

---

# Integrated Rural Energy Utilities

## A review of literature and opportunities for the Establishment of an IREU

---

Final first report

Prepared by: Douglas Banks, Alix Clark, Katherine Steel, Chris Purcell,  
Jonathan Bates

Revision number 4  
Last edited 3 July 2008



renewable  
energy  
& energy  
efficiency  
partnership

**RESTIO Energy Pty Ltd**  
Suite 166, Private Bag X18,  
Rondebosch, 7701  
17 Roseberry Rd, Mowbray, 7700  
Tel +27 21 686 0151 Fax +27 866197 872  
Email [admin@restio.co.za](mailto:admin@restio.co.za)



## Acknowledgements

We would like to thank a number of people who have kindly given of their time and thoughts during discussions on Integrated Rural Energy Utilities. These include

- Uganda: Godfrey Turyahikaho (REA), Benon Bena (MEM) and participants from other Ministries, private sector organizations and institutions in a workshop held in October 2007
- Tanzania: Mr N Mwihava, Dr Lutengano Mwakaheya (Ministry of Energy and Minerals), Therese Hindman Persson (ECON), Tanesco staff, EWURA staff and several others.
- South Africa: Mr Lambone Aphane, Mohau Nketsi (DME) and others who have engaged in discussions about IREU
- The contribution of REEEP through funding of this project is further gratefully acknowledged.

And, the team would like to thank our boss, Doug Banks, for everything.

## Table of Contents

<b>INTEGRATED RURAL ENERGY UTILITIES.....</b>	<b>1</b>
<b>1 INTRODUCTION .....</b>	<b>1</b>
1.1 PURPOSE OF THIS DOCUMENT AND ITS CONTEXT WITHIN THE OVERALL IREU ROADMAP PROJECT .....	2
1.2 WHAT IS AN INTEGRATED RURAL ENERGY UTILITY?.....	3
<b>2 REVIEW OF AFRICAN EXPERIENCE OF DELIVERING INTEGRATED ENERGY AND SERVICES .....</b>	<b>5</b>
2.1 INTRODUCTION .....	5
2.2 COUNTRY PROFILES .....	5
2.3 REVIEW OF POLICIES, PROGRAMMES AND PROJECTS IN SOUTH AFRICA .....	15
2.3.1 <i>Background commentary</i> .....	15
2.3.2 <i>Energy policy</i> .....	18
2.3.3 <i>Regulatory framework</i> .....	18
2.3.4 <i>Projects and programmes</i> .....	19
2.3.5 <i>A case study: The South African off-grid concessions programme</i> .....	23
2.3.6 <i>Conclusions</i> .....	35
2.4 REVIEW OF POLICIES, PROGRAMMES AND PROJECTS IN TANZANIA .....	37
2.4.1 <i>Background</i> .....	37
2.4.2 <i>Energy policy thrusts and direction</i> .....	37
2.4.3 <i>Regulatory framework</i> .....	39
2.4.4 <i>Identification of Stakeholders</i> .....	39
2.4.5 <i>Projects and programmes</i> .....	42
2.4.6 <i>Conclusions</i> .....	49
2.5 REVIEW OF POLICIES, PROGRAMMES AND PROJECTS IN UGANDA.....	51
2.5.1 <i>Background</i> .....	51
2.5.2 <i>Energy policy thrusts and direction</i> .....	51
2.5.3 <i>Identification of Stakeholders</i> .....	57
2.5.4 <i>Projects and Programmes</i> .....	61
2.5.5 <i>Conclusions</i> .....	65
2.6 OTHER CASE STUDY MATERIAL OF PARTICULAR INTEREST .....	66
2.6.1 <i>UNDP/GEF supported activities in Botswana</i> .....	66
2.6.2 <i>Yéelen Kura – Mali</i> .....	67
<b>3 ANALYSIS OF CASE STUDY PROGRAMMES.....</b>	<b>68</b>
<b>4 WAY FORWARD .....</b>	<b>70</b>
4.1 RATIONALE FOR AN IREU .....	70
4.2 REACHING THE IREU GOAL .....	74
4.3 MOVING FORWARD TO ESTABLISH AN INITIAL IREU .....	75
<b>APPENDIX A .....</b>	<b>79</b>

## List of Figures

Figure 1 Elements of the rural energy dynamic in Africa: Multi-fuel use in electrified South African home .....	17
Figure 2. NuRa's area of operations in northern KwaZulu Natal, South Africa .....	28
Figure 3 Off-grid fee-for-service utility infrastructure .....	29
Figure 4: Generating house and distribution network for unlicensed power seller, inset shows the 54kW diesel generator enclosed in the wood building .....	49
Figure 5: Access to electricity by region in Tanzania .....	79
Figure 6: Potential PV market in Tanzania .....	79

