High-Level Conference on:

Water for Agriculture and Energy in Africa: the Challenges of Climate Change

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National Investment Brief

BOTSWANA

EXECUTIVE SUMMARY:

Improvement of food security in Botswana is one of the main objectives of the Government for the development of the agricultural sector. Both the number and the proportion of undernourished people have increased from 1990-91 to 1999-2001 and food supply has decreased during the nineties. Furthermore, domestic production of cereals has never been sufficient to meet the national food requirements and a significant part of the annual cereal requirement is imported.

The available climate change projections and the impact studies conducted suggest that Botswana is highly vulnerable to climate change, with a particularly strong negative influence on water resources and crop production. There is no dedicated policy to respond to climate change in Botswana, but a range of studies have been produced and a number of national policies are already in place responding to climate change and demonstrating the high level of concern for environmental issues in the country.

Irrigation potential is estimated at about 13 000 ha. From the 1 439 ha (2002) developed for full/partial control irrigation, only about 620 ha were irrigated in the dry season, the rest were not being irrigated owing to factors such as no water, poor marketing conditions and the high cost of irrigation. The contribution of the agricultural sector to GDP decreased from 40 percent at independence in 1966 to 2.5 percent in 2003. Nonetheless, the agricultural sector remains fundamental as a source of food and income for nearly 44 percent of the total population.

Most of the rivers in Botswana (the Okavango, Limpopo, Zambezi and Orange) are shared with other countries. The country does not produce hydropower and relies on two coal fired power stations for its domestic generation of electricity. In 2006, 40% of the electricity supply in Botswana was generated in the country, and 60% was imported, mainly from the Southern African Power Pool.

The National Development Plan 9 (NDP9) for 2003-2009 stresses the need for Botswana to be less dependant on minerals (notably diamonds) and diversify the agricultural production base (dominated by cattle farming) for both export and local production and to reverse the trend in declining areas under both rainfed and irrigation farming. Consideration should be given to food security and employment generation. The irrigation policy and strategy is being finalised and has been guided by NDP9 and NAMPAADD – the National Master Plan for Arable Agriculture and Dairy Development – which started in 2002 and is ongoing.

Currently, there are four project profiles already prepared with a large water component. Amongst them, there is a Bankable Investment Project Profile with large water component for US$65 million which focuses on the reduction of water–logging through the provision of a drainage system with the main objective to increase the productivity of the Pandamatenga Commercial Arable Farms. A secondary objective is to improve about 1 000 ha of Molapo (flood recession) irrigation. Moreover, there are two recent and ongoing projects involving two different donors.

1. CONTEXT

1.1 AGRICULTURE AND FOOD SECURITY

Agriculture

The contribution of the agricultural sector to GDP in Botswana decreased from 40 percent at independence in 1966 to 2.5 percent in 2003, partly because of the expansion of mining but also as a result of the stagnation of the sector itself and recurrent droughts. Despite this, the agricultural sector remains fundamental as a source of food and income for nearly 44 percent of the total population (2004).

The agricultural sector is composed of two distinct farming systems, the commercial and the traditional systems which both engage in crop and livestock production. The difference between commercial and traditional farming is based on land tenure, use of technology and marketing as opposed to consumption of production. The average yield of cereal crops on commercial farms is 500 kg/ha, compared with 200 kg/ha on traditional farms. Commercial farms also have higher annual calving rates and lower animal mortality.

Irrigation and water control

Around 13 000 ha have been identified as suitable for irrigation on the basis of soil and water availability in the Limpopo, Okavango and Chobe river basins. However, this figure is based on major surface water resources thus ignoring the potential for small-scale irrigation from minor surface water or groundwater resources both of which are limited by climate, hydrogeology and topography.

From the 1 439 ha (2002) developed for full/partial control irrigation, only about 620 ha were irrigated in the dry season The rest were not being irrigated owing to factors such as no water, poor marketing conditions and the high cost of irrigation. No recent figures on irrigation technology are available, but in 1992, 15 percent of the equipped area was equipped for surface irrigation, 65 percent for sprinkler irrigation and 20 percent for localized irrigation.

