WORLD SMALL HYDROPOWER DEVELOPMENT REPORT 2013

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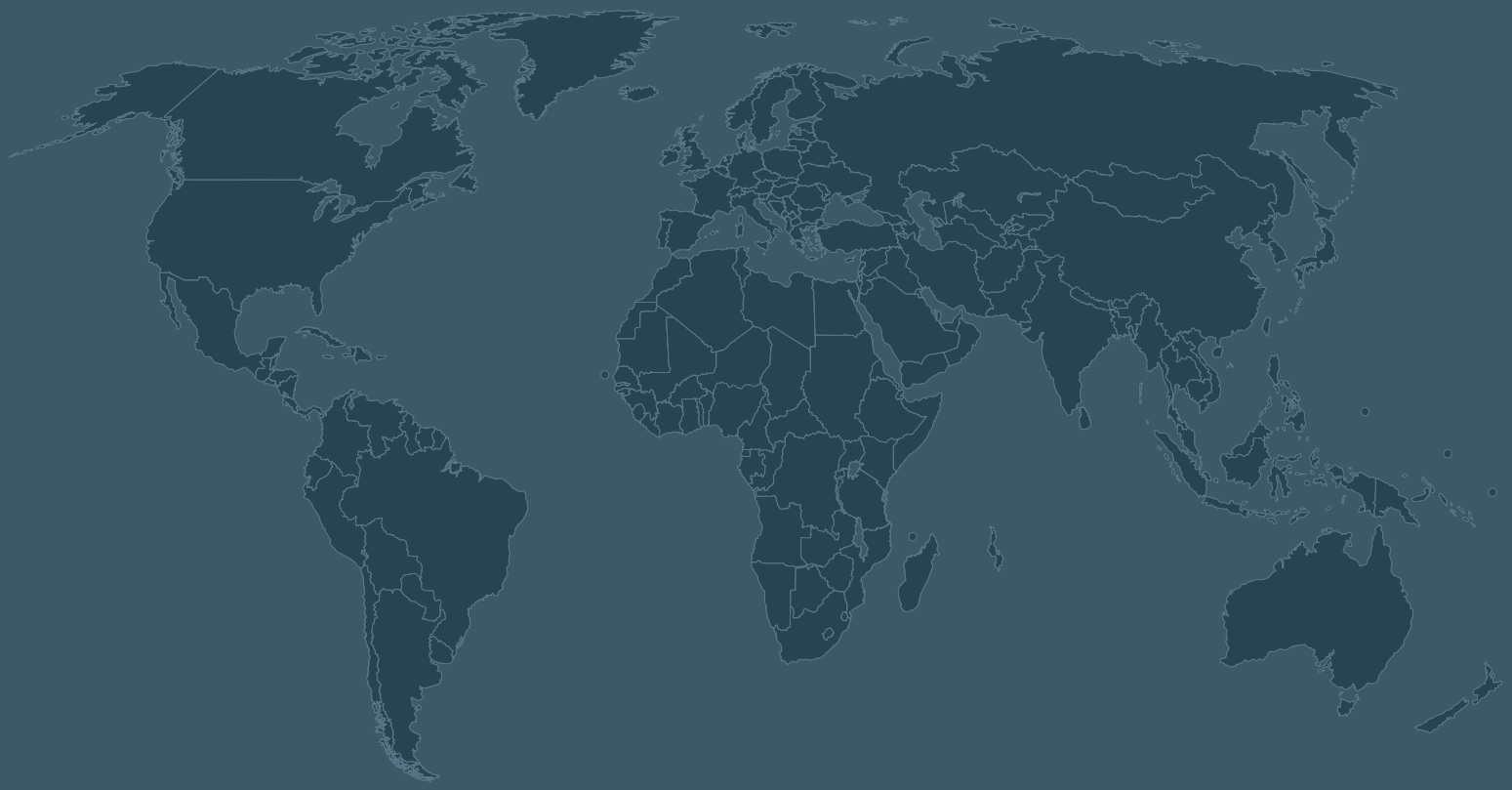
MOZAMBIQUE



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1 Africa
1.1 Eastern Africa

1.1.7 Mozambique
Wim Jonker Klunne, Council for Scientific and Industrial Research, South Africa

Key facts

Population	23,515,934[1]
Area	799,380 km^2
Climate	Tropical to subtropical
Topography	Mostly coastal lowlands, uplands in center, high plateaus in northwest, mountains in west[1]
Rain Pattern	Mean annual rainfall is between 800 to 1,000 mm at the coastal strip, it declines to less than 400 mm in the dry interior bordering Zimbabwe.[1]

Electricity sector overview

The total installed electricity capacity in Mozambique is 2.308 GW in 2009, nearly all generated exclusively from hydropower (99.7 per cent). Mozambique has large reserves of coal. There are utilizable reserves of natural gas that might be as high as 3 trillion cubic feet. Natural gas is exported to South Africa via a pipeline.

