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

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National Investment Brief

MOZAMBIQUE

EXECUTIVE SUMMARY:

Mozambique portrays a very high level of undernourishment with 53 percent of the population recorded as such. The situation has not changed significantly from 1990-92, benchmark period of the World Food Summit (WFS) and the Millennium Declaration (MD), to 1999-2001, the last period available. Furthermore, the food commercial bill in the country is rapidly increasing putting a substantial burden on the country's commercial balance. The rate of growth of the food bill has accelerated in recent years, jumping from 14% for the period 1995-2000 to 52% for the period 2000-2004.

Mozambique is extremely vulnerable to natural disasters in particular floods, droughts and cyclones that damage property and livelihoods and take lives. Planning for adaptation to climate change has not really begun at any significant scale, although improved attention to regional river basin management has started. Irrigation potential is estimated at about 3 072 000 ha, of which 118 120 ha are equipped for irrigation, and 49,000 ha are actually irrigated. Most of the agriculture practiced in Mozambique is on a subsistence basis and non-irrigated. About 98 percent of all farming is practiced on small plots with yields per hectare lower than the regional averages.

Mozambique shares nine river basins with other countries and depends on them for 53.8 percent of its water resources. The country has four dams with major hydropower stations for the production of electricity. Actual power demand (2006) is about 320 MW with an annual energy consumption of 2381,6 GWh. Given the increasing power demand in Mozambique and in the region, particularly in South Africa, hydropower development on the Zambezi River is seen as a priority in water resources development.

The national development agenda in Mozambique focuses on reducing current levels of absolute poverty through rapid, and sustained economic growth, largely driven by a strengthened private sector. Priority is given to rural development, with emphasis on agricultural, optimal natural resource use, and local economic development. The actual Strategic Plan has a 10 years time horizon and its implementation will be divided in two phases: immediate anti-hunger actions and expansion and consolidation of the interventions to achieve the millennium objectives. The NEPAD–CAADP National Medium–Term Investment Programme (NMTIP) has two pillars for agriculture: (a) the empowerment of producers to increase productivity, and (b) influencing policy to change the role of public institutions.

The financial envelope for the investment strategy is estimated at 1 836 million US$. Currently, there are some of 24 project profiles already prepared with a large water component that range from US$4 million for the construction of a weir to monitor transboundary water flows to US$2.7 billion for the construction of the Moatize hydropower plant. There are also two Bankable Investment Project Profiles with large water component; one for US$22.4 million and the other for US$30 million. Finally, there is a total of some 20 recent and ongoing projects from about US$1 million to about US$45 million.

1. CONTEXT

1.1 AGRICULTURE AND FOOD SECURITY

Agriculture

Mozambique's GDP was US$7.6 billion in 2007, and the value added by agriculture was 27.4 percent of the GDP in 2006. Agriculture provides work for 80 percent of the economically active population, and 60 percent of the people working in the sector are female. Since the end of the civil war in 1992, Mozambique has made impressive gains in restoring food production and, at a national level, the country is virtually self-sufficient in terms of food grain production, with the exception of wheat and rice. However, this growth has been uneven spatially and natural disasters such as floods and droughts are an important cause of temporary food insecurity.

The agriculture sector comprises two categories of producers: the smallholder "family" sub-sector and the commercial sub-sector. The smallholder sub-sector accounts for about 95 percent of the area under production. It is characterized by small areas (1.8 ha each on average), low inputs, inadequate equipment and low yields and returns. Small and medium private companies represent the commercial sub-sector. These companies have some technological know-how, use agricultural inputs, generally have access to credit and, particularly in the south of the country, have access to irrigation. They are an important source of employment and notably contribute to technology dissemination and transfer.

