

WORLD SMALL HYDROPOWER DEVELOPMENT REPORT 2013

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LESOTHO



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1 Africa

1.4 Southern Africa

1.4.1 Lesotho

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Key facts

Population	1,930,493 ¹
Area	30,300 km ²
Climate	Temperate; cool to cold, dry winters; hot, wet summers
Topography	Of the total land mass, 1/4 in the west is lowland country, the remaining 3/4 are highlands ²
Rain Pattern	The lowest average annual precipitation occurs in the Senqu River Valley (450 mm) and the highest in the northeastern mountains zones (1,300 mm). The amount of precipitation received is highly variable in both time and space resulting in regular occurrences of droughts and floods. High intensity rainfall often leads to flash floods that accelerate soil erosion causing high sediment loads in rivers. Snowfall occurs annually over the mountain tops and once every three years in the lowlands.

Electricity sector overview

Lesotho does not have any known indigenous sources of oil, coal or natural gas. About three quarters of its total energy demand is met by biomass fuels in the forms of wood, shrubs, animals manure and agricultural residues. The only other fuels consumed in significant quantities are mineral coal and paraffin.

The electricity sector is thus relatively small (3 per cent of total energy consumed) with an installed capacity of only 76 MW, mainly from the Muela hydropower plant linked to and managed by the Lesotho Highlands Development Authority water scheme to provide water to South Africa. As the Muela hydropower plant is connected to the South African Eskom (Electricity Supply Commission in South Africa) grid and not to the main Lesotho electricity grid, the country is highly dependent on Eskom and it's a net importer of electricity (figure 1). Maximum peak load in the system stands at around 125 MW.

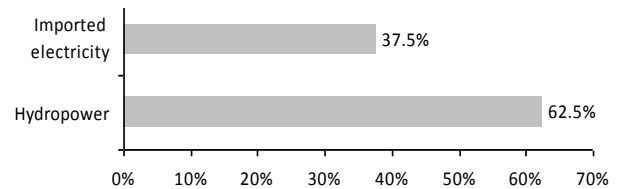


Figure 1 **Electricity generation in Lesotho**

Note: Imported electricity from Eskom South Africa

In 2011, only about 22 per cent of households had access to electricity, with most of these being in urban areas.³ The Government has set a goal of increasing electrification rate to 35 per cent of total households by 2015 and 40 per cent by 2020.

The Electricity Supply Industry in Lesotho is regulated by the Lesotho Electricity Authority (LEA). LEA is an independent regulator responsible for issuing licences, approving electricity tariffs, setting and monitoring quality of supply and service standards, and resolving disputes between suppliers and customers. LEA has the authority to regulate all aspects of the industry, including the generation, transmission, distribution, supply, import and export of electricity.⁴

Lesotho currently trades exclusively with Eskom. As a member of the Southern African Power Pool (SAPP) Independent Power Producer- in Lesotho are, in theory, allowed, to sell to other buyers of electricity as well.⁴

Electricity is supplied to customers by the Lesotho Electricity Company (LEC). The LEC is a parastatal entity established under the Electricity Act 7 of 1969, and is empowered to distribute, transmit and supply electricity. The Lesotho Highlands Water Development Authority (LHWDA) is the agency responsible for the generation of hydropower from the Muela hydropower station. The roles and responsibilities of these two bodies are set out in the 1993 Policy on the LHWDA/LEC interface.³

Small hydropower sector overview and potential

All locally generated electricity in Lesotho is hydropower based, with the 72 MW Muela plant providing most of it. Currently only augmented by two mini hydropower plants. The Lesotho Highlands Water project does offer opportunities for more hydropower developments and several studies have been conducted on possible pumped-storage plants as well.

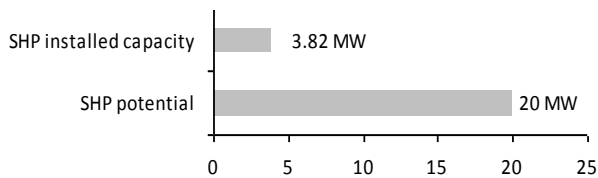


Figure 2 **Small hydropower capacities in Lesotho**

Sources: Clean Energy Portal – Reegle³, Taelé, Mokhutšoane and Hapazari⁵

It is estimated that the large-scale hydropower generation potential for Lesotho is approximately 450 MW. The potential for small-scale hydropower plants in Lesotho has been investigated in a number of studies. By 1990 a total capacity of 20 MW had been identified at 22 sites for both mini- and micro-hydropower (figure 2).⁵ French company Sogreah (now it is part of Artelia) has studied nine potential sites in the range of 100 kW to 1,000 kW and completed feasibility studies on three preferred sites: Tlokoeng, Motete and Qacha's Nek. In the micro range of hydropower, it is estimated that a potential of 20-40 feasible sites exist in the country with an average capacity of 25 kW.⁶

