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SUGAR SECTOR DECARBONIZATION POTENTIAL IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC)

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EXECUTIVE SUMMARY

SADC and the Sugar Sector

The Southern African Development Community (SADC) promotes regional socio-economic, political, and security cooperation among its 16 Member States in Southern Sub-Sharan Africa (SSA). The region is known for achieving some of the world's highest sugarcane yields, positioning SADC as a low-cost sugar production region. The categorization of SADC countries based on sugar markets is the following:

- **Sugar surplus:** Seven countries typically generate a surplus of sugar (i.e., production is above domestic needs leading to net exports); these are Eswatini, Malawi, Mauritius, Mozambique, South Africa, Zambia, and Zimbabwe.
- **Sugar deficit:** The sugar-deficient countries (i.e., production is below domestic needs, leading to net imports) include the Democratic Republic of Congo (DR Congo), Angola, Madagascar, and Tanzania.
- **No sugar production:** There are five other countries that produce no sugar at all (i.e., no production and only imports), namely Botswana, Namibia, Lesotho, Comoros, and Seychelles.

The agro-climatic characteristics of the SAC region—fertile soils, a defined wet season, and seasonal temperature variation—are highly conducive to sugar production. Total annual sugarcane production in the region is around 51.382 million tons from about 781,000 hectares (ha) of harvested area, with an average yield of 68.5 tons per ha. Over the past two decades, Zambia, Mozambique, and Eswatini have recorded modest net increases in sugarcane production, driven mainly by Government-backed expansion of cultivation

areas and estate-led infrastructure development. Other countries such as South Africa, Malawi, and Zimbabwe have experienced stagnation or decline, largely due to urbanization, water scarcity, low profitability, and aging infrastructure.

The sugar industry in SADC is well established, with 41 sugar mills operating across 11 countries. These sugar mills vary in terms of ownership pattern (public, private, or public-private partnership [PPP]), production capacity, sugarcane cultivation, outgrower schemes, and product diversification. Apart from these sugar mills, there are also standalone ethanol distilleries that use sugarcane juice or molasses as feedstock. The total sugar output from the region stands at 5.208 million tons per year, while regional consumption is about 4.277 million tons, resulting in a net surplus of approximately 0.931 million tons, most of which is exported.

The surplus sugar is majorly traded within the five members of the Southern African Customs Union (SACU)—covering Botswana, Eswatini, Lesotho, Namibia, and South Africa—while the remainder is exported to Europe and the United States, with smaller volumes reaching other markets in Africa. Sugar-deficient countries in SADC (outside SACU) tend to import sugar from the global market rather than from regional suppliers. At the SADC level, sugar production has not achieved significant growth in recent years: it has been around 5 million tons per year. Output has been impacted by weather events, declining sugarcane production, and market fluctuations. In contrast, regional consumption has grown steadily over the years to more than 4 million tons per year, primarily driven by population growth. As a result, the regional sugar surplus has been shrinking over time.

Similar to other countries and global markets, the sugar sector in SADC is highly regulated by both domestic and regional trade policies. Sugarcane cultivation, land use, and irrigation are generally governed by the Ministry of Agriculture, while sugar production and its sale are overseen by the Ministry of Commerce, Industry, or Trade. Dedicated sugar authorities are also present in some countries—such as Angola, Mauritius, Mozambique, and Tanzania—and in general, the market is coordinated by sugar industry associations and sugarcane grower organizations. Within the SADC region, different forums support cross-border cooperation and sugar trade. The SADC Sugar Agreement provides a framework for enhancing and regulating sugar trade within its Member States. Some of the key forums in the SADC region include (i) the Technical Committee on Sugar (TCS) under the SADC Secretariat, ii) the Federation of SADC Sugar Producers (FSSP), and iii) the Sugar Producers Consultative Forum (SPCF). Strategically, the SADC Industrialization Strategy and Roadmap (2015-2063) prioritizes agro-processing and includes targeted initiatives for the sugar sector.

Access to Clean Energy and Sustainable Development

Despite the economic growth in SADC, the region's energy sector faces persistent challenges. Much of the population still relies on fossil fuels and unsustainable biomass for their energy needs, contributing to greenhouse gas (GHG) emissions. As off 2024, approximately half of SADC countries have electricity access rates below 50 per cent, and a rural access as low as 32 per cent. Coal continues to dominate the power mix, accounting for 62 per cent of electricity generation. The Southern African Power Pool (SAPP), which comprises both national power utilities and Independent Power Producers (IPPs) from the 12 countries in the SADC region, has a combined installed capacity of about 83 GW. It has helped Member States to trade surplus electricity more efficiently. Also, growing adoption of mini-grids, solar home systems, and other decentralized technologies signals a shift toward more resilient and cleaner energy models. SADC has one of the highest solar irradiation levels and strong wind energy potential in SSA. However, only about 1 percent of solar and wind energy potential has been developed to date. Diversification of energy sources is therefore critical to safeguard sustainable electricity access in the face of rising climate change challenges.

SSA, including the SADC, accounts for about 15 per cent of the global population, but more than 34 per cent of the world's reliance on traditional cooking fuels and technologies. The cost of inaction on clean cooking in SSA is estimated at $330 billion annually due to impacts on health and climate. Nearly 1 billion people in the region do not have access to clean cooking, and traditional biomass continues to supply more than 80 per cent of cooking energy needs. In the transport sector, gasoline consumption across SADC is over 45 million litres per day, of which sugar-producing countries account for nearly 42 million litres. South Africa alone has the largest share, at 24 million litres per day. Several SADC countries—Angola, Eswatini, Malawi, Mozambique, South Africa, Zambia, and Zimbabwe—have established bioethanol blending mandates, but implementation levels vary.

Collectively, SADC countries contribute around 639 million tCO2 annually to global GHG emissions. South Africa has the highest contribution (59 per cent). The main drivers of GHG emissions in the region are coal-based power plants, land-use change, deforestation linked to agricultural practices, and reliance on traditional cooking fuels.

Existing Performance, Opportunities and Challenges in the Sugar Value Chain

The SAPP regional grid is largely supported by coal-based power. There is a growing need to increase the share of renewable energy in the SAPP, and bagasse-based cogeneration power plants can play a key role in this transition. Even in countries like Zambia and Malawi, where there is a limited national grid, sugar mills offer opportunities for mini-grid power supply to surrounding communities.

Total potential of cogeneration power plants in sugar mills (excluding Mauritius)	Installed cogeneration power plants in sugar mills (excluding Mauritius)	Percentage utilisation
1,124 MW	546 MW	49 %

Cumulatively, sugar cogeneration plants can supply nearly 5,000 GWh of electricity to the grid. Mauritius has successfully integrated sugar-based cogeneration into its national grid, contributing up to 15 per cent of national electricity supply. In addition, over 200 GWh is currently exported to the grid, mainly in Angola, Eswatini, and Zimbabwe. Country-level assessments reveal varying degrees of cogeneration uptake. Other countries, such as Mozambique, Zambia, Tanzania, and Zimbabwe, have significant potential but face constraints from infrastructure limitations and low electricity tariffs. In South Africa, despite having 162 MW of installed cogeneration capacity, most of the generated electricity is consumed internally due to unfavourable feed-in tariff policies.

The current status of the sugar sector has a high possibility to promote ethanol. Despite the existence of a biofuel policy and a developing ethanol cooking market in the SADC region, there has been limited promotion of ethanol production. Strong Government commitment is needed to create sufficient market demand for bioethanol —whether for cooking or transport—so that sugar mills can invest with confidence in ethanol distilleries. The region could produce an estimated 682 million litres of ethanol annually, equivalent to $751 million in market value. However, this would meet only about 34 per cent of the total estimated demand of 2 billion litres, required to support 70 per cent transport blending and 30 per cent clean cooking across SADC. This demonstrates both the untapped potential and the need for strategic investment and policy support to scale up bioethanol production.

Total potential for bioethanol in sugar mills	Current ethanol generation in sugar mills	Percentage utilisation
682 million litres/year	**195 million litres/year**	**29 %**

Apart from bioethanol, there is also significant biogas potential from molasses and wastewater generated during bioethanol production. The resulting biogas can be used for electricity generation in gas engines, for process heating needs in ethanol plants and other industries, or for cooking in nearby households. The estimated biogas generation potential in the SADC region is around 123 million m3 per year.

Despite these opportunities, several challenges hinder the scale-up of product diversification. Some constraints include land and water availability, climate change risks, market price fluctuations, difficulties in mobilizing investment, limited infrastructure for blending and distribution, regulatory inconsistencies, competition with food crops for land, and market volatility. Organizations such as the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), through the Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP), are working to overcome these barriers via coordinated research, financing, and policy harmonization.

Electricity	Transport	Clean cooking
Total installed capacity in SAPP	Total gasoline consumption	Total clean cooking households targeted
83,000 MW	16,660 million litres/year	81 million
Sugar cogeneration potential	Sugar bioethanol potential	Potential bioethanol support from sugar sector
1,109 MW	682 million litres/year	2.47 million
Estimated contribution	Estimated contribution	Estimated contribution
1.35%	4.10%	3.05%

Note: *The estimations assume 100% utilisation of available resources, without accounting for any cross-contribution or alternative use, and irrespective of blending and cooking targets.*

Overall, the sugar value chain offers a significant decarbonization opportunity by reducing coal and diesel consumption in the power sector, gasoline use in the transport sector, kerosene reliance in clean cooking, and fuel oil use in industrial heating. Enhancing resource efficiency and expanding the capacity of the sugar sector can also generate new green job opportunities in rural and agricultural communities. Considering the sector's impacts on sectors like clean cooking and transport, it can contribute to several Sustainable Development Goals (SDGs 3, 7, 9, 13, etc.). In order to realize these benefits, timely investment is needed in new sugar mill installations, expansion of cultivation areas, improved resource use, and the development of ethanol distilleries. Table ES1 presents the required investments and the expected socio-economic benefits from expanding the sugar sector and developing its value chain over the next 10 years.

Table ES1. Summary of expected investments and socio-economic benefits

No.	Aspect	Unit	Value
1	Expected sugar production by 2035 in SADC	Million tons/year	7
2	Investment needed for sugar sector development	Billion $	5.81
3	Expansion of cane cultivation area	Million ha	0.30
4	Employment opportunities for farmers, women and youth	Number	154,000
5	Number of households benefitting from ethanol based clean cooking	Number	742,000
6	Households served with electricity through mini-grids	Number	498,206
7	Estimated cumulative GHG emission reductions	Million tons/year	5.87
8	Estimated cumulative cost/forex savings	Million $/year	1,548

Recommendations

More inclusive discussions among stakeholders at both the country and regional levels are needed to close the existing gaps and realize these opportunities. Such initiatives will lead to broader economic, social and environmental development in the region, creating new job opportunities, and supporting land and forest conservation.

From the sugar sector perspective, key priorities in the SADC region include expanding irrigation infrastructure to reduce climate risks, enlarging out-grower schemes to support smallholder farmers, modernizing sugar mill operations to improve resource efficiency, mobilizing funds through public-private partnerships (PPP) for large-scale investment projects, and enhancing regional cooperation on sugar pricing, quality standards, and trade (including sugar, electricity, and ethanol). Sugar value chain diversification will play an important role in achieving these priorities and in attaining sugar self-sufficiency across SADC Member States.

In the short term, it is recommended to support cross-sectoral partnerships to boost investment, improve pricing, and increase revenue from sugar by-products. Documenting and showcasing successful stories of product diversification within SADC can be valuable. A SADC-level sugar sector diversification roadmap and investment strategy, coordinated through the SADC Secretariat, can further support sector stakeholders.

In the medium term, it is recommended to align sugar value chain interventions with national climate actions under the Nationally Determined Contributions (NDCs) for greater visibility. There is also a need to harmonize policies and standards across SADC regarding bioethanol production and use.

Achieving sugar self-sufficiency within SADC will be the long-term goal. It is recommended to improve resource efficiency through the rehabilitation and upgrading of existing infrastructure. Establishing dedicated sugar sector investment funds for the SADC region, connecting national and regional financial institutions with international development funding agencies, can facilitate access to lowcost financing for enterprises in the sugar value chain.

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ABBREVIATIONS

AfCFTA	African Continental Free Trade Area
BIOCOM	Companhia de Bioenergia de Angola
BOD	Biological Oxygen Demand
CECC	Council on Ethanol Clean Cooking
CHP	Combined Heat and Power
CMCS	Malagasy Cane and Sugar Centre
COD	Chemical Oxygen Demand
COMESA	Common Market for Eastern and Southern Africa
COP	Conference of the Parties
CSKN	Compagnie Sucrière Kwilu-Ngongo
DNA	Distribuidora Nacional do Açúcar
DRC	Democratic Republic of Congo
EAC	East African Community
ECOWAS	Economic Community of West African States
EPA	Economic Partnership Agreement
ESA	Eswatini Sugar Association
EthCO	Ethanol Company Limited
EU	European Union
FAO	Food and Agriculture Organization
FQD	Fuel Quality Directive
FSSP	Federation of SADC Sugar Producers
GEF	Global Environment Facility
GHG	Greenhouse Gas
ha	hectare

HBL	Health Promotion Levy
IAA	Instituto do Açúcar e do Álcool
IEA	International Energy Agency
ILUC	Indirect Land Use Change
INADEC	Instituto Nacional do Açúcar e Derivados
IPPs	Independent Power Producers
IRP	Integrated Resource Plan
ISCC	International Sustainability and Carbon Certification
ISO	International Sugar Organization
LPG	Liquefied Petroleum Gas
MCIA	Mauritius Cane Industry Authority
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organization
NOCZIM	National Oil Company of Zimbabwe
PPP	Public-Private Partnership
RE	Renewable Energy
RED	Renewable Energy Directive
REEESAP	Renewable Energy and Energy Efficiency Strategy and Action Plan
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RERA	Regional Energy Regulators Association of Southern Africa
RES	Royal Eswatini Sugar Corporation
RSB	Roundtable on Sustainable Biomaterials
SACREEE	SADC Centre for Renewable Energy and Energy Efficiency

SACU	South Africa Customs Union
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SASA	South African Sugar Association
SBT	Sugar Board of Tanzania
SDG	Sustainable Development Goals
SPARC	Supporting Preparedness for Article Six Cooperation
SPCF	Sugar Producers Consultative Forum
SSA	Sub-Saharan Africa
SSB	Sugar-Sweetened Beverages
TBS	Tanzania Bureau of Standards
TCS	Technical Committee on Sugar
UNIDO	United Nations Industrial Development Organization
US	United States
USDA	United States Department of Agriculture
WWF	World Wildlife Fund for Nature
ZESCO	Zambia Electricity Supply Corporation
ZLD	Zero Liquid Discharge
ZPC	Zimbabwe Power Company



1. INTRODUCTION

Sugar is one of the most highly traded commodities across the globe. Around 108 countries are involved in sugar production, either from sugarcane and/or sugar beet. Sugarcane accounts for about 80 per cent of the 190 million tons of sugar produced globally each year. Originating in Southeast Asia, sugarcane has now spread to various tropical and subtropical regions around the world. With continuous improvements and innovations, the sugarcane industry has also expanded into other sectors such as biofuels, electricity, and paper. Sugar production is highly labour- and resourceintensive, providing livelihoods for farmers as well as skilled and semi-skilled workers in the sugar industry. Thus, the sugar sector exerts a strong influence on agricultural economies and international trade relationships.

The United Nations Industrial Development Organization (UNIDO) is working on the uptake of clean fuels and technologies to improve the competitiveness of the sugar sector in Africa through increased productivity, technology upgrading, and revenue diversification via the utilisation of by-products from sugar processing. As part of this ongoing initiative, UNIDO engaged an international consultant to carry out a market assessment study to evaluate the current conditions and potential of bioenergy in the sugar industries of the Southern African Development Community (SADC). This market study report presents an analysis from different dimensions—economic, energy, market and decarbonization—along with the opportunities and challenges that lie ahead.

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2. METHODOLOGY

To assess the decarbonization potential of the sugar sector in the region, 11 SADC member countries with domestic sugar production were considered. The methodology for estimating this potential—through contributions along the sugar value chain and based on inputs collected from desk reviews, literature studies, and previous market research reports—is presented in Figure 1.

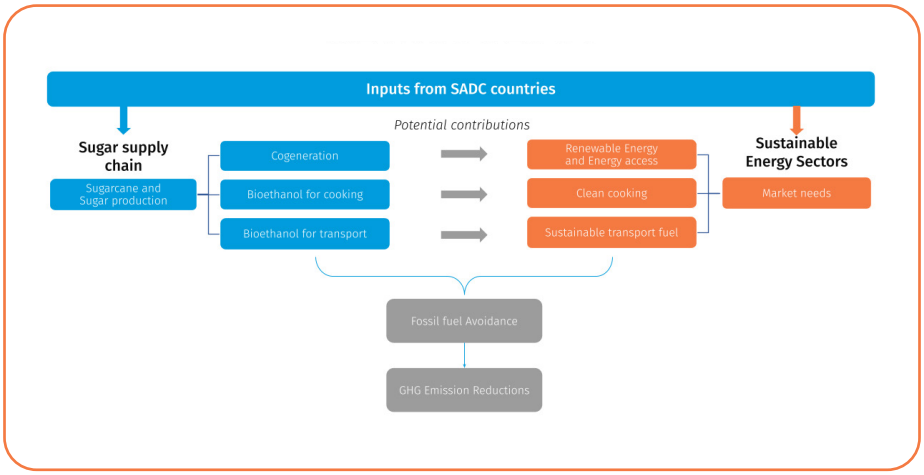


Figure 1. Methodological approach for assessing decarbonization potential

Sugarcane and sugar production trends, consumption patterns, and surpluses are analysed at the country level to estimate the annual availability of bagasse and the potential for bioethanol generation. Similarly, the status, trends, and demand for electricity, clean cooking and transport are assessed by reviewing national policies and targets. Data on average annual sugarcane cultivation and sugar production from both sugar mill estates and outgrowers are drawn from key sources, such as SADC, reports from sugar sector authorities and sugar mills, the Food and Agriculture Organization (FAO), and the United States Department of Agriculture (USDA), after applying consistency checks. Information on climate action commitments, energy scenarios, and transport fuel blending is compiled from Nationally Determined Contributions (NDC), energy sector publications, and international assessment reports by development agencies.

The collected information is validated through comparative and consistency checks. The validated data are then fed into energy as well as GHG models to quantify potential fossil fuel reduction opportunities and corresponding GHG mitigation potential. An investment needs analysis is also carried out to assess resource mobilization at the country level.