## List of Tables

Table 1 Country overview of rural energy context .....	7
Table 2: Household energy expenditure by fuel .....	15
Table 3: Ownership of concessionaires, concession areas and current installed base (2007) .....	25
Table 4: NuRa region: Estimates of the total number of non-grid households .....	30
Table 5 Analysis of opportunities to establish and IREU in South Africa .....	36
Table 6: Potential customers for Mwanza PV project .....	43
Table 7: UECCO electricity tariffs compared to TANESCO .....	45
Table 8: Subsidies for rural electrification available from REF .....	55
Table 9 Energy sector targets, Uganda .....	56
Table 10: Connection charges for consumers to UMEME network (incl. VAT) .....	59
Table 11: Summary of end-user tariffs from 1st November 2006 .....	60

## List of Abbreviations

BUDS	Business Uganda Development Scheme
CEF	Central Energy Fund (South Africa)
CFL	Compact Fluorescent Light
CIREP	Community Initiated Rural Electrification Project
DDP	District Development Plan
DEO	District Energy Office
DLG	District Local Government
DME	Department of Minerals and Energy, South Africa
EDC	Energy Development Corporation
EDG	Energy & Development Group
ERA	Electricity Regulatory Authority (Uganda)
ERT	Energy for Rural Transformation
ESD	Energy for Sustainable Development, UK
EWURA	Electricity and Water Utility Regulatory Authority, Tanzania
FBE	Free Basic Electricity
FBAE	Free Basic Alternative Energy
GoU	Government of Uganda
IEC	Integrated Energy Centre
IREMP	Indicative Rural Electrification Master Plan, Uganda
IREU	Integrated Rural Energy Utility
KES	KwaZulu Energy Services Pty Ltd (solar utility in South Africa)
LIREP	Locally Initiated Rural Electrification Project
LPG	Liquid Petroleum Gas
MEM	Ministry of Energy and Minerals, Tanzania
MEMD	Ministry of Energy and Mineral Development, Uganda
MFP	Multi Functional Platform
MOLG	Ministry of Local Government, Uganda
NEDN	New Electricity Distribution Network

NEEA	National Energy Efficiency Agency (South Africa)
NERSA	National Energy Regulator of South Africa
PASASA	Paraffin Safety Association of Southern Africa
PUC	Productive Use Containers
PPP	Public Private Partnership
PREP	Priority Rural Electrification Project
PSF	Private Sector Foundation, Uganda
PV	Photovoltaic
PVTMA	Photovoltaic Targeted Market approach
REA	Rural Electrification Agency, Uganda
REA	Rural Energy Agency, Tanzania
RED	Regional Electricity Distributor, South Africa
REB	Rural Electrification Board, Uganda
REEEP	Renewable Energy and Energy Efficiency Partnership
REF	Rural Electrification Fund, Uganda
REF	Rural Energy Fund, Tanzania
RESP	Rural Electrification Strategy and Plan, Uganda
UEDCL	Uganda Electricity Distribution Company
SACCO	Savings and Credit Co-operative, Uganda
SHS	Solar Home System
SIDA	Swedish International Development Agency
SWER	Single Wire Earth Return
SSMP	Sustainable Solar Market Packages, Tanzania
SWH	Solar Water Heater
TANESCO	Tanzania Electric Supply Company
TaTedo	Tanzanian Traditional Energy Development and Environment Organisation
TREC	Tradable Renewable Energy Certificate
TREESPA	Tanzanian Renewable Energy and Energy Efficiency Project to Sustain Poverty Alleviation
UETCL	Uganda Electricity Transmission Company
UGX	Uganda Shilling
UPPPRE	Uganda Photovoltaic Pilot Project for Rural Electrification

UECCO	Urambo Electric Consumers Co-operative Society (UECCO)
USD	United States Dollar
WENRECO	West Nile Rural Electrification Co-operative

## 1 Introduction

Rural energy service delivery remains a significant challenge for many countries in Africa. Modern energy forms, and particularly electricity, are generally not available to the majority of rural areas, and many urban areas. Household energy profiles are typically non-optimal for a variety of reasons including (but by no means limited to) the following:

- Poor access to reasonable quality lighting sources (inhibits study, productive activity after dark, social interaction)
- Lighting sources used are often expensive (candles, dry-cell batteries)
- Poor access to modern fuels for thermal needs, with resulting reliance on woodfuel, or in some cases charcoal
- High indoor air pollution exposure (wood fuel, charcoal, coal)
- Environmental damage (woodfuel harvesting, charcoal production)
- Extensive use of kerosene in poor quality appliances, with resulting risk of destructive fires, and poisoning
- Limited access to grid electrification (a small number of countries such as South Africa have extensive grid)
- Limited affordability of solar or other alternative electrification options (for low power applications such as TV, radio, communications)
- Limited access to, and often high cost of LPG or other commercial fuel supply
- High cost of LPG or commercial fuel appliances
- Constraints to micro- and medium scale enterprise development as a result of limited access to electricity and other modern energy sources.
- Poor conditions for operating wireless loop telephones (including data lines for internet access).