The current electricity generation in Mozambique is dominated by hydropower which supplies 95 per cent of the electricity demand followed by 5 per cent supplied via various thermal alternatives (figure 1).

Mozambique is a net exporter of electricity: 73.44 per cent of the 2,075 MW generated by the company, Hidroelectrica de Cahora Bassa (HCB) is exported to South Africa.

The country's electrification access is 14 per cent, estimated at 26 per cent in urban areas and 5 per cent in rural areas. In the latter, kerosene is the main fuel for lighting. The State-owned utility Electricidade de Mozambique (EDM) prepared a Master Plan for the expansion of the country's national power grid and distribution networks with the goal of reaching 15 per cent of the population by 2020, a target that had been achieved in 2010.[2]

In Mozambique's Plan for the Reduction of Absolute Poverty II (PARPA II), the Government has affirmed the critical role of the energy sector in reducing poverty. The importance of the energy sector is also emphasized in the World Bank's 2008–2011 Country Partnership Strategy (CPS), which identifies adequate access to energy resources and services as a key driver of economic growth and poverty alleviation. The CPS prioritizes the provision of energy services to rural schools, administrative posts, hospitals and clinics. At present, energy-related goals set in PARPA II are being turned into strategies such as the Off-grid and Renewable Energy Strategy, Generation and Transmission Master Plan, North–South (Backbone) Transmission Least-Cost Study, and National Biofuels Strategy.[3]

The major players in the supply of electricity in Mozambique are EDM, the state-owned power utility, HCB and MoTraCo.[4] EDM is involved in all parts of the electricity supply chain, including some generation (although it is not the primary generator in the country), transmission, distribution, and consumer connection, supply and billing.

HCB manages and operates the Cahora Bassa hydropower stations and their associated transmission networks that supply power to the Southern African Power Pool (SAPP). The installed capacity of 2,075 MW at the Cahora Bassa dam makes this the primary electricity source for both Mozambique and Southern Africa as a whole.[5]

MoTraCo is the third major supplier of electricity in Mozambique and it's a joint venture company formed by the state power companies in Mozambique, South Africa and Swaziland to transport power from South Africa to the Maputo-based Mozambique Aluminium Smelter (Mozal) plant. The company manages transmission lines in these three countries and was created in 1998 through an equity debt arrangement worth US$120 million.

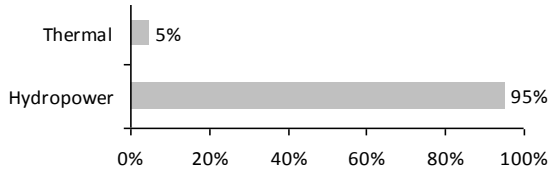

Figure 1 **Electricity generation in Mozambique**
Source: Electricidade de Mozambique[6]

Small hydropower sector overview and potential

Mozambique's greatest hydropower potential lies in the Zambezi River basin at sites such as Cahora Bassa North and Mphanda Nkuwa. So far, about 2,200 MW of generating capacity have been developed. In addition, the potential for small hydropower projects of 190 MW, which includes 6 MW of micro hydropower (plant capacity lower than 2 MW), 18 MW of mini hydro (capacities between 2 MW and 6 MW) and 166 MW of small hydropower (capacities between 8 MW and 15 MW). Potential sites for these micro hydropower

schemes are located in the mountainous terrain and perennial streams and rivers of Manica, Tete and Niassa provinces.[3]

A study on medium-sized and large plants reveals that the small hydropower potential is very high in the Central (Sofala, Manica and Zambézia provinces) and Northern (Nampula, Cabo Delgado and Niassa provinces) parts of the country. The South (Maputo, Gaza and Inhambane provinces) is relatively poor in hydropower resources for energy generation. The tea-producing areas, which are concentrated in the districts of Gurue, Ile, Milange and Lugela in Zambézia Province, also have high potential hydropower resources, according to an energy survey undertaken by the National Energy Fund (FUNAE) in 2004. An Intermediate Technology Development Group (ITDG) publication gives an overview of micro hydropower potential in Mozambique, especially in Manica Province, while a scoping study for micro hydropower investments in the provinces of Manica, Niassa and Tete undertaken by ITDG for the Energy Reform and Access Project of the World Bank, identifies the critical issues in developing the hydropower sector.[7] [8]

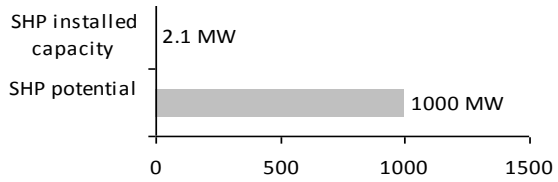

Figure 2 **Small hydropower capacities in Mozambique**
Source: Hankins[4]
Note: The potential may include plants larger than 10 MW and is different than other sources.