To avoid any food-energy conflicts, this study considers only sugar production by-products for energy generation. Finally, the analysis highlights the overall energy transition potential at the SADC level, while further technical and economic feasibility assessments are recommended at the country and sector levels based on the study's findings.

3. OVERVIEW OF SADC

The Southern African Development Community (SADC) was founded in 1992 to promote regional socio-economic integration and political and security cooperation among countries in southern Africa. Currently, it comprises 16 Member States, ranging from Africa's only high-income country (Seychelles) and four upper-middle-income countries (Botswana, Namibia, Mauritius, and South Africa) to seven lower-middle-income countries (Angola, Comoros, Eswatini, Lesotho, Tanzania, Zambia, and Zimbabwe). The remaining four members (the Democratic Republic of Congo, Madagascar, Malawi, and Mozambique) are low-income countries, as presented in Figure 2.

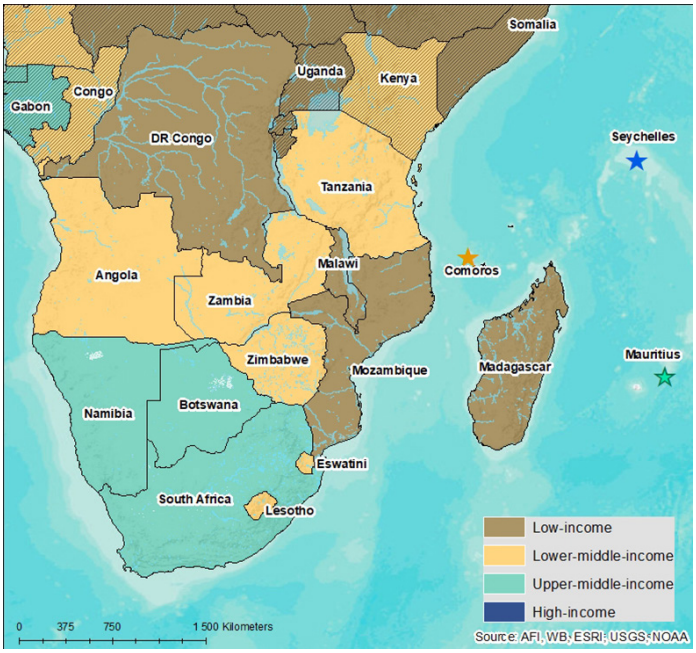


Figure 2. Countries in SADC and their economic status[1]

The SADC Secretariat is headquartered in Gaborone, Botswana. The official languages of SADC are Swahili, English, French, and Portuguese. As of 2023, the total population is approximately 406 million. SADC is one of the eight recognised building blocks of the African Union and has developed into one of the most stable and peaceful regions, attracting investment, trade, and growth. The region covers over 900 million hectares (ha) of land, of which 147 million ha are arable, and it borders two oceans, namely the Indian Ocean and the Atlantic Ocean. Four Member States—Madagascar, Seychelles, Mauritius, and Comoros—are island nations, and six countries—Botswana, Eswatini, Lesotho, Malawi, Zambia, and Zimbabwe—are landlocked. Overall, the Community represents an extremely diverse set of countries in terms of wealth, geography, population, systems of government, and natural resource endowments.

[1] https://futures.issafrica.org/geographic/recs/sadc/.



4. SUGAR SECTOR

The region boasts some of the world's highest cane yields, supported by strong cultivation practices and efficient sugar mill performance. As a result, SADC is recognised as a low-cost sugar production region. Below is a categorization of Member States based on their sugar production levels:

Sugar surplus: Seven countries typically generate a surplus of sugar (i.e., production is above domestic needs, resulting in net exports). These are Eswatini, Malawi, Mauritius, Mozambique, South Africa, Zambia, and Zimbabwe.

Sugar deficit: Four countries are sugar-deficient (i.e., production falls short of domestic demand, leading to net imports). These are the Democratic Republic of Congo, Angola, Madagascar, and Tanzania.

No sugar production: Five countries produce no sugar at all (i.e., no production; they rely entirely on imports). These are Botswana, Namibia, Lesotho, Comoros, and Seychelles.[2]

In this report, the analysis focuses mainly on the 11 countries with domestic sugar production. The non-producing countries are, however, taken into consideration when examining the broader SADC regional market and socio-economic trends as appropriate.

4.1 Sugarcane Cultivation

The agro-climatic characteristics of the SADC region—fertile soils, a defined wet season, and seasonal temperature variation—are highly conducive to sugar production. Sugarcane is cultivated in both rain-fed and irrigated areas, with a growing cycle of 12 to 18 months, depending on location and conditions. The average sugarcane production and harvested area by country are shown in Figure 3. In 2023, total annual sugarcane production in the region was around 51.382 million tons.[3] Average yields vary significantly across countries, depending on climatic conditions, the extent of irrigation, and cultivation practices. Figure 4 presents the average yield levels across different countries.

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[2] https://www.isosugar.org › publication.

[3] Sugar cane production data are taken from FAO statistics for the latest available year (2023). SADC reports also reference FAO data.

Water scarcity poses a challenge in some SADC regions, requiring efficient irrigation techniques and the use of drought-resistant varieties. High labour costs also affect sugarcane farmers in some areas, potentially driving increased mechanization. High levels of mechanization in land preparation, irrigation, and harvesting are prevalent in South Africa and Eswatini. In other countries, mechanization is moderate within sugar mill estates and often manual among individual farmers and outgrowers. Extension services, such as shared machinery, seed distribution, and technical support, are offered to outgrowers through Governments, sugar mills and cooperatives. In return, outgrowers or farmers commit to delivering their cane to the mills.

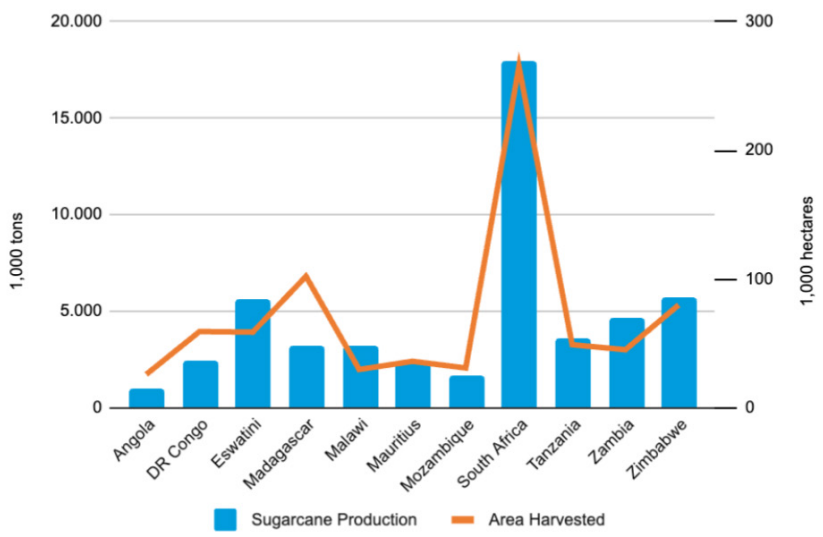


Figure 3. Annual sugarcane production and cultivation area

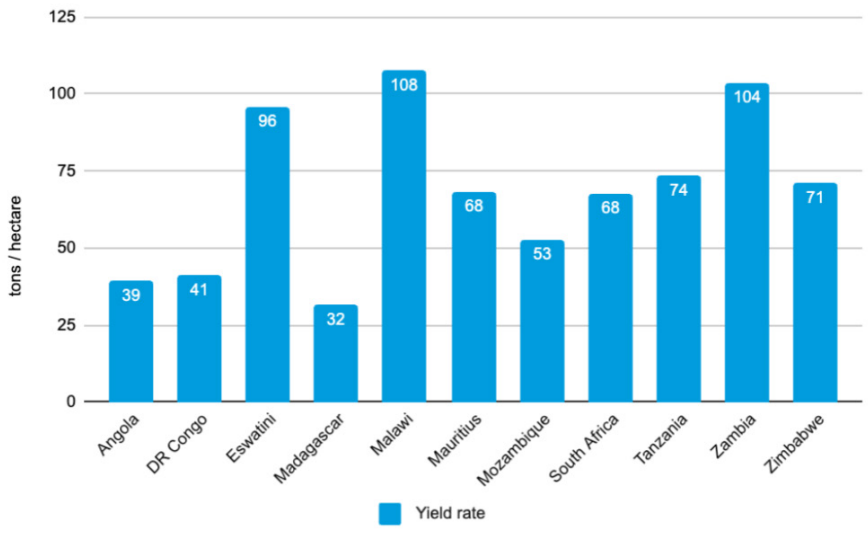


Figure 4. Average sugarcane yield in SADC

The total sugarcane cultivation area in SADC has been approximately 920,000 ha (2020), which shows an increasing trend at the regional level from around 800,000 ha in the early 2000s. At the individual country level, some countries have expanded their cultivation areas, while others have experienced decreases or stagnation in recent years. The latest reported cane-harvested area is around 781,000 ha, based on the sum of individual country areas from Figure 3. Table 1 presents some of the challenges associated with sugarcane cultivation in the region.

Table 1. Trends in sugarcane cultivation area in the SADC region

Increase in cultivation	Decrease in cultivation
A modest net increase in cultivation area reported in Zambia, Mozambique, and Eswatini. Key contributing factors are: ○ Government-backed expansion ○ Strong support for outgrowers ○ Expansion of irrigation systems ○ Land availability ○ Estate-driven growth and investment	A decrease or stagnation in cultivation area reported in South Africa, Zimbabwe, and Malawi. Key contributing factors are: ○ Urbanization and limited land availability ○ Water scarcity ○ Declining profitability for smallholders ○ Aging infrastructure ○ Diversification away from sugar

4.2 Sugar Production

Two types of sugar are produced in Southern African countries: raw sugar and refined sugar. Raw sugar, also known as brown sugar, is widely used for domestic consumption, traditional food preparations, and local food markets. Refined, or white, sugar is used for industrial purposes in sectors such as food, beverages, and pharmaceuticals. SADC countries have both public and private sector players in sugar production. These producers typically operate sugar mills and plantations, and often provide support to outgrowers and farmers as well. The average annual sugar production in the region is 5.208 million tons (2024-2025).[4] Figure 5 presents the average sugar production for each SADC country.

[4] Sugar production data are taken from USDA database for the 2024/2025 marketing year (May to April).

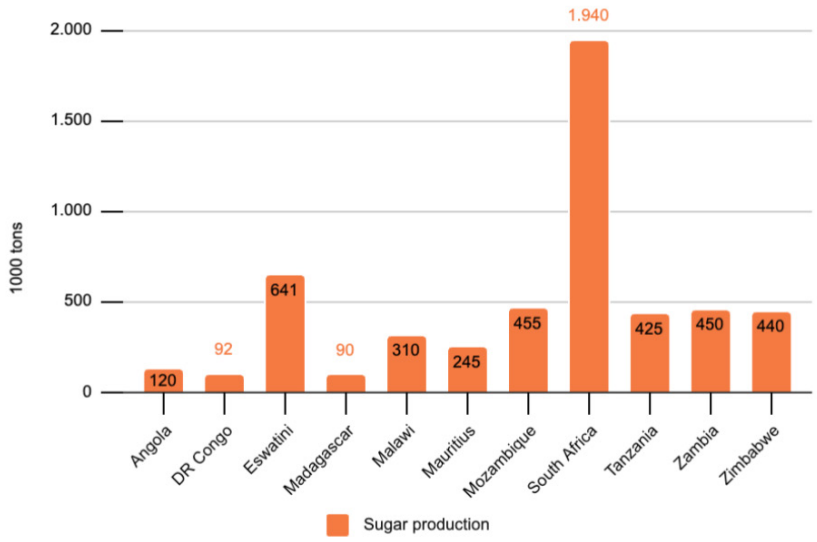


Figure 5. Annual average sugar production in SADC countries

Table 2 presents a summary of the sugar mills operating in each country.

Table 2. Sugar producers in SADC countries

Country	Sugar Companies	Number of mills	Remark
Angola	Biocom (Companhia de Bioenergia de Angola)	1	Private owned
DR Congo	• Mills ○ Compagnie Sucrière Kwilu-Ngongo (CSKN) • Refineries ○ South Kivu Sugar Refinery	1	State has 40% share in sugar mill
Eswatini	• The Royal Eswatini Sugar Corporation (2 mills) • Ubombo Sugar Limited	3	6.5% share by Government of Eswatini and 10% share by Government of Nigeria in Royal Eswatini Sugar
Madagascar	• Namakia • Ambilobe	2	Private owned

Country	Sugar Companies	Number of mills	Remark
Malawi	• Illovo Sugar Plc (2 mills) • Salima sugar	3	• 76% owned by Illovo Sugar and the rest by the State • 60 % owned by AUM Sugar Co. Ltd (India) and 40 % by the State
Mauritius	• Omnicane • Terra • Alteo	3	Private owned
Mozambique	• Tongaat Hulett Mozambique (2 mills) • Illovo Sugar Africa - Maragra Açúcar SA • Sena Sugar Plant	4	12–15% share by State in Xinavane, Marrameu and Mafambisse sugar mills
South Africa	• Tongaat Hulett Sugar Ltd (3 mills) • Illovo Sugar Ltd (3 mills) • RCL Foods (3 mills) • Gledhow Sugar Company • Umfolozi Sugar Mill Ltd • UCL Company Ltd	12	Private owned
Tanzania	• Kilombero Sugar Company • Tanganyika Planting Company • Kagera Sugar Limited • Mtibwa Sugar Estates • Bagamoya Sugar Limited • Mkulazi Holding Company Limited • Zanzibar Sugar Factory Ltd	7	25% stake by State in Kilombero and Tanganyika

Country	Sugar Companies	Number of mills	Remark
Zambia	• Zambia Sugar Plc • Kafue Sugar (Consolidated Farming Ltd) • Kalungwishi Kasama Sugar	3	Zambia Sugar is owned by Illova Sugar and contributes to 92% of countries sugar production
Zimbabwe	• Mills o Hippo Valley Estates Ltd o Triangle Sugar Estates Ltd • Refineries o Star Africa Sugar Refinery Ltd	2	In Hippo Valley, 50% is owned by the State

At the regional level, sugar production has not achieved significant growth in recent years, remaining around 5 million tons per annum. Production has been impacted by adverse weather events, declining sugarcane yields, and market fluctuations. Two sugar mills in South Africa—Darnall and Umzimkulu—were closed in 2020 due to financial constraints.

Annex 1 presents the geographical location of sugar mills and sugarcane cultivation areas (counties/districts) in SADC countries.

4.3 Sugar Consumption and Trade

Regional sugar consumption has grown steadily over the years, reaching approximately 4.7 million tons per year, primarily driven by population growth. Consequently, the regional surplus has diminished over time. According to the International Sugar Organization (ISO), the regional surplus declined from 2.2 million tons in 2002 to around 0.4 million tons in 2022. Figure 6 compares sugar production and consumption in the region based on the latest information collected as part of the study. Total production is 5.208 million tons/year, while total consumption is around 4.277 million tons/year (4.114 million tons/year from sugar producing countries and 0.163 million tons from nonsugar producing countries), resulting in a surplus of 0.931 million tons/year. Figure 7 presents a summary of country-wise sugar surpluses and deficits in SADC. Figure 8 shows the overall surplus and deficit for the region.

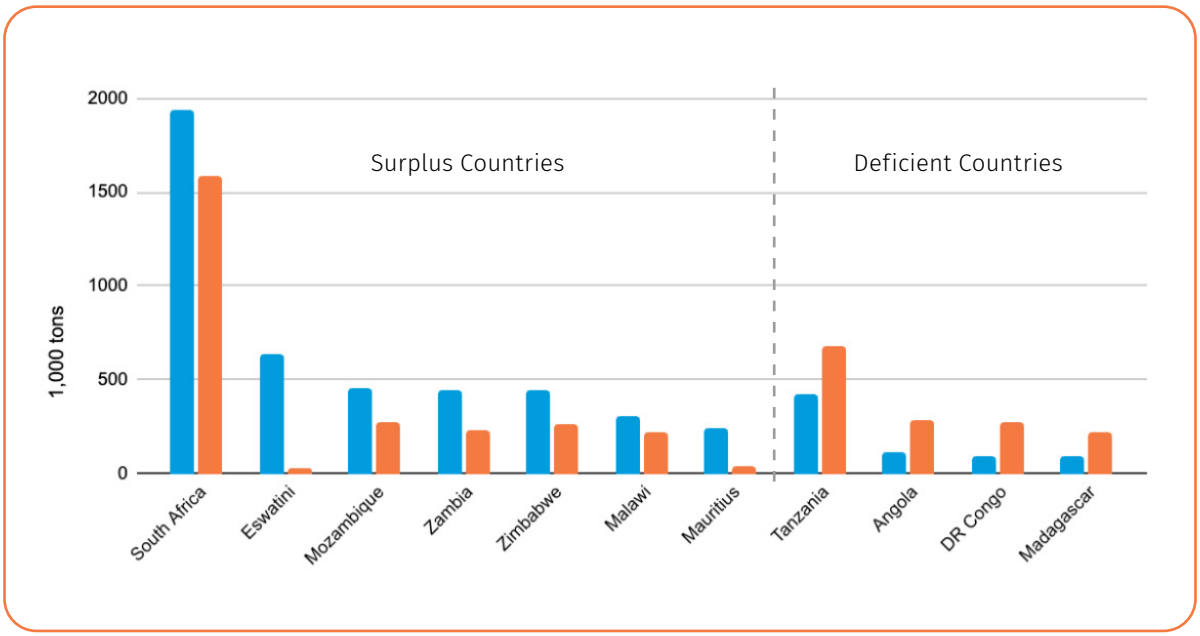


Figure 6. Comparison of sugar production and consumption in SADC countries

The surplus sugar is primarily traded within the five members of the South Africa Customs Union (SACU) bloc, which includes Botswana, Eswatini, Lesotho, Namibia, and South Africa. The remaining surplus is exported to Europe and the United States (US), with smaller volumes going to other markets within Africa. Sugar-deficient countries outside the SACU bloc tend to import from the global market rather than sourcing from regional producers.