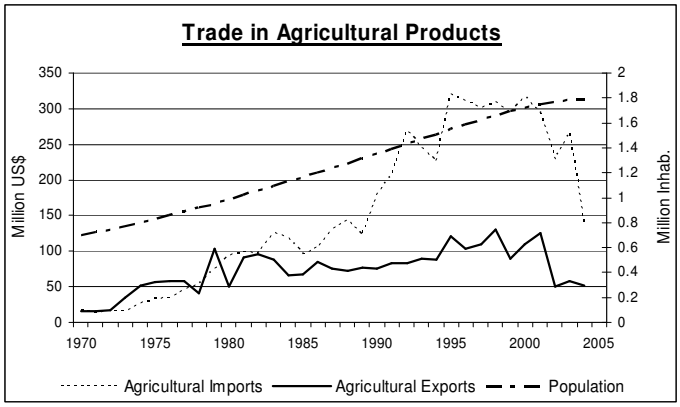
Generally, irrigation is used for the production of vegetables and citrus crops. Depending on the amount of flooding experienced, there are up to 6 500 ha of recession agriculture in the North West and Chobe districts, along the Okavango and Chobe rivers.

Food security

Improvement of food security in Botswana is one of the main objectives of the Government for the development of the agricultural sector. Statistics show that one out of four persons is undernourished (2001). Both the number and the proportion of undernourished people have increased from 1990-91 to 1999-2001, and food supply has decreased during the nineties, though there is less undernourishment in Botswana than in Southern Africa (41%) and in Sub-Saharan Africa (33%).

Food and agriculture trade and import balance

The contribution of agriculture to total exports and imports in 2001 was 5 percent and 17 percent respectively. The imports of agricultural products (as shown in the chart) steadily increased reaching their maximum in 1995 (US$320 million) after which they dropped to reach a value of US$135 million in 2004. Agricultural exports remained generally stable over time, at values that average US$ 74 million.



Domestic production of cereals has never been sufficient to meet the national food requirements and a significant part of the annual cereal requirements of 250 000 – 300 000 tonnes is imported from South Africa. From 1997/98 to 2002/03, the domestic production of cereals met only about 10 percent of the requirements. The share of cereals in the food import bill plays a prominent role: in 2004 with around 30% of the commercial bill due to cereals, with coarse grains alone accounting for 22%.

1.2 WATER RESOURCES AND HYDROPOWER

Five major drainage basins exist in the country: the Limpopo basin in the east, the Orange/Senqu basin in the south, the Zambezi basin in the north, the Okavango basin in the northwest and the Nata-Makgadikgadi. The South Interior occupies the remaining area (about 63 percent) and includes the Kalahari Desert and the Makgadikgadi Pans. Most of the rivers in Botswana (the Okavango, Limpopo, Zambezi and Orange) are shared with other countries. The Okavango River Basin Water Commission (OKACOM) was created in 1994 between Angola, Namibia and Botswana; and the agreement to establish the Zambezi Watercourse Commission was signed in 2004 between the eight countries sharing the basin. The Orange/Senqu River Basin Commission was created in 2002, and the agreement to establish the Limpopo River Basin Commission was signed in 2004.

Internal renewable surface water resources are estimated at 0.8 km^3/year. Most dams on rivers have been constructed for urban water supplies or for livestock watering. The major dams are constructed on the larger rivers. It is considered that most 'good' sites for larger dams have now been used or are reserved for large water supply dams (for urban and industrial water uses), which are expected to be constructed in the near future. The smaller dams on smaller rivers currently suffer from sedimentation and irregular stream flows, making planning for use by irrigation difficult. Many earth dams built for livestock watering and irrigation (over 240 since 1970) have also suffered from lack of maintenance and many are now not in use.

Botswana does not produce hydropower. Its domestic energy production is dominated by coal fired technology. Fuelwood is used in low-income households for domestic purposes but Government is promoting programmes for rural electrification, solar power, wind-generated electricity and liquid petroleum gas use. In 2003, 40% of the electricity supply in Botswana was generated in the country, and 60% was imported, mainly from the Southern African Power Pool.

1.3 CLIMATE CHANGE

The welfare of the people of Botswana, the performance of the economy, and the state of the environment are all very closely linked to the climate. The climate is arid and semi-arid, with low rainfall and high rates of evapotranspiration. Rain generally falls between October and March, but the pattern is highly irregular. Drought is a recurring problem which has negative impact on the economy and living conditions in Botswana. Nonetheless, incidents of high rainfall sometimes occur, as for example in early 2000 record rainfall caused serious flooding.

