BEFS

Bioenergy and Food Security Projects

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BOTSWANA

BEFS COUNTRY BRIEF

FAO FIAT PANIS

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1.BEFS

1.1 Bioenergy and food security

Increasing costs of fossil fuels, the threat of climate change and the need to increase energy security and access have put alternative renewable energy sources, including bioenergy, high on the development agenda. Compared with other sources of energy, bioenergy potentially offers some developmental advantages. Bioenergy can target and stimulate the agriculture sector, a critical sector for development and poverty reduction, while improving energy access, creating a new market for producers, offering new employment opportunities, and potentially contributing to environmental objectives. Nevertheless, there are concerns regarding the actual viability of the sector and its environmental and socio-economic sustainability, also in terms of potential competition with food security.

1.2 The Bioenergy and Food Security Approach

To date, the rush to develop bioenergy as an alternative to fossil fuels has tended to occur in the absence of an understanding of the associated risks and benefits. In order to assist governments in gaining a proper understanding of the issues at stake, FAO has developed the Bioenergy and Food Security (BEFS) Approach.

FAO's **Bioenergy and Food Security (BEFS) Approach** aims to assist policy-makers in assessing the interplay between natural resource availability, bioenergy production potential, rural development and food security, and in strengthening their capacity to manage the trade-offs associated with bioenergy development.

1.3 The BEFS country brief

Part of the first stage of the implementation of the BEFS Approach in a country, is to undertake a review of the agriculture, energy and food security situation at domestic level. This review provides the basis for the identification of potential bioenergy sources, and for a preliminary assessment of potential risks associated with the development of the sector.

The BEFS Approach consists of a multidisciplinary and integrated set of tools and guidance that can support countries throughout the following key steps of the bioenergy policy development and implementation process:

- **Identification of** the key **issues** surrounding **bioenergy and food security**, based on the conceptual foundation provided by the BEFS Analytical Framework, and through an **institutionalized dialogue** among relevant national stakeholders;
- **Assessment of the sustainable bioenergy potential**, based on an assessment of **land suitability** and **production costs**, and through an **analysis** of the **environmental** and **socio-economic** dimensions and implications of different bioenergy development pathways, with particular emphasis on food security;
- **Risk prevention and management**, through good environmental and socio-economic practices and related policy instruments;
- **Investment screening and appraisal** through an assessment of the viability and sustainability of proposed bioenergy investments/projects;
- **Impact monitoring, evaluation and response** at both national and project levels; and
- **Capacity building** both at **technical** and **policy** level through training on the above technical tools and guidance.

The BEFS Approach helps countries design and implement sustainable bioenergy policies and strategies, by ensuring that bioenergy development fosters both food and energy security, and that it contributes to both agricultural and rural development in a climate-smart way.

2. Country Overview

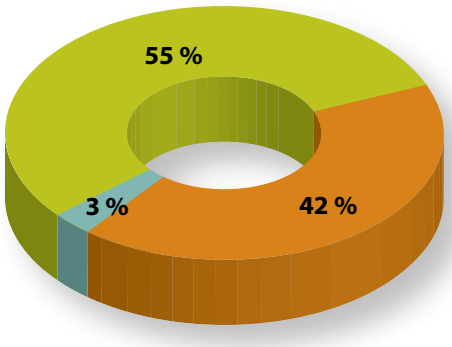
2.1 Quick facts

Botswana is a landlocked country located in Southern Africa and has a total area of 566,730 square kilometers[1]. It has a dry climate with the Kalahari desert covering about 70 percent of the country[2], and with an average annual rainfall of just over 400 mm[3]. The population in 2010 was 2,006,945 and increasing by an average of 1.3 percent per annum[1]. Of this, 39 percent lives in rural areas, down from 47.6 percent in 1999.

2.2 Economy

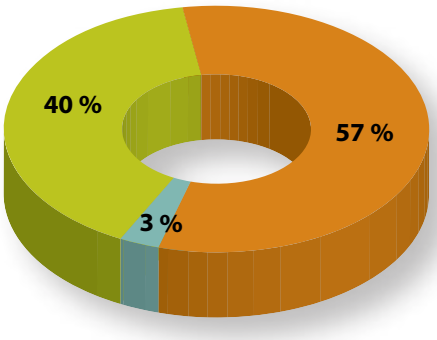
In 2009, Botswana's GDP fell by 3.7 percent. However, between 1999 and 2009 GDP per capita increased from $3,078 to $3,957 (in constant US dollars)[1]. In 2010, inflation amounted to 6.9 percent. In the same year, trade equaled over 72 percent of the gross domestic product, and foreign direct investments equaled 1.8 percent of the latter[1]. Between 1999 and 2009, the contribution of the industrial sector to the GDP decreased from 55 percent to 40 percent, while services became the most important sector, with an increase from 42 percent to 57 percent. The share of the agricultural sector remained stable at 3 percent, which is very low level compared to the rest of the region **(Figures 1,2)**.