In the Policy for Renewable Energy and Master Plan for Off-Grid Electrification, a list of 60 identified hydropower locations is provided.[9] The Department of Energy estimates that over 60 potential micro- and mini-hydropower projects with a potential of up to 1,000 MW exist in the country. The central part of the country (Manica Province) has the best resources (table 1).[4]

Table 1
Government hydropower projects in Mozambique

Project	*Installed capacity (kW)*	*River*	*Pre-feasibility*	*Distance to nearest village (km)*	*Location (District, province)*
Mbahu	2 000	Lucheringo	Yes	30.0	Lichinga, Niassa
Majaua	1 000	Majaua	Yes	-	Milange, Zambezia
Kazula	30	Lazula	Yes	~12.0	Chiuta, Tete
Maue	280	Maue	Yes	~1.0	Angonia, Tete
Mavonde	30	Nhamukwarara	-	3.0	Manica,Manica
Rotanda	30	Rotanda	Yes	~1.5	Sussundenga, Manica
Sembezeia	30	Bonde	-	2.0	Sussundenga, Manica
Honde	75	Mussambizi	Yes	4.0	Barue, Manica
Choa	20	Nhamutsawa	-	~2.5	Barue, Manica

Source: Hankins[4]

Currently six hydro stations are connected to the national grid (table 2), while a substantial number of off-grid systems do exist.

Table 2
Grid connected hydropower stations in Mozambique

Name	*Province*	*Capacity (MW)*
Cahora Bassa	Tete	2 075.00
Mavuzi	Sofala	52.00
Chicamba	Manica	38.40
Corrumana	Maputo	16.60
Cuamba	Niassa	1.10
Lichinga	Niassa	0.75

Source: KPMG[9]

There is a growing interest in Mozambique to promote the use of small-scale hydropower schemes for isolated rural communities. One example of this is the Honde scheme, in the Province of Manica (Bárue District). The project started in 2005 and is able to electrify a 200-household village, a health centre, a school, two maize mills and shops, all by a micro hydropower plant on the Muzambizi River. The total demand was determined to be 65 kW and the scheme was sized at 75 kW taking into account of the demand growth. The project is being implemented by the provincial government of Manica, with support from the German Agency for Technical Cooperation GTZ (now Deutsche Gesellschaft für Internationale Zusammenarbeit - GIZ) .[9]

Besides the national Government of Mozambique, a number of NGOs and bi-lateral donors are active in the micro hydropower field. Practical Action and their Mozambican counterpart Kwaedza Sumukai Manica (KSM) are developing village electrification projects following what they called the 'generator model'. This model is built around a private entrepreneur generating electricity for the community, while the local

transmission and distribution infrastructure will be owned by the community.[10] The GIZ has also worked with local entrepreneurs to extend their business from milling to local electricity distribution and has upgraded three systems, supporting local production of turbines. GIZ is currently assisting local education institutes in Chimoio, Manica province, to set up a local hydropower training and knowledge centre.[11 12 13]

Renewable energy policy

The reforms in the energy sector have created the necessary enabling environment for private investments in the sector. Particularly the 1997 Electricity Act foresees the granting of concessions for private energy production, distribution and sales.

The private sector can operate its own generating system, provide electricity to surrounding communities and sell its energy surplus to the state power utility while buying energy from the utility when it is required. Furthermore, the Energy Fund Fundo de Energia (FUNAE), with its focus on rural electrification using renewable energy technologies, will provide good support for possible private investors, as some of the resources needed for the rehabilitation and/or construction of new hydropower schemes can be mobilized locally. However, it is important that the Government actively encourages private sector investment in renewable energy projects in Mozambique and creates clear incentives for investors, manufacturers and developers to utilize renewable energies when making investments in the country. Renewable energy support should not be targeted exclusively at off-grid initiatives and poverty alleviation, and renewables should be encouraged in economically active sectors, including tourism, telecommunications and commercial enterprises, as well as among middle-class households.[3]

Legislation on small hydropower

On the regulatory side, hydropower installations are required to have a water use concession which is regulated under the Water Policy. In fact, the Water Policy mentions the use of water resources for stand-alone and dam-connected hydropower purposes and states that small- and medium-scale hydropower facilities should be encouraged for off-grid electricity in remote areas, extension of the national electricity grid production and transmission capacity, as well as economic development in general.[9]