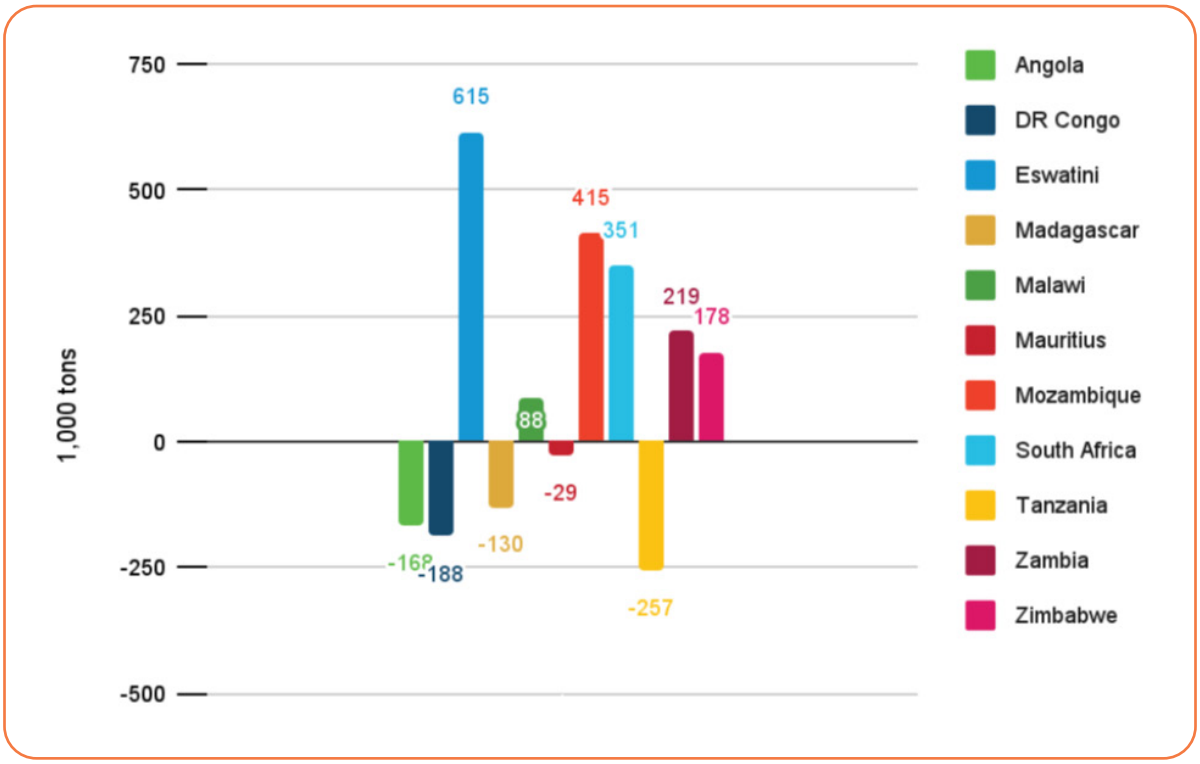


Figure 7. Country-wise sugar surplus and deficit summary

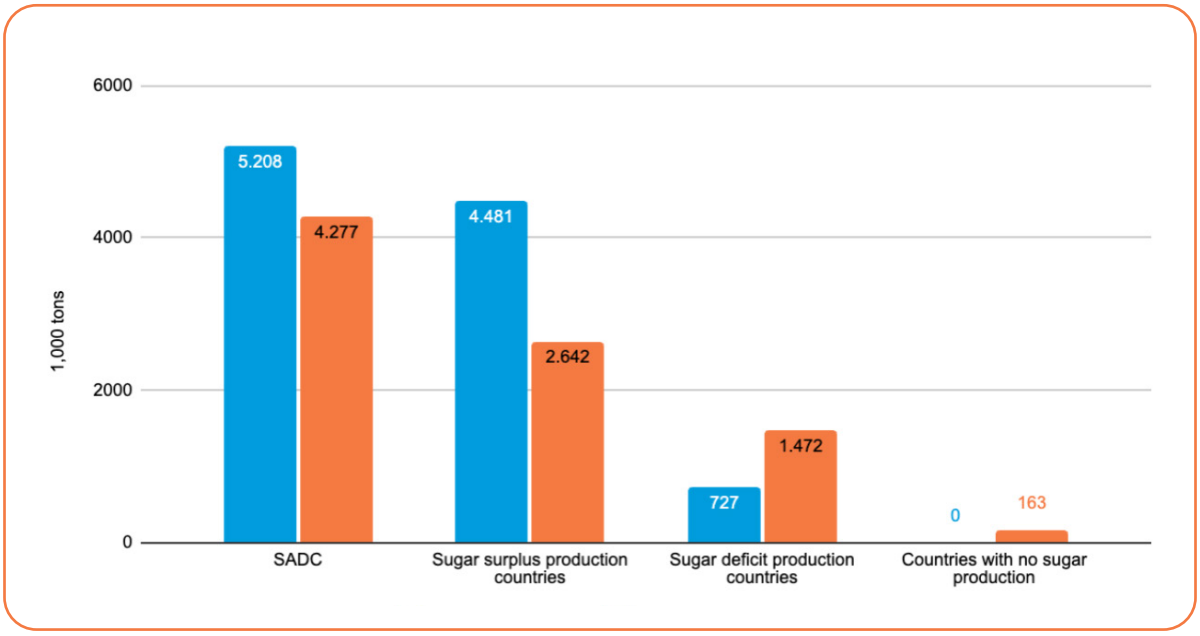


Figure 8. Regional sugar surplus summary

Table 3 provides a summary of sugarcane production, sugar production, and consumption for each sugar-producing country in the SADC region.

Table 3. Sugarcane and sugar production in SADC

Country	Annual sugarcane production (×1000 tons)	Area harvested (×1000 ha)	Average yield (tons/ha)	Annual sugar production (×1000 tons)	Annual average sugar consumption (×1000 tons)	Sugar surplus / deficit (×1000 tons)
Angola	1,013	26	39	120	288	-168
DR Congo	2,434	59	41	92	280	-188
Eswatini	5,621	59	96	641	26	615
Madagascar	3,215	102	32	90	220	-132
Malawi	3,169	29	108	310	222	90
Mauritius	2,453	36	68	245	274	205
Mozambique	1,621	31	53	455	40	181
South Africa	17,944	265	68	1,940	1,589	351

Country	Annual sugarcane production (×1000 tons)	Area harvested (×1000 ha)	Average yield (tons/ha)	Annual sugar production (×1000 tons)	Annual average sugar consumption (×1000 tons)	Sugar surplus / deficit (×1000 tons)
Tanzania	3,589	49	74	425	682	- 257
Zambia	4,653	45	103	450	231	219
Zimbabwe	5,670	80	71	440	262	178
Total	**51,382**	**781**	**68.5**	**5,208**	**4,114**	**1,094**

Domestic and Regional Trade Policies on Sugar

The sugar sector is heavily subsidized worldwide, and global sugar prices are generally considered to be well below fair costs of production. In order to protect domestic sugar industries from the dumping of low-cost sugar, sugar prices and markets are highly regulated in many African countries. This has resulted in higher domestic prices in these countries compared to world market prices, benefiting producers who sell most of their sugar in domestic markets over those who rely more on exports. Different countries adopt various strategies to address these challenges. For example, sugar exports in South Africa are closely managed by the South Africa Sugar Export Corporation Limited, which is effectively the sole exporter of bulk raw sugar. In Zambia, the sugar sector is protected from external competition through a legal requirement that all household sugar intended for direct consumption be fortified with Vitamin A.[5]

As rapid urbanization and population growth continue to drive consumption, African countries are witnessing an increase in sugar demand domestically. To tackle these challenges and leverage domestic sugar production, several regional trade cooperation initiatives are underway, including SADC, the East African Community (EAC), the Economic Community of West African States (ECOWAS), and the Common Market for Eastern and Southern Africa (COMESA). Greater trade integration among African nations is also being promoted through the African Continental Free Trade Area (AfCFTA).[6] The SADC Industrialization Strategy and Roadmap 2015–2063 (SADC roadmap) recognises regional value chains as important tools for driving structural transformation and industrialization, with sugar identified as a top agro-processing value chain.

[5] Regional value chains: Exploring linkages and opportunities in the agro-processing sector across five SADC countries, Tamara Paremoer, CCRED, April 2018.

[6] Trade and competitiveness of African sugar exports, Frontiers in Sustainable Food Systems, December 2023.

Export Markets

Historically, the European Union has been the primary export market for African sugar, providing favourable conditions for sugar exports. For example, Mozambican sugar producers are particularly reliant on the European market. SADC-EU Economic Partnership Agreement (EPA) countries account for approximately 11 per cent of the EU's total sugar imports. Recently, Asian countries such as India, Indonesia, and Pakistan have been emerging as significant importers of African sugar.

Box 1. Increased Awareness of Sugar Consumption and Health Risks

In recent years, overweight and obesity have become pressing public health concerns in African countries. Excessive consumption of sugar-sweetened beverages (SSBs) is recognised as one of the strongest contributing factors. In response, several African countries have launched awareness campaigns and introduced measures to curb SSB consumption.

Since 2018, a Health Promotion Levy (HBL) is implemented in South Africa on SSBs containing more than 4 grams of sugar per 100 millilitres. The introduction of the sugar tax resulted in a significant reduction in SSB consumption: the maximum sugar consumed per month through taxable drinks fell by nearly 45 per cent, from around 20,000 metric tons in 2018 to around 11,000 metric tons in 2022.[7] Similarly, other SADC countries—DR Congo, Madagascar, Mauritius, Mozambique, Seychelles, Tanzania, and Zambia—are applying SSB taxes.[8] The implementation of such awareness measures and SSB taxes is expected to slow the long-term growth of sugar demand in the SADC region.

[7] Impacts of South Africa's Health Promotion Levy on sugar-sweetened beverages, Tim Cejka, Marlies Piek and Mazhar Waseem, UNU WIDER, April 2025.

[8] Taxing for health: taxes on sugar-sweetened beverages in east and southern African countries, Artwell Kadungure, Rene Loewenson, TARSC, July 2023.



5. STATUS OF ENERGY ACCESS IN SADC

5.1 Electricity Access Scenario

Southern Africa has the lowest electricity access rates in the world, with approximately half of the 16 SADC countries recording access rates below 50 per cent in 2024. To address this challenge, SADC enables its Member States to trade surplus electricity with one another, thereby helping to meet their rising energy demand.

Some of the most relevant mechanisms supporting this include the Southern African Power Pool (SAPP), the Protocol on Energy, and the Regional Electricity Regulators Association of Southern Africa (RERA). The Southern African Power Pool (SAPP), established in August 1995, coordinates the provision of reliable and cost-effective electricity supply while facilitates electricity trading among the member utilities. Figure 9 presents the current energy mix of SAPP energy sources. SAPP membership includes both national power utilities and Independent Power Producers (IPPs) from 12 SADC countries, with a cumulative installed capacity of about 83 GW. Table 4 provides the details of electricity access and the share of renewable energy (RE) in national grids.

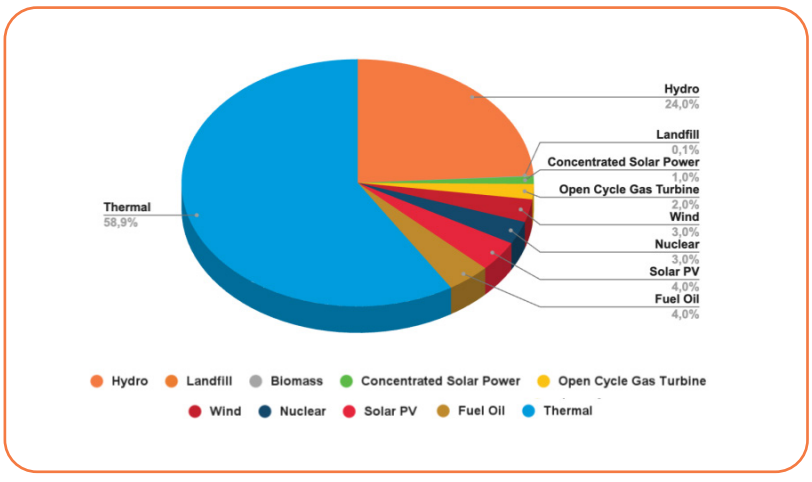


Figure 9. SAPP electricity generation mix[9]

[9] Paving the way for renewable energy and hydrogen adoption in Southern Africa, Phakamile Ndlovu, June 2025.

The SADC continues to face several challenges in the energy sector. Approximately 50 per cent of the region's population have access to electricity, with only 32 per cent of rural residents benefitting from this access.

Although the region possesses significant potential for RE development, SADC continues to rely heavily on coal for its energy needs, which accounts for 62 per cent of power generation in the region.[10]

Table 4. Electricity access and RE in SADC

Country	**Access to electricity** (% of population) 2022[11]	**RE share in installed grid capacity** (% of MW) 2023[12]	**RE share in grid electricity generation** (% of GWh) 2022[13]
Angola	48	63.4	76.3
Botswana	76	0.7	0.2
Comoros	90	20.2	0.1
DR Congo	21	97.7	100
Eswatini	82	94.7	98.7
Lesotho	52	99.4	99.8
Madagascar	36	28.1	45.8
Malawi	14	79.7	79.0
Mauritius	100	29.7	19.3
Mozambique	33	78.2	84.1
Namibia	56	74.2	92.1

[10] https://mecs.org.uk/blog/sadc-2024-sustainable-energy-week-and-the-6th-international-off-grid-renewable-energy-conference-and-exhibitions-iorec-feb-24th-28th-2025-gaborone-botswana/.

[11] https://trackingsdg7.esmap.org/.

[12] Renewable energy statistics 2024, IRENA, July 2024.

[13] Renewable energy statistics 2024, IRENA, July 2024.

Country	Access to electricity (% of population) 2022[11]	RE share in installed grid capacity (% of MW) 2023[12]	RE share in grid electricity generation (% of GWh) 2022[13]
Seychelles	100	17.8	5.7
South Africa	86	17.0	5.4
Tanzania	46	34.4	33.8
Zambia	48	86.4	88.9
Zimbabwe	50	39.8	50.2

Sub-Saharan Africa (SSA) is reported to have an additional energy generation capacity of 260 gigawatts (GW) for universal energy access, with 53 per cent renewables in the energy mix by 2040, and the SADC's contribution is expected to be around 52.8 GW. The SADC region has one of the highest solar and significant wind energy potentials within SSA. Yet, only 1 per cent of solar and wind energy potential in SADC has been tapped to date.[14]

Diversification of electricity sources is highlighted as essential for sustainable access to electricity in the face of rising challenges such as climate change. For example, in Zambia, where most electricity generation comes from hydropower, severe droughts are having a significant impact on energy supply, resulting in blackouts. Therefore, countries must invest in diverse, sustainable sources of energy to increase the resilience of their national electricity systems.

The trend in rural electrification in the SADC region is moving strongly towards the use of mini-grids and/or household solar systems, as well as other mini- and pico-scale technologies, because national grid utilities face significant financial constraints that have hampered their capacity to meet Government targets for energy access and grid extension.

Annex 2 outlines the share of electricity generation sources in the national grids of SADC countries.

[14] https://www.bu.edu/gdp/2024/06/27/funding-feasibility-expanding-renewable-energy-and-energy-access-in-the-sadc-region-with-regional-prefeasibility-facilities/.

5.2 Clean Cooking Access Scenario

SSA accounts for approximately 15 per cent of the global population, but more than 34 per cent of the world's use of traditional cooking fuels and technologies. The cost of inaction on clean cooking in SSA is estimated at $330 billion annually due to impacts on health and climate.[15] As of 2023, nearly 1 billion people in SSA do not have access to clean cooking, and traditional biomass continues to be the main source of cooking energy, representing 80 per cent of the total, followed by Liquefied Petroleum Gas (LPG) (please refer to Figure 10).[16]

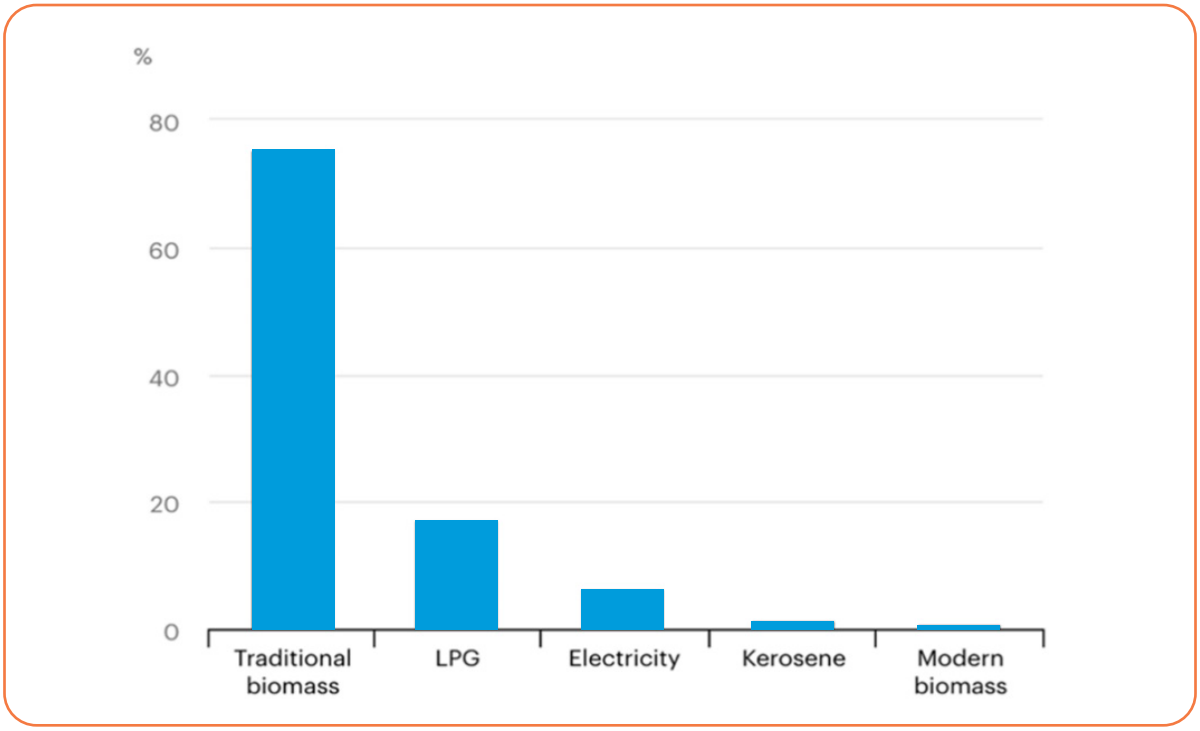


Figure 10. Share of cooking energy in SSA

Access to clean cooking is high in South Africa (89 per cent), while other Southern African states score poorly, with rates of around 25-30 per cent. Clean cooking access rates are less than 10 per cent in the DR Congo, Madagascar, Malawi, Mozambique, and Tanzania.