The available climate change projections and the impact studies conducted suggest that Botswana is highly vulnerable to climate change. Temperatures are predicted to rise by 1 to 3°C during the next hundred years, as a result of global warming caused by the release of greenhouse gases. Future trends in rainfall in Botswana are less certain, but may decline by as much as 25%. Climate change will impact on all sectors of the economy (grazing and livestock, forestry, human health) but the predicted impact will be particularly serious on agriculture and water resources: under a scenario of a hotter, drier future potential crop yields are predicted to be reduced by about 30% for both maize and sorghum and the current water resources of Botswana are inadequate to supply the projected increase in demand by the year 2075 in all the catchments on the south-eastern side of the country.

Adaptation strategies have been undertaken, particularly water transfers from an area with surplus to less endowed areas (for instance the North South Carrier Water Transfer Scheme) , water purchase from neighbouring countries, and national programmes aimed at increased food security (e.g. the import of cereals). Future adaptations could include wider use of minimum tillage farming methods, which conserve soil, water and carbon; wider use of varieties with a short growing season; and strategic analysis of optimum planting dates.

2. NATIONAL STRATEGIES FOR WATER, AGRICULTURE AND ENERGY

2.1 POLICY CONTEXT

The strategic approach adopted by the Government of Botswana, in particular concerning agricultural development and water control, is comprehensively included in a series of documents: the *Vision 2016* (Perspective Plan), the *National Development Plan 9* (NDP9), the *National Master Plan for Arable*

Agriculture and Dairy Development (NAMPAADD), the *Revised National Policy for Rural Development (NPRD), the National Water Master Plan* and the *National Strategy for Poverty Reduction* (NSPR).

Both the Perspective Plan (*Vision 2016*) and the NDP9 recognize the importance of the agriculture sector to enhance the growth of the national economy, create employment opportunities, improve food security, and also to alleviate poverty, particularly rural poverty. As stated in NPD9 the objectives of the development of agriculture will be to:

- Improve food security at house hold and national levels,
- Diversify agricultural production base,
- Increase agricultural output and productivity,
- Increase employment opportunities,
- Provide secure and productive environment for agricultural producers, and
- Conserve scarce agricultural and land resources.

To realize these objectives and to enhance the contribution of the sector to the national economy, the government has devised the following plans or strategies:

- The *National Master Plan for Arable Agriculture and Dairy Development* (NAMPAADD);
- The *Revised National Policy for Rural Development* (RNPRD);
- The *National Strategy for Poverty Reduction* (NSPR).

The NAMPAADD aimed at devising strategies and programs that would enhance the performance and sustained development of agriculture. The plan addresses rain fed agriculture (crop production), irrigated agriculture, and dairy development. In particular, concerning rain fed agriculture the main thrust of the plan is to transform the small farms into viable commercial farms. To this end the plan calls for the introduction of mechanization service centres and improvement of farm inputs and farm management practices. The plan also envisages the possibility of encouraging the flow of private investment into the development of agri–business. In order to exploit the irrigation potential, then, the plan recommends the development of irrigation schemes using both fresh water and treated urban wastewater. During the current plan period, the target is to bring 5,200–5,400 ha of farm land under irrigation of which 1,600–1,800 ha of land is planned for irrigation with fresh water and 3,600 hectares with reclaimed urban wastewaters. On top of these area–specific measures, emphasis will be given to expand infrastructure services such as roads, electrical power, and telecommunication facilities to the production areas.

The main thrust of the RNPRD remains the improvement of living conditions of the rural population. The policy is based on reducing rural poverty; providing opportunities for income generation and investment in economic activities, creating employment opportunities; and enhancing popular participation in the development process.

The government's principal strategy to fight poverty was based on the promotion of broad– based growth, diversification of the economy, improvement of the access by poor people to social investment, and the provision of safety nets for the needy. The NSPR, adopted in 2003, re–iterated the continuing relevance of these strategies. While the broad strategies remained the same, more emphasis will be given to sectors and areas that have direct impact on poverty reduction. Hence, in the growth policy more attention would be paid to the development of agriculture and to the strategy to diversify agricultural products as the most effective anti–poverty initiative.