Figure 1: Botswana GDP by Sector (1999)



Source: WDI (2010)

Figure 2: Botswana GDP by Sector (2009)



Agriculture Industry Services

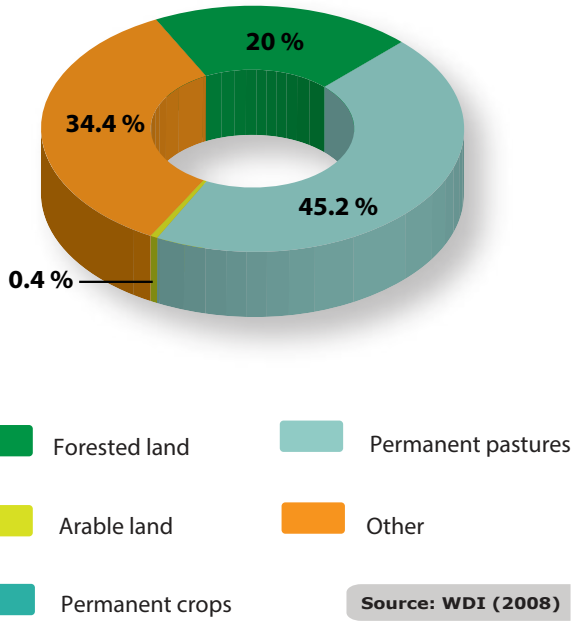
Source: WDI (2010)

3. Agriculture and Biomass

3.1 Land and water

Botswana has 258,520 square kilometers of agricultural land, or 45.6 percent of the total land area. **(Figure 3)**. Of that, less than one half percent is classified as arable land. The country has over 160 billion cubic meters of renewable water resources available, of which 1.6 percent is withdrawn annually[4]. Of the total water withdrawn each year, around 41 percent is used in the agricultural and municipal sectors[4].

Figure 3: Botswana Land Use (2008)



3.2 Agriculture and livestock

Botswana's agricultural sector employs approximately 30 percent of the total labor force[2] and contributes 3.1 percent of total exports[3]. Livestock production dominates the agricultural sector, while crop production and productivity are very low due to the agro-ecological conditions of the country[5].

Roots and tubers are the main crop produced in Botswana in terms of volume, followed by pulses and sorghum. Sugar products and maize flour are the main export crops based on value. Between 1999 and 2009, sorghum production increased by 189 percent, pulse production increased by 151 percent, and production of roots and tubers by 4 percent **(Figure 4)**.

Figure 4: Botswana Crop Production - tonnes (2009)