Examples of small hydro projects:

Commissioned in the early 1990s, the Tsoelike small hydropower plant is a 400-kW run-of-river installation that was constructed to serve the town of Qacha's Nek in the south of Lesotho, near the border of South Africa. This hydropower station was built as part of the French development assistance to Lesotho. The Tsoelike plant consists of the two Francis hydropower turbines supplemented by a 200-kVA diesel generator set located on a ledge next to the power station, and a 320-kVA set at the town of Qacha's Nek. Previously an isolated system, Qacha's Nek has been connected to the South African Eskom grid in 1997. This cross-border connection enabled LEC to decommission Tsoelike as it was developing serious technical and siltation problems.

Tlokoeng is a 670-kW hydropower station built with the French development aid to serve the town of Mokhotlong. The station has two Francis turbines of 460 kW and 210 kW capacity, augmented by two diesel generator sets as back up (one at the power station with 200 kVA and another one at Mokhotlong town with 500 kVA). The station was commissioned in February 1990. During its operation, the plant met an average of 27 per cent of Mokhotlong's electricity demand.⁷ The station was decommissioned in November 2002 when the 33 kV transmission line from the Letseng diamond mine reached the town of Mokhotlong. The difficult access situation and limited availability of spare parts for the French-origin equipment have inhibited refurbishment of the site.

The Katse Dam, a concrete arch dam on the Malibamat'so River in Lesotho, is Africa's second largest dam. It is also part of the Lesotho Highlands Water Project, which will eventually include five large dams in the remote rural areas. Although the main purpose of Katse dam is water storage and diversion, and contained a 570-kW mini hydropower plant. It is located in gallery K (123 metres below the spillway level) of the dam. The plant consists of a horizontal Francis turbine and an 800-KVA synchronous generator as the main component, together with associated equipment. Since its commissioning in August 2000, the plant has been running in an isolated mode from the LEC grid, the main power source to Katse Dam. The intention is to link the plant to the LEC grid and have it operating continuously at an average 500 kW power output.⁸

The Mantsony'ane hydropower plant (2 MW) was financed by a grant from Norway and handed over to LEC in February 1989. The power station is located on the Mantsony'ane River in central Lesotho and is feeding the LEC grid through Mantsony'ane Substation on the 33-kV Mazenod-Taba Tseka line. The station can operate on an isolated network when required, but the main operational strategy has been the daily peak loppingⁱ. The station is equipped with two Francis turbines of 1,500 kW and 500 kW, together with a 1,900-KVA and a 650-KVA generator. The station features a storage dam on the river and an unlined 655-metre long tunnel from the intake to the rock cavern power house. The design head is 35.5 metre.



Figure 3 **Powerhouse of the Mantsony'ane hydropower plant in Lesotho**

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The power station was flooded at the beginning of November 2006 and was out of operation since then.⁹ In 2011, LEC was in the process of rehabilitating the power station as part of the African Development Bank's Lesotho Electricity Supply Project. A tender

process for the station was started in the second half of 2011.¹⁰

The Semonkong project currently has an installed capacity of 180-kW hydropower, supplemented by a 120-kW diesel generator. The plant supplies an isolated community of approximately 25 customers, with the potential of adding a further 50 customers in the future. It contains space for two 190-kW hydropower generation units, one stand-by peak load 120 kW diesel unit, control room, switch gear room and an office/shop/storage room. The scheme comprises intake structure, headrace and penstock piping, powerhouse and power generating equipment. The intake structure consists of a 100-metre long concrete weir, a headrace inlet with trash rack and a simple pipe with a light steel gate for flushing of sediment in front of the intake. The low pressure headrace is a 290-metre long concrete pipe and the penstock is a 150-metre long fibreglass-polyester pipe.¹¹

Renewable energy policy

Lesotho has identified wind, solar and hydropower as potential renewable energy sources. Wind power potential of a few hundred MW has been identified, and there are currently three sites being investigated.