While access is nearly 100 per cent in the island states of Mauritius and Seychelles, Comoros has achieved only 10 per cent access to clean cooking. Table 5 presents a summary of clean cooking levels in individual SADC countries. The overall average access rate in the region is 38 per cent.

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15 https://blogs.worldbank.org/en/investinpeople/how-clean-cooking-solutions-can-help-protect-human-capital-sub-saharan-africa.

16 https://www.iea.org/data-and-statistics/charts/population-without-access-to-clean-cooking-in-sub-saharan-africa-and-developing-asia-in-the-stated-policies-scenario-2010-2030.

Table 5. Population with access to clean cooking

Country	Population in 2025[17] (numbers)	Access to clean cooking (%) 2022[18]	Population with access to clean cooking (numbers)	Population without access to clean cooking (numbers)
Angola	39,040,039	50	19,520,020	19,520,019
Botswana	2,562,122	66	1,691,001	871,121
Comoros	882,847	10	88,285	794,562
DR Congo	112,832,473	4	4,513,299	108,319,174
Eswatini	1,256,174	49	615,525	640,649
Lesotho	2,363,325	42	992,597	1,370,728
Madagascar	32,740,678	2	654,814	32,085,864
Malawi	22,216,120	1	222,161	21,993,959
Mauritius	1,268,280	99	1,255,597	12,683
Mozambique	35,631,653	6	2,137,899	33,493,754
Namibia	3,092,816	47	1,453,624	1,639,192
Seychelles	132,779	100	132,779	0
South Africa	64,747,319	89	57,625,114	7,122,205
Tanzania	70,545,865	9	6,349,128	64,196,737
Zambia	21,913,874	9	1,972,249	19,941,625
Zimbabwe	16,950,795	31	5,254,746	11,696,049
Total	**428,177,159**	**38%**	**104,478,836**	**323,698,321**

[17] https://www.worldometers.info/world-population/population-by-country/.

[18] https://trackingsdg7.esmap.org/.

5.3 Biofuel for Transport

So far, five countries—namely Angola, Malawi, Mozambique, South Africa, and Zimbabwe—have enacted policies for bioethanol blending in the transport sector. Malawi and Zimbabwe have successfully achieved their bioethanol blending targets through domestic production. In 2024, Zimbabwe mandated ethanol blending, thereby banning the sale of pure, unblended gasoline in the country.[19]

The South African Biofuels Regulatory Framework established a target of 4.5 per cent market share for biofuels in the fuels market, with 2 per cent allocated to first-generation biofuel technologies. The programme set mandatory blends of E2 for gasoline and B5 for diesel, starting in 2015. However, South Africa has faced challenges to meet these targets. Table 6 presents a summary of annual gasoline consumption and the biofuel mandates in SADC countries.

Table 6. Annual gasoline consumption and biofuel mandates

Country	Gasoline consumption per year for transport (Litres per day) In 2023[20]	Current ethanol blendingmandates[21]	Planned ethanol blending targets
Angola	4,333,994	10%	-
Botswana	1,772,708	-	-
Comoros	171,706	-	-
DR Congo	1,414,987	-	-
Eswatini	445,164	-	10% by 2030[22]
Lesotho	341,823	-	-

19 https://theelectricityhub.com/zimbabwe-bans-unleaded-petrol-in-the-country/.

20 https://www.theglobaleconomy.com/economies/.

21 https://www.globalrfa.org/biofuels-map/.

22 Update of the Nationally Determined Contributions, Kingdom of Eswatini, October 2021.

Country	Gasoline consumption per year for transport (Litres per day) In 2023[20]	Current ethanol blendingmandates[21]	Planned ethanol blending targets
Madagascar	494,450	-	-
Malawi	1,268,719	10%	20% by 2040[23]
Mauritius	729,752	-	-
Mozambique	1,383,189	10%	-
Namibia	939,615	-	-
Seychelles	157,397	-	-
South Africa	24,339,365	2% to 10%[24]	-
Tanzania	4,489,801	-	-
Zambia	1,628,030	-	10%[25]
Zimbabwe	1,731,372	10%	20% by 2030[26]

23 Updated Nationally Determined Contributions, Republic of Malawi, July 2021.

24 https://www.iea.org/policies/5297-regulations-regarding-the-mandatory-blending-of-bio-fuels-with-petrol-and-diesel-government-notice-no-r-671.

25 https://www.globalrfa.org/biofuels-map/.

26 Biofuels Policy of Zimbabwe (2020), Food and Agriculture Organization of the United Nations.



6. MODERNIZATION OF SUGAR SECTOR

Sugar production is an energy-intensive process, requiring significant amounts of electricity and steam throughout extraction and processing. In general, sugar mills use electricity and steam as the primary energy sources for sugar production. In a sugar plant, these requirements are met by (i) conventional cogeneration, deploying a bagasse-fired boiler in conjunction with an extraction-condensing back-pressure steam turbine, or (ii) a double extraction-condensing turbine coupled to an electrical generator.

Sugar mills have the advantage of surplus bagasse, which can be used to meet their own energy needs. In addition, excess power can be exported to the national grid or supplied to other industries in the locality. A modern sugar factory may cost around $100 million, while the minimum costs associated with developing irrigated cane land is approximately $10,000/ha.27

The energy demand of a sugar mill depends on the type of technology used for milling and the efficiency of its cogeneration system. Older steam-driven sugar mills have a process steam demand of 480–600 kg/ton of cane crushed. In contrast, modern sugar mills with energy-efficient systems and electric drives have a process steam demand of 350–400 kg/ton of cane crushed. Electricity consumption ranges from 20 kWh/ton of cane crushed in older mills to 35 kWh/ton in modern mills, reflecting the increased use of electric motor drives. Old mills generate less additional electricity for export to the grid compared with modern energy-efficient mills. In traditional sugar mills, excess bagasse is often disposed of as waste. Table 7 provides a comparison of the energy performance of old sugar mills versus modern ones.

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27 SADC-EU economic partnership agreement: Opportunities for the sugar industry, SADC – EU EPA, 2018.

Table 7. Energy performance of traditional and modern sugar mills

Aspect	Traditional (old) sugar mills	Modern energy-efficient sugar mills
Steam pressure (bar)	20-25	60-87
Steam temperature (°C)	260-380	480-520
Steam requirement (kg/ton of cane)	480-600	350-400
Electrical power generation (kWh/ton of cane)	10-20	100-150
Electrical power consumption (kWh/ton of cane)	10-20	25-35

6.1 Existing Cogeneration and Electricity Export

Angola

The Biocom sugar mill has an installed cogeneration power plant of around 40 MW, capable of generating around 136,000 MWh per year. During harvest, the mill consumes around 30-40 per cent of the energy produced. The surplus, which is 60-70 per cent, is supplied to the national grid network[28].

Eswatini

The sugar industry in Eswatini is undergoing significant modernisation, driven primarily by the Royal Eswatini Sugar Corporation (RES), which operates the Mhlume and Simunye mills. Together, these mills crush approximately 3.6 million tons of cane/year, producing around 430,000 tons of sugar and 32 million litres of ethanol annually.[29] Table 8 presents the current cogeneration status.

[28] https://theenergyyear.com/articles/reducing-angolas-reliance-on-food-imports/.

[29] https://www.res.co.sz/products/sugar.php.

Table 8. Sugar cogeneration in Eswatini

Sugar mill	Installed cogeneration (MW)[30]	Electricity export to grid
Royal Eswatini Sugar	65.5	None. Generated electricity is used for internal purposes and nearby communities.
Ubombo Sugar	41.5	Produces around 165 gigawatt-hours (GWh) of electricity annually, of which about 60 GWh is supplied to the grid.[31]

Malawi

Illovo Sugar operates two sugar mills in Malawi—Nchalo Sugar Estate and Dwangwa Sugar Estate.

An 18 MW cogeneration plant was installed some decades ago with the aim of reducing energy costs and supplying uninterrupted power to the industry and staff residences.[32] Overall, the two mills together generate about 90 per cent of their own energy needs via bagasse cogeneration, with the remainder supplied by the national grid to manage additional load.

Mauritius

Sugar-industry combined-cycle cogeneration plants account for nearly one-third of Mauritius's total installed power capacity, reflecting their major role in the country's power infrastructure. Table 9 presents the current cogeneration status.

30 https://www.esera.org.sz/electricity/.

31 https://www.illovosugarafrica.com/our-brands/electricity-co-generating.

32 An Overview of Community Energy Systems in Malawi, Christopher M. Hara, CESET, November 2021.

Table 9. Sugar cogeneration in Mauritius

Sugar mill	Installed cogeneration (MW)	Electricity export to grid
Omnicane	90 MW	Surplus exported to the Central Electricity Board (CEB) during crop season. Their integrated "flexi-factory" model combines sugar refining, cogeneration, and bioethanol production, optimising resource use and enhancing supply to the grid.
Terra	70 MW, consisting of two 35 MW units Bagasse in season, coal/ intercrop; wood-chip co-firing in progress	~400 GWh annual export to the grid.
Alteo	41 MW (biomass + coal cogeneration unit)	~170 GWh annual export to the grid.

Mozambique

A rough estimate of power generation potential based on bagasse indicates that the Xinavane sugar mill has a maximum potential of around 40 MW. However, only 12 MW of cogeneration capacity is installed, and some of the surplus power is supplied to nearby industries and for irrigation by outgrowers. The Mofambissae sugar mill has a maximum potential of around 15 MW and exports excess power to the grid. In 2021, around 6,654 MWh was exported to the grid.[33] No information is available for the Sena, Maragra, and Marromeu sugar mills.

South Africa

The current installed capacity of sugar-cogeneration power plants in South Africa is around 177 MW. However, most of the electricity generation is used within the sugar mills themselves, with only limited export to the grid. This is mainly because of the low feed-in tariff offered by the grid utility. Table 10 presents the current cogeneration status.

[33] Based on performance data collected from sugar mills as part of this study.

Table 10. Sugar cogeneration in South Africa

No.	Sugar mill	Installed capacity (MW)[34]
1	Felixton (TH)	31.5
2	Malalane (RCL)	26.4
3	Maidstone (TH)	22.5
4	Komati (RCL)	20
5	Sezela (Illovo)	19
6	Umfolozi	16
7	Gledhow	14.2
8	Noodsberg (Illovo)	13
9	Amatikulu (TH)	12
10	Estom (Illovo)	2
11	Pongola (RCL)	Data not available
12	UCL	Data not available

Tanzania

Out of the five sugar plants, only one—Tanganyika—has obtained a license to connect to the grid and exports surplus electricity. The remaining sugar mills use all electricity generated for internal consumption. Table 11 presents the current cogeneration status.

[34] https://www.power-technology.com/data-insights/power-plant-profile-felixton-sugar-cogeneration-plant-south-africa/.

Table 11. Sugar cogeneration in Tanzania

No.	Sugar mill	Licence type	Installed capacity (MW)	Export capacity (MW)
1	Tanganyika	Generation and sales	20.0	9.0
2	Kilombero	Generation-own use	12.5	0
3	Kagera	Generation-own use	6.2	0
4	Mtibwa	Generation-own use	13.0	0
5	Zanzibar	Generation-own use	7.0	0
Total			**58.7**	**9.0**

Zambia

Zambia Sugar Plc operates a 40 MW cogeneration power plant. In 2024, the company entered into an agreement with Zambia Electricity Supply Corporation (ZESCO) Limited (the national power utility) to supply electricity to the grid.[35] Kafue Sugar has an existing cogeneration capacity of 6 MW. No information is available on the capacity of Kalungwishi Kasama sugar mill.

Zimbabwe

Together, Hippo Valley and Triangle sugar mills are expected to have a cogeneration capacity of 84 MW, and around 12 MW is expected to be exported to the grid under a swap agreement with the Zimbabwe Power Company (ZPC). During peak crushing seasons, surplus bagasse-generated electricity is exported, while the mills draw power during off-peak periods.

[35] https://www.linkedin.com/pulse/zesco-zambia-sugar-forge-historic-power-ezalf/.

6.2 Bioethanol production

The annual ethanol production capacity of sugar mills across SADC is presented in Table 12. An economic impact study of bioethanol in South Africa (2013) estimated that biofuel produced from 10 per cent of the country's sugarcane cultivation area would be sufficient to replace more than 2 per cent of petroleum consumption.[36] Table 13 outlines other bioethanol production units within SADC.

Table 12. Current bioethanol production in SADC

Country	Sugar Mill	Production capacity (million litres/year)	Remarks
Angola	BIOCOM[37]	17	Annual production is estimated to expand to 30 million litres of ethanol[38] (sugar cultivation is expanding)
DR Congo	Compagnie Sucrière Kwilu-Ngongo (CSKN)	3.7	Produces alcoholic beverages from ethanol
Eswatini	The Royal Eswatini Sugar Corporation Limited (RES Corporation)[39]	35.3	-
Malawi	-	-	Ethanol produced by non-sugar mill distilleries (refer to Table13)

[36] The economywide impact of bioethanol production in South Africa, Lungani Mvelase, Stuart Ferrer, October 2024.

[37] An Evaluation of the Land Available for Sustainable Sugarcane Cultivation and Potential for Producing Ethanol and Bioelectricity in Angola, Adilson Joao Matias, Luiz Augusto Horta Nogueira, Eric Alberto Ocampo Batlle, August 2024.

[38] https://www.himoinsa.com/power-at-biocom-one-of-the-biggest-biofuel-production-plants-in-angola/news/news-list/news/50/.

[39] Integrated report, RES corporation, 2024.

Country	Sugar Mill	Production capacity (million litres/year)	Remarks
Mauritius	Omnicane Ethanol Production Limited	24	Around 12.9 million litres produced in 2022[40]
Mozambique	-	-	Tongaat Hulett is building a facility (since 2021) to produce 20 million litres/year of bioethanol from its Xinavane mill[41]
South Africa	Illovo, Glendale	5	A total of 259 million litres of ethanol is produced,[42] including non-sugar mill ethanol distilleries (refer to Table13)
	Illovo, Merebank	50	
Tanzania	Kilombero sugar mill	12	Expected to increase to 16 million litres per year
Zimbabwe	Triangle Sugar mill	30	-

40 https://omnicane.com/bioethanol.

41 https://clubofmozambique.com/news/mozambique-tongaat-hulett-to-invest-in-ethanol-production-aim-205927/.

42 https://grains.org/bioethanol/ethanol-market-profiles/south-africa/.

Table 13. Ethanol distilleries (non-sugar mills) in SADC

Country	Ethanol distillery	Production capacity (million litres/year)	Remarks
Malawi	Ethanol Company Limited (EthCo)[43]	18	Approximately 32 million litres of ethanol produced to meet the bioethanol blending mandates.[44] Molasses is sourced from domestic sugar mills and also imported from Mozambique and Zambia.
	PressCane Limited[45]	27	
South Africa	Mabele Fuels	150	Grain sorghum is utilised as the primary feedstock.
	NCP Alcohols	54	-
Zimbabwe	Green fuels	120	Dedicated sugar-to-ethanol distillery.

[43] https://app.swapcard.com/event/1st-malawi-eu-investment-forum/exhibitor/.

[44] The Bioethanol Industry in Sub-Saharan Africa: History, Challenges, and Prospects, Evanie Devi Deenanath, Sunny Iyuke, Karl Rumbold, Mar 2012.

[45] https://www.getfmw.org/projects/presscane-limited.

6.3 Product Diversification

Mauritius (Omnicane)

The distillery processes around 45,000 tons of molasses per year, producing approximately 24 million litres of bioethanol. The resulting vinasse, rich in organic matter, nitrogen, potassium, and magnesium, is concentrated and converted into a bio-liquid fertiliser. This reduces the need for mineral fertilisers and improves soil health and crop yields. Another by-product, filter cake (also known as scum or press-mud), is composted and distributed to smallholder farmers, providing phosphorus and organic matter that enhance soil microbial activity and fertility. In addition, CO_2 captured during fermentation is purified and sold as food-grade carbon dioxide, mainly for beverage applications.

Omnicane's composting and nutrient recycling practices align with circular economy principles and are endorsed by sustainability frameworks such as Bonsucro, which certified its operations in 2019—the first in Africa.[46]

DR Congo (Compagnie Sucrière Kwilu-Ngongo)

Almost 50 per cent of the sugarcane is directly used for ethanol production, which is further processed into rum (Kwilu Rum). The annual ethanol output is around 3.7 million litres.

Malawi (PressCane Ethanol Biogas CHP Plant)

The plant operates a 2.126 MW electricity generator powered by biogas derived from sugarcane molasses wastewater treatment. The biogas power plant is primarily used for on-site power and heat.

Other countries

Similar initiatives and pilot projects are reported in Eswatini, Malawi, Mozambique, and Zambia, although detailed information and progress updates are not readily available.

[46] https://bonsucro.com/omnicane-mill-certification/.



7. OPPORTUNITIES AND CHALLENGES

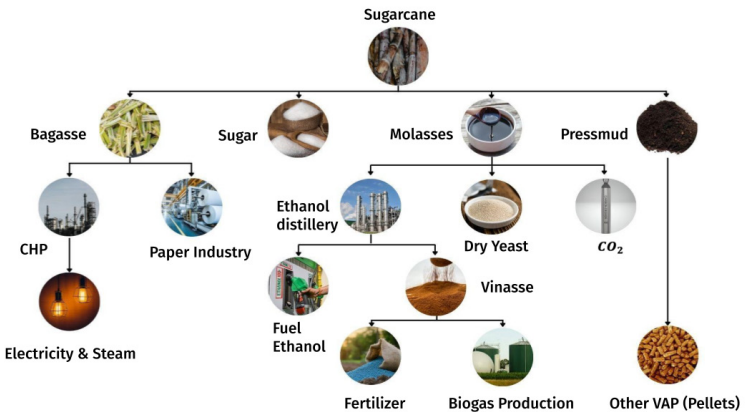
The key by-products from the sugar production process are:

(i) Bagasse: the dry fibrous material that remains after crushing sugarcane. Sugar mills use bagasse as the primary fuel source to generate electricity through cogeneration. This meets the mill's internal energy demand, with surplus electricity supplied to the grid.