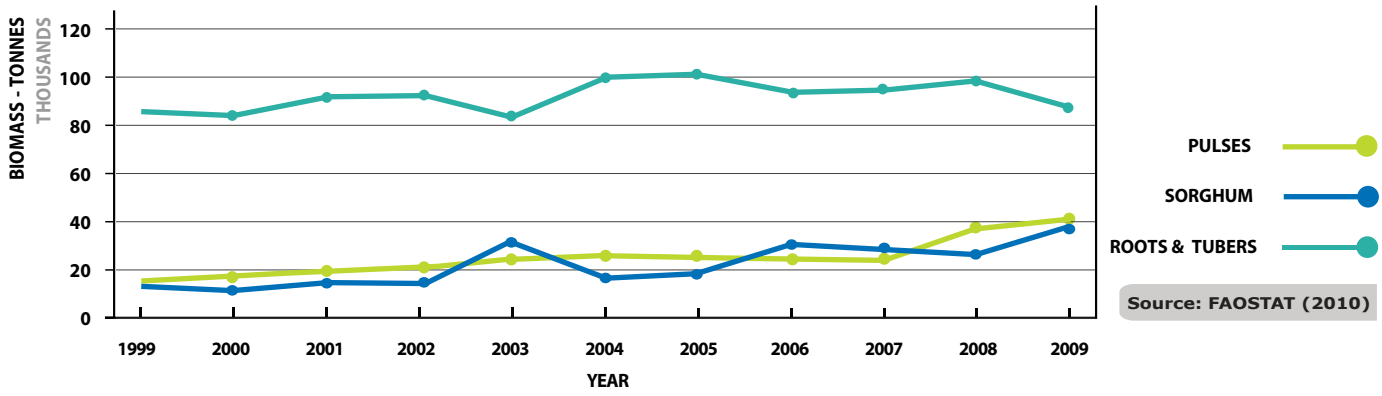
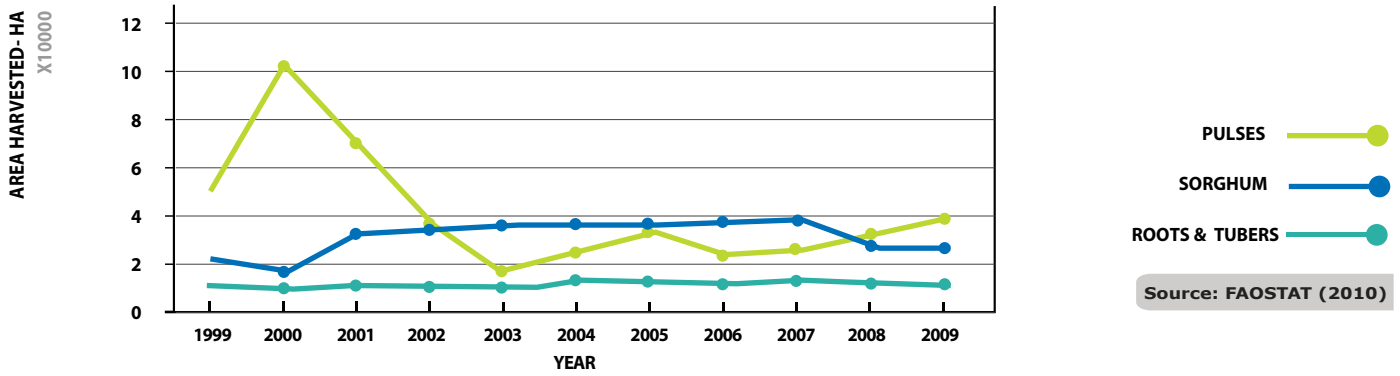
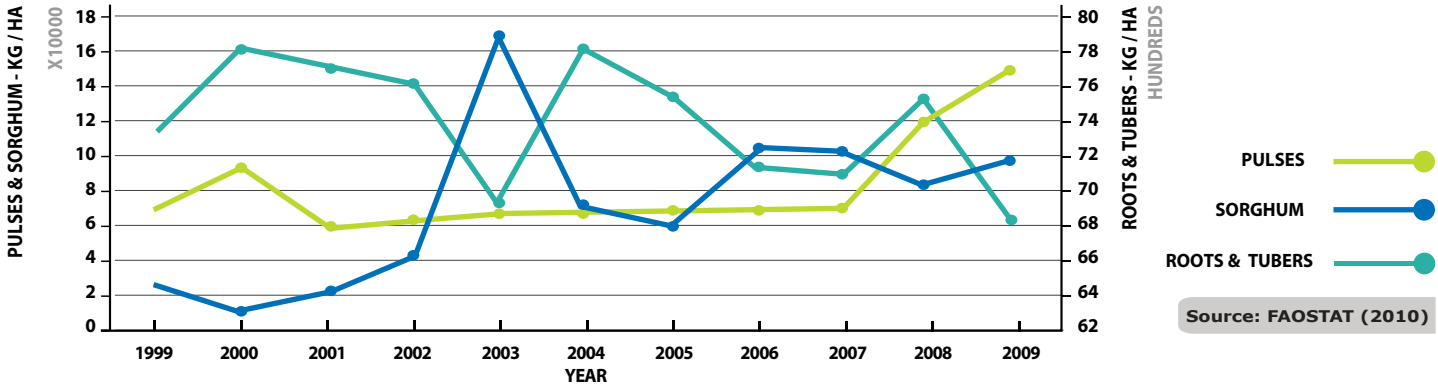


Figure 5: Botswana Area Harvested - hectares (2009)



The increase in pulse production was the result of a large increase in yields (+ 115 percent), with area harvested increasing slightly (+ 17 percent). The increase in sorghum production was entirely due to a significant improvement in yields (+ 260 percent), while the area harvested decreased by 20 percent. On the other hand, in the case of roots and tubers there was an increase in the area harvested (+13 percent) and a decrease in yields (- 8 percent) **(Figures 5,6)**.