In accordance with its 1991 Agricultural Policy, and in order to achieve its Vision 2016, the Government of Botswana highlighted the relevance of both arable agriculture and dairy development underlining that irrigation has a potential role in both sub-sectors, specifically with respect to high value horticulture and dairy fodder. This is especially so if the economy is to be diversified and dependency on imports reduced. Accordingly, in 2002 the Government approached FAO for assistance in identifying and studying the relevant issues and for the preparation of such an irrigation policy and strategy. As a result of this process, the Botswana Draft Irrigation Policy and Strategy was produced. The overall objective for the irrigation sector, in line with that proposed in *Vision 2016* and in the NDP9, is to promote "increased household food security, enhanced rural employment, import substitution and exports as a result of the establishment of sustainable Botswana's irrigation sector".

There is no dedicated policy to respond to climate change in Botswana, but the potential for future climate change and the associated environmental threats is acknowledged in the National Development Plan. Specific climate adaptation and mitigation policies are already in place in some

sectors, such as the strong governmental support for solar energy technologies in the energy sector. Climate change considerations in Botswana are championed by the National Committee on Climate Change. The National Committee has orchestrated a range of studies specifically dealing with issues and impacts of climate change. In addition, a number of National policies are already in place that support climate change considerations and demonstrate the high level of concern for environmental issues in Botswana.

The climate change action agenda in Botswana will continue to require support from the international community if it is to become firmly established. In particular, assistance is needed in:

- Capacity-building: capacity support is specifically needed to improve understanding of Botswana's vulnerability to climate change, understand the interaction between economic activities and emissions of greenhouse gases, and finally to enhance the ability of policy makers to support a sustainable development pattern that takes climate change into account.
- Research and systematic observations: research is still needed to reduce uncertainties in the emissions inventory, particularly in the land use change and forestry sector.
- Technology needs: access to technology, specifically regarding predictive models, remote sensing and adaptation, is needed – especially in the agriculture, livestock, water supply and health sectors. Energy efficient technologies in the mining, industrial, energy, housing and transport sectors are also called for.

2.2 INVESTMENT ENVELOPE

The investment envelope for the short, medium and long term is presented in the Table below and expressed in million US $ (based on CAADP investment projections):

Time scale	Type of investment (million US$)			
	Small scale water control	Rehabilitation of irrigation	Large scale hydraulic projects	Total
Short-term	7	1	0	8
Medium-term	5	1	1	7
Long-term	2	0	2	4
Total	14	2	3	19