Several interventions have been undertaken in the rural energy sector in Africa (and of course other developing regions), and there is a plethora of ongoing projects, programmes and national activities aimed at improving rural energy access and affordability. Significant projects are listed below.

- Grid electrification (particularly in South Africa)
- Solar electrification (more limited, and not universally accepted as a success story in South Africa, fairly extensive use in Kenya, and mixed success in numerous other African countries including Tanzania and Zambia – particularly parts of Asia, including the Philippines and Bangladesh)
- Ceramic lined jiko dissemination (e.g. Kenya, Uganda and Tanzania)
- Biogas digester dissemination (limited in Africa, but more success in Nepal, India, China)
- Mini-grid projects (more limited experience, Senegal, South Africa, north Africa)
- LPG role out (Ghana, Morocco, some success in South Africa)
- Kerosene distribution (commercially successful, but for health and safety reasons not highly encouraged by policy makers and responsible investors).

For the most part, large-scale interventions have been technology specific, and thus address only part of the energy needs of rural households. Grid electrification has perhaps been the most successful (particularly in South Africa), but even then, it only meets part of the need - in rural areas electricity is not extensively used for cooking. Rural grid electrification is seldom financially viable, and often struggles to achieve economic viability, and connection rates have not been good in many countries. In some regions the grid has been retracted. Significant efforts are underway to establish and support rural electrification programmes in



countries such as Uganda, Madagascar, Mozambique and Senegal. However, for the most part these only address electricity, and it is well documented that electricity provision alone does little to address the vital cooking or productive-use of energy needs of households.

A further feature of many rural energy supply projects, is that they have a good initial start up period, while supported by international funders, and 'expert' technical assistance. However, over time, the level of innovation, management and skilled resources available to manage and support the project often drops off, simply because the projects are too small to sustainably employ highly skilled staff.

Private sector involvement in rural electrification (grid and off-grid), while being mooted as a key component of rural electrification strategies by several authors, and integrated into several large scale programmes, has not yet been a resounding long term success, in part because the institutional and policy environment remains investor 'unfriendly', and because the market is a challenging one<sup>1</sup>. National governments, transaction advisors and programme developers still have some way to go in developing optimum, workable models for different country contexts.

## 1.1 Purpose of this document and its context within the overall IREU Roadmap Project

This document reviews key elements of the ongoing energy delivery environment in South Africa, Uganda and Tanzania, with a view to gaining preliminary answers to the following three questions:

- Is an Integrated Rural Energy Utility an appropriate way to deliver energy services in one or more of the three focus countries (South Africa, Uganda, Tanzania)?
- Given the context in these countries, what are the main issues that a more detailed IREU design phase will need to take into consideration?
- Are there particular ongoing activities in one or more of the target countries that would lend themselves well to becoming more like an *Integrated Rural Energy Utility*?

This report is the first substantive output of a REEEP funded project seeking to:

- Build a case for *rural integrated energy service utilities*, serving grid and off-grid households, thermal energy needs, social sector energy needs (education, health, water, ICT) and business needs, and raising awareness of energy options and efficiency
- Develop best practice guidelines for these utilities, including business models and implementation and regulatory frameworks

Subsequent reports and project activities will focus on one main case study in one country (decision on focus areas/country still pending) to develop guidelines and reference material – but in such a way that lessons and experience can be beneficial to a broader audience, and in particular to the other two countries: The guidelines and reference material will cover the following areas:

- IREU partnership and investor criteria
- Regulatory models, institutional framework
- Finance mechanisms
- Capacity requirements – particularly for rural implementation
- Costing of fuel and service options
- Business models for IEUs – including path from current to proposed

---

<sup>1</sup> There are of course some successful implementations: grid, mini-grid and also SHS. Some of these are highlighted in this report.

- Financial/economic models for investors (including governments)

The final phase of the project will focus on documentation and dissemination, and in so doing seek to link stakeholders and move towards implementation of an identified case, and target more general project output dissemination to key stakeholders.

The main IREU project outputs are:

- An brief review of existing cases of rural energy service delivery (this report)
- Guidelines, reference materials: for governments, regulators, donors, investors to use in implementing rural IEU (developed for selected case, emphasis on replication in other regions)
- IEU business plan that provides information for investment decision and growth path in the identified case
- Financial model for business operations
- The project team will work with stakeholders to try and achieve an IREU investment decision in at least one case.