(ii) Molasses: a dark, sweet, and syrupy by-product, traditionally used as a sweetener and as feedstock for alcohol production.

(iii) Press-mud: a nutrient-rich organic matter used as a natural fertiliser for agricultural purposes.

In addition to these uses, other avenues such as paper, fertiliser, and beverage production are practised worldwide as means of diversifying revenue streams for sugar mills. Products such as packaged drinking water, dry yeast, bottled CO_2, fly ash, and fly ash bricks, organic fertilisers, bagasse briquettes and pellets, and bottled biogas can also be explored based on market conditions. Lessons learned and best practices from sugar mills in Africa and other leading sugar-producing regions can provide valuable insights for replication in SADC. Figure 11 presents examples of value-added products from the sugar value chain.



CHP: combined heat and power plant; VAP: value added products

Figure 11. Potential for product diversification in the sugar sector

7.1 Cogeneration and Clean Energy Supply

Total potential of cogeneration power plants in sugar mills (excluding Mauritius)	Installed cogeneration power plants in sugar mills (excluding Mauritius)	Percentage utilisation
1,124 MW	546 MW	49 %

Note: *Mauritius is excluded, as its cogeneration plants operate with coal co-firing units.*

The following are common scenarios in sugar mills regarding the utilisation of excess bagasse and electricity:

- Excess bagasse is either used as mulch in sugarcane fields, sold in the market, or supplied to other sugar mills.
- In the absence of a reliable grid network, cogeneration plants often supply electricity to staff quarters, irrigation systems, and nearby communities associated with the mills, by operating at full capacity and using all available bagasse.
- Cogeneration power plants are operated below capacity due to the lack of power export infrastructure and supportive policies or tariff structures.

The SAPP regional grid is majorly coal-based, underscoring the need to increase the RE share in the energy mix. Bagasse-based cogeneration can play a key role in this regard. Even in countries like Zambia and Malawi, where national grid coverage is limited, sugar mills offer opportunities for minigrid power supply to surrounding communities.

However, a key challenge is that the operation of sugar mills—and thus their cogeneration plants—is seasonal. Power is generated only during the milling period. Effective bagasse management to address the deficit during non-operational period could drastically improve the reliability of cogeneration facilities. Additionally, the use of alternative biomass feedstocks during non-milling periods could be explored. Table 14 summarises existing cogeneration power plants capacity and the estimated potential based on bagasse generation at country level in the SADC region.

Table 14. Bagasse-based cogeneration potential

No.	Country	Cogeneration capacity (MW)			Excess supply to grid (GWh/year)	
		Potential	Existing	%	Potential	Existing
1	Angola	41	40	97	184	8
2	DR Congo	26	Not available	-	113	-
3	Eswatini	156	107	69	690	60
4	Madagascar	15	Not available	-	66	No export
5	Malawi	52	18	35	228	No export
6	Mauritius	85	201[47]	NA	375	All generation
7	Mozambique	91	15	17	402	Limited
8	South Africa	461	177	38	2,046	No export
9	Tanzania	94	59	62	418	Limited
10	Zambia	82	46	56	365	Limited
11	Zimbabwe	106	84	79	470	80
Total		**1,209**	**747**	**57**	**5357**	-
Total excluding Mauritius		**1,124**	**546**	**49**	**4,982**	-

[47] In Mauritius, the existing cogeneration capacity exceeds the potential due to the co-firing of coal and other biomass.

7.2 Bioethanol Generation

Total potential for bioethanol in sugar mills	Current ethanol generation in sugar mills	Percentage utilisation
682 million litres/year	195 million litres/year	29 %

The prevailing status of the SADC sugar sector has significant potential to promote ethanol. Despite the existence of biofuel policies and the growing ethanol cooking market in the region, there is little promotion of ethanol production. Strong Government commitment is required to create sufficient market demand for bioethanol (whether for cooking or transport) to give sugar mills the confidence to invest in ethanol distilleries. A comprehensive assessment of the ethanol market, accounting for all stakeholders, would help address these challenges, thereby promoting ethanol in a more sustainable way. The bioethanol potential within the sugar sector in the SADC region is presented in Table 15.

Table 15. Bioethanol potential of the SADC sugar sector

No.	Country	Ethanol generation (million litres/year)			Potential revenue generation (million $/year) @ $ 1.1048 per litre
		Potential	Existing	%	
1	Angola	23	17	74	25
2	DR Congo	14	4	29	16
3	Eswatini	88	35	40	97
4	Madagascar	8	-	-	9
5	Malawi	29	18	67	32

[48] Based on bioethanol price in the Zimbabwe market (https://equityaxis.net/post/18321/2025/3/zimbabwecommands-highest-fuel-price-in-sadc-top-4-in-africa).

No.	Country	Ethanol generation (million litres/year)			Potential revenue generation (million $/year) @ $ 1.1048 per litre
		Potential	Existing	%	
6	Mauritius	48	24	50	53
7	Mozambique	51	-	-	56
8	South Africa	261	55	21	287
9	Tanzania	53	12	23	58
10	Zambia	47	-	-	52
11	Zimbabwe	60	30	50	66
Total		**682**	**195**	**29%**	**751**

7.3 Biogas Generation

Wastewater from sugar processing and vinasse from ethanol production can be treated using anaerobic digesters to produce biogas. A vinasse-based biogas facility can help sugar mills or ethanol distilleries achieve Zero Liquid Discharge (ZLD) and ensure compliance with environmental safeguards. Due to its high Biological Oxygen Demand (BOD) (35,000–50,000 mg/L) and Chemical Oxygen Demand (COD) (100,000-150,000 mg/L), vinasse can become a potential contaminant to the environment if not properly managed.[49]

For estimation purposes, it is assumed that biogas is generated solely from vinasse, the by-product of bioethanol production. Biogas from the wastewater treatment of sugar mills is not considered. Table 16 presents the estimated biogas generation potential from vinasse management.

[49] Techno-economic analysis of reactor types and biogas utilization schemes in thermophilic anaerobic digestion of sugarcane vinasse, Purwanta, Ardian Indra Bayu, Melly Mellyanawaty, Arief Budiman, and Wiratni Budhijanto, December 2022.

Table 16. Biogas generation potential of the SADC sugar sector

No.	Country	Vinasse production (million litres/year)	Biogas generation (million m3/year)
1	Angola	281	4.21
2	DR Congo	173	2.59
3	Eswatini	1,056	15.84
4	Madagascar	101	1.52
5	Malawi	349	5.24
6	Mauritius	574	8.61
7	Mozambique	616	9.23
8	South Africa	3,131	46.97
9	Tanzania	639	9.59
10	Zambia	559	8.38
11	Zimbabwe	719	10.78
Total		**8,198**	**122.96**

The biogas generated can be used for electricity generation in gas engines, for process heating in ethanol plants or other industries, and for cooking in nearby households. This approach is already being practiced by Press Cane in Malawi. Market reviews indicate that heavy fuel oil is the most commonly used heating fuel in SADC industries. For the purposes of this report, it is assumed that biogas can replace heavy fuel oil in industrial and commercial heating applications.

8. INSTITUTIONAL ARRANGEMENT AND REGIONAL COOPERATION

Similar to the sugar sector in other countries and global markets, the sugar market in SADC is highly regulated by both domestic and regional trade policies. Sugarcane cultivation, land use, irrigation, and related activities are governed by the Ministry of Agriculture, while sugar production and sales fall under the remit of the Ministry of Commerce, Industry, or Trade. Dedicated sugar authorities have been established in a few countries, namely:

- Mauritius Cane Industry Authority (MCIA)
- Sugar Board of Tanzania (SBT)
- Instituto do Açúcar e do Álcool (IAA), Mozambique
- Instituto Nacional do Açúcar e Derivados (INADEC), Angola

Table 17 presents a summary of the key stakeholders in the SADC sugar sector.

Table 17. Key institutional agencies in the SADC sugar sector

Country	Government Ministries	Associations/related agencies
Angola	• Ministry of Agriculture and Rural Development • Ministry of Industry and Trade • Instituto Nacional do Açúcare Derivados (INADEC)	-
DR Congo	• Ministry of Agriculture • Ministry of Trade, Supply and Consumption	-
Eswatini	• Ministry of Agriculture • Ministry of Commerce, Industry and Trade	• Eswatini Sugar Association • Eswatini Cane Growers Association
Madagascar	• Ministry of Agriculture, Livestock and Fisheries • Ministry of Industry, Trade and Handicrafts • Malagasy Cane and Sugar Centre (CMCS)	-
Malawi	• Ministry of Agriculture • Ministry of Trade and Industry	• Sugarcane Growers Association of Malawi
Mauritius	• Ministry of Agro-Industry, Food Security, Blue Economy and Fisheries • Ministry of Industry, Small and Medium Enterprises and Cooperatives • Mauritius Cane Industry Authority	• Mauritius Sugar Syndicate • Mauritius Sugar Industry Research Institute

Country	Government Ministries	Associations/related agencies
Mozambique	• Ministry of Agriculture and Rural Development • Ministry of Trade and Industry • Instituto do Açúcar e do Álcool (IAA) • National Sugar Distributor (Distribuidora Nacional do Açúcar – DNA)	• Association of Sugar Producers of Mozambique
South Africa	• Department of Agriculture, Land Reform and Rural Development • Department of Trade, Industry and Competition	• South African Sugar Association • South African Cane Growers Association • South African Sugar Millers' Association • South African Sugar Technologists' Association • Sugar Milling Research Institute • South African Sugarcane Research Institute
Tanzania	• Ministry of Agriculture • Ministry of Industry, Trade, and Investment • Sugar Board of Tanzania (SBT)	• Tanzania Society of Sugarcane Technologists
Zambia	• Ministry of Agriculture • Ministry of Commerce, Trade and Industry	-
Zimbabwe	• Ministry of Lands, Agriculture, Fisheries, Water and Rural Resettlement • Ministry of Industry and Commerce	• Zimbabwe Sugar Association • Zimbabwe Sugarcane Development Association • Commercial Sugarcane Farmers Association of Zimbabwe

Within SADC, different forums exist to facilitate cross-border cooperation and trade in sugar. SADC has established a "Sugar Agreement" to enhance and regulate sugar trade among its Member States, with key aspects including:

- Acknowledging the volatility of the global sugar market and aiming to protect SADC sugar producers from artificially low prices caused by global market distortions.
- Allowing duty-free access for sugar-producing Member States to the markets of the South African Customs Union (SACU) (Botswana, Eswatini, Lesotho, Namibia, and South Africa).
- Offering preferential treatment to support sugar producers in developing competitive industries within their own countries.

Some of the key forums available in the SADC region include:

a. Under the SADC Secretariat, there is a dedicated **Technical Committee on Sugar (TCS)**. This committee includes two working groups—a technical working group and a trade policy working group. The groups meet three times a year and include representatives from both Government and the sugar industry.

b. The **Federation of SADC Sugar Producers (FSSP)** was established in 2000. It meets annually alongside the SADC Technical Committee on Sugar to discuss common interests, such as trade policy, market protocols, and best practice guidelines.

c. SADC sugar producers also have their own **Sugar Producers Consultative Forum (SPCF)**. The SPCF meets prior to TCS and working group meetings. The forum's secretary is the International Affairs Manager at the South African Sugar Association (SASA), while the chairman is the Chief Executive Officer of the Eswatini Sugar Association (ESA).



9. EXPECTED DEMAND AND ONGOING INITIATIVES

The sugar sector makes a significant contribution to the GDP and economy of several SADC countries. Under the Paris Agreement, Angola and Mauritius have explicitly mentioned the sugar sector as part of their mitigation and adaption measures in their NDCs. With respect to clean cooking targets, several SADC countries are still lagging, and clean cooking has been incorporated as a mitigation measure in their NDC commitments. Similarly, ethanol blending in the transport sector is mentioned in the NDCs of Eswatini and Malawi. Table 18 summarises these climate commitments under the NDCs for SADC countries (as of June 2025).

Collectively, SADC countries contribute approximately 639 million tCO2 annually to global GHG emissions.[50] South Africa has the highest contribution (59 per cent). The key sources of GHG emissions in the region are coal-fired power plants, land-use change, loss of forests due to agricultural practices, and the use of traditional cooking fuels by the communities.

[50] Evaluating institutional climate finance barriers in selected SADC countries, Kamleshan Pillay, Shanice Mohanlal, Blaise Dobson, Bhim Adhikari, Climate risk management, 2025.

Table 18. SADC countries and relevant NDC commitments

Country	Specific sectors mentioned in the country's latest NDC		
	Sugar sector	Clean cooking	Ethanol blending
Angola	✓	✗	✗
Botswana	✗	✗	✗
Comoros	✗	✓	✗
DR Congo	✗	✓	✗
Eswatini	✗	✓	✓
Lesotho	✗	✓	✗
Madagascar	✗	✓	✗
Malawi	✗	✓	✓
Mauritius	✓	✗	✗
Mozambique	✗	✓	✗
Namibia	✗	✓	✗
Seychelles	✗	✗	✗
South Africa	✗	✗	✗
Tanzania	✗	✓	✗
Zambia	✗	✗	✗
Zimbabwe	✗	✗	✗

9.1 Expanding Sugar Production

Historically, sugar consumption in SADC has grown at an average rate of 2 to 3 per cent per year. Assuming a continued growth rate of 3 per cent, sugar production would need to reach 7 million tons/year by 2035, up from the current 5 million tons/year.

At the regional level, the SADC Industrialization Strategy and Roadmap (2015–2063) prioritises agroprocessing, including the sugar value chain. For sugar-surplus countries, strategies are focussed on sustainable farming, modernisation of sugar processing, and diversification within the sugar value chain. For example, South Africa's Sugar Industry Value Chain Master Plan 2030 aims to revitalise the sugar sector through domestic market protection, out-grower support, and value chain diversification. The SASA has developed a local standard called SUSFarms, which introduces principles of sustainability and an appropriate protocol for improved agricultural practices. The sector is also working closely with the World Wildlife Fund for Nature (WWF) to integrate internationally recognised standards, such as Bonsucro. In Malawi, The Green Belt Initiative is underway to expand sugarcane cultivation areas.

For sugar-deficient countries, strategies are focussed on expanding production capacity to achieve selfsufficiency, mobilising public and private sector finance, and diversifying the sugar value chain. For example, Illovo Sugar is planning to double the capacity of its Kilombero sugar mill in Tanzania through new milling units and expansion of the cultivation area.

Overall, initiatives in the SADC sugar sector are centred on:

- Expanding irrigation to reduce climate risk.
- Supporting smallholders through out-grower schemes.
- Modernising mills to improve processing efficiency.
- Promoting public-private partnerships for large-scale projects.
- Enhancing regional cooperation on sugar pricing, quality standards, and exports.

9.2 Electricity Generation

In South Africa, RE generation, including biomass-based power, is promoted under the Integrated Resource Plan (IRP) and the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). These plans include provisions for sugarcane cogeneration. However, sugar mills have not participated, citing lower tariff offers. The sugar industry is still exploring opportunities with the national grid utility and relevant ministries to secure participation under these programmes.

In Malawi, Illovo has implemented demand-shifting initiatives, reducing its draw from the national grid by about 4 MW during peak periods by scheduling irrigation and operations in off-peak hours, in coordination with ESCOM (the national utility). Further, Illovo has announced

plans for a hybrid cogeneration system—combining photovoltaics (solar), coal, and biogas—to reach a total capacity of over 40 MW, with surplus electricity exported to the grid. According to the Illovo Sugar Malawi Plc Annual Report (2023), a $106 million project is in progress to install two generators—17 MW at Dwangwa and 35 MW at Nchalo—to enhance power generation and enable exports to the national grid.

In Zambia, the Kafue sugar mill is implementing a $70 million project to produce 40 MW of electricity from biomass energy as part of the Supporting Preparedness for Article Six Cooperation (SPARC) initiative, backed by the Swedish Energy Agency in collaboration with the Zambian Government.[51]

These initiatives show that there is an increasing awareness among sugar mills of the need to improve energy efficiency and export surplus power to the grid. However, success depends largely on the individual country's grid infrastructure, the location of sugar mills, national electricity generation policies, tariff structures, and other enabling conditions based on country priorities.

9.3 Scaling-Up Bioethanol Production

The demand for bioethanol is rising, driven by its diverse applications across multiple sectors, including alcoholic beverages, chemicals, pharmaceuticals, clean cooking, and ethanol blending in transport fuels. Table 19 presents the clean cooking targets set by individual countries in the SADC region.

Table 19. SADC countries' clean cooking targets

Country	Clean cooking targets
Angola	Reach over 2 million people with clean cooking solutions by 2030 by Eni[52]
Botswana	No official targets recorded
Comoros	No official targets recorded

[51] https://www.openzambia.com/lifestyle/2024/8/25/kafue-sugar-company-set-to-generate-40mw-from-biomass.

[52] Eni, an Italian multinational energy company, launched its Clean Cooking Program in Angola (2022) through its subsidiary Eni Natural Energies, under an agreement with the Government.

Country	Clean cooking targets
DR Congo	Accelerate the rate of access to clean cooking at 5% per year, or 30% access by 2030
Eswatini	Achieve 100% access to clean modern energy for cooking at household-level by 2030
Lesotho	Disseminate efficient stoves to reach a penetration rate of 30% in 2030
Madagascar	Achieve 50% access to improved and clean cooking technologies by 2030
Malawi	Achieve 75% access to clean cooking by 2030
Mauritius	No clean cooking targets have been published, given that the country has achieved 99% access
Mozambique	Reach 50% access to clean cooking by 2030[53]
Namibia	No official targets recorded
Seychelles	No clean cooking targets have been published, given that the country has achieved 100% access
South Africa	Reach 100% access to clean cooking by 2030
Tanzania	Achieve 75% access by 2030 and 80% access by 2034
Zambia	Increase access to clean cooking solutions from 8.9% to 40% by 2030, with an expected annual increase of 7%
Zimbabwe	Achieve 70% clean cooking access by 2030

53 https://www.zitamar.com/nampula-struggles-to-deliver-mozambiques-ambitions-for-cooking-with-gas/.

