

SMALL SCALE HYDROPOWER FOR RURAL ELECTRIFICATION

1 Introduction

South Africa has generally been heavily dependent on coal and has recently started looking at ways to diversify its power-generating capacity. With abundant coal supplies, South Africa meets around 77% of its energy needs through coal. While it is largely used to generate electricity, a significant amount is channelled to synthetic fuel and petrochemical operations. Because of its dependence on coal, South Africa is the 14th highest emitter of greenhouse gases. However, the country is a signatory to the Kyoto Protocol, committing it to reducing its emissions of greenhouse gases.

Since 2007, Eskom, the state owned electricity supplier in South Africa, had experienced challenges in the generation and reticulation of electricity. As a result, in the first quarter of 2008, blackouts all over the country became common place, with damaging effects on South Africa's economy. Approximately R50bn was lost from the economy according to National Energy Regulator South Africa(NERSA).

The reasons for shortages of electricity supply are attributed amongst other things to years of under investment in the country's power infrastructure and energy demands rising faster than Eskom the state-owned company in charge of the majority of energy generation and distribution can supply.

The Mandate of the Department of Energy is to ensure sustainable provision of energy for socio-economic development. Together with Eskom, the Department of Energy has embarked on a massive programme to bring the electricity supply and distribution system into balance. With an infrastructural price tag of around R340-billion, Eskom is building new power stations, including Medupi in Limpopo that was

scheduled to make its first contribution to the grid by 2013, and Kusile, intended to come on stream thereafter.

The government is also looking to support sustainable green energy initiatives on a national scale through a diverse range of clean-energy options as envisaged in the Integrated Resource Plan 2010. In terms of this plan, which is a 20-year projection on electricity demand and production, about 42% of electricity generated must come from renewable resources. Independent power producers have been introduced in this regard and alternative energy sources include solar photovoltaic technology, wind, small hydro and concentrated solar thermal generators. These independent power producers are privately held entities and facilities meant to sell power to the government, contributing to the country's energy mix.

In 2001, Free Basic Electricity policy (FBE) was introduced by Eskom after suggestions made by the Department of Minerals and Energy (DME). It was argued that "conventionally, the average poor household does not consume more than 50 kWh of electricity per month" and hence this amount was to be offered free of charge. The subsidy was however made available to all consumers regardless of their income levels. Consequently, there is an amount of electricity consumed that is not connected to price but to the population that use it. This finds more expression in the National Energy Efficiency Strategy of South Africa, which required immediate implementation of low-cost and no-cost interventions, as well as those higher-cost measures with short payback periods.

Furthermore, low cost and no cost alternatives to power supply could have been seen appropriate for rural areas where only 17% of rural areas are connected to the national electricity grid.

It is on the basis of government's policy to prioritise rural development and provision of basic services to rural areas that, the need for alternative energy sources at low cost especially in rural municipalities with less operational and maintenance capacity has become a need. This has necessitated the Department of Science

and Technology within the framework of the Innovation Partnership for Rural Development Programme to identify and demonstrate small scale hydropower for rural electrification in two district municipalities.

Due to current electricity supply shortages, the potential electricity users in the rural areas of primarily the Eastern Cape and KwaZulu-Natal provinces now have to wait until the national utility ESKOM will be able to increase its margin between the supply and demand generation capacities and to satisfy delayed electrification expansion development of those users already connected. Due to SA having a semi-arid climate, we have a vast network of large dams and water distribution infrastructure (according to SANCOLD > 4900 registered dams with ca. 794 large dams.) Small hydropower schemes can play a critical role in providing energy access to remote areas in South Africa as stand- alone isolated mini grids.

Through knowledge, evidence and learning, the Department of Science and Technology aims to inform and influence service delivery departments, Municipalities and the Department of Energy in this particular instance on how science and alternative technologies can be used to achieve inclusive development and improved delivery and supply of electricity to rural areas. To ensure the attainment of this vision, the Department of Science and Technology and the Council for Scientific and Industrial Research are implementing the Small Scale Hydropower for Rural Electrification.

2 Legislative Context

The Constitution (1996) provides the legal basis for allocating powers to different spheres of Government and contains a number of rights specifically relevant to energy policy. The Constitution states that Government must establish a national energy policy to ensure that national energy resources are adequately tapped and delivered to cater for the needs of the nation. Energy should be made available and affordable to all citizens, irrespective of geographic location. The production and distribution of energy should be sustainable and lead to an improvement in the standard of living of citizens.

The Bill of Rights provides that *“Everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations. In order to meet this obligation Government’s has to date enacted a number of legislations including the White Paper on Energy Policy (1998) which states that: “Government will work towards the establishment and acceptance of broad targets for the reduction of energy related emissions that are harmful to the environment and to human health”.*

South Africa’s energy policy in the past focused heavily on issues of security of energy supply and self-reliance. With the publication of the White Paper on Energy (1998), more focus was placed on ensuring adequate supply to a large section of the population that had been largely ignored in past. i.e. rural areas.

The White Paper on Energy (1998) identifies the increased access to affordable energy services as a national overarching objective. As such, government has to implement programmes and initiatives aimed at promoting access to affordable, adequate and secure energy services for disadvantaged households, small business, small farms in rural areas.