The Government of Lesotho and UNDP/GEF have worked together to increase electricity access in their rural electrification programme. The main objective is the promotion of renewable energy for the reduction of carbon dioxide emissions by the substitution of paraffin and diesel with clean technology.¹² A key target, for example, was the installation of 5,000 solar home systems by the end of 2012. Some 1,537 homes have been installed with the system. Another project with 500 solar units will be installed independently as a result of its influence. From January to April 2011, an average of 15 households per village in more than 10 villages had been electrified by independent installers.¹³

Barriers to small hydropower development

In order to boost small hydropower electricity production, viable business models for the development of small hydropower in Lesotho need to be found. Barriers to small hydropower development are the difficulties to access some sites and the lack of availability of spare parts in the local market.

Note

i. Peak lopping is a technical term for storing energy during low demand periods for use during high demand periods.

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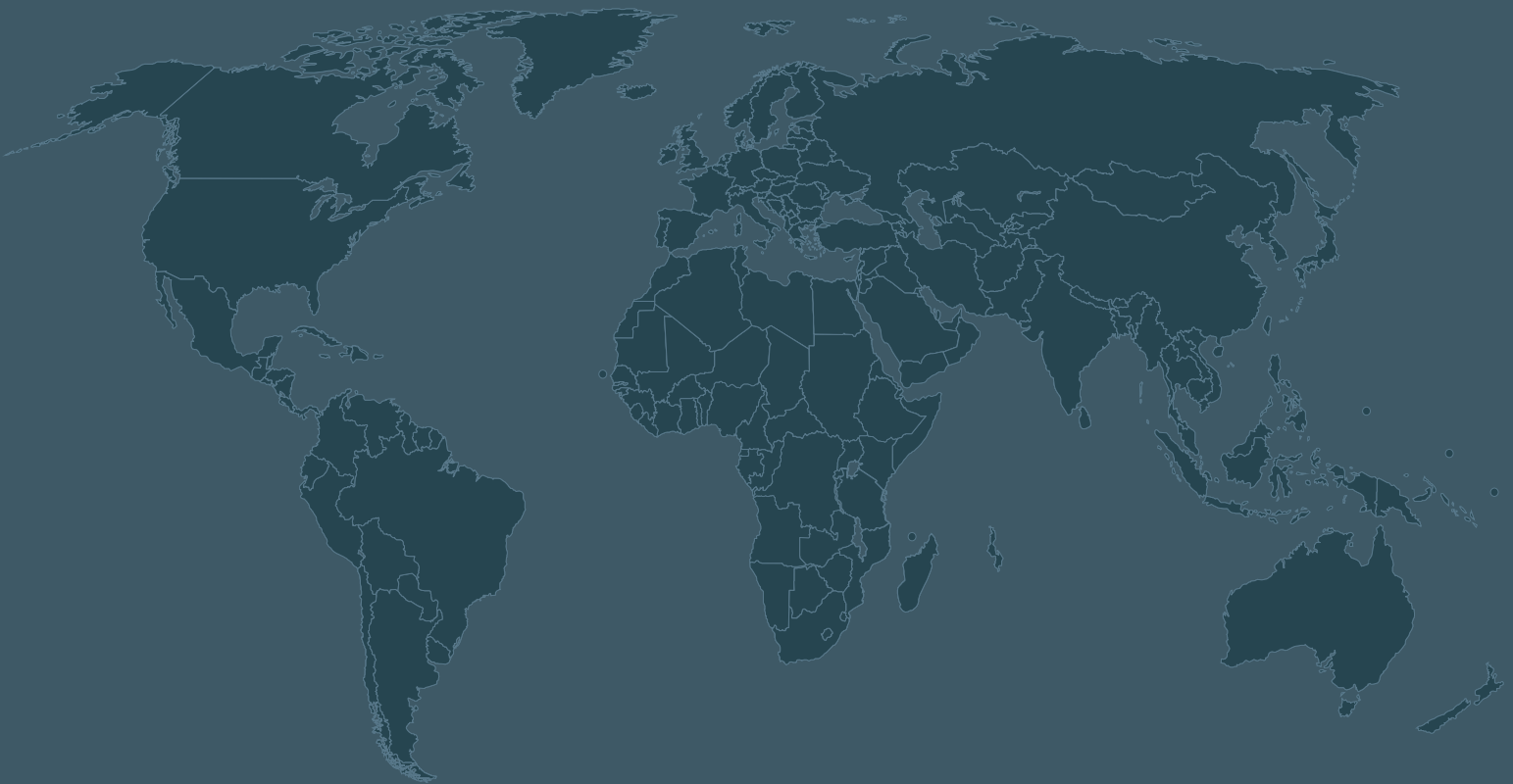
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