## 1.2 What is an Integrated Rural Energy Utility?

For the purposes of this project, an *Integrated Rural Energy Utility* (IREU) is defined as:

**a medium- to large-scale decentralized entity that delivers a range of renewable and other energy services to primarily rural regions (households, social services and productive use applications) – meeting both thermal and grid and/or off-grid electricity needs in an energy efficient manner, and within an institutional framework that has necessary critical mass and long-term financial integrity.**

Such entities could utilize a range of different business models, finance systems, technologies and could deliver different energy services. Ownership and management models need to be tailored to specific country and regional context. This review report seeks to explore such aspects of *existing* energy service activities with a view to enabling the team and stakeholders to collectively work out what the optimum strategy to create an IREU would be. As an example of an IREU ‘vision’ see text Box 1. However, in reading the vision, it must be noted that there are several possible ownership and delivery structures that could fit into an IREU. For example:

- Co-operatives (as per rural electrification co-operatives established, for example, in the USA and Philippines);
- National or regional utility models which are given extended mandates;
- Distribution services run by local government authorities (as for grid electrification in large parts of South Africa)
- Public-Private-Partnership based approaches, where an implementation utility is established to operate in a particular area;
- In some cases an IREU may be an independent private sector (or community-led) operation with little local or national government involvement.
- Smaller-scale initiatives were a community establishes integrated service delivery activities on a village level.

There are a range of different energy service products that may or may not be included within an IREU. The most probable ones are:

- Grid electricity
- Mini-grid/isolated grid in appropriate areas
- Off-grid electricity services

- LPG or another commercial fuel

Other products/services that deserve significant consideration include:

- Biogas
- Improved wood burning stoves (in some cases charcoal burning)
- Ethanol gel and other 'modern' biofuels
- Solar Water heaters
- Heat retention cookers
- Solar cookers

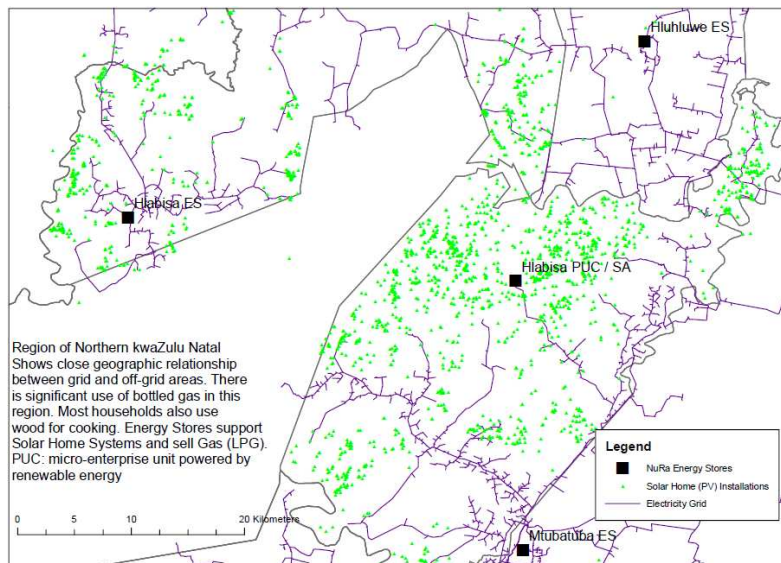
Effective energy service delivery to rural communities requires good communication between service providers and both residential and institutional consumers. There is significant scope for improvements through greater awareness, and dissemination of energy fuel, appliance and energy efficiency information. This needs to be treated as a service area, and methods found to justify and finance it.

Box 1 A possible IREU implementation

Picture a rural area, with 400 villages, (a total of about 200 000 households, with associated businesses, schools, health facilities), scattered over a region hundreds of kilometres across. At several of these villages is located an 'energy store' that has sales staff and provides a base for maintenance technicians. These energy stores stock liquefied petroleum gas, appliances for LPG and biogas, improved biomass stoves, hay boxes, and ethanol gel, perhaps even solar cookers. The stores also supply and maintain solar home systems and other PV technologies. In suitable regions, the stores also support biogas dissemination activities. In addition, the stores act as a payment and customer service point for grid electrified customers in the area. They have a management system that tracks customer payments, and feeds data back to utility head quarters. The technicians associated with the stores install and maintain household solar systems. They also carry out basic maintenance on several institutional systems and productive use energy systems in the area (and on hybrid or mini-grid systems with wind and/or diesel generation). Their basic knowledge of electricity is adequate to allow them to assist the grid customers in the electrified settlements with simple fault resolution.

At regular intervals a supply truck visits each store as well as specific points in some of the neighbouring villages, drops off pre-filled gas bottles, and other thermal fuels at selected sub-agents and collecting electricity service fees or credit payments from agents in smaller villages. These agents in turn supply local consumers, saving them a trip to the energy store.

The 'energy stores' and their staff are part of a regionally located **Integrated Rural Energy Utility (IREU)**. This Public-Private-Partnership, is responsible on the ground for grid and off-grid electrification under the nationally agreed framework for the specific allocated region. The IREU has a management team, which has competent



technical, human resource and financial skills. It arranges longer-term supply deals with liquefied petroleum gas and other fuel providers (including a national biogas programme), PV equipment manufacturers and suppliers and the national electrification agency, regulator and electricity supply industry. The IREU secures maintenance contracts for the institutional PV systems, access to financial support for energy service delivery, and the critical grid electricity purchase, supply and distribution contracts. The management team and local shareholders also negotiates with regional and national government. Shareholders who have international connections facilitate access to renewable energy certificate trade for the PV systems installed in the region.

