

Small hydro in Africa

Wim Jonker Klunne gives an insight into the development of small hydro across Africa.

Around 10% of the world's hydropower potential can be found on the African continent. However, only 4 to 7% of the potential for large scale hydropower has been exploited [1,2]. For small and micro scale hydropower this percentage is most probably even lower, although no proper statistics are available. To indicate the low rate of development of small hydropower on the African continent, Gaul et al [3] compare the 45,000 plants below 10MW in China with a total of a few hundred developed sites in the whole of Africa.

Small hydro can play a pivotal role in providing energy access to remote areas that are currently not connected to the national electricity grid. The potential role of small hydro in eradicating energy poverty has been recognized by a number of national governments and donors. An example is the new draft energy strategy for the World Bank which specifically highlights small scale hydropower as an important component of future World Bank activities in Africa [4].

The large knowledge base on technical aspects of microhydro in general does suggest a thorough understanding of the technology. However, the relatively small number of projects implemented in Africa suggests that other barriers than the technology itself are still persistent.

Small hydropower in Africa

Although small hydropower projects have been implemented in several countries on the continent, information on the current state of affairs is scattered and incomplete. To a limited extent technical information is available about implemented projects, however, information on implementation models followed and their successfulness is not available in most cases [5,6]. Basic technical information on existing hydro stations might be available but can be incomplete and inconsistent over the different information sources. This lack of information does severely hamper the possibility to learn from past experiences and is a barrier to large uptake of village level hydro on the continent [3].

Small hydropower is a proven, mature technology with a long track record, even in Africa. For example the gold mines at Pilgrim's Rest in South Africa were powered by two 6kW hydro turbines as early as 1892, complemented by a 45kW turbine in 1894 to power the first electrical railway. In several African countries church missions built small hydro installations, like in Tanzania where more than 16 small

hydropower systems installed during the 1960s and 70s are still operating [7]. Another example are the large scale commercial farmers in the Eastern Highlands of Zimbabwe who installed hydro stations as early as the 1930s [8].

Many countries in Africa have a rich history of small scale hydro, but over time large numbers of these stations have fallen into disrepair, some because the national grid reached their location, some due to a lack of maintenance or even neglect.

Barriers

Most of the challenges facing small hydropower exploitation are not specific for hydro but generic for all types of renewable energy and rural electrification projects. General barriers for renewable energy projects are: the absence of clear policies on renewables; a limited budget to create an enabling environment for mobilising resources and encouraging private sector investment; the absence of long-term implementation models that ensure delivery of renewable energy to customers at affordable prices while ensuring sustainability.

For small hydro development, the following barriers can be identified:

- Policy and regulatory framework: unclear or non-existent policies and regulations that govern the development of (small) hydropower. In some countries hydropower developments under a certain threshold are not regulated at all, while in other countries it might be part of a broader regulatory framework for rural electrification in general. Generic frameworks often lack clarity on a number of hydropower specific issues like access to water and water infrastructure and the associated payments.
- Financing: hydropower developments are faced with high up-front costs and low O&M costs, something most available financing models do not favour. Nearly all of the new developments on the continent are relying on one form or the other on donor financing. Development of alternative financing models is needed to facilitate developments.
- Capacity to plan, build and operate hydropower plants: national and regional knowledge and awareness of the potential of small hydro in rural electrification is missing or very minimal. This includes knowledge at political, government and regulatory entities, as well as knowledge on local production of parts and components.
- Data on hydro resources: linked to the limited

knowledge about the technology is the lack of proper resource data on water availability and flow on which hydro developments can be based.

Micro hydro has the technical capability of providing electricity to rural areas of Africa which are currently not supplied with electricity. Several initiatives are currently ongoing on the continent which aim to install a large number of microhydro schemes to serve rural populations (see table).

Although information is available on the technical aspects of these projects, little has been published on the implementation models used.