Figure 6: Botswana Crop Yield - kilograms/hectare (2009)



A considerable share of agricultural output is wasted due to post-harvest losses **(Table 1)**. In 2009, Botswana lost 13 percent of the roots and tubers, 5 percent of the pulses, and 17 percent of the sorghum to waste.

Table 1: Botswana Crop Utilization (2009)

Commodity	Production	Domestic Consumption	Food Supply	Processing	Wastage	Feed	Seed	Other Utility
	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Root & Tubers	21 907	24 423	21 460	–	2 875	–	–	89
Pulses	2500	2 376	21 07	–	127	–	375	–
Sorghum	37 581	64 855	49 000	8 743	6 362	–	750	–

Source: FAOSTAT (2009)

As already mentioned, Botswana's agricultural sector is dominated by livestock production. Permanent pastureland accounts for just over 45 percent of total available land according to 2010 data[3]. Approximately 5 million chickens, 2.4 million cattle, 2 million goats, 330 thousand asses, and 170 thousand sheep are raised in Botswana.

3.3 Policy

In 1991, Botswana adopted the *National Policy on Agricultural Development (NPAD)*. Since then, this policy has undergone a number of revisions, with the latest version (NDAP 9) dating back to 2009[5]. NDAP 9 outlined a number of objectives, including: to increase agricultural productivity, natural resource management, and land conservation; to improve food security; to diversify the agricultural sector; to promote rural employment; and to mainstream gender and youth issues in the agricultural sector[5].

4. FOOD SECURITY

4.1 NUTRITION

In Botswana, 14 percent of children under the age of five were underweight in 2009[6]. Wheat, maize, sugar and sorghum are the top commodities in terms of average daily calorie intake. Animal products account for 14 percent of the calorie intake **(Table 2)**.

4.2 FOOD SECURITY AND FOOD PRICES

Currently, 31 percent of the population lives below the poverty line[3] and one quarter is undernourished[6]. With almost one third of the country's population living in poverty, food security is a national concern. Botswana is a net importer of wheat, maize, and sugar, which are the main staple crops in the country. In 2009, 100 percent of the wheat and sugar consumed domestically was imported, with 64.3 percent of the maize consumed also imported **(Table 3)**. Potential increases in the price of these commodities on the international market can thus affect the trade balance, as well as the welfare of net consuming households.

TABLE 2: BOTSWANA FOOD CROP CALORIC INTAKE (2009)

Ranking	Commodity	Calorie Share(%)
1	Wheat	14.4
2	Maize	13.8
3	Sugar	13.3
4	Sorghum	9.7
5	Sunflowerseed Oil	8.6
6	Root & Tubers	4.9
Subtotal Food Crop share		64.7
Animal Products Share		13.9
Total Calories (kcal/capita/day)		2 164

Source: FAOSTAT (2009)

TABLE 3: BOTSWANA NET FOOD CROP TRADE (2009)

Commodity	Production	Import	Export	Stock Variation	Domestic Consumption	Import Share of Consumption
	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	%
Wheat	0	107 166	4 972	-28 000	74 194	100
Maize	13 193	65 181	14 297	15 000	79 077	64.3
Sugar	—	82 488	652	0	81 837	100

Source: FAOSTAT (2009)

4.3 POLICY

The *Integrated Support Programme for Arable Agriculture Development (ISPAAD)* is a key programme addressing food security. The primary objectives of the ISPAAD are: to increase grain production; to promote food security at both household and national levels; to mechanize agriculture in order to increase commercialization; to facilitate access to inputs and credit for farmers; and to improve extension outreach.[5]

5. Energy and Bioenergy

5.1 Energy supply and access

Approximately 45 percent of the country has access to electricity[3], with the majority of electrified households living in urban areas. Under the current rural electrification strategy, the access rate should increase to roughly 80 percent by the year 2016[7].

Botswana is a net energy importer. In 2009, imports accounted for 54.2 of domestic energy consumption[1]. Oil products provide the largest contribution to both primary energy supply and final energy consumption, with a share of 48 percent **(Figure 7 & 8)**. Potential renewable energy options include modern bioenergy, solar energy, and hydropower[7].