## **2 Review of African experience of delivering integrated energy and services**

### **2.1 Introduction**

In the first instance, the IREU Roadmap project focuses on three countries: South Africa, Uganda and Tanzania. Although the concept may well have application potential on other countries – these three are of particular interest for the following reasons:

- South Africa has an extensive grid electrification programme, yet several parties including government have identified the need for strategies to address thermal energy needs. The Department of Minerals and Energy has also grappled with the challenge of developing and managing an Integrated National Electrification Programme with the context of an “Access for All” target by 2012. However, there still remain questions about the best way to manage and implement grid and off-grid electrification in an integrated fashion. Furthermore, South Africa has also tested the concept of private sector implemented off-grid electrification using solar home systems. Some of these SHS operations have included LPG dissemination activities. These are effectively prototype IREUs. Finally, the feasibility of mini-grid applications have also been tested.
- Tanzania is in the process of establishing a Rural Energy Agency, and has a framework in place for implementation of electrification projects that involve co-operatives, or private sector partners. The country also has active off-grid electrification, and the “Sustainable Solar Market Programme” is gaining momentum. These initiatives, coupled with a significant need for improved energy services mean that Tanzania is also a candidate for the potential establishment of Integrated Rural Energy Utilities.
- The Rural Electrification Agency and the Ministry of Mines and Minerals in Uganda are currently completing an Integrated Rural Electrification Master Plan in Uganda – which includes grid, off-grid and mini-grid planning and project development. There are also parallel activities related to thermal energy services. A key component of the Uganda strategies is to include private sector participation, not only for off-grid electrification, but also in the management and implementation of grid extensions/distribution to rural areas. The concept of an IREU has been discussed with Ministry and REA officials, and there seems to be potential for its application in the Uganda context.

There are a number of other countries where the potential for IREUs is promising, or where existing electrification or energy service delivery projects have particular relevance. Some of these experiences are discussed briefly below. The sections to follow introduce the South African, Tanzanian and Ugandan case studies. Section 2.2 presents a high-level overview of the three countries, while Sections 2.3, 2.4 and 2.5 provide details on current energy policy thrusts, programmes and projects.

### **2.2 Country Profiles**

This section provides a high-level overview of economic and socio-economic country contexts for South Africa, Uganda and Tanzania. Table 1 below provides economic and socio-

economic factors that many influence/guide the manner in which energy and energy services are delivered in these countries. As is presented below, South Africa has a large economy by comparison with Tanzania and Uganda, a significantly higher GDP/capita, more established infrastructure, and a far higher level of electrification. Yet, around half of South African's still live below the poverty line – and this is similar to Tanzania and Uganda

Table 1 Country overview of rural energy context

	<b>South Africa</b>	<b>Tanzania</b>	<b>Uganda</b>
Population (millions)	47, 5 million (2007 est.)	39.3 million <sup>2</sup>	24.7 million, growth rate 3.4% (2002 census)>
Urban/rural population	59, 72% urban/40, 28% rural	23%urban / 77%rural <sup>3</sup>	12% urban/88% rural
Population below poverty line	50% (2000 est.)	51% <sup>4</sup>	38%
GDP (US dollars)	USD587, 5 billion (2006 est.)	USD13.14 billion <sup>1</sup>	USD5.93 billion
GDP/Capita (US dollars)	USD 13 300	USD 800 <sup>1</sup>	USD 240
Key energy institutions (programme, planning, regulation)	Department of Minerals and Energy National Energy Regulator Eskom, Eskom Enterprises Municipalities (future REDs) Central Energy Fund (incl PetroSA., and IGas,) Gas distributors SASOL PetroNet	Ministry of Energy and Minerals. TANESCO (electric utility) SONGAS (gas industry). <sup>5</sup>	Ministry of Energy Mineral Development Rural Electrification Agency (REA) - responsible for planning future network extensions through the IREMP UETCL – responsible for planning and implementing improvements/upgrades to transmission network. UMEME – ERA – allocates licences for projects
Key energy institutions (funding)	Central Energy Fund/Strategic Fuel Fund, Energy Development Corporation Eskom	Government of Tanzania, UNDP World Bank, GEF GTZ	Ministry of Energy Mineral Development  World Bank, SIDA, GTZ, UNDP Private Sector Foundation