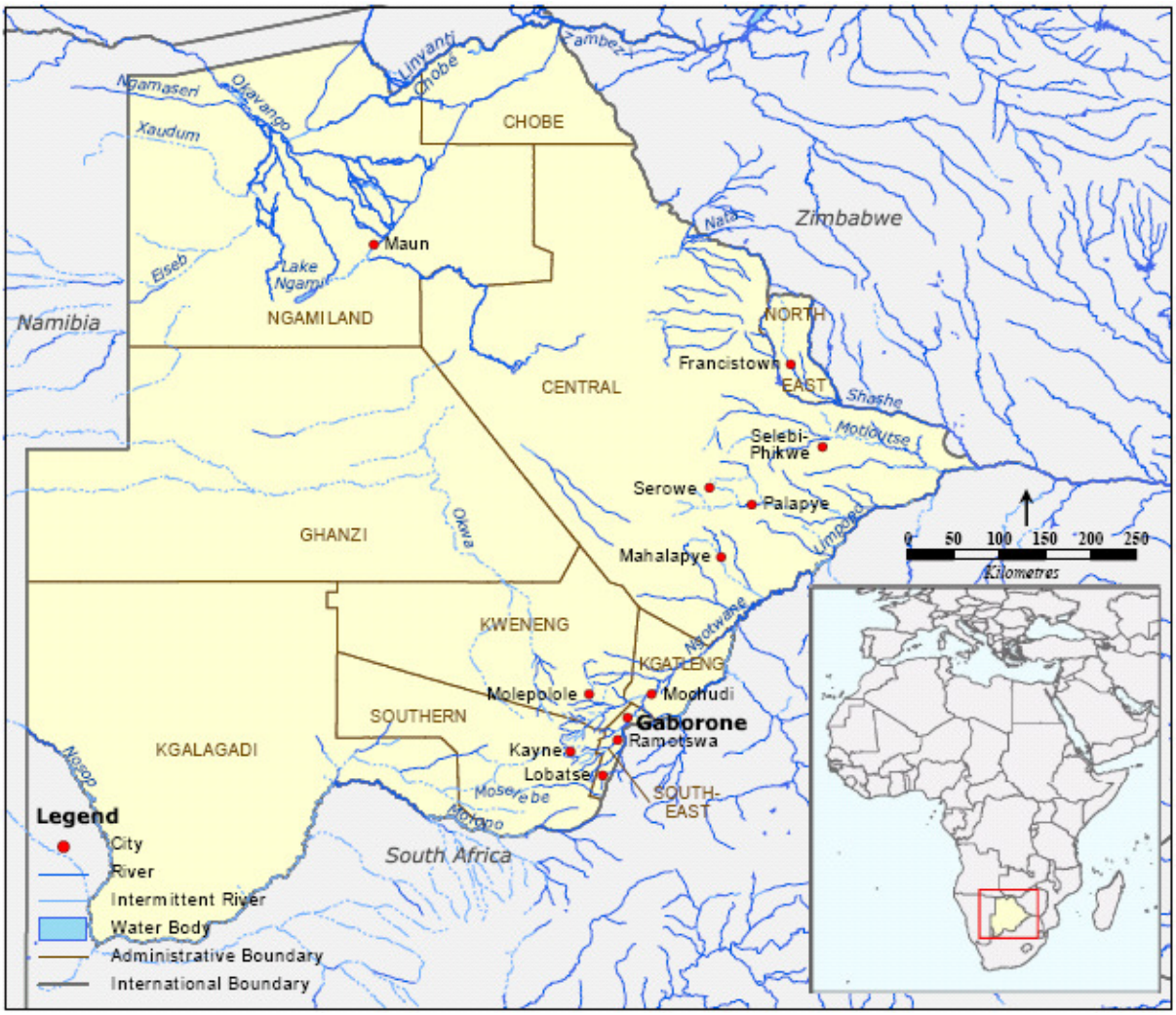
2.3 PROJECT PORTFOLIO

Section 3 presents recently achieved, active and pipeline projects related to the above investment envelope. Currently there are 4 project profiles already prepared with a large water component that range from US$ 5 million for wastewater and irrigation expansion project to US$ 65 million for the Bankable Investment Project for the infrastructure development of the Pandamatenga Commercial Arable Farms, aimed at increasing the productivity of these farms by reducing water–logging through the provision of a drainage system. There are also 2 recent and ongoing projects, one funded by the Government of Botswana, the other by the Japan Bank for International Cooperation, the first providing funds for US$2.5 million, the second for about US$42.5 million.

3. PROJECT PROFILES (ON-GOING AND PROJECTED)

Project title	Funding Partners	Time Scale	Total Budget	Description
I. PROJECTS RECENTLY IMPLEMENTED				
Glen Valley Wastewater project I	Government	2005-2007	$2.5 million	203 ha pilot project using Gaborone waste water.
North South Carrier Water Project	JBIC	1995 -	4 685 million Yen	
II. ON-GOING PROJECTS				
Pandamatenga Agricultural Infrastructure Development Project	AfDB	2008-2012	US$ 67.41 million	The project will provide drainage and access road infrastructures over an area of 27,574 hectares in the Pandamatenga area
Water Control and Management System Study	African Water Facility	2007-2009	US$ 1.64 million	The study includes the Environmental Impact Assessment and detailed design of drainage and access road infrastructures related to an area of 2,500 ha in the Pandamatenga area
National Programme for Food Security	FAO	5 years	US$81 million	The overriding goal of the NPFS is to improve the food and nutrition security of Botswana by contributing towards the operationalisation of the RNFS. The NPFS therefore aims at: 1) increasing local food production of crops, livestock, fish and wild forest foods; 2) improving the access to food; 3) enhancing food quality and food safety in the country; and 4) raising levels of food nutrition among the general population.
III. PIPELINE PROJECTS				
Bankable Investment Projects Profiles (BIPPS): Pandamatenga Commercial Arable Farms Infrastructure Development	FAO-NEPAD		US$ 65 million	M**ain objective:** increase the productivity of the Pandamatenga Commercial Arable Farms by reducing water–logging through the provision of a drainage system. The **specific objectives** are**:** • Increasing cereal production; • Creating favourable conditions for the development of agro–industrial enterprises; • Reducing the foreign exchange the country spends for importing food crops; • Enhancing the food security at the national level; • Increasing employment opportunities. **Expected outputs:** • 150 km drainage channels constructed and lined; • 275 km bunds constructed; • 160 km gravelled road network.
Wildlife Conflict Management and Biodiversity Conservation for Improved Rural Livelihoods in Botswana	World Bank		US$ 36.5 million	
Mid Zambezi Project (Zambia, Zimbabwe and Botswana)	AfDB + others	2009-2015	US$37.5 million (Botswana)	Mainly drainage works. Some recession irrigation (1,000ha).