Irrigation and water control

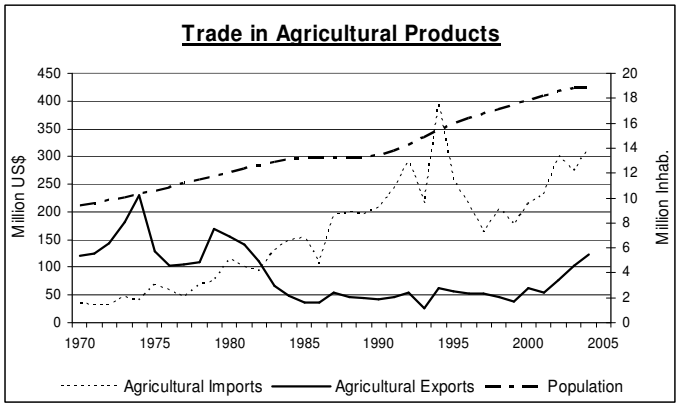
Irrigation potential is estimated to be 3 072 000 ha. Presently, irrigated areas are occupied by smallholders and agricultural enterprises. The most important large schemes are Chokwe scheme in the Limpopo basin (30 000 ha equipped area) and a series of sugarcane plantations in the Incomati, Buzi and Zambezi valleys (34 000 ha equipped area). Small-scale irrigation exists everywhere in the country, with schemes either abandoned or partly utilized. Most of the schemes are in bad to very bad condition, and only a relatively small part of the irrigation schemes is actually irrigated. Most of the schemes are in bad to very bad condition, and only a relatively small part of the irrigation schemes is actually irrigated. Currently, 118 120 ha are equipped for irrigation, of which 49,000 ha are actually irrigated, consisting mainly of large schemes over 500 ha. The main irrigated crops are sugarcane, rice, citrus, and vegetables (mostly tomato and lettuce).

Food security

Mozambique portrays a very high level of undernourishment with 53 percent of the population classified as undernourished. The situation has not changed significantly from 1990-92, the benchmark period of the World Food Summit (WFS) and the Millennium Declaration (MD), to 1999-2001, the last period available. However, the increasing trend observed from 1990-92 to 1995-97 reversed from 1995-97 to 1999-2001; that is both the proportion and the number of undernourished people have decreased in recent years.

Food and agriculture trade and import balance

The food import bill in the country has rapidly increased (see figure aside), putting substantial burden on the country's commercial balance. The agricultural exports decreased over time since 1970, though a slight increase can be noticed after 2001. The rate of growth of the food bill accelerated in the recent years, jumping from 14% in the period 1995-2000 to 52% in the period 2000-2004. The total commercial food bill in Mozambique reached a value of $253 m in 2004. Cereals are contributing to the largest share of the bill, accounting for 51%, and, in particular, wheat alone accounts for more than 30% of the total commercial bill.



1.2 WATER RESOURCES AND HYDROPOWER

Mozambique has 104 identified rivers basins that drain the central African highland plateau to the Indian Ocean. It shares nine river basins with other countries and depends on them for 54 percent of its water resources. The total capacity of 27 dams with a height of 10 m or more is estimated at 64.5 km3. This refers mostly to the useful reservoir capacity. The Cahora Bassa dam on the Zambezi River is the largest hydroelectric plant in southern Africa with an installed capacity of 2 075 MW and a useful storage capacity of 39.2 km3 (± 80% of the total storage capacity). In 1971, 583 small dams were registered, with a total volume of 60 million m3. It is believed that most of them have been destroyed during the war.

The country has four major hydropower stations at the Cahora Bassa, Chicamba, Mavuzi and Corumana dams for the production of electricity. Actual power demand is about 320 MW (2006) with an annual energy consumption of 2381,6 GWh. 80% of the current energy production in Mozambique comes from the Cahora Bassa hydropower plant (HCB) with an installed capacity of 2075 MW.

Potential hydropower generation in Mozambique is quite large. According to EDM, about 13000 MW, producing 65000 GWh/year of energy, can be economically developed. About 70% of this potential (10000 MW, 45000 GWh/year) is concentrated in the Zambezi watershed, most of it on the Zambezi River.