<sup>2</sup>CIA World Factbook Tanzania

<sup>3</sup> <http://www.tanzania.go.tz/census/>

<sup>4</sup> <http://www.helio-international.org/uploads/Tanzania-EN.pdf>

<sup>5</sup> <http://www.mem.go.tz/index.php>

	<b>South Africa</b>	<b>Tanzania</b>	<b>Uganda</b>
	Government DBSA International funders including World Bank, IFC, GEF, energy utilities, NGOs, Foundations.	SIDA	
Entities currently responsible for grid electrification implementation	Eskom Municipalities	The Tanzania Electric Supply Company Ltd. (TANESCO <a href="http://www.tanESCO.com/">http://www.tanESCO.com/</a> )	UEDCL – legal owner of most of country's distribution network UMEME – distribution concession holder responsible for operation of UEDCL networks across country except West Nile. UMEME is obligated to connect anyone within 1km of the existing 33kV/11kV network. WENRECO - distribution concession holder for operation of West Nile network. WENRECO is obligated to connect anyone within 100 m of a 33kV/415V transformer.
Entities implementing off-grid electrification	Concessionaires (for example, NuRa, KES, Solarvision)	Most programs are implemented under the administration of the MEM, with partnerships with funding institutions. Private sector is active, either independently or supported through programmes such as UNDP/GEF/MEM or GEF, SSMP	REA MEMD Ministry of Health, Ministry of Education & Sports Ministry of Agriculture Directorate for Water Development Private Sector Foundation
Current overall level of electrification	74% (2006 est.)	10% <sup>2</sup>	Total: 8%
Current level of electrification	82% urban (2006 est.)  61% rural (2006 est.)	Urban 39% and rural 2% <sup>2</sup>	Urban: 39% Rural: 3% Primary Schools: 5%

	South Africa	Tanzania	Uganda
	64% of Schools have been electrified, of which 3% is PV and 1% gensets (2004 – DME)		Secondary Schools: 27%
Number of electrical connections still needed	3,2 – 3,4 million (2006 est)	36 million people without access to electricity	The RESP aims to achieve a rural electrification rate of 10% by 2010 <sup>6</sup> , meaning that 480,000 rural consumers, a net increase of 400,000 over the year 2000 figure are to be serviced <sup>7</sup> . This would still leave approximately 4.3 million households without access. It is estimated that 15% of the increase in serviced households will come from an increased rate of connection to the existing grid outside the urban triangle, 40% from extension of the interconnected grid, 25% from isolated grids and 20% from photovoltaic solar systems. The rural electricity coverage rate, - the percentage of rural households living in the service areas of low voltage distribution grids – to be achieved in the year 2010 is 30%. More than 1.2 million rural households will be living in electrified areas.
Electrification planning responsibility	DME (National Electrification Program) Eskom - who have been tasked with planning an "Access for all" programme – and are in turn	The Tanzania Electricity Supply Company (TANESCO) is responsible for generation, transmission and distribution of electricity in Tanzania with an	Electrification planning is undertaken by UMEME and WENRECO in their areas. Otherwise, REA takes lead (through IREMP) for 'major' extensions.

<sup>6</sup> According to REA's Subsidy Policy, this is currently being revised to 2012.

<sup>7</sup> In 2000, the former Uganda Electricity Board (UEB) had some 170,000 customers, of which 80,000 were outside the urban Kampala-Jinja- Entebbe triangle. UEB were adding new connections at a rate of roughly 8,500 a year mainly in urban and peri-urban areas, whilst the number of households is growing at 100,000 every year, more than half of which are in rural areas.



	<b>South Africa</b>	<b>Tanzania</b>	<b>Uganda</b>
	<p>employing consultants</p> <p>Municipalities (local govt) are responsible for preparing Electricity (sometimes Energy) Service Development Plans as part of the Integrated Development Planning Process.</p> <p>Off-grid utilities (within their service areas for off-grid) undertake more implementation specific planning.</p>	<p>installed capacity of 860 MW. At present the electricity supply industry in Tanzania is dominated by a vertically integrated electricity supply and distribution utility TANESCO which is state owned.</p> <p>A uniform pan territorial tariff is charged with a lifeline tariff of the first 100 units of consumption. Only 1 % of the rural households are electrified. For rural areas government follows a selective process of electrifying district head offices, agro-processing industries and economically viable settlements near the grid. The Ministry of Health and the Directorate of the Environment / National Environmental Management Council (and the Office of the Vice-President) are more distantly involved in energy matters.<sup>3</sup></p>	<p>Smaller, 'Community Initiated Rural Electrification Projects' (CIREPS) and 'Locally Initiated Rural Electrification Projects' (LIREPS) on an unplanned, ad hoc basis.</p>
Availability of gas (reserves and units)/Extent of the distribution network /nature of distribution	<p>LP Gas is available in most urban areas in South Africa, at filling stations and gas suppliers. LPG is also generally available in major towns in rural areas.</p> <p>Although LPGASA mentions that supply shortage is a possible reality, its projections are that supply will outstrip demand in Africa for a few years.</p> <p>Note that NuRa has experienced</p>	<p>While LPG is generally thought to have considerable potential as a source of household energy, the lack of distribution infrastructure limits its availability. In the few households where it is used, it is preferred for cooking only. LPG stoves mostly are high-pressure gas cookers - similar to the low pressure ones, except that they are attached directly to the gas bottle. Also LPG stoves are in short supply, and tend to be available mostly as single flame cookers. LPG as yet offers a</p>	<p>LP Gas available in all urban centres and some larger towns mainly at Filling Stations. All LPG supplies imported through Kenya.</p> <p>Distribution is not good in rural areas as is expensive</p> <p>Gas has been "discovered" in Western Uganda but will be some time before exploitation.</p>

