Disclaimer

Published in 2013 by United Nations Industrial Development Organization (UNIDO) and International Center on Small Hydro Power (ICSHP).

2013 © UNIDO and ICSHP

All rights reserved

This report was jointly produced by United Nations Industrial Development Organization (UNIDO) and International Center on Small Hydro Power (ICSHP) to provide information about small hydropower. The document has been produced without formal United Nations editing. The designations employed and the presentations of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of UNIDO and ICSHP concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgement about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO or its partners. The opinions, statistical data and estimates contained in the articles are the responsibility of the author(s) and should not necessarily be considered as reflecting the views or bearing the endorsement of UNIDO and its partners.

While every care has been taken to ensure that the content is useful and accurate, UNIDO and ICSHP and any contributing third parties shall have no legal liability or responsibility for the content or the accuracy of the information so provided, or for any loss or damage caused arising directly or indirectly in connection with reliance on the use of such information.

Copyright: Material in this publication may be freely quoted or reprinted, but acknowledgement is requested, together with a copy of the publication containing the quotation or reprint.

Recommended citation:
1 Africa

1.1 Eastern Africa

1.1.2 Ethiopia
Lara Esser, International Center on Small Hydro Power

Key facts

| Population | 91,195,675 | 1
| Area | 1,104,300 km² |
| Climate | Tropical monsoon with wide topographic-induced variation |
| Topography | High plateau with central mountain range divided by Great Rift Valley |
| Rain Pattern | Mean annual rainfall ranges from 2,000 mm over some pocket areas in the southwest highlands, and less than 250 mm in the lowlands. In general, annual precipitation ranges from 800 to 2,200 mm in the highlands (altitude >1,500 m) and varies from less than 200-800 mm in the lowlands (altitude <1,500 m).² Parts of Ethiopia have uni-modal and others bimodal rainfall patterns. |

Electricity sector overview

In 2009, 89 per cent of Ethiopia’s population lived in rural areas and rural electrification was estimated at a mere 2-per cent.³ The Government of Ethiopia launched its Rural Electrification Strategy in 2002 as a large governmental programme for electrification, consisting of three parts: grid extension by the public utility, Ethiopian Electric Power Corporation (EEPCo), private sector led off-grid electrification and promotion of new energy sources.

The Rural Electrification Fund (REF) with its loan programmes for diesel-based and renewable energy-based projects is the main implementing institution. With an initial budget of €29 million, REF has been supporting 180-200 rural micro-hydropower and photovoltaic (PV) mini-grids for educational and health care facilities.⁴ The fund provides loans up to 95 per cent of investment needs with a zero interest rate for renewable energy projects. Renewable energy technologies that receive support under this programme include solar PV, mini- and micro-hydro, and biomass co-generation.³

According to EEPCo, the number of electrified towns and rural villages has increased significantly in the last five years of the strategic plan period. By July 2011 it had reached a total number of 5,866, bringing the country’s electricity access to 46 per cent.⁵ In contrast, World Energy Outlook 2011 reported Ethiopia’s 2009 national electrification access as 17 per cent.⁶ This difference is probably due to the different reference points and sources.

The EEPCo has two electricity supply systems: the Inter-Connected System (ICS) and the Self Contained System (SCS). The main energy source of ICS is hydropower plants and for the SCS the main sources are mini hydropower schemes and diesel power generators allocated in various areas across the country (figure 1).

![Figure 1 Electricity generation in Ethiopia](source: Ministry of Energy and Mines)

Small hydropower sector overview and potential

According to a 2010-German Agency for Technical Cooperation Report, small- and micro-hydropower are not yet developed on a larger scale. Three small hydropower schemes exist in Yadot (0.35 MW), Dembi (0.8 MW) and Sor (5 MW) with a cumulative installed capacity of 6.15 MW (figure 2).