From the analysis of a number of the current initiatives it has been very clear that micro hydro developments need to be embedded in a national programme for capacity building and industrial development to foster the emergence of a new industry. Particular attention needs to be given to governance issues related to hydro stations as experience from the described projects suggests that linkages with ongoing economic activities will ensure proper management of the system.

It is very clearly that the inclusion of entrepreneurs/private sector developers could benefit the sustainability of the systems. However this does in most cases also come with requirements from the financiers of these private developers. As shown with the case of Rwanda, there is a tendency to favour developments that feed in to the national grid as this ensures a steady income stream for the enterprise.

Several African countries have established renewable energy feed-in tariffs (Kenya, South Africa and Uganda) that do support the establishment of small scale hydropower linked to the electricity grid. For remote locations without access to the national grid, rural electrification agencies and/or funds, like in Tanzania, do provide the needed legislative and financial incentives for the uptake of remote hydropower.

To enhance the uptake of microhydro technology local stakeholders need to be made aware of the opportunities for the technology and coordinated efforts required to get this technology thriving again. To make people aware of the potential of small hydro, the author has started an online database of small hydropower projects in eastern and southern Africa. The main aim of the database is to catalogue the current situation and to make that accessible to policymakers, project developers, as well as the general public. This database can be found at http://hydro4africa.net/hp_database. ■

Selection of initiatives on small hydropower in Africa

Location	Project	Implementer	Description	Important component
East Africa	Greening the tea industry	UNEP/GEF	Small hydro plants at tea factories, including rural electrification component	Linking rural electrification with existing industrial activity
Kenya	Tungu-Kabiri hydro project	Practical Action / UNDP/GEF-SGP	Community owned system to power micro enterprises centre	Legislative framework prohibited connection of households
	Rural Energy Access Model	GPower	11 small hydro plants initially off-grid, later to be interconnected. Includes local turbine production	Long term planning, integration with grid, part of larger development plan, local turbine manufacturing
Malawi, Mozambique, Zimbabwe	Catalysing Modern Energy Service Delivery to Marginal Communities in Southern Africa	Practical Action/ EU	Rehabilitating existing systems, development of local/regional capacity	Inclusion of capacity building component
Mozambique	Access to modern energy services	GLZ	Rehabilitation of microhydro mills	Direct link with productive use
Nigeria	UNIDO Regional Centre for Small Hydro Power, Abuja	UNIDO	National and regional capacity building	Capacity building, linkages with International Centre for Small Hydro Power, Hangzhou, China. Current status unclear
Rwanda	Energizing Development	GTZ	Support to private sector to develop hydroplants	Need to incorporate requirements of financial sector
	Rural energy development in Rwanda	UNIDO	Rural energy development	Learning-by-doing project – increased role of private sector in construction and O&M
Tanzania	Kinko Village hydro, Lushoto	UNIDO/ MoEM/ TANESCO/ TaTEDO	Establishment of village hydro scheme	Integration of productive uses (grain milling and ICT centre)
South Africa	Bethlehem hydro	NuPlanet	7MW capacity at Sol Plaatje and Merino sites	CDM project
Uganda	Kisiizi Hospital hydropower	Kisiizi Hospital Power Limited	300 kW crossflow turbine serving hospital and local community	Hospital as anchor client
West Africa (Cameroon, Mali, Central African Republic, DRC, Gabon, Congo, Rwanda, Equatorial Guinea, Togo and Benin)	First regional micro/mini-hydropower capacity development and investment in rural electricity access	UNDP/GEF	Regional integration project aiming at developing 36 small hydropower stations. Included a network on small hydropower.	Establishment of regional network. PLEASE NOTE; project cancelled

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Author information

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Currently Wim is working at the Council for Scientific and Industrial Research (CSIR) in South Africa as senior researcher for Rural Energy and Economic Development. One of his research projects is looking at the sustainability of micro hydro projects in Eastern and Southern Africa.

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