	South Africa	Tanzania	Uganda
	local supply shortages over extended periods.	convenient, though supplementary source of household energy to a limited number of people who can afford it. <sup>8</sup>	
Availability of paraffin (reserves and units)/Extent of distribution network /nature of distribution	Paraffin is, due to an extensive distribution network, available in almost every corner of the country. It is provided by petroleum companies and delivered in tanks by trucks to shops all over.	Kerosene is popular among medium and low-income households, because of its generally good availability in both rural and urban areas. Kerosene is mainly used for lighting and cooking. Despite its popularity kerosene, is often unsafe because of its hazardous exhausts. About 225,778 cubic meters of kerosene were imported in 1997 mostly for household level consumption. About 7,600,000 households use kerosene for fuel. Kerosene Stoves are popular because they are relatively cheap, and simple to use. <sup>3</sup>	Paraffin available at most filling stations and is widely used for domestic lighting.
Potential for solar	<p>South Africa has some of the best natural conditions for solar energy. In addition, the country has an established SWH and PV industry, operating in urban and rural settings. Potential in almost all regions is good (&gt;4.6 kWh/m<sup>2</sup>/day), with several regions such as the Northern Cape excellent (7.3 kWh/m<sup>2</sup>/day)</p> <p>The solar market is of the order of 3 MWp per annum, with growing interest in independent power fuelled by supply uncertainties. The rural</p>	Average insolation for Tanzania is 5.5 kWh/m <sup>2</sup> . There is a relatively small regional variation in the country. Also see Figure 6 in the Appendix for potential market for solar energy technologies.	<p>Solar resource very good (4.8 kWh/m<sup>2</sup>/day)</p> <p>Policy framework for PV very positive – The IREMP process identifies 3.7 million remote and dispersed households. A 10 % target would mean 370 000 off-grid households.</p> <p>Subsidies available from BUDS-ERT (equiv to 14% of system value):</p> <ul style="list-style-type: none"> <li>• SHS – 3 USD/Wp up to 60 Wp</li> <li>• Institutional system - 2.5 USD/Wp up to 2,000 Wp</li> <li>• Subsidy paid direct to supplier</li> </ul>

<sup>8</sup> <http://www.hedon.info/goto.php/TanzaniaCountrySynthesis>

	<b>South Africa</b>	<b>Tanzania</b>	<b>Uganda</b>
	household market is already significant, but not well quantified (apart from the concessions – see below).		Additional subsidies are being mooted as part of the IREMP process, and the PVTMA process <sup>9</sup>  Potential for SWH in health and tourism sectors, but very little implementation or policy support.
General extent of off-grid services	Fairly extensive off-grid services, 6 concessionaires operating, contract signed for a large 7 <sup>th</sup> concession. Some questions around future implementation funded by government. Several thousand privately installed systems. 15 to 20 MWp installed base of PV	Household installations number in thousands, with wholesales/importers, dealers and rural installation agencies established in selected key areas. Some health centre and school demonstrations/experience.	Programmes and policies in place to support SHS delivery, but still clear need to scale up. Key programmes include UPPPRE, the PSF BUDS ERT programme, PVMTA (new) but installations are counted in thousands so far. Plans allow for tens of thousands to several hundred thousand off-grid systems.
Status of rural health services energy supply	Most rural health facilities (94%) have energy supply (89% grid, 4% solar and 1% gensets), made possible by the DME's National Electrification Program's Schools and Clinics focus. According to 2004 figures (HST), about 176 clinics still needs to be electrified (6%).	Tanzanian health facilities can be broken down into four categories (number of centres): regional hospitals, district hospitals, health centres, dispensaries. It is assumed that the hospitals have access to electricity, either through grid-connections or stand-alone generators, while the other facilities do not have electricity.	DoH have commissioned development of specifications and tender processes for health Centre electrification. There are also detailed guidelines for health centre energy services published in the ENABLE reports. However, only a small percentage of health facilities in rural areas have been electrified. (For example, data gathered during IREMP masterplan process indicates 3342 health centres, of which 307 already have access, 378 could gain grid access through IREMP, leaving 2,657 requiring off-grid access
Status of rural education services energy supply	About 64% of South African schools have electricity supply (Eskom, PV, gensets). The remaining 36% is	Overall status of school electrification in 'grid' areas is unknown.	Energy not generally seen as a priority in Education sector due to far more pressing constraints .