![Figure 2 Small hydropower capacities in Ethiopia](source: Shanko)

In February 2012, three micro hydropower plants with a cumulative capacity of 125 kW were inaugurated in the villages of Ererte, Gobecho and Hagara Sodicha in Sidama zone in the Southern Nations, Nationalities and the Peoples’ Regional State (SNNPR). The plants were implemented in partnership with Sidama Mines, Water and Energy Agency, the Sidama Development Association and local communities, and with the support of the Energy Coordination Office of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

The Sor small hydropower plant has the potential to be expanded by an additional 5 MW. A feasibility study was undertaken in 1992 and another study conducted with the support of the United Nations Development Programme (UNDP) also calculated the same results. The Supervisory Review and Evaluation Process (SREP) Strategic Draft Report plans to implement this development between 2012 and 2014 by updating the existing feasibility study; design and tender document preparation; installation of additional penstock and additional 5 MW third unit, construction of a rock-fill
The following sites in Oromia region have been approved for REF financing: Aleltu (300 kW), Bello (192 kW), Bote (160 kW), Dila (480 kW) and Sonkole (260 kW). The potential for small- and micro-hydropower is estimated to be 1,500–3,000 MW (10 per cent of the total hydropower potential in Ethiopia). It is limited by the seasonality of rainfall and reduced availability of water. Increased levels of small-scale irrigation farming, as a result of population growth, lead to increases in water needs. In the early 1980s, over 70 micro hydropower potential sites were identified by the Ethiopian Rural Energy Development and Promotion Center (EREDPC) under the Ministry of Mines and Energy of Ethiopia, Ethiopian Evangelical Church Mekane Yesus and a team of experts from People’s Republic of China. These sites are however lacking in socio-economic studies. Supported by GIZ, a south-south knowledge-transfer between Indonesia and Ethiopia started in 2008. Initial attempts have been made to set up local companies to produce micro-hydro equipment. However, most of the installed turbines and generators used are still being imported from abroad.

Renewable energy policy
The Ministry of Mines and Energy (MME) is the leading ministry for national energy policy and expansion of electricity provision. The Ministry of Rural Development is involved in matters of rural electrification. The Ethiopian Energy Agency is the regulating agency for the electricity market and is responsible of price regulations, power purchase agreements, licensing of independent power producers and regulating access to the grid by private producers.

The EREDPC, under the MME, have the mandate to promote renewable energy technologies, including micro-hydropower for rural areas. It is a donorfunded institution. The REF, which operates as part of the EREDPC of the Ethiopian Government, is an institutional focal point for the deployment of renewable energy technologies.

Furthermore, a feed-in tariff (FIT) for renewable energies (now in the fourth draft) is under preparation by the electricity regulatory agency.

The Government of Ethiopia has initiated the Climate-Resilient Green Economy (CRGE) initiative to protect the country against the adverse effects of climate change and to build a green economy that will help realize its ambition of reaching middle-income status before 2025. The CRGE foresees to develop up to 25,000 MW of Ethiopia’s generation potential by 2030 (hydro 22,000 MW, geothermal 1,000 MW and wind 2,000 MW).

Legislation on small hydropower
An environmental impact assessment is needed for all hydropower plants, but it is not enforced by the regulator for micro-hydropower projects. If the micro hydropower project is supported by a loan from the rural electrification fund then such assessment and approval from all neighbouring upstream and downstream countries is required (regulation by World Bank). Other requirements for off-grid plants and those connected to mini-grids are a distribution licence, which can be obtained from the regulator. Although rules are not transparent, the regulator is supporting this procedure. An investment licence is also required (except for cooperatives) and water rights have been checked by the Ministry (if the owner is not the community which normally already possesses the water rights).

Barriers to small hydropower development
In order to boost the small hydropower capacity in Ethiopia, improvements can be made in the following areas:

- Despite a long history of micro hydropower in Ethiopia, local skills to manufacture, operate and maintain the plants are not well developed. The schemes built in the 1940s were fully controlled and managed by foreign experts.
- Small- and micro-hydropower equipment and components are not available off-the-shelf in local market.

PEOPLE'S ETHIOPIAN CHURCH (MEKEANE YESUS)
• Relatively low return on investment is currently discouraging individual private investment in small hydropower, but cooperatives with members that will benefit from getting access to electricity may be potential developers, since their primary motive is not return on investment.8
• Competitive water uses and demand may prevent small hydropower development. An increasing population could create more demand for water by upstream users.8

References