Mozambique as downstream country of major international rivers of the SADC is very active in regional cooperation on Water Resource Management (WRM) exemplified by a number of regional initiatives on Maputo, Incomati, Umbeluzi, Limpopo, Save, Buzi, Púngue, Zambeze and Rovuma river basins. This initiative aims to create a framework for joint management of water resources trough joint studies, joint Governance institution for river basins which is critical for tackling a challenge to be posed by climate change.

1.3 CLIMATE CHANGE

Mozambique is extremely vulnerable to natural disaster in particular floods, droughts and cyclones. An increase in temperature and a decline in rainfall totals are expected for Mozambique under global warming scenarios. The impact of drought, which worsened in the second half of 2005, affected cattle and goat herd breeding, reducing the sector's growth to 0.7 percent during the year compared to the 5.1 percent growth recorded in 2004. Planning for adaptation to climate change has not really started on any significant scale, although improved attention to regional river basin management has begun. (Poor management of regional water flows compounded the 2000 flooding disaster).

2. NATIONAL STRATEGIES FOR WATER, AGRICULTURE AND ENERGY

The national development agenda, as distilled in Mozambique's national development goals (Programa Quinquenal do Governo (PQG) and Plano de Acção para a Redução da Pobreza Absoluta (PARPA)), focuses on reducing current levels of absolute poverty through rapid, and sustained economic growth, largely driven by a strengthened private sector and directed toward lowering social

inequities and levelling regional development imbalances. Priority is given to rural development, with emphasis on agricultural, optimal natural resource use, and local economic development.

In 1996–7, the Government of Mozambique prepared a set of guidelines for the agricultural sector: the Política Agrária e Estratégias de Implementação (PAEI). The PAEI set the context for the development of the first phase of the National Agricultural Programme (ProAgri I) in 1998. The Visão do Sector Agrário em Moçambique (VSAM), established in 2003, seeks *"An agricultural sector that is integrated, sustainable, and competitive, diversified, a basis for welfare and economic accumulation,* [and] *articulated through value added chains with broadly shared benefits"*.

The first phase of the ProAgri I was developed in 1998 and operated between 1999 and 2004. ProAgri II, expected to operate between 2005 and 2009, builds upon the concepts and key objectives of the vision and lessons learned from ProAgri I. ProAgri II promotes six main pillars: Development of Input and Output Markets; Rural Finance; Rural Infrastructures; Technology; Natural Resource Management, and Enabling Environment for smallholder and private sector development.

The Government of Mozambique has approved in the end of 2007 a National Strategy for Green Revolution and currently is preparing the Strategic Plan for the Development of Agricultural Sector (Plano Estratégico de Desenvolvimento do Sector Agrário - PEDSA)[1]. These tools highlights the actions and programmes to be undertaken by the Ministry of Agriculture in order to achieve a rapid increase in the national agricultural production to reverse the country's agricultural deficit, contributing, thus, to the national food security and poverty reduction. The plan has a 10 years time horizon and its implementation will be divided into two phases:

- Phase I (2009 – 2011): Immediate anti-hunger actions, with a particular focus on plans to tackle increasing food prices.
- Phase II (2011 – 2018): Expansion and consolidation of the interventions to achieve the millennium objectives.

A major challenge is posed by the deteriorated status of the hydro-agricultural infrastructure, requiring investment and technical assistance for its rehabilitation as well as maintenance operations. A National Irrigation Programme (NIP) is in preparation. This Programme is clustered around three main objectives: to generate and support demand driven irrigation investment; to provide reliable and cost-effective irrigation services, and to promote an enabling environment for progressive commercialisation.

Within the NIP, Government's priority targets for irrigation development will be: maintaining the productive value of existing, active schemes; rehabilitation of inactive irrigation infrastructure; construction of new public irrigation schemes where feasible; and promotion of private sector irrigation schemes.

Given the increasing power demand in Mozambique and in the region, particularly in South Africa, hydropower development on the Zambezi River is seen as a priority in water resources development. The main hydropower potential concentrated on the main stream of the Zambezi between Cahora Bassa and Lupata, the tributaries Luia, Revubué, and Luenha also present good opportunities for hydropower developments.