Barriers to small hydropower development

The main barriers to the development of small hydro projects in Mozambique include the lack of framework to support independent power producers. Reducing the uncertainty of the project revenue streams and increasing the availability of project finance would help to promote economically sustainable projects. The following measures are suggested by the International Renewable Energy Agency to improve project bank-ability:

- Electricidade de Mozambique could take a small equity stake in small hydropower projects to reinforce the credibility of its long-term power purchase agreement;
- The Ministry could work with the donor group to develop a partial risk-guarantee fund with financial institutions in Mozambique to promote lending to small hydro projects;
- A system of feed-in tariffs could be developed to provide long-term power purchase agreements, access to the grid and attractive return on investment;
- Consultations could be held with stakeholders to design a simpler process for environmental impact assessment for small run-of-river hydro plants.[14]

In overall perspective the local situation in Mozambique seems quite favourable to the development of small hydropower, although it has proven to be difficult to attract private sector funding.

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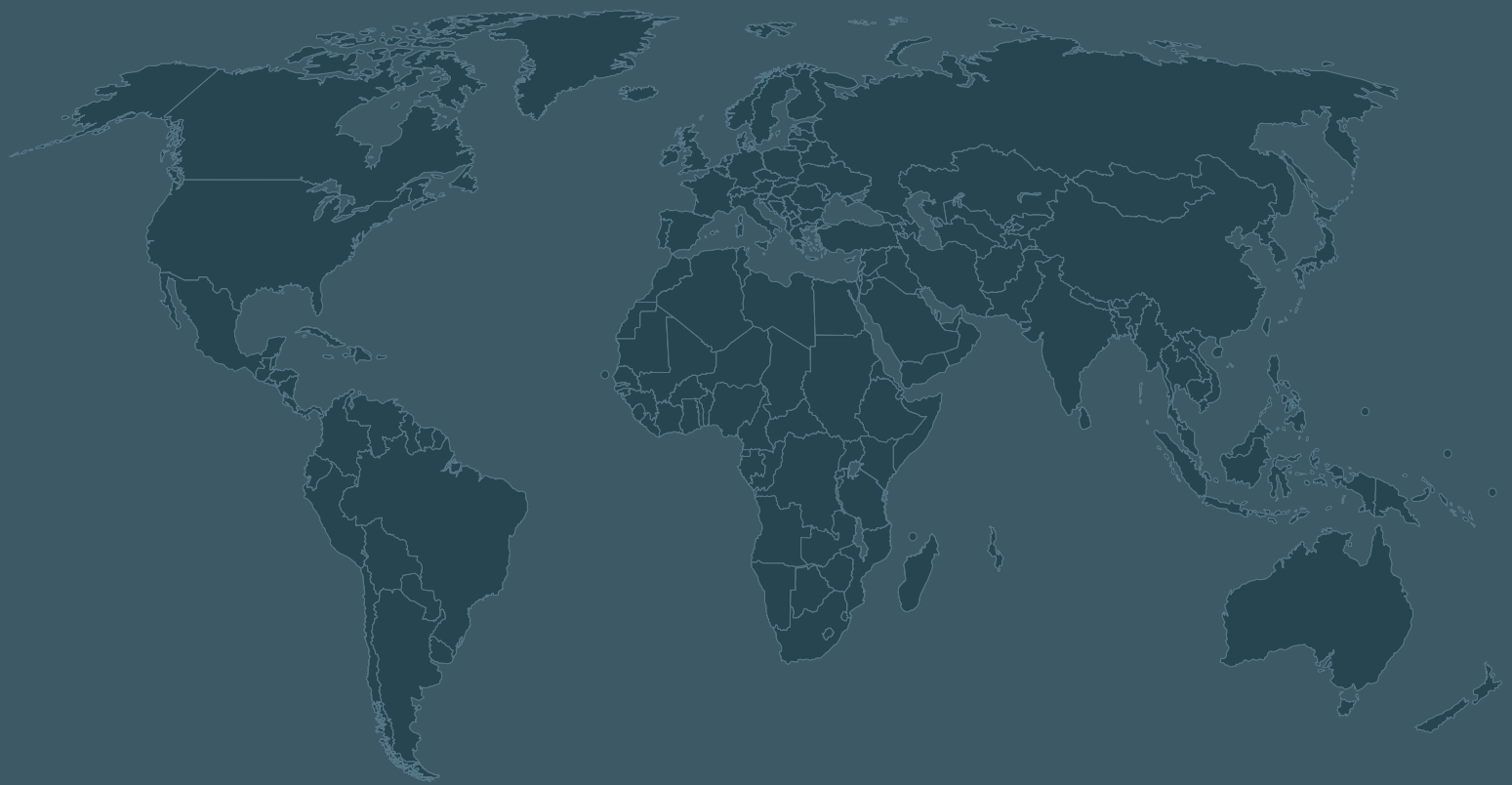

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