Box 2. Need for Clean Cooking Investments in Africa

Although African countries have actively promoted access to improved and clean cooking practices, the rate of adoption remains low. The annual average increase in access in Sub-Saharan Africa is only around 1 per cent compared to 4 per cent in Asian countries. This growth is slower than the population increase in the region, meaning there will be around 980 million people without access to clean cooking by 2030. As per International Energy Agency (IEA) estimates, more than $8 billion is needed annually to achieve clean cooking targets, with almost half of this ($4 billion per year) needed for Sub-Saharan Africa alone. In a 100 per cent clean cooking access scenario by 2030, developed by the IEA, biogas and ethanol together are expected to meet the cooking needs of nearly 20 per cent of the population.

Source: A Vision for Clean Cooking Access for All, IEA, 2023.

Based on the bioethanol blending demand (calculated at the current gasoline consumption rate) and the clean cooking access targets of SADC countries, the total bioethanol demand has been estimated. The results are summarised in Table 20. For bioethanol blending, the demand is estimated to meet the blending target in respective countries. For bioethanol used in cooking, it is assumed that approximately 5 per cent of the clean cooking access target in each country will be met through ethanol-based cooking systems. The model estimates that around 2 million households across the region could be supported by ethanol-based cooking systems.

Table 20. Expected bioethanol demand in SADC[54]

Country	Bioethanol blending targets (%)	Target bioethanol for blending (litres/year)	Target households using ethanol for clean cooking (number)	Targeted bioethanol for cooking (litres/year)	Total expected bioethanol demand (litres/year)
Angola	10%	158,190,769	0	0	158,190,769
Botswana	-	0	0	0	0
Comoros	-	0	0	0	0
DR Congo	-	0	288,000	79,200,000	79,200,000

[54] Projected demand after 10 years, assuming full achievement of blending and cooking targets.

Country	Bioethanol blending targets (%)	Target bioethanol for blending (litres/year)	Target households using ethanol for clean cooking (number)	Targeted bioethanol for cooking (litres/year)	Total expected bioethanol demand (litres/year)
Eswatini	10% by 2030	16,248,502	11,995	3,298,625	19,547,127
Lesotho	-	0	0	0	0
Madagascar	-	0	132,500	36,437,500	36,433,500
Malawi	20% by 2040	69,462,344	153,750	42,281,250	111,743,594
Mauritius	-	0	0	4,959,034	4,959,034
Mozambique	10%	50,486,416	172,500	47,437,500	97,923,916
Namibia	-	0	14,773	3,818,691	3,818,691
Seychelles	-	0	0	378,826	378,826
South Africa	2-10%	888,386,822	885,000	243,375,000	1,131,761,822
Tanzania	-	0	446,250	122,718,750	122,718,750
Zambia	10%	59,423,091	70,000	19,250,000	78,673,091
Zimbabwe	20% by 2030	126,390,130	133,000	36,575,000	162,965,130
Total		**1,368,588,073**	**2,292,995**	**630,573,625**	**1,999,161,698**

The estimation shows that around 2 billion litres of ethanol will be required per year by SADC countries to meet their bioethanol demand—70 per cent for blending and 30 per cent for clean cooking. The overall production potential from sugar mills is around 682 million litres, which could cover 34 per cent of the expected total demand. This highlights the potential for bioethanol production scale-up in the region.

In February 2022, the Government of Mozambique signed an agreement with Eni to develop biofuel production projects. Angola

is also planning to increase its biofuel industry, and the Government expects to produce biofuels for both domestic use and export before 2030. Biocom sugar mill in Angola plans to produce 30 million litres of ethanol per year. Meanwhile, Malawi has already implemented an E20 fuel blend, with all ethanol supplied by a single producer, EthCo (a Malawian company).[55]

Box 3. Council on Ethanol Clean Cooking

The Council on Ethanol Clean Cooking (CECC) was officially launched at the Conference of Parties (COP) 27 in 2022, with support from UNIDO. The CECC engages with developing countries on the use of ethanol for clean cooking to raise awareness, strengthen capacities, enhance ambition, facilitate technology transfer, and support progress towards SDG 7 and NDC commitments. The CECC provides its members with a platform for experience sharing and networking. Currently, there are 23 members in the CECC, including five from SADC: Botswana, DR Congo, Eswatini, Madagascar, and Malawi.

SACREEE (SADC Centre for Renewable Energy and Energy Efficiency), established with UNIDO's assistance, promotes bioethanol adoption by coordinating research, financing, and policy alignment. The Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) of SADC recommends regional harmonisation of biofuels policies and regulations. According to the action plan, the key challenges in the biofuel sector include:

- Lack of infrastructure for blending and distribution.
- Policy and regulatory inconsistencies.
- Competition with food crops and land use.
- Price volatility and investment risks.

Box 4. UNIDO's Initiatives in Tanzania, Madagascar, and DR Congo

Tanzania ethanol-based clean cooking programme: Through funding from the Global Environment Facility (GEF), UNIDO has rolled out the ethanol cookstoves programme to distribute at least 500,000 stoves in the country. If fully implemented, this initiative would generate demand for around 138 million litres of bioethanol per year. A draft standard for ethanol cookstoves has been developed and is currently under review by the Tanzania Bureau of Standards (TBS).

Madagascar semi-industrial sugar processing project: The EU-funded UNIDO project was implemented between 2013 and 2022. It carried out detailed studies on different sugar value chains and their business potential, identified potential cultivation zones, and aimed to establish semi-industrial processing units for sugar, rum, and ethanol production. To date, the project has developed two semi-industrial units at Antanamifafy and Mahatalaky. It has also provided capacity building and skill development training for farmers and entrepreneurs, as well as support in market and business development.

[55] Emerging-Markets-Policy-Brief-pb2_v06.

DR Congo bioethanol production unit for medical use:[56] UNIDO, in partnership with the Panzi Foundation, inaugurated the first bioethanol production unit for medical use in eastern DR Congo, empowering 300 vulnerable women. Funded by the Government of Japan, the project is being implemented in collaboration with the Government of DRC, the Panzi Foundation, the University of Tokyo, and the Japanese NGO RITA-Congo. The bioethanol production unit is projected to process approximately 196 tons of sugarcanes annually, producing more than 13,500 litres of 96 per cent bioethanol and around 37,000 litres of 70 per cent bioethanol.

Table 21 summarises the estimated contribution of the sugar sector to key sustainable development sectors in the SADC region.

Table 21. SADC sugar sector contribution to clean energy

Electricity	Transport	Clean cooking
Total installed capacity in SAPP	Total gasoline consumption	Total clean cooking households targeted
83,000 MW	16,660 million litres/year	81 million
Sugar cogeneration potential	Sugar bioethanol potential	Potential bioethanol support from sugar sector
1,109 MW	682 million litres/year	2.47 million
Estimated contribution	Estimated contribution	Estimated contribution
1.35%	4.10%	3.05%

Note: *The estimations assume 100% utilisation of available resources, without accounting for any cross-contribution or alternative use, and irrespective of blending and cooking targets.*

[56] https://www.unido.org/news/unido-and-panzi-foundation-inaugurated-first-bioethanol-production-unit-medical-use-eastern-drc.

Bioethanol from South Africa is granted duty-free access to the EU for up to 80,000 tons under the EPA. Exports of South African bioethanol must meet EU requirements under the RED II (Renewable Energy Directive) and the Fuel Quality Directive (FQD). These regulations address sustainability and require that the biofuel's GHG emissions are at least 50 per cent lower than those of fossil fuels. Indirect land use change (ILUC) requirements specify that land used for biofuel production must not have been cleared from forests, wetlands, or areas of previously high carbon stock, nor converted from a high biodiversity state. There are a number of standards that can demonstrate compliance with these requirements, including Bonsucro, ISCC (International Sustainability and Carbon Certification), and RSB (Roundtable on Sustainable Biomaterials). While sugar mills in South Africa, Malawi, Mozambique, and Tanzania are working towards Bonsucro certification, no bioethanol has yet achieved successful certification. However, RSB has certified biodiesel producers (from oil-based feedstocks) in South Africa that are fully compliant with RED II for export to the EU.[57]

In Tanzania, Mkulazi Holdings Co and Tanzania Distilleries Limited are producing bioethanol. Bagamoyo Eco Energy is expected to add a 4-million-litres-per-year distillery once operational.

In Zimbabwe, Green Fuels cultivates about 9,000 ha of sugarcane solely for ethanol production, with an annual capacity to produce about 120 million litres. Green Fuels previously held a monopoly in ethanol supply for fuel blending. Recently, Triangle Sugar entered into a partnership with the National Oil Company of Zimbabwe (NOCZIM) to produce and market molasses-based bioethanol for fuel blending. Triangle Sugar ethanol production is estimated to range from 20 to 50 million litres annually.[58]

[57] SADC-EU economic partnership agreement: Opportunities for the sugar industry, SADC – EU EPA, 2018.

[58] Sugar annual report Zimbabwe, USDA, FAO, April 2021.



10. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The sugar value chain spans several sectors, including agriculture, industry, energy generation, distillation, and the transportation and distribution of end products. Most environmental concerns in the sugar sector relate to the sugarcane cultivation, with a lesser extent linked to the operations of sugar mills and ethanol distilleries.

Accordingly, this section briefly discusses the key aspects along the value chain, focusing on the environmental and social impacts of existing sugar mills and the implications of expanding cultivation areas or establishing new mills within the SADC region.

10.1 Key Environmental Concerns in the Sugar Industry

The sugarcane value chain involves resource-intensive processes, from cultivation to the processing of final products. If not properly managed, this can lead to negative impacts on the local ecological environment. The key concerns at different stages are discussed below.

a) Sugarcane Cultivation

Unsustainable cultivation practices can lead to the exploitation of water resources for irrigation, soil erosion, and loss of soil fertility. This may also lead to more and more land being converted to sugarcane farming to meet market demand, resulting in biodiversity loss. Pre-harvest burning is carried out to reduce field trash, mitigate risks posed by wildlife to labourers, and reduce manpower requirements. Post-harvest burning is used to dispose of waste trash and provide favourable conditions for ratooning. However, these practices result in high air pollution during harvesting seasons, affecting both labourers and nearby communities. Figure 12 illustrates the air pollution impacts resulting from pre-harvest burning in sugarcane fields.



Figure 12. Air pollution due to pre-harvest burning

For example, in Mozambique, all sugar mills and associated outgrowers practise pre-harvest burning. To address this issue, Mozambique has published regulations requiring farmers to use alternative methods for removing the outer leaves of the cane, such as mechanical cutting.[59]

b) Sugarcane Processing

Sugarcane processing generates large amounts of wastewater as well as other wastes and by-products. Fortunately, all by-products, such as bagasse, molasses, and press-mud, have commercial value and are utilised within sugar mills and in other processing industries across the SADC region. In general, there are minimal concerns regarding solid waste management and disposal. Most issues arise from wastewater and effluent treatment.

Energy demand in sugar mills is met mainly by using bagasse, with any surplus often accumulated or dumped on site. Improper management of bagasse disposal can lead to several environmental issues, including leachate generated during the wet season, which can contaminate groundwater resources.

c) Bioethanol Distilleries

While bioethanol blending offers clear advantages, considerations such as land use, water resources, and potential impacts on food security must be addressed. It is crucial to ensure that bioethanol production is sustainable, adheres to environmental and social safeguards, and does not compete with food production or adversely affect local communities.

A key effluent from sugarcane-based bioethanol distilleries is the dark-coloured vinasse generated from the rectification and distillation operations of ethanol. Vinasse is odorous, sulphur-rich and has a low pH. Each litre of ethanol produced generates around 15 litres of vinasse. Although vinasse has been used in ferti-irrigation, unmanaged disposal into water bodies may lead to water pollution and damage nearby ecosystems.

d) Bioethanol Storage, Handling and Transport

Pure ethanol is non-toxic and biodegradable, and if spilled, it breaks down into harmless substances. In the case of fuel ethanol, denaturants are added to render it unfit for human consumption. Therefore, the environmental impact of any spillage during handling, storage, or transport of bioethanol is considered minimal.

Effective commercial use of waste generated can help reduce the volume of waste that sugar mills need to manage or dispose of. Some approaches include:

- Trading excess bagasse to biomass-based mini-grid operators for electricity generation.

[59] https://unitransafrica.com/bittersweet-time-to-get-ready-for-the-sugar-cane-harvesting-season/ (last accessed on 25/10/2023).

- Supplying excess bagasse to ethanol distilleries for thermal energy requirements.
- Using bagasse for mulching in sugarcane fields.
- Applying press-mud as an organic fertiliser.
- Utilising vinasse to generate biogas.

SADC countries may consider introducing a "Zero liquid discharge" policy to promote the reuse and recycling of water in industries, similar to practices in India and other major developing countries.

10.2 Current Contribution of the Sugar Industry to GHG Emissions

The GHG emissions from sugar industries cover the entire sugarcane value chain, from cultivation to the production of end-products (sugar/biofuel) and waste disposal. Among all agricultural practices, the major sources of emissions arise from farming activities, including residue burning, fertiliser use, and fuel/electricity consumption. Open burning leads to CO_2 emissions, though these may not be considered due to regrowth over subsequent periods. However, non-CO_2 emissions (CH_4, CO, N_2O, and NO_X) released during biomass burning are significant and must be included in national inventories.

Fertilisers (calcium silicate slag, dolomite, nitrogen, phosphate, potash, and micronutrients) and soil conditioners (dolomite for liming) are other sources of GHG emissions. In addition, fuels and electricity consumption involved in irrigation, soil preparation, and transport are also minor emission contributors. According to Fair Trade international, the GHG emissions from sugar production in Mauritius and Eswatini are 0.36 and 0.55 kg CO_2e/kg of sugar, respectively.[60]

Using an average emission factor of 0.46 kg CO_2e/kg of sugar, the annual GHG emissions for 5.208 million tons of sugar production in SADC are approximately 2.4 million tCO_2/year.

The mitigation potential in the sector is limited because most energy consumption in sugar processing is met using biomass (bagasse), which is carbon neutral. Currently, sugar mills also import only a small amount of electricity from the grid. This results in negligible GHG emissions from grid electricity.

For reference, the GHG emissions from one litre of bioethanol can be calculated by accounting for inputs from sugarcane seed cultivation to ethanol processing, blending, and transport to ethanol cooking stoves. The total GHG emission for one litre of bioethanol is estimated at 270 gCO_2/litre.[61] But GHG emissions are highly dependent on the fuel consumed by sugar mills, cultivation practices, and by-product management. For example, when more nitrogen fertilisers are used during cane cultivation, emissions rise to 1,140 gCO_2/litre.[62]

[60] https://www.fairtrade.net/content/dam/fairtrade/global/products/sugar/Fairtrade_Climate_Action_sugarcane_factsheet_2023_eb1c80a0d8.pdf.

[61] Environmental Impact Assessment of Bioethanol Production From Sugarcane Molasses in Kenya,J. Mbothu, U. Mutwiwa, B. Eshton and L. Abubakar, 2021.

[62] Life cycle environmental performance and energy balance of ethanol production based on sugarcane molasses in Ethiopia,Gabisa E.W., Bessou C., Gheewala S.H, 2019.

10.3 Environmental Benefits of Bioethanol

Bioethanol is considered a carbon-neutral fuel, since the carbon captured from the atmosphere during sugarcane growth is released back only when the bioethanol is burned. The emitted carbon is then reabsorbed during the next sugarcane plantation cycle. Bioethanol is also biodegradable, making it less toxic in cases of spillage or mishandling.

One of the key concerns in biofuel feedstock cultivation is water and fertiliser use, which can be substantial in dedicated energy plantations. But for bioethanol derived from sugarcane, this is not the case, since the cultivation is primarily for food production, and only the by-products are used for biofuel generation. Another advantage is that all waste streams can be properly managed with minimum environmental impact, and with appropriate technology, zero liquid discharge is achievable.

The environmental benefits associated with bioethanol use are largely due to the reduced impacts compared with fossil fuel supply chains, which involve extensive raw material extraction, processing, transport, and final use. The production of petroleum fuels generates a lot of hazardous wastes, wastewater, and emissions. By replacing biomass-based cooking fuels, bioethanol also helps reduce deforestation. Unlike firewood and charcoal, burning bioethanol does not generate any particulate emissions. Reduced reliance on biomass fuels further mitigates these harmful emissions to the global environment. Additionally, blended bioethanol is expected to reduce the release of cancer-causing pollutants from the combustion of fossil fuels.

10.4 Socio-Economic Impacts of Reviving the Sugar Sector

The sugar sector in the SADC region currently employs around 146,000 permanent and seasonal workers across sugar mills and cane plantations. In addition, a significant number of farmers are also engaged as outgrowers in the sugar value chain. The expansion of cane cultivation and production in SADC strongly depends on onboarding and integrating additional farmers/outgrowers into sector expansion plans. This will require enhanced coverage of agriculture extension services provided by both governments and sugar mills, supported by networks of cooperatives.

Improved resource efficiency and capacity expansion in the sugar sector will create new green job opportunities in rural and agricultural communities. Considering the sector's impacts on related areas such as clean cooking and transport, it can contribute to several SDGs, particularly:

- SDG3: Reduce deaths and illnesses from household pollution
- SDG7: Ensure universal access to affordable, reliable, and modern energy services

- SDG9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation
- SDG13: Accelerate decarbonisation of the energy sector

The expected socio-economic benefits from the expansion of the sugar sector and the development of its value chain by 2035 are presented in Table 22.

Table 22. Summary of expected socio-economic benefits

No.	Aspect	Unit	Value	Remark
1	Expected sugar production by 2035 in SADC	Million tons/ year	7	A historic annual average growth of 3% from 2025
2	Investment to be mobilised for sugar sector development	Billion $	5.789	Expected investment to be mobilised within next 10 years
3	Expansion of cane cultivation area	Million ha	0.30	Increase from current harvested farm area at an average yield of 68.5 tons/ha
4	Job opportunities for farmers, women and youth	Number	154,000	Direct and indirect jobs created
5	Households benefitting from ethanol-based clean cooking	Number	742,000	Ethanol generation from sugar mills in SADC
6	Households served with electricity through mini-grids	Number	498,206	Assuming 2 MWh per year consumption per household

Table 23 summarises the sector- and country-wise investment requirements for the expansion of the sugar sector.

Table 23. Country-wise investment requirements for the expansion of the sugar sector

Country	For sugar mill expansion (Million $)	For cultivation area expansion (Million $)	For ethanol distilleries (Million $)	For cogeneration expansion (Million $)	Total expected investment (Million $)
Angola	153	431	6	2	592
DR Congo	171	459	11	33	674
Eswatini	201	230	0	63	493
Madagascar	118	406	9	20	553
Malawi	97	99	12	42	249
Mauritius	0	0	26	0	26
Mozambique	142	295	55	99	591
South Africa	235	381	134	369	1,119
Tanzania	234	347	44	46	670
Zambia	141	149	50	70	410
Zimbabwe	138	213	32	29	412
Total	**1,629**	**3,010**	**379**	**771**	**5,789**

More information about the modelling methods and key assumptions are provided in Annex 6.