A master plan for Mozambique grid development has been prepared and Mozambique is now seeking to prepare a power generation master plan. The grid has two main centers of demand: Maputo, which has the highest demand by a large margin, and Beira. In the coming years, Hidroelectrica de Cahora Bassa (HCB) - the dam operating company - expects to cover the demand growth from additional power allocation from the HCB and with the surplus still to be exported to South Africa, Zimbabwe and probably Malawi. In addition to Cahora Bassa North, the Mphanda Nkuwa project and the backbone transmission line Tete-Maputo has been promoted by the Government of Mozambique (GoM) partly as a means to gain independent control of both the management of the Zambezi and the potential power market.

[1] With a separate but linked irrigation strategy and policy being prepared for 2009.

In 2007 the GoM also approved the new Water Policy and the National Water Resource Management which sets a comprehensive framework for infrastructure development aiming at irrigation, power production and mitigation of floods and droughts.

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 and World Bank Water investment needs assessment).

Time scale	Type of investment (million US$)			
	Small scale water control	Rehabilitation of irrigation	Large scale hydraulic projects	Total
Short-term	112	45	547	704
Medium-term	178	108	363	649
Long-term	156	27	300	483
Total	446	180	1210	1836

2.3 PROJECT PORTFOLIO

Section 3 presents recently achieved, active and pipeline projects related to the above investment envelope. Currently, there are 13 project profiles already prepared with a large water component that range from US$2.5 million for a crop production project to US$81 million for the completion of a large dam. There are also two Bankable Investment Project Profiles with large water component; one for US$22.4 million and the other for US$30 million. Finally, there are 11 recent and ongoing projects involving 11 different donors ranging from about US$1 million to about US$20 million.

3. PROJECT PROFILES (ON-GOING AND PROJECTED)

Project title	Funding Partners	Lifeline	Total Budget	Description
I. PROJECTS RECENTLY IMPLEMENTED				
Rehabilitation of infrastructure and credit	OPEC	2004-2006	US$9 million; US$0.4 million; US$0.6 million	Drainage and secondary infrastructure. Buildings and related equipment. Credit line.
PIDA	Italy	2002-2006	€9.12 million	Small scale irrigation works, extension support, institutional development and crop improvement.
Rehabilitation of irrigated area of Chockwe	France	2001-2005	€4.4 million	Main canal rehabilitation. Other works still required.
Agricultural Markets Support Programme	IDB	2002-2006	US$23.5 million	Access roads, improved market access, support to GoM.
Projecto do Desenvolvimiento Agrario do Niassa	IDB	1994-2005	US$20.1 million	
Improving household food security and nutrition in Manica Province	Belgium	2002-2007	US$4.3 million	
Crop diversification in cotton areas in Zambezia province	EC	2002-2006	€1.5 million	
Development of agriculture and livestock in Maputo province	Ec	2001-2005	€0.712 million	
Crop diversification in cotton areas in Cabo Delgado province	EC	2002-2007	€0.7 million	
Food security project in Niassa province	EC	2001-2004	€1.1 million	
Crop diversification in cotton areas in Nampula province	EC	2002-2006	€1.5 million	
Support to judiciary in implementing new legislation on land, forestry and wildlife, and environment	Netherlands	2001-2004	US$1.3 million	
Private sector support in Niassa (mainly agriculture)	Sweden	2002-2005	US$9.3 million	
Zambezia agricultural development project	DFID	2002-2004	£1.5 million	
Technical assistance to PROAGRI	DFID	2002-2004	£1.2 million	
II. ON-GOING PROJECTS				
Small Scale Irrigation Project (SSIP)	AfDB	2002-2008	US$16 million (loan). US$1.7 million (grant)	24 small scale irrigation projects in 3 provinces. Project ends 03/09
Massingir Dam and Xai Xai irrigation project	AfDB	2004-2009	UA55 million + add UA17million 2008.	Completion/improvement of the dam + 9000ha irrigation scheme. Floods disrupted project start up.
Banana production project	Private	3 years	US$45 million	Dam and 3000ha scheme near Nacala. Due for completion 2009.
Support to coconut palm sector in Mozambique	France	2001-2008	7.2 million (revitalization of the coconut sub-sector, Quelimane)	
III. PIPELINE PROJECTS				
Water resources development and management in the Incomati and Umbeluzi basins - Completion of Corumana Dam	World Bank	2008-2010	US$81 million	Study underway 2008. 29000ha sugar project proposed.

