REEECAP 2.6 INVESTIGATION AND MACRO IMPACT OF HYBRID SYSTEMS (SYMPOSIUM)

Executive Summary

Hybrid electricity systems powering mini-grids are understood to be systems and technologies that make use of two or more electricity generating options selected according to the least-cost energy resources available, e.g. a diesel-powered generator coupled with a solar photovoltaic generator, or a combination of a wind and solar system or similar, to feed electricity into a distribution network to provide on-demand electrical energy to multiple consumers.

The Symposium held at Gobabeb, Namibia, on 24 and 25 October 2007, entitled – *"Hybrid electricity systems powering mini-grids: a southern African perspective"* – focused on the experiences and lessons learnt with hybrid systems in southern Africa.

Specifically, the Symposium provided participants with an opportunity to exchange views, and reflect on issues such as the costs and benefits of hybrid systems, technical and managerial aspects, institutional arrangements, and the roles that hybrid electricity systems can play in the continued electrification in southern Africa.

Energisation and development
In southern Africa, energy and development are closely linked: while access to affordable energy services is viewed as a prerequisite for development, it is also recognised that development drives the demand for energy. Hundreds of thousands of southern African households – mainly in rural areas – remain unelectrified, despite considerable past electrification efforts. If people in the region are to experience the convenience, versatility and opportunities that access to modern electrical energy services bring, electrification will have to continue. Here, the provision of decentralised electricity services by way of hybrid electricity systems and solar home systems offer considerable opportunities, and therefore warrant greater attention in future.

Rural electrification
Southern African electrification plans indicate that many settlements and villages will not be connected to the electricity grid in the coming years, which is mainly due to the high costs associated with grid electrification, and the generally low demand for electricity in many rural areas. This raises a general question: should areas with low population densities be electrified at all, or should people, if they wish to have access to

contemporary energy services, move to places where such services are available? Some would say that the continued influx of people in search of the bright lights of our cities is unsustainable. Southern African towns and cities bear testimony to the fact that rapid urbanisation is taking place at rates that strain most service providers, and create additional societal burdens. Continued rural electrification therefore holds the key to many national development issues.

Equitable access to energy services

If national development criteria are to be equitable, those living in rural or informal areas should have access to modern energy services. In regards to the provision of electrical energy to off-grid areas and informal settlements in southern Africa, hybrid electricity systems can either bridge the pre-grid years, or serve as permanent least-cost options when far away from the national grid. The equitable access to affordable energy services will remain an important aspect on how successful national development agendas can be implemented in future.

Grid-connected versus hybrid-connected consumers

When connecting households to an electricity distribution system, the actual service that the electrical energy provides, i.e. the use of electricity, is of little interest to the utility. In times of cheap and abundant electricity – and many southern African countries are only now emerging from such a cycle – questions regarding the productive or efficient use of electricity were seldom asked. This distinguishes grid-connected users from consumers dependent on the electrical energy generated by a hybrid electricity system, as the question whether the energy provided is actually used productively – or at least efficiently – is important for hybridconnected users. Few consumers are really interested in purchasing kWh, but want to use the energy to render certain desirable services, such as lighting or refrigeration; their consumptive behaviour is mostly limited by what they are willing to pay for the associated electrical energy.

In the case of hybrid systems however, users cannot arbitrarily decide to connect a device of their liking to the system as it may undermine the integrity of the entire system, and therefore has an impact on how everyone else connected to the system can derive benefits from it. The links between hybrid systems, the application of energy efficiency concepts and practices, as well as the introduction of complimentary thermal fuels, are therefore quite natural.

Ownership and subsidisation

An interesting distinction between grid-supplied electricity and the energy delivered by decentralised electricity systems is the question of ownership. While a person who has bought a solar home system to provide electrical energy for lighting and feeding the television set is the owner, operator and user of that system, hybrid systems powering mini-grids introduce the added complexity that the owner and operator are often different legal and operational entities.

In addition, the user of hybrid-supplied electricity is often a third party with little or no connection to the owner and operator, and has to abide by the service level arrangements put in place to ensure the stability and continued operability of the system. In case of a hybrid system providing electricity to a close-knit community, or in case the owner, operator and users share similar views on why it is advantageous to collaborate, such

systems are relatively straightforward to manage. The Gobabeb hybrid system in Namibia is one such example.

However, systems where there is a considerable difference between the three main actors, such as in Hluleka, or may become the case in Tsumkwe (as described in the proceedings), require agreements between the owner and the operator, as well as between the operator and the users. Whether such systems, especially when servicing transient populations or those having ambiguous or non-viable ownership arrangements, are feasible, remains to be demonstrated.

Levelling the grid- and off-grid playing fields

A different angle on continued electrification is raised when considering the question of who pays for which costs. In most southern African countries, capital costs associated with a grid connection are subsidised by Government. Sometimes, local authorities or municipalities even pay for part of the ongoing operational expenses, which are then recovered through crosssubsidisation arrangements between other services or users. For solar home system users, and those benefiting from hybrid systems, subsidisation of capital costs is not automatic. It is realised that the playing field between grid- and off-grid applications remains far from being levelled.

Electrification and the use of public funds

One arrangement that has found its way into some southern African off-grid electrification initiatives, such as the Namibian revolving fund scheme, is where individuals interested in purchasing a solar home system can acquire such a system and benefit from a subsidy on interest rates. This burdens users with capital costs that, had they been living in grid-connected areas, would have been subsidised. Many clients making use of such financing arrangements, or those that would benefit from off-grid energisation programs in general, however, are from the poorer sections in society. Public funds continue to be used for capital subsidies, and while it is Government's decision how such public funds are spent, we should refocus on what actually constitutes the best use of such funds.

Incentivising IPPs to drive rural energisation

As the southern African electricity market is liberalised and unbundled, independent power producers (IPPs) are expected to establish themselves. However, if IPPs are to venture into the electrification or even energisation of rural or informal areas, will they be compensated for such 'infrastructure' investments? If not, what incentive will IPPs or the Regional Electricity Distributors (REDs) have to drive and support electrification efforts? If southern African Governments are serious about IPPs, and if REDs are to contribute to national development, investment incentives have to be created to allow such entities to infuse additional momentum into national energisation efforts.

Challenges

As was stated on several occasions during the Symposium: "the problem is money". This cannot go unchallenged: while rural areas in southern Africa have difficulty attracting infrastructure investments, South Africa's concession approaches show that with a clear mandate and commitment from Government, the private sector is willing and able to undertake considerable off-grid energisation efforts. So while the problem may appear to be money, others say that prevailing ambiguities in regard to how development goals are

to be reached, who benefits from subsidies, and the non-commitment of Governments to actively level the playing field between grid- and off-grid electrification and therefore rural energisation, are the real issues that need to be tackled.

Alternatives to grid electrification

In a time where many of the low-hanging conventional rural electrification fruit have been harvested, alternatives to centralised grid-provision will have to be considered more seriously. Here, the questions of how political advantages can be realised by promoting rural electrification, and how best to curb the continued unsustainable urbanisation, remain to be answered. Hybrid systems can – under well-managed conditions – be viewed as a mature and reliable technology option for the electrification of non-grid areas. Sometimes, as is the experience in other parts of Africa, hybrid systems and their associated mini-grids provide valuable pre-grid solutions, thus allowing communities to benefit from services that electrified city-folk take for granted. It is our hope that the Symposium on hybrid electricity systems powering mini-grids will make a contribution to the ongoing debate about energisation in southern Africa, and assist decision makers to better understand the roles and multiple requirements of such systems.