The expected effects of reviving the sugar sector are as follows:

a) Sugarcane Farmers

Sugarcane farmers and their families will directly benefit from productivity interventions and optimised sugar sector operations. Capacity development on integrated farming and bio-fertiliser usage will further support them. Improving out-grower schemes and extension services by the Government will help increase productivity per hectare, thereby increasing farmers' profits. Streamlining sugarcane

pricing and payment systems will attract more farmers to adopt sugarcane cultivation. Climate-smart agricultural practices can reduce natural resource use and mitigate climate change impacts. Potential negative impacts include switching from other crops to sugarcane, loss of biodiversity, and increased use of pesticides, herbicides, and fertilisers.

b) Skilled Workers

There is an opportunity to develop a skilled workforce across the sugar value chain. Capacity expansion will create new job opportunities in sugar mills and other associated industries. Introduction of climate-smart agricultural practices and green harvesting will generate additional employment in the sector. In addition, ethanol distillery capacity development, as well as cookstove and ethanol dispensers manufacturing, will support employment generation and improve livelihoods for skilled workers.

However, green harvesting practices are expected to involve mechanized sugarcane collection, which may reduce job opportunities for manual labourers who are currently engaged in harvesting. This could lead to increased migration of labourers out of the sugar sector and across regions in search of sustainable livelihoods.

c) Clean Cookstove Users

Replacing traditional biofuels with bioethanol for cooking improves overall health and living standards, especially for women and children. The shift from woody biomass to ethanol as cooking fuel reduces indoor air pollution, and time saved from firewood collection is an added advantage.

d) Rural Households with Clean Electricity Access

Excess energy from the sugar sector can serve millions of households that do not have access to reliable electricity supply. This includes farmers, micro-businesses, and agro-industries that otherwise rely on diesel generators for their electricity needs. Improved electricity access can foster local economic growth in rural and remote communities.

10.5 Social Mitigation Measures

The promotion of the sugar sector and bioethanol production and use is not expected to have any critical social impacts. However, the following aspects should be considered during the implementation of project activities:

- Capacity building and job creation for local communities, rather than displacing skilled labour from other regions.
- Awareness raising and training for sugarcane farmers to avoid unsustainable cultivation practices.
- Adequate training for women and households on the safe handling and use of ethanol fuel.
- Creation of alternative livelihoods through the bioethanol supply chain or other networks for those communities affected by the replacement of charcoal-based cooking systems,

- Development of local workforce skills and capacity by experts in climate-smart agricultural practices, green harvesting, and bioethanol distillery installation, operation and maintenance to reduce dependence on international expertise.

10.6 Contribution to NDC Ambitions

The expansion and modernization of the SADC sugar sector can support enhanced climate action in the region. Table 24 presents a summary of fuel savings, emission reductions, and cost savings from the utilisation of cogeneration and bioethanol in the region. The key assumption is that 34 per cent of the total ethanol demand (for transport and cooking) in SADC is met by the sugar sector.

Table 24. Sugar sector's contributions to SADC's climate action

Aspect	Unit	Value
Sugar value chain contribution		
Electricity to SAPP	GWh/year	3,985
Electricity to mini-grids	GWh/year	996
Bioethanol: transport fuel blending	Million litres	477
Bioethanol: clean cooking	Million litres	205
Biogas for industrial heating	Million m^3/year	123
Fossil fuel reduction		
Coal savings in SAPP	Million tons/year	2
Diesel savings in mini-grids	Million litres/year	398
Gasoline savings in transport	Million litres/year	477
Kerosene savings in households	Million litres/year	205
Fuel oil savings in industrial heating	Million tons/year	0.06

Aspect	Unit	Value
GHG emissions reduction		
Electricity replaced in SAPP	Million tCO_2/year	3.42
Diesel replaced in mini-grids	Million tCO_2/year	0.65
Gasoline savings in transport	Million tCO_2/year	1.09
Kerosene savings in households	Million tCO_2/year	0.51
Fuel oil savings in industrial heating	Million tCO_2/year	0.20
Cost savings		
Cost savings on coal for power generation	Million $/year	187
Forex savings on imported diesel for power generation	Million $/year	574
Forex savings on imported gasoline for transport	Million $/year	520
Forex savings on imported kerosene for cooking	Million $/year	229
Forex savings on imported fuel oil for industrial heating	Million $/year	38

The GHG emission savings and forex savings create multiple opportunities in climate action and climate finance. Sugar mills can potentially generate carbon revenues by achieving GHG reductions in their operations, providing an additional revenue stream. For Governments, the reduction in fossil fuel imports can free up resources to support climate change adaptation measures—such as climatesmart agriculture within the sugar sector—or to strengthen other sectors of the economy vulnerable to climate risks.



11. CONCLUSION AND RECOMMENDATIONS

The SADC region contributes over 58 per cent of Africa's sugar production.[63] The sugar sector is a key industry due to its role in supporting the livelihoods of millions, fostering economic development, and enabling regional trade. SADC countries are among the top sugarcane producers globally, recognized in terms of yields and low-cost production. Although the region currently has a net sugar surplus, rising sugar consumption —growing faster than sugarcane cultivation—may reverse this trend in the coming years. The sugar industry is working together with Governments and other agencies to achieve selfsufficiency in sugar production in the region within the next 10 years. However, this target faces challenges, including land and water availability, climate change risks, market price fluctuations, and investment mobilization. Diversifying the sugar value chain presents an opportunity to strengthen the sector and build resilience.

Meanwhile, GHG emissions in SADC countries are increasing due to the rapid economic development. Meeting the GHG reduction targets outlined in individual countries' NDCs will require additional funds and technology. These countries are also falling short of achieving SDGs related to energy access, clean cooking, and transport by 2030. Population growth and heavy dependence on imported fossil fuels further hinder progress toward GHG as well as SDG targets.

The diversification of the sugar value chain can complement the efforts of SADC countries in supporting sustainable regional economic development by decarbonizing energy access, clean cooking, and transport sectors. In turn, there is potential for market expansion, access to finance, technology transfer, and other benefits for the sugar industry. This assessment found that diversification best practices are already being implemented at different scales. The greatest potential lies in the transport sector, followed by clean cooking and energy access. Creating a conducive regulatory environment, attracting international assistance/finance, and enhancing stakeholder cooperation across the region can help scale-up these efforts, creating a low-carbon pathway for SADC while ensuring a sustainable sugar value chain.

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63 Driving sustainability in the sugarcane industry: Life Cycle Assessment of conventional and emerging spraying technologies in Tanzania, Paschal Simon Milindi, Elibariki Eliushu Nsenuka, Shauhrat S. Chopra, 2024.

RECOMMENDATIONS

a) Short-term

1. Assess energy access, clean cooking, and bioethanol blending opportunities in each country, and support partnerships to boost investment, optimise pricing, and increase revenue from sugar byproducts.

2. Identify public-private-partnership (PPP) and investment opportunities for faster resource mobilization and infrastructure development.

3. Document and showcase existing sugar value chain diversification initiatives to attract international investment and climate finance, sustaining current operations and enabling future scale-up.

4. Develop a SADC sugar sector diversification roadmap and investment strategy through the SADC Secretariat.

b) Medium-term

5. Incorporate sugar value chain decarbonization initiatives into national climate action commitments, explicitly reflecting them in NDC targets under the Paris Agreement.

6. Standardize bioethanol denaturing processes and fuel-grade ethanol regulations across the SADC region to enable broader market access.

7. Establish bioethanol blending infrastructure covering all regions and locations in member countries.

8. Promote climate-smart sugar cultivation practices and environmentally friendly production and marketing of sugar and its by-products.

9. Address gaps in policy and regulatory frameworks at national and regional levels to enable wider participation in decarbonization initiatives.

c) Long-term

10. Identify and overcome barriers to achieving surplus production in sugar-deficient countries, supporting the expansion of the SADC sugar sector for global market competitiveness.

11. Improve resource efficiency in sugarcane cultivation and sugar production by modernizing the existing infrastructure and operational practices.

12. Establish dedicated sugar sector investment funds for the SADC region, connecting national and regional financial institutions with international development funding agencies to offer concessional loans to sugar companies, ethanol distilleries, cookstove manufacturers, and other associated enterprises along the sugar value chain.

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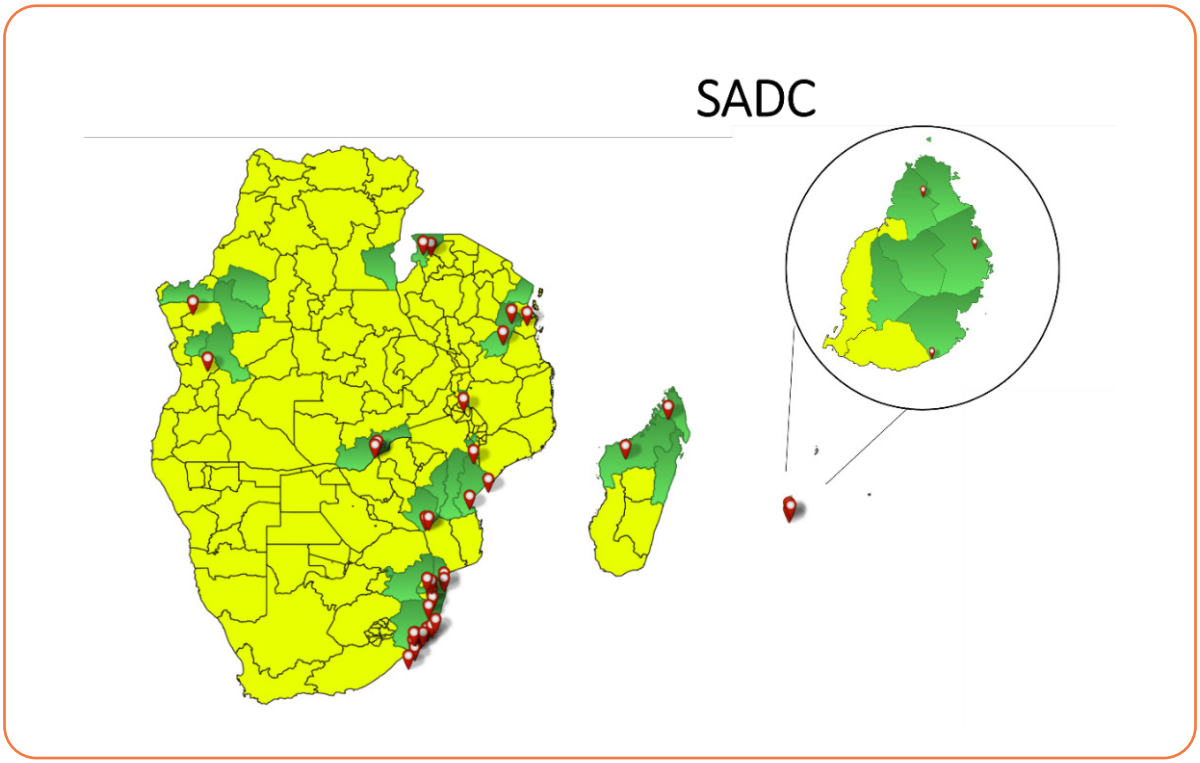
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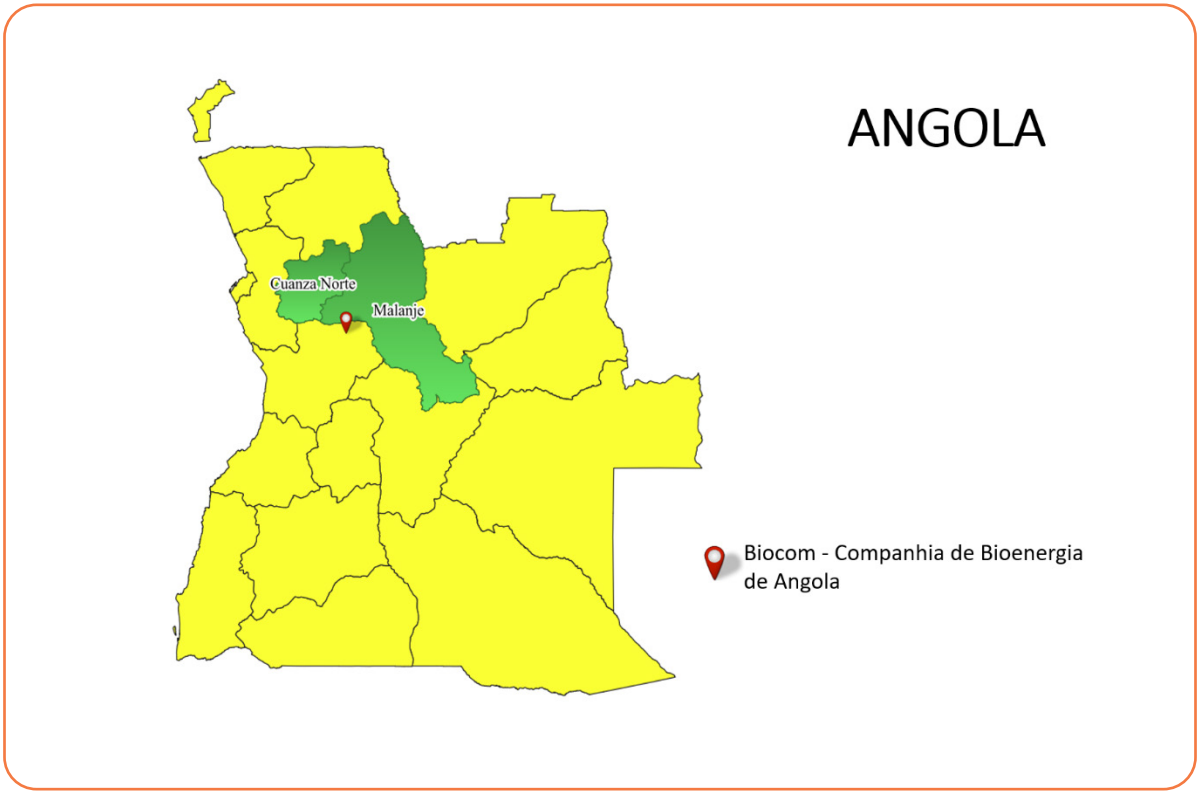
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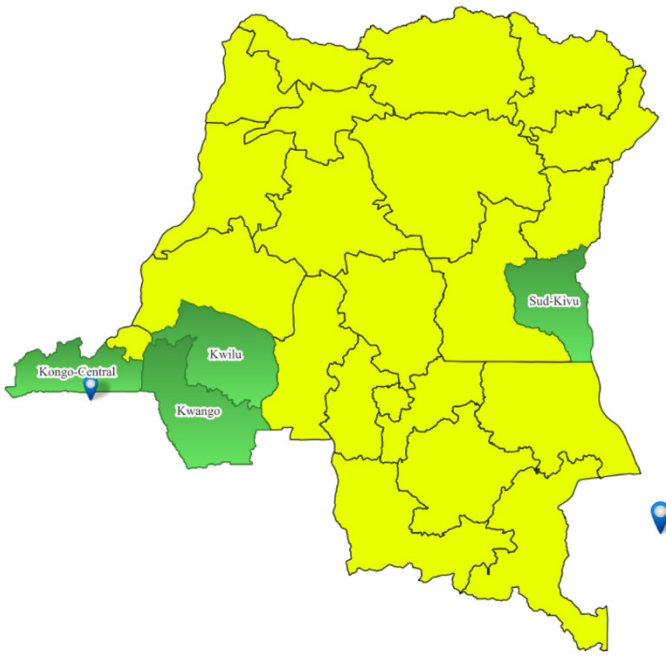
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Annex 1. Maps of SADC Countries Showing Sugar Mills and Cultivation Areas


SADC

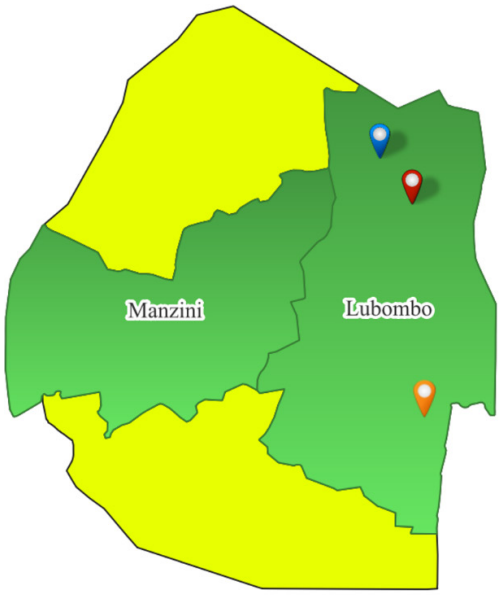

ANGOLA
Cuanza Norte
Malanje
Biocom - Companhia de Bioenergia de Angola

DR CONGO



Compagnie Sucrière Kwilu-Ngongo (CSKN)