Figure 7: Botswana Total Primary Energy Supply (2009)

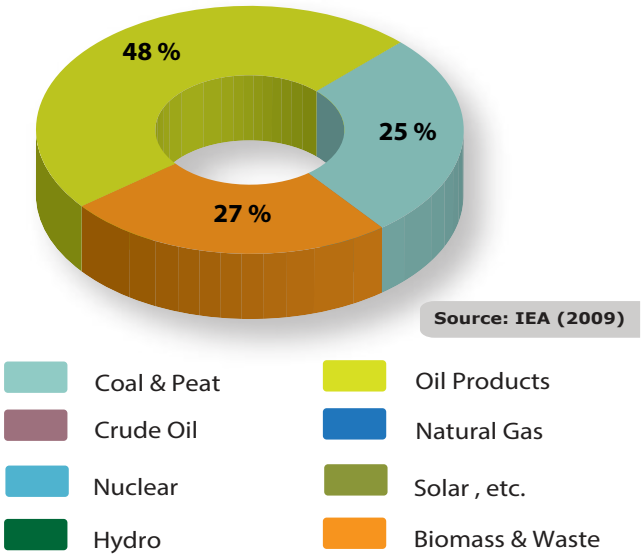
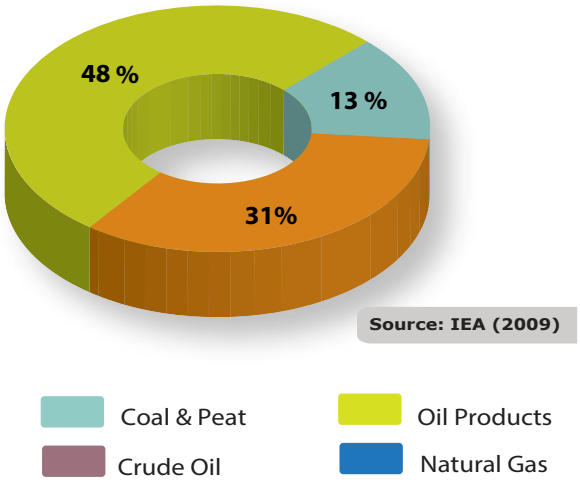


Figure 8: Botswana Total Final Consumption (2009)



The main consumer of energy in Botswana is the transport sector, accounting for around 36 percent of energy use, followed by the residential sector, with around 32 percent **(Figure 9)**.

5.2 Modern bioenergy

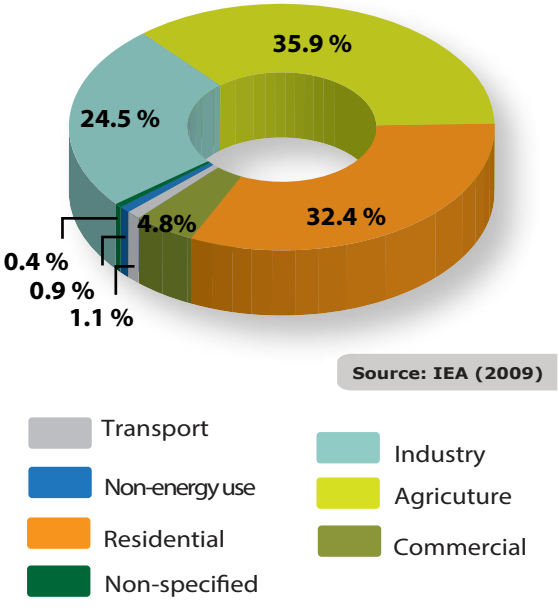
As of May 2010, there are a number of small-scale modern bioenergy facilities which produce biodiesel from used vegetable oil[9]. The country has a national biofuel development programme in place. Within this programme, ethanol production from sweet sorghum and biodiesel production from jatropha have been identified as the most suitable options for Botswana[8].

Further assessment is needed in order to adequately understand the potential role of bioenergy within Botswana's energy mix.

5.3 Policy

Botswana's *National Energy Policy* of 2009 has the overall goal of meeting the energy needs of the country for social and economic development in a sustainable manner. The objectives include securing a safe, sustainable and reliable energy supply for all sectors of the economy; providing readily available information to interested parties; increasing participation and investment in the sector by both public and private interests; providing an equitable, transparent, and consultative regulatory system that promotes efficiency and accountability; and continued research and development of alternative forms of energy[10].