The NDP proposes that by 2030 the proportion of people with access to electricity grid should rise to at least 90% .with non-grid options available for the remainder of households. Where municipalities lack technical capacity, regional utilities or alternative institutional mechanisms should be used so that basic service are not compromised. Key targets for the MTSF include 1.4 million additional households to be connected to the grid between 2014 and 2019, and 105 000 additional non-grid connections.

3 Project Description: Small Scale Hydropower for Rural Electrification

The proposed project shall demonstrate the possibilities of using small scale hydropower systems for rural electrification in South Africa as an alternative to ease

off electricity demand from the national grid. The aim of this project would be to enhance the uptake of micro- hydro technology, making local stakeholders aware of the opportunities that this technology brings and the coordinated efforts required to get this technology successful. The project will prove that under the current legislative and policy framework small hydropower technology is able to provide “grid-quality” electricity to rural communities. Small hydropower schemes can play a critical role in providing energy access to remote areas in South Africa as stand-alone isolated mini grids.

The intended outcomes of the project will be to:

- Develop a guideline for the formulation of clear policies and regulations that govern the development of small –scale hydropower
- Manuals and training material to assist prospective small-scale hydropower developers
- Demonstration of technology by means of a full scale pilot plant installation
- A form of clean renewable and sustainable energy for rural communities with a considerable lower output level of greenhouse gas carbon dioxide
- Reduced operating costs per annum as low as 1% of the initial investment cost, and define optimal cost models for running small scale hydro in rural settings.

4 Policy Considerations

Eskom’s position though is premised on the fact that Eskom is licenced by NERSA to distribute electricity to specific areas as per the **Electricity Regulation Act**, and that this agreement overrides the requirements of the Municipal Systems Act. (AMEU 2014) This may require attention from policy maker to clarify roles and responsibilities. For rural, non-grid electrification projects, it is important to know where Eskom is distributing electricity, irrespective of the institutional mechanism through which it is undertaken due to the fact that non-grid projects need to fall outside of any current or future electrification programme.

The uncertainty regarding the allocation of responsibilities could potentially create uncertainties with regards to which legal entity would be the appropriate contractual

stakeholder when implementing non-grid rural electrification projects. **The Electricity Regulation Act, Act 4 of 2006** as amended, describes the responsibilities and powers of the National Energy Regulator, NERSA, specifically in regards to the processing and issuing of electricity generation-, transmission- and distribution licences.

Institutional arrangements and governance mechanisms around community involvement vs. municipal regulations and technical support that may be necessary to be provided to these kind of projects may require further attention, especially in areas where the potential exist for electricity generated from small scale hydro power to be sold back to the national grid.

5 Conclusion

Rural electrification has the potential to improve the standard of living of people in a developing country such as South Africa. Universal access to modern forms of energy is still far from being reality in many parts of South Africa. Many remote areas – especially small settlements, villages or farms - will never be connected to a national grid, often due to their remoteness, sparse population and relatively low average energy demands. Small scale hydro offers the opportunity for low cost and green energy options.

Rural electrification applying small-scale hydropower technology contributes to Government's objectives of poverty alleviation and potentially also to local economic development through the provision of a basic electricity supply to communities. It aligns with the strategies of the Department of Rural Development and Land Reform, and the Department of Energy. Though the institutional environment within which such projects are to be implemented is complex, renewable energy, stand-alone systems such as small-scale hydropower projects, can be implemented within this robust institutional and legislative environment. Understanding these protocols and policies will also empower project implementers to appropriately engage with all affected stakeholders.

6 Recommendations

General Authorizations allow the DWS to authorize large numbers of people to take up water without the need for a license. A general authorization can be limited to a specific group of people, and/or specific water resources, and has several advantages, including: (DWS 2015):

- *Smaller scale emerging users would not need to be ready to apply for a licence;*
- *General authorizations can be adapted for specific regional and social needs;*
- General authorizations can promote the uptake of smaller amounts of water by many people - and hence can have a greater impact on poverty;
- They can allow for the gradual uptake of water by the poor, paralleled with the gradual reduction of use by existing lawful water users.

If the intended water use activity is covered under a General Authorisation published in the Government Gazette in terms of section 39 of the NWA from time to time (normally every 5 years), then a registration process is to be followed. Importantly, a General Authorisation is only applicable to specific rivers or catchments and is not applicable to the whole country. The current applicable General Authorisation, GA1199 published in December 2009 for Section 21(c) and 21(i) water uses, is currently under review. It is also these two water uses that are specifically applicable to small-scale hydropower projects.

In lieu of this, as well as the potential cost associated with specialist studies required to attain water use licenses for small rural electrification projects which would potentially make these types of projects financially unviable, the Department of Water and Sanitation has been approached through this DST funded demonstration project with the request to include the construction of small-scale hydropower projects towards non-grid electrification in the rural areas of South Africa into the new General Authorization as an activity. This review process is currently in progress. If this request is successful it would imply that small-scale hydropower projects initiated for islanded, non-grid electrification purposes would need to follow a registration process to attain the required water use authorization, and not a full water use license application process.