable precautions are not taken as the process involves storage, handling and use of hazardous substances. The manufacture of both biodiesel and bioethanol is accompanied by hazards of fire, toxic and corrosive properties of the chemicals used such as caustic soda. Biodiesel has rather unusual solvent properties, and will attack some common engineering polymers, including polyvinyl, natural rubber, some gasket and hose materials and metals, including copper, tin and zinc.

Local communities can also be exposed to chemical and biological pollution and adverse labour practices that can take place at biofuel plantations such as child labour, extended exposure to unfavourable weather conditions such the sun or rain without any protective clothing; or unfavourable employment conditions like working without any contracts etc.

5.2.3.1 Policy guidelines

- Health and safety of all people in the whole biofuel production value chain need to be ensured.
- The country's labour laws will be ensured to protect local communities from adverse labour practices that can take place at biofuel plantations such as child labour, extended exposure to adverse weather conditions or unfair employment conditions.
- Safety and health standards will be maintained at production and processing sites with the National Social Security Authority (NSSA) playing a role.

5.2.3.2 Strategies

- Government will liaise with factory inspectors to produce guidelines on handling biofuels and will ensure that the guidelines are followed.
- Training of operators, environmentalists and local fire-fighters on safe handling of biofuels.
- Use of correct equipment in handling biofuels.
- Regular and frequent risk assessment on all facilities that handle biofuels.
- Environmental education to create awareness along the different production and distribution processes of biofuels will be carried out.

- Build skills and capacity to handle environmental and safety issues across the biofuel value chain, by reviewing educational curriculum at university and other tertiary institutions on production, processing and distribution, as well as consumption of biofuels.
- Development of an effective communication strategy on the environment in biofuels sector to Policy implementation

6 Policy implementation

6.1 Institutional coordination on biofuels policy implementation

There are a variety of institutions that are critical to coordinate the biofuels sector at implementation. Successful biofuel development programs require a multi-sectoral approach and as such require a very strong and effective coordination mechanism to orchestrate the efforts of every player towards the common goal, backed by a strong regulator and vibrant research and development institutions. The regulator monitors the implementation of the policy. Research is required to ensure continual improvement in efficiency and finding new and better ways of doing things.

- The MoEPD, Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement and Ministry of Environment, Tourism and Hospitality Industry will be the most critical in successful development of biofuels, with each and its technical departments playing their specialist roles. Input from the other Government Ministries of Indigenisation and Empowerment, Women Affairs, Science and Technology, as well as research institutions and non-governmental organizations cannot be overemphasized.
- The MoEPD is responsible for setting the vision for biofuel development in the country, policy formulation/review and setting of biofuel blending targets in line with its vision, feedstock availability, fuel demand and national energy strategies. The Ministry, through ZERA also issues permits for biofuel producers, issuing guidelines for mandatory blending and fuel standards for the country.
- Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement is responsible for elaborating programs for the production and commercialization of biofuel feedstock, productivity improvement and the development of feedstock varieties. Through its research and extension departments Agricultural Extension Services (AGRITEX), Research and Specialist Services (R&SS)), the Ministry will conduct research and development on biofuels and assist by training farmers in the proper methods of production of biofuel feedstock. The Ministry of Agriculture is also expected to issue standards on specific requirements for sustainable feedstock production and related penalties.
- To ensure food security, the Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement is expected to carry out periodic assessments of the impact of feedstock production on food security. If Government decides that some food crops can be used as feedstock for biofuel production under certain conditions, it is the Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement that should issue permits for such use.
- Ministry of Environment, Tourism and Hospitality Industry is the custodian of the country's environment and ensures environmental protection and access of national biofuel programs to international carbon financing programs where applicable. The Ministry of Environment, Tourism and Hospitality Industry should also make sure that pollution of air, soil and water do not occur from feedstock and biofuel production, and will authorize the operation of the biofuel producers after they satisfy all environmental requirements such as environmental impact assessment and environmental impact mitigation plans.

- The Regulators monitor the implementation of the policy, regulate the production and quality of biofuels and license biofuel producers, attaching relevant conditions to these licenses, such as promotion and protection of the small-holder farmer.
- Research and development institutions will research into suitable biofuel crop varieties and productivity improvements, biofuel production technologies as well as matching fuel characteristic with vehicle technologies.

The successful implementation of the NBPZ will require coordination on two levels:

MoEPD internal coordination. Departmental coordination is critical given that it handles a range of aspects that are relevant to the biofuels sector. In order to provide effective guidance and to oversee implementation of the NBPZ on a continuing basis, it is proposed to set up a Biofuel Internal Steering Committee that synchronizes biofuel developments with renewable and non-renewable energy sectors.

Inter-ministerial co-ordination. An Inter-ministerial Biofuel Development Coordination Committee, chaired by MoEPD, and composed of representatives of the key players in biofuel development (Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement, Ministry of Environment, Tourism and Hospitality Industry, Ministry of Finance and Economic Development, Ministry of Local Government Public Works and National Housing and R&D institutions will be established to coordinate all biofuel related programs.

