Improving the sustainability of village hydropower in eastern and southern Africa

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BACKGROUND

Local, village-level, micro-hydropower schemes can play an important role in energising rural areas in Africa, in particular those areas far away from the national electricity grid.

Substantial numbers of projects and programmes have been implemented in Africa to provide solar systems to rural populations. However, it has become clear that the costs of photo-voltaic (PV) systems are very high and that they do not provide households with the level of energy services required. Micro-scale hydropower, often implemented through local isolated mini grids, is able to provide higher levels of energy services than can be offered by solar PV or battery charging, and at lower costs.

The large knowledge base on technical aspects of micro-scale hydropower indicates a proper understanding of the technology involved. Simultaneously, however, the number of hydro projects implemented does not reflect the enormous potential that exists in Africa, suggesting that barriers other than the technology itself still persist.

Studies on rural electrification conclude that technology issues are only part of the reason why energy access is still very low in certain areas. The way new (energy) technology is introduced in rural areas and the systems set up for operation and maintenance are equally important.

Although small hydropower projects have been implemented in several countries on the continent, information on the current state of affairs is scattered, incomplete and sometimes even inconsistent. To a limited extent information is available on technical details of implemented projects, while information on implementation models and their success is lacking in most cases.

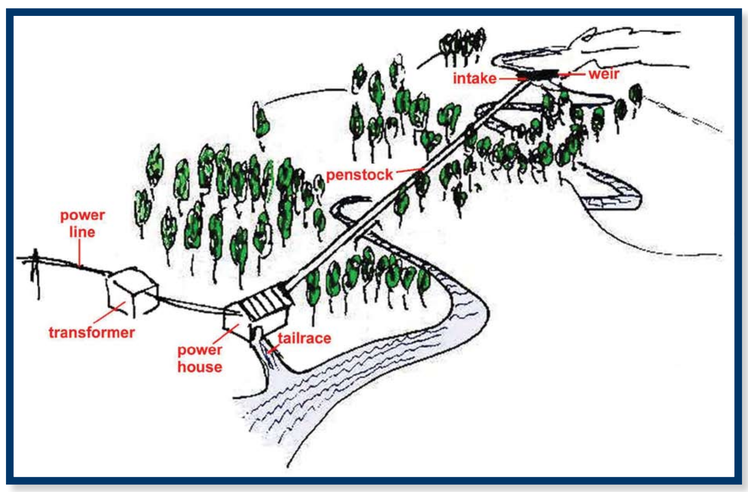
The current research is collecting information on the status of micro-hydropower in eastern and southern Africa. Information on existing schemes and new developments will be used to determine success factors in improving the sustainability of village-level hydro developments.

Micro-hydro has the technical capability of providing electricity to rural areas of Africa that are currently not supplied with electricity. Several initiatives are currently underway aimed at installing a large number of micro-hydro schemes to serve rural populations (see table for a summary). From the analysis of a number of projects it is clear that micro-hydro can bring sustainable development to rural areas, provided a proper legislative framework is in place that allows local production and distribution of electricity.

Linked to the development of individual hydro schemes, a national programme for capacity building and industrial development will need to be developed to foster a new emerging industry. Particular attention needs to be given to governance issues relating to hydro stations as experience suggests linkages with ongoing economic activities will ensure proper management of the system.

The inclusion of entrepreneurs/private sector developers could benefit the sustainability of the systems, although in most case this also comes with requirements from the financiers of these private developers. In the case of Rwanda, there was a tendency to favour developments that feed into the national grid as this ensures a steady income stream for the enterprise. However, it should also be emphasised that entrepreneurial involvement does not necessarily mean that the hydro system itself needs to be owned by a commercial entity. An example is the experience in Kenya of a community-owned hydro system that serves micro-enterprises only.

DEFINING MICRO-HYDRO



No internationally agreed definitions exist of the different hydro sizes. The words "large" and "small" hydro are used commonly as a form of distinction. The upper limit of "small" is usually in line with the World Commission on Dams as 10 MW of installed capacity. Large countries such as China and India tend to put the limit higher at 50 MW and 25 MW, respectively. Recently some international donors seem to use a limit of 15 MW when referring to small hydro.

Within the range of small hydro, the distinction can be made between mini-hydro (often defined as with an installed capacity below 1 MW), micro-hydro (below 300 or 100 kW depending on the definition) and pico-hydro (below 20 or 10 kW), each with its own specific technical characteristics. Micro- and pico-hydro installations are typically used in developing countries for energy provision to isolated communities where the national electricity grid is not available, whereas mini-hydro tends to be grid connected. Micro- and pico-hydro can also differ from mini-hydro. This is because local materials and labour could be used in the case of the first two, while mini-hydro typically involves more traditional engineering approaches and will usually need heavy access roads for delivery of materials and electro-mechanical equipment.

Uniform definitions also don't exist in the mini-, micro- and pico-hydro ranges. In the research described here the term micro-hydro is used to refer to hydro installations that are typically used for village electrification, using a local distribution network. In line with the definition used by Fraenkel *et al.* (1991) it is assumed that these hydro plants have an installed capacity below 300 kW.

Table: Recent projects in Africa

Implementing agent	Project name	Country/ region	Description	Important component
UNEP/GEF	Greening the Tea Industry	East Africa	Development of small hydro plants at tea factories, including rural electrification component	Linking rural electrification with existing industrial activity
GTZ	Energising Development	Rwanda	Support to private sector to develop hydro plants	Need to incorporate requirements of financial sector
Practical action/EU	Catalysing Modern Energy Service Delivery to Marginal Communities in Southern Africa	Malawi Mozambique Zimbabwe	Rehabilitating existing systems, development of local/ regional capacity	Inclusion of capacity building component
Practical action/ UNDP/GEF-SGP	Tungu-Kabiri Hydro Project	Kenya	Community-owned system to power micro-enterprises centre	Legislative framework prohibited connection of households

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