ESWATINI



Simunye Sugar mill

Mhulme Sugar mill

Royal Eswatini Sugar Corporation

Ubombo Sugar Limited – Illovo Sugars



MADAGASCAR

Namakia

Ambilobe



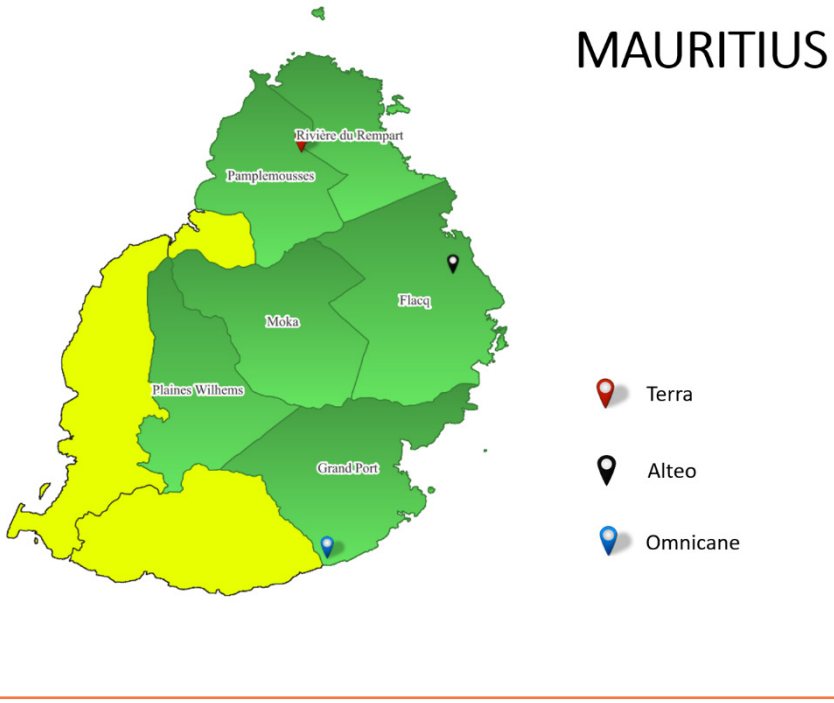
MALAWI

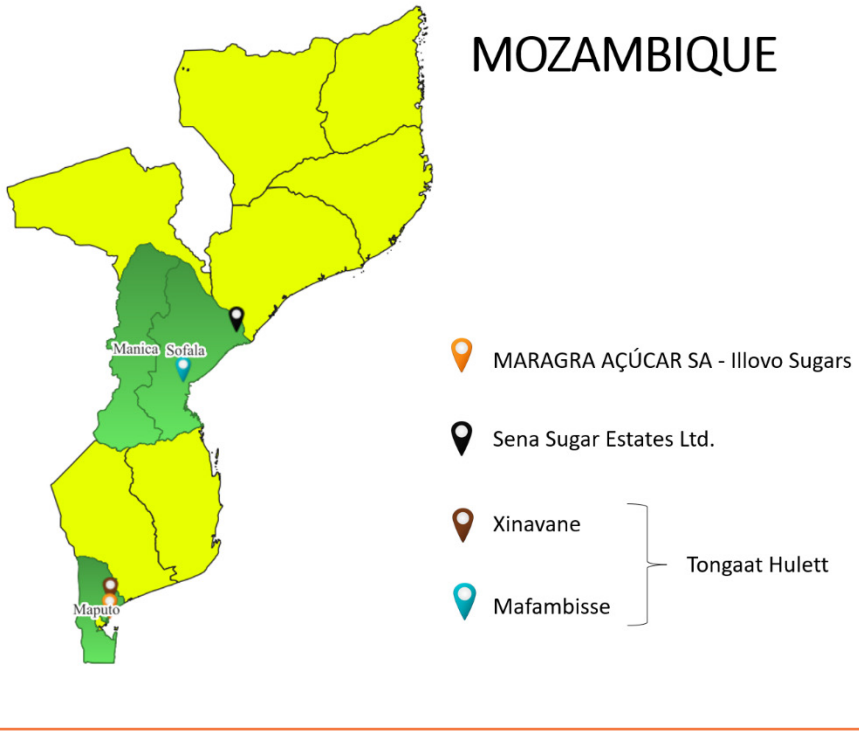
Salima sugar mill

Dwangwa sugar mill

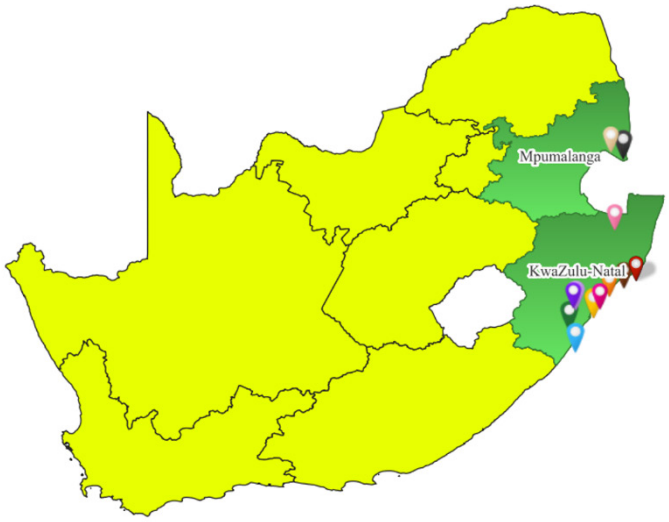
Nchalo sugar mill

Illovo Sugars


MAURITIUS
Rivière du Rempart
Pamplemousses
Flacq
Moka
Plaines Wilhems
Grand Port
Terra
Alteo
Omnicane


MOZAMBIQUE
Manica
Sofala
Maputo
MARAGRA AÇÚCAR SA - Illovo Sugars
Sena Sugar Estates Ltd.
Xinavane
Mafambisse
Tongaat Hulett

SOUTH AFRICA



- Maidstone
- Amatikulu
- Felixton

Tongaat Hulett

- Eston
- Sezela
- Noodsberg

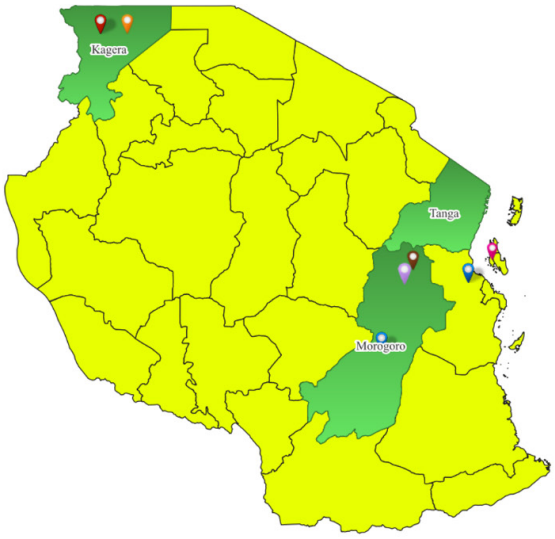
Illovo Sugars

- Komati
- Pongola
- Malelane

RCL Foods

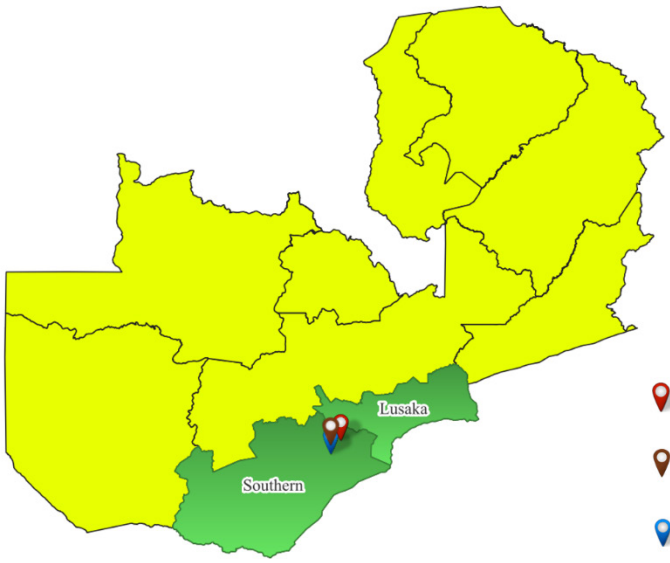
- Gledhow Sugar Company
- Umfolozi Sugar Mill Ltd.
- UCL Sugar Company

TANZANIA



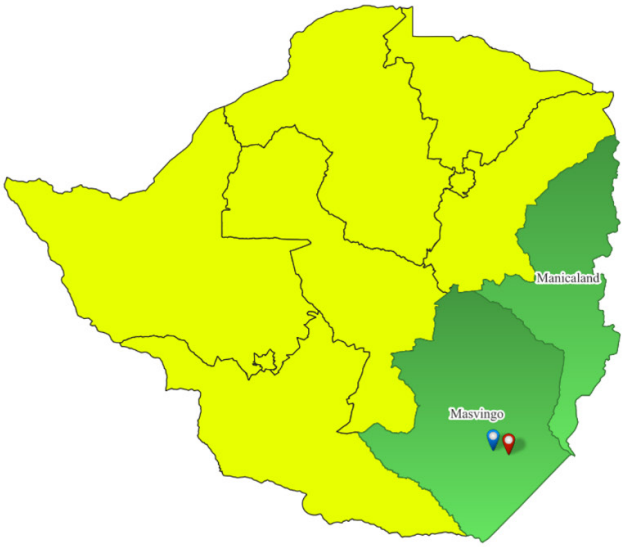
- Bagomoya Sugar mill
- Kagera Sugar Limited
- Mtibwa Sugar Estates
- Kilombero Sugar Company - Illovo Sugars
- Tanganyika Planting Company
- Mkulazi Holding company Ltd
- Zanzibar Sugar Factory Ltd.

ZAMBIA



- Zambia Sugar Plc - Illovo Sugars
- Kafue Sugar Ltd.
- Kalungwishi Kasama Sugar

ZIMBABWE



- Triangle Sugar mill
- Hippo Valley mill

Tongaat Hulett



Annex 2. Electricity Generation Sources in SADC Countries

The table summarises the share of different electricity generation sources in the national grids of SADC Member States.

Country	Coal	Oil	Natural Gas	Un-specified Fossil Fuels	Nuclear	Hydro	Solar PV	Biofuels	Wind	Solar Thermal	Total
Angola		16.2	10.9			70.4	2.5				100
Botswana	96.2	3.6					0.2				100
Comoros				100.0							100
DR Congo						99.6	0.2	0.2			100

Country	Coal	Oil	Natural Gas	Un-specified Fossil Fuels	Nuclear	Hydro	Solar PV	Biofuels	Wind	Solar Thermal	Total
Eswatini	2.7					60.5	4.2	32.6			100
Lesotho						100					100
Madagascar	19.5	46.1				31.5	2.0	0.9			100
Malawi				4.4		92.3	0.5	2.8			100
Mauritius	33.6	48.9				2.9	4.5	9.9	0.2		100
Mozambique		0.6	15.7			82.7		0.6	0.4		100
Namibia	1.4	0.1				58.7	38.2		1.6		100
Seychelles				85.7			12.7		1.6		100
South Africa	81.6	3.5			3.7	2.9	2.3	0.2	5.1	0.7	100
Tanzania		0.2	69.4			29.3	0.3	0.8			100
Zambia	11.1					87.8	0.7	0.4			100
Zimbabwe	31					67.6	0.3	1.1			100

Annex 3. Recent Policies and Strategies in the Power and Energy Sector of SADC Countries

Country	Policies/Strategies	Years
Angola	Angola Energia 2025	2018 - 2025
Botswana	National Energy Policy	2021 - 2040
	Integrated Resource Plan for Electricity for Botswana	2020 - 2040
Comoros	Country Strategy Paper	2021 - 2025
DR Congo	National Energy Compact	2025 - 2030
	Politique Nationale de l'Energie de la	2022 - 2040
Lesotho	Lesotho National Energy Policy	2015 - 2035
Eswatini	National Energy Policy	2018 - 2030
	Kingdom Of Eswatini Energy Masterplan	2034
	Energy Efficiency and Conservation Policy	2019 - 2030
Malawi	National Energy Compact	2025 - 2035
	National Electrification Strategy & Action Plan	2018 - 2030
	Integrated Energy Plan	2022 - 2030
Mauritius	Long-Term Energy Strategy	2009 - 2025
	Energy policy	2007 - 2025
	Mauritius Renewable Energy Roadmap	2030
Mozambique	National Electrification Strategy	2018 - 2030
	Programme Énergie pour tous (MEFA)	2021 - 2030
Namibia	National integrated resource plan	2022
	National Energy Policy	2017
Seychelles	Seychelles Energy Policy	2010 - 2030
South Africa	Just Energy Transition Implementation Plan	2023 - 2027
	South African Renewable Energy Masterplan (SAREM)	2025 - 2030
Tanzania	National Energy Compact	2025 - 2030
	National Energy Policy	2015
Zambia	National Energy Compact	2025 - 2030
	Renewable Energy Strategy and Action Plan	2022 - 2030
	Integrated Resource Plan for Power Sector	2021 - 2050
	National Energy Policy	2019 - 2030
Zimbabwe	National Renewable Energy Policy	2020 - 2030

Annex 4. Recent Policies and Strategies in the Clean Cooking Sector in SADC countries

Country	Policies/Strategies	Years
Botswana	National Energy Policy	2021 - 2040
Comoros	Renewable Energy & PCE 2030 Strategy	2019 - 2030
DR Congo	Compact Énergétique National	2024 - 2030
Eswatini	National Bioenergy Policy	2024
	Kingdom Of Eswatini Energy Masterplan	2034
Madagascar	Integrated Energy Access Planning	2024 - 2030
Malawi	Malawi ECooking Roadmap	2024 - 2030
	National Energy Compact	2025 - 2030
	National Charcoal Strategy	2017 - 2027
Mozambique	Mozambique Biomass Energy Strategy	2012 - 2030
South Africa	Liquefied Petroleum Gas Rollout Strategy	2022
Tanzania	National Energy Compact	2025 - 2035
	National Clean Cooking Strategy	2024 - 2034
	Biomass Energy Strategy (BEST) Tanzania	2014 - 2030
Zambia	National Energy Compact	2025 - 2035

Annex 5. Recent Policies and Strategies in the Transport Sector in SADC Countries

Country	Policies/Strategies	Years
Angola	National Development Plan	2023–2027
Comoros	Country Strategy Paper	2021-2025
	Plan Comores Émergent	2030
DR Congo	Programme d'Action du Gouvernement	2024 - 2028
Lesotho	National Transport Master Plan	2024 - 2044
Eswatini	National Development Plan	2023/24 – 2027/28
Malawi	Ministry of Transport & Public Works Strategic Plan	2023 - 2030
	The Comprehensive Medium Term Implementation Framework	2020 - 2025
	National Transport Master Plan	2017 - 2037
Mauritius	10 Year Electric Vehicle Integration Roadmap for Mauritius	2020 - 2030
Mozambique	Country Strategy Mozambique	2023 - 2027
Namibia	Sustainable Urban Transport Master Plan	2012 - 2032
South Africa	South Africa's Automotive Industry Master Plan	2035
	Electric Vehicles White Paper	2035
	Green Transport Strategy	2018 - 2035
	White Paper on National Transport Policy	2021
Zambia	National Transport Policy Implementation Plan	2019 - 2028
	Eighth National Development Plan	2022 - 2026
Zimbabwe	National Development Strategy	2021 - 2025
	National Policy Roadmap for Electric Mobility in Zimbabwe	2022 - 2035



Annex 6. Additional Information on Modelling Assumptions

In modelling the country-wise investment requirements, the SADC's total sugar production is projected to reach 7 million tons/year within the next 10 years. Priority is given to sugar-deficient countries to expand their cultivation area and production capacity. The remaining production gap is allocated to other countries based on their current share of contribution.

For cost estimation, a modern sugar factory is assumed to cost $100 million, while the minimum costs associated with the development of irrigated cane land is $10,000/ha.[64] The gap in bioethanol production and cogeneration (at current operating levels) is assumed to be 100 per cent utilised.

Note: These estimates are indicative. A more detailed country- and sugar mill-specific analysis is recommended, after studying their proposed expansion plans and potential operational constraints.

[64] SADC-EU economic partnership agreement: Opportunities for the sugar industry, SADC – EU EPA, 2018.

Country	Planned additional expansion (TCY)	Additional cultivation area (ha)	Expansion of ethanol distilleries (million litres/year)	Expansion of cogeneration plants (MW)	Investment needed for sugar mill (Million $)	Investment for cultivation area (Million $)	Investment for ethanol production (Million $)	Investment for cogeneration expansion (Million $)	Total investment (Million $)
Angola	1,680,000	43,077	6	1	153	431	6	2	592
DR Congo	1,880,000	45,854	10	26	171	459	11	33	674
Eswatini	2,205,591	22,975	0	49	201	230	0	63	493
Madagascar	1,300,000	40,625	8	15	118	406	9	20	553
Malawi	1,066,667	9,877	11	32	97	99	12	42	249
Mauritius	0	0	24		0	0	26	0	26
Mozambique	1,565,591	29,539	51	76	142	295	55	99	591
South Africa	2,589,785	38,085	125	284	235	381	134	369	1,119
Tanzania	2,570,000	34,730	41	35	234	347	44	46	670
Zambia	1,548,387	14,888	47	36	141	149	50	70	410
Zimbabwe	1,513,978	21,324	30	22	138	213	32	29	412
Total	**17,920,000**	**300,973**	**353**	**576**	**1,629**	**3,010**	**379**	**771**	**5,789**

The methods and assumptions on clean energy access and GHG mitigation are as below:

It should be noted that individual plant-level performance and capacities will vary depending on various factors. For this study, average performance numbers at the SADC level have been considered for the estimations.

Cogeneration Power Plant Potential (MW) = (4.634/1000) × TCY × 280

Where,

4.634	=	Average MW cogeneration capacity per 1,000 tons of cane crushed per day, based on analysis of sugar mills' performance in Africa
TCY	=	Installed capacity in tons of cane crushed per year in sugar mills
280	=	Average annual operating days of sugar mills in Africa

Bioethanol Generation Potential (Million litres) = (TCY × 0.03 × 312) / 1,000,000

Where,

TCY	=	Installed capacity in tons of cane crushed per year in sugar mills
0.03	=	Tons of molasses produced per ton of sugarcane crushed
312	=	Litres of bioethanol produced from 1 ton of molasses

Biogas Generation Potential (million m^3 / year) = (Bioethanol production × 12 × 1000 × 15) / 1,000,000

Where,

Bioethanol production	=	As calculated in Step 2
12	=	Litres of vinasse produced per litre of bioethanol
15	=	m^3 of biogas yield from 1 m^3 of vinasse

GHG Mitigation Potential

a) Emission reduction from kerosene avoided in clean cooking = Litres of kerosene replaced by ethanol (litres/year) × Emission Factor (EF) of kerosene (tCO_2/litre)

b) Emission reduction from gasoline avoided in transport = Litres of gasoline replaced by ethanol (litres/year) × EF of gasoline (tCO_2/litre)

c) Emission reduction from diesel avoided in power generation = Electricity supplied to mini-grids from sugar cogeneration power plants (MWh/year) × EF of diesel-based electricity generation (tCO_2/MWh)

d) Emission reduction from avoided power generation in SAPP = Electricity supplied to SAPP from sugar cogeneration power plants (MWh/year) × EF of SAPP-based electricity generation (tCO_2/MWh)

e) Emission reduction from replacing fuel oil by biogas in Industries = Energy yield from biogas (GJ) × EF of fuel oil

Where, emission factors are derived from IPCC and IEA values, considering net calorific values, density, and other relevant parameters.

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