- Construction of Ressano Garcia weir to monitor transboundary water flows			US$4 million	
- Metuchira and Gorondgosa Dam	World Bank			Water supply and irrigation
Institutional building in the water sector	World Bank	2008-2010		
Small scale water resources development. - Construction of small and medium multi-purpose dams for Nampula, Nacala and Quelimane	World Bank	2008-2010	US$60 million	
Transboundary water agreements (Incomati, Maputo and Umbeluzi basin agreements between Mozambique, South Africa and Swaziland)	World Bank	2008-2010		
Sustainable water resources management for economic growth and poverty reduction in the Zambezi basin - Support to the possible development of the Mphanda Nkuwa and Cahora Bassa North water resources project	World Bank	2008-2010		
Rice development project		5 years	US$7.7 million	
National Programme for Agricultural Development	IFAD	2008-2016	US$ 50.6 million	
Bankable Investment Projects Profiles (BIPPS) - Small scale irrigation Project II (BIPP) - Small dams rehabilitation/construction project	FAO-NEPAD	 6 years 5 years	 US$22.4 million US$30 million	 The outcome of the project: to enlarge the areas under irrigation, but also to reinforce the institutional capacity of the irrigation sector at national and provincial level, in the context of the poverty reduction policy of the country. The specific objective is to improve smallholder agricultural production and productivity in the project area. The programme was developed in order to ensure water storage capacity to address the issue of water requirement for rural water supply, irrigation, livestock and hydropower.
Market led (commercial) irrigation project	World Bank	2010-2015	US$50 million	Identification and preparation phase 2006/2009.
Small scale water resources development.	World Bank	2008-2010		
- Community-based sustainable management and development of water resources of small streams, groundwater resources, and local watersheds in the poorest areas - Support to smallholder irrigation - Water infrastructure for small towns			Requires feasibility s Requires feasibility s Requires feasibility s	
Water resources development and management in the Incomati and Umbeluzi basins: Support to institutional strengthening of ARASul	World Bank	2008-2010	Requires feasibility s	
Massingir Dam Supplementary Loan	AfDB		US$ million 25.5	
Mavuzi and Chicamba Projects	Public Private Partnership, EdM	End: 2011	US$ 30 million	Hydro long term rehabilitation project. Feasibility study completed.
Lurio II	EdM/Public Private Partnership	End: 2013	US$ 400 million	Construction of 2 hydro Ocua (63 MW) and Quedas (120 MW).

Mphanda Nkuwa (Phase I)	Public Private Partnership, EdM	End: 2015	US$ 2500 million	Includes development of and RCC curved gravity dam, power station and transmission lines. Plant to operate at 95% availability to target a regional market. Phase 2 to be a total of 2400 MW
Moatize	EdM/ Strategic Partner	2013-15	US$ 2700 million	Greenfield baseload plant mainly for regional exports. Phase I: 600 MW in 2013, Phase II in 2015
Massingir	EdM , Strategic Partner	End: 2015	US$ 55 million	Hydro power development on the Zambezi River
HCB North Bank	Government of Mozambique/ Private Partner	End: 2015	US$ 771 million	Development of north bank at an existing dam site. Project to target mostly export market
Nhacangara Dam	Italia	2009-2013	Euro 40 million	Flood control and Irrigation in lower Púnguè
HVDC line Tete- Maputo	EdM , Strategic Partner	End: 2015		Construction of a Transmission line from Tete to Maputo