Figure 9: Botswana Energy Use by Sector (2009)

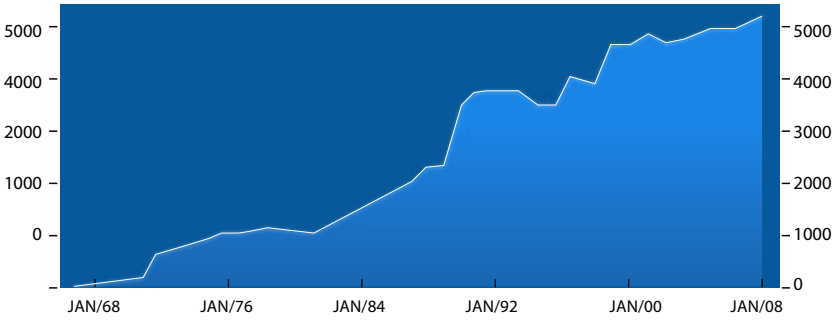


6. Environmental Concerns

6.1 Climate change

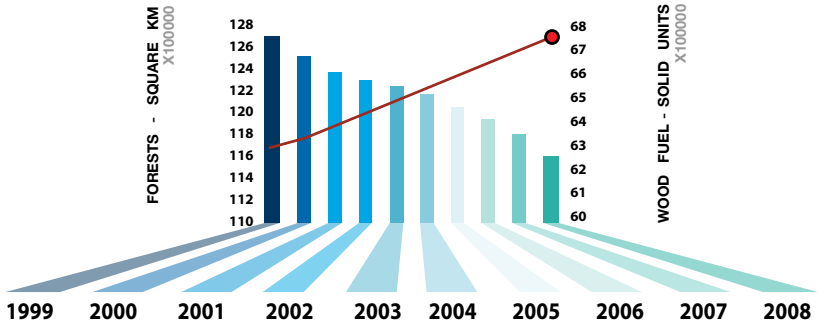
Climate change could have serious consequences for agricultural production and food security in Botswana and in the countries in the region. CO2 emissions have steadily increased over the past few decades. In 2008, liquid and solid fuel consumption accounted for 52.7 percent and 47.3 percent of total emissions respectively[1] **(Figure 10)**.

Figure 10: Botswana CO_2 Emissions- KT (2008)



Source: WDI (2010)

Figure 11: Botswana Forest Area vs. Wood Fuel Production (1999-2008)



Source: FAOSTAT (2010)

Land-use change and especially deforestation and forest degradation are major sources of GHG emissions in Botswana. Forested areas are rapidly shrinking to meet domestic demand for wood fuel and export demand for wood products[13] **(Figure 11)**. With regard to the former, biomass and waste account for 27 percent and 31 percent respectively of primary energy supply and final energy consumption. In addition to GHG emissions, unregulated harvesting of wood fuel is causing other environmental problems as well, especially in terms of biodiversity loss.

6.2 Policy

The 1999 *National Policy in the Use and Management of Natural Resources* aims to create a framework for the promotion of a sustainable use of natural resources that allows for the preservation of ecosystems and of their functions[5].

Summary

- Botswana's agricultural sector employs around 30 percent of its total labor force and accounts for 3 percent of the country's GDP.
- Out of Botswana's total land area, 45.6 percent is used for agricultural purposes, with less than half percent of this area classified as arable land. The country has significant renewable water resources available, of which 1.6 percent is withdrawn annually.
- Wheat, maize, sugar and sorghum , account for more than half of the average daily calorie intake, with animal products providing an additional 14 percent.
- Botswana imported 100 percent of the total amounts of wheat and sugar consumed domestically and 64.3 percent of total domestic maize consumption in 2009. Potential increases in the price of these commodities on the international market can thus affect the trade balance, as well as the welfare of net consuming households.
- Around 45 percent of households have access to electricity. Oil products provide the largest contribution to total final energy consumption.
- Botswana currently produces biodiesel from used vegetable oil. The country also has a national biofuel development programme in place, with a focus on ethanol production from sweet sorghum and biodiesel production from jatropha[8]. Further assessment is needed in order to adequately understand the potential role of bioenergy within Botswana's energy mix.
- Botswana's forest area is declining as the demand for forest products and wood fuel wood increases.
- Over the last ten years, Botswana has implemented a range of policies affecting the agricultural, energy, and environmental sectors. The development of better data on the topics covered in this brief will strengthen the government's ability to assess the effectiveness of these policy interventions and improve future decisions regarding food security and energy sector development in Botswana.

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