ANNEX 1: MAP OF WATER CONTROL IN BOTSWANA:



ANNEX 2: COUNTRY STATISTICS

Country and population			
Area of the country	2005	58173	1000 ha
Cultivated area as % of the total area of the country	2005	0.7	%
Total population	2005	1765	1000 inhab
• of which rural	2005	47	%
Population economically active in agriculture	2005	354	1000 inhab
• as % of total economically active population	2005	43	%
• female	2005	57	%
• male	2005	43	%
Economy and Development			
Gross Domestic Product (GDP) (current US$)	2007	11781	million US$/yr
• value added in agriculture (% of GDP)	2006	1.96	%
• GDP per capita	2007	6263	US$/yr
Access to improved drinking water sources			
Total population	2006	96	%
Urban population	2006	100	%
Rural population	2006	90	%
Water Resources and management			
Average precipitation	2007	241.8	10^9 m^3/yr
Total actual renewable water resources	2007	12.24	10^9 m^3/yr
Dependency ratio (transboundary rivers)	2007	80.4	%
Total actual renewable water resources per inhabitant	2007	6935	m^3/yr
Total dam capacity	1995	0.38	10^9 m^3
Total water withdrawal	2000	0.194	10^9 m^3/yr
• as % of total actual renewable water resources	2000	1.58	%
IRRIGATION AND DRAINAGE			
Irrigation potential	2007	13	1000 ha
Water Management			
Area equipped for irrigation: full control - total	2002	1.439	1000 ha
Equipped lowlands	2002	0.000	1000 ha
Area equipped for irrigation: total	2002	1.439	1000 ha
• Area equipped for irrigation as % of cultivated area	2002	0.4	%
• Annual increase rate	2002	0.4	%
• Power irrigated area as % of area equipped for irrigation	1992	81	%
• Area actually irrigated as % of area equipped for irrigation			%
Non-equipped cultivated lowlands and flood recession	2002	6.500	1000 ha
Agricultural water managed area: total	2002	7.939	1000 ha
• Agricultural water managed area: as % of cultivated area	2002	2.1	%
• Drained cultivated area as % of total cultivated area			%
Typology of irrigation schemes			
Small-scale schemes (<ha)			1000 ha
Medium-scale schemes (- ha)			1000 ha
Large-scale schemes (>ha)			1000 ha
Irrigated crops			
Maize	1991	0.350	1000 ha
Vegetables	2002	0.299	1000 ha
Citrus	2002	0.321	1000 ha
Cotton	1991	0.100	1000 ha
Fodder	1991	0.220	1000 ha
Other perennial crops	1991	0.200	1000 ha

ENERGY INDICATORS			
Energy Production	2005	1.05	Mtoe
Net Imports	2005	0.84	Mtoe
TPES	2005	1.89	Mtoe
- TPES/Pop	2005	1.07	toe/capita
- TPES/GDP	2005	0.23	toe/thousand 2000 US$
- TPES/GDO (PPP)	2005	0.10	toe/thousand 2000 US$ PPP
Electricity Consumption	2005	2.58	TWh
- EC/Pop	2005	1462	kWh/capita

ENERGY SUPPLY AND CONSUMPTION (2005)*

	Coal	Gas	Crude oil	Petroleum products	Hydro	Other Renewable & Waste	Others	TOTAL
Production	595	0	0	0	0	456	0	1051
Imports	1	0	0	692	0	0	151	844
Exports	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0
Stock Changes	0	0	0	0	0	0	0	0
Total Primary Energy Supply (TPFS)	**596**	**0**	**0**	**692**	**0**	**456**	**151**	**1895**

* in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis.

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