- There are also key parastatals that have a role to play such as the Agriculture and Rural Development Authority (ARDA), Environmental Management Agency, ZERA, ZINWA at the central level. At the meso scale, there are also Rural District Councils and Traditional Authorities with a say on land related matters.
- To coordinate and inform this institutional network, the MoEPD will set up an institutional mechanism for coordination, most likely in the form of an Energy Management Act to empower the Minister of Energy to coordinate biofuel development across all sectors of the economy.

6.2 Policy harmonisation

- Biofuel production falls under the domain of a number of policies: the Vision 2030, The National Energy Policy, National Agricultural Policies, the Broad Based Black Economic Empowerment policy, the Industrial etc. To ensure comprehensive implementation of the NBPZ, efforts will be made to harmonise all these policies and eliminate any conflicts and contradictions.

6.3 Financial resources mobilisation for the biofuels sector

Developing a thriving domestic biofuel sector will require significant investment, especially in infrastructure project. Considering the constraints of the national fiscus, other financial resources will need to be mobilised to this end. The options under consideration are:

- Investments by state-owned companies;
- Development banks proving loans, private equity investments and technical assistance;
- Bilateral development financing and foreign investment loans;
- Foreign private investors.

6.4 Capacity building in the biofuels sector

All institutions involved in biofuel feedstock production must be capacitated to play their roles. This includes training of agricultural extension workers on biofuel crop production, small holder farmers, land

use planners and research institutions. In addition, effective institutional framework must be set up to coordinate all the activities and give clear leadership and direction.

- Significant thrust will be provided to capacity building and training and development of human resources:
- Universities, Polytechnics and Industrial Training Institutes will be encouraged to introduce suitable curricula to cater for the demand for trained manpower at all levels in different segments of the biofuel sector.
- Interactions among professionals in scientific and technological disciplines related to biofuels research and sustainable production programs will be strengthened, along with extension agents responsible for producers outreach and decision makers concerning responsible biofuels feedstock production.
- Efforts should be directed at enhancing and expanding consultancy capabilities to meet the diverse requirements of this sector.

6.5 Communication for greater awareness on biofuels

There is a clear deficit of information and awareness among producers and authorities concerning the importance of biofuels in the national economy. Support will be provided for creation of awareness about the role and importance of biofuels in the domestic energy sector, as well as about the potential opportunities it offers to the rural economy. The MoEPD will therefore develop a communication strategy on biofuels, to fight any negative perceptions on them, giving facts backed by scientific proof from a respected source and championed by a trusted neutral person or institution.

Other targeted communication measures could include:

- Sensitising politicians and community leaders,
- Educating public media,
- Government must lead in dialogue with stakeholders,
- Success stories should be publicised,
- Government should lead by example by putting its vehicles on high blend and publicise the switch,
- Vehicle-blend compatibility should be confirmed through additional tests and the results publicised widely.

6.6 Phased approach to implementation

To ensure efficient implementation, the following phases and milestones are proposed:

Phase 1 [2015-2020]: Inception

Milestones:

- Establishment of a biofuels inter-Ministerial coordinating committee.
- Achieving consistent blending of ethanol at ten percent (10%) (E10) on a volume basis.
- Engage with car manufacturers and importers to prepare petrol market for ethanol blending beyond ten percent (10%) (low and high blends).
- Prepare fuel market for biodiesel blending mandate.
- Revise licensing conditions for biofuel producers to remove market inefficiencies.
- Increase funding for feedstock R&D.

Phase 2: [2021-2025]: Consolidation of the sector

Milestones:

- Increase ethanol blending mandate to twenty percent (20%) (E20).

- Establish a network of petrol stations offering E85 across the country.
- Mandate a biodiesel blending target.
- Establish tertiary education programs on biofuel production.
- Achieve internationally comparable feedstock yields.
- Achieve conformity with international sustainability standards for biofuels and start exporting.

Phase 3 [2020-2030]: Development of long-term plans

Milestones:

- Engage with stakeholders to develop sector development plans beyond year 2030.

6.7 Monitoring and evaluation

The MoEPD should establish or appoint an independent body for M&E of the NBPZ implementation, composed of all sectors as suggested under institutional implementation framework. The M&E body should be representative of all interest groups. It should then develop an M&E framework that justly and fairly monitors the sector and liaise with other sectors for opinions and decision making in the national interest. Ensuring that there is benchmarking across the four (4) pillars, will be an important task for M&E so that specific indicators are developed and socialized within the interest groups and communicated to the public adequately. Broad consensus is needed on a set of principles, criteria and indicators that are measurable, reportable and verifiable. These should be derived from international standards, which are of significance in shaping the economic, social and environmental impacts of biofuel and biofuel feedstock production.