ANNEX 1: MAP OF WATER CONTROL IN MOZAMBIQUE:

ANNEX 2: COUNTRY STATISTICS

Country and population			
Area of the country	2005	79938	1000 ha
Cultivated area as % of the total area of the country	2005	5.8	%
Total population	2005	19792	1000 inhab
• of which rural	2005	62	%
Population economically active in agriculture	2005	8250	1000 inhab
• as % of total economically active population	2005	80	%
• female	2005	60	%
• male	2005	41	%
Economy and Development			
Gross Domestic Product (GDP) (current US$)	2007	7752	million US$/yr
• value added in agriculture (% of GDP)	2006	28.31	%
• GDP per capita	2007	363	US$/yr
Access to improved drinking water sources			
Total population	2006	42	%
Urban population	2006	71	%
Rural population	2006	26	%
Water Resources and management			
Average precipitation	2007	827.2	10^9 m^3/yr
Total actual renewable water resources	2007	217.11	10^9 m^3/yr
Dependency ratio (transboundary rivers)	2007	53.8	%
Total actual renewable water resources per inhabitant	2007	10970	m^3/yr
Total dam capacity	2000	64.474	10^9 m^3
Total water withdrawal	2000	0.63	10^9 m^3/yr
• as % of total actual renewable water resources	2000	0.29	%
IRRIGATION AND DRAINAGE			
Irrigation potential	2007	3072	1000 ha
Water Management			
Area equipped for irrigation: full control - total	2001	118.120	1000 ha
Equipped lowlands	2001	0.000	1000 ha
Total area equipped for irrigation	2001	118.120	1000 ha
• Area equipped for irrigation as % of cultivated area	2001	2.7	%
• Annual increase rate		1.3	%
• Power irrigated area as % of area equipped for irrigation			%
• Area actually irrigated as % of area equipped for irrigation	2001	33.9	%
Non-equipped cultivated lowlands and flood recession	2001	0.000	1000 ha
Total agricultural water managed area	2001	118.120	1000 ha
• Agricultural water managed area: as % of cultivated area	2001	2.8	%
• Drained cultivated area as % of total cultivated area			%
Typology of irrigation schemes			
Small-scale schemes (< 50 ha)	2001	6.39	1000 ha
Medium-scale schemes (50 – 500 ha)	2001	19.647	1000 ha
Large-scale schemes (> 500 ha)	2001	92.084	1000 ha
Irrigated crops			
Rice	2001	4.130	1000 ha
Maize	1998	5.000	1000 ha
Sugar cane	2001	23.858	1000 ha
Vegetables	2001	7.011	1000 ha
Citrus	2001	0.370	1000 ha
Tobacco	2001	0.445	1000 ha
Other perennial crops	1985	2.000	1000 ha

ENERGY INDICATORS			
Energy Production	2005	11.74	Mtoe
Net Imports	2005	-1.53	Mtoe
TPES	2005	10.21	Mtoe
- TPES/Pop	2005	0.52	toe/capita
- TPES/GDP	2005	1.77	toe/thousand 2000 US$
- TPES/GDO (PPP)	2005	0.47	toe/thousand 2000 US$ PPP
Electricity Consumption	2005	9.24	TWh
- EC/Pop	2005	467	kWh/capita

ENERGY SUPPLY AND CONSUMPTION

	Coal	Gas	Crude oil	Petroleum products	Hydro	Other Renewable & Waste	Others	TOTAL
Production	13	1867	0	0	1141	8721	0	11742
Imports	0	0	0	543	0	0	825	1368
Exports	-13	-1849	0	0	0	0	-1032	-2894
International Marine Bunkers	0	0	0	-3	0	0	0	-3
Stock Changes	0	0	0	-5	0	0	0	-5
Total Primary Energy	**0**	**18**	**0**	**535**	**1141**	**8721**	**-208**	**10207**

Supply (TPFS)

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

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