<sup>9</sup> PVMTA is the Solar Targeted Market Approach being developed by REA and MEMD

	<b>South Africa</b>	<b>Tanzania</b>	<b>Uganda</b>
	being targeted as part of the National Electrification Program, according to 2004 data. However, more recent data (2006) shows that around 8000 schools still need to be electrified, with between 2800 and 5600 of those schools being high schools, which generally have larger energy needs. There has been extensive provincial school electrification – and there remains considerable uncertainty over numbers.	<p>The authors have visited some schools in the Mwanza region which had PV systems installed. The ENABLE series of reports does address rural education needs in Tanzania</p> <p>The Sustainable Solar Market Packages (SSMP) approach directly addresses social institutions in a new and innovative way. There are preparations underway for scaling this approach up. The Clinton foundation has a solar PV programme for health facilities.</p>	The ENABLE series of reports does address rural education needs in Uganda
Energy and enterprise	The Central Energy Fund and SANERI are currently supporting development of a framework for enhancing productive use of renewable energy in SA. Apart from this, there have been fairly limited renewable energy/rural enterprise activities. See for example the Restion Energy PUC project. From a grid perspective there has been limited direct focus on enterprise support.	<p>Tanzania has started with multi-functional platform pilots. There is also significant biofuels activity. Mwanza Market Transformation Project also piloted productive use of energy activities (cellphone charging, barber shops, quest houses, chicken raising, fish farming).</p> <p>The Sustainable Solar Market Packages (SSMP) approach directly aims to stimulate the private/business market.</p>	<p>There is limited multifunctional platform activity. UPPPRE programme did not specifically target productive use of rural energy.</p> <p>Uganda is recognised as an enterprenuerial country. Of the countries monitored in the GEM process, it has the second highest “Total Entrepreneurial Activity” score with 1 out of 3 adults being an entrepreneur (Walter et al, 2004).</p>
Road infrastructure	South African roads infrastructure is some of the best and most expansive in Africa, with around 534 000 km of roads in the country, 170 000 km of which is in urban settlements. The remaining rural roads network has about 63 000km of tarred roads, with	Total: 78,891 km paved: 6,808 km unpaved: 72,083 km (2003) <sup>1</sup>	10,800 km National Roads under the responsibility of MoWT, of which about 2700 km are paved and the remaining 8,100 km gravel; 27,500 km District roads under the responsibility of Ministry of Local Government;

	<b>South Africa</b>	<b>Tanzania</b>	<b>Uganda</b>
	the remaining 301 000km consisting of gravel roads. About 2000 km of tarred roads are made up by 4/6 lane freeways, mostly concentrated around the metropolitan areas.		4,300 km Urban Roads under the responsibility of Urban Councils; 30,000 km Community Access Roads under a lower tier of Local Government responsibility (LC III)
Telecommunications Fixed line Mobile	South Africa has a strong telecommunications industry, with about 4,7 million fixed line units (provided by 1 operator), more than 30 million cellphone users (provided by 4 big operators) and 4, 78 million internet users. Major investment is taking place in the sector (R7,5 billion in 2004), with a second national landline operator being introduced soon.	169,135 (fixed) 6.72 million ( mobile) general assessment: fair system operating below capacity and being modernized for better service; small aperture terminal (VSAT) system under construction <sup>1</sup>	Fixed lines: 137,916 Mobile: 3,015,493 Pay phones 16,059 ISPs: 17

## 2.3 Review of policies, programmes and projects in South Africa

### 2.3.1 Background commentary

This section of the document focuses on South Africa. When reading and thinking about its applicability in other countries, it would be useful to consider the following (adapted from Banks 2007):

- South Africa has electricity supplied to more than 70% of households.
- Rural electrification rates in South Africa range from 47% to 80% in the different provinces, but in the provinces with a larger rural population, rural electrification rates are of the order of 50% to 60%.
- At present there are about 3.4 million households that do not have access to electricity, of which over two million are in rural areas.
- The country has for several years had a very active grid electrification programme, which has in some years connected at a rate of 1000 households per day – as a result, grid expectation is strongly anticipated in many rural communities.
- As a result of the active electrification programme, most communities are within 20 kilometres or usually much less of an electricity grid.
- The above electrification programme has been made possible through allocation of capital subsidies. Households have either had to pay a relatively small (USD10 to 20 connection fee), or in some cases have even had the connection provided with no 'connection fee' payable.
- Pre-payment metering is the norm for rural electrification projects, and as such poor consumers need only pay for the kWh that they use, as needed. No fixed monthly charge is payable.
- South Africa has introduced a Free Basic Electricity (or in some cases a Free Basic Alternative Energy) policy, which seeks to subsidize the first 50 kWh of electricity per month.

The strong grid electrification activities and support are a significant boon for rural communities, however, as will be seen below, these factors also present a significant challenge for off-grid electrification. While some may feel that these unique South African circumstances make the experience less relevant to other countries, the authors have sought to contextualise observations in a manner that may be applied elsewhere. Indeed, as other countries increase their rate of rural grid electrification, their situation will move slowly in the direction of that of South Africa.

Table 2, drawn from Aitken 2007, illustrates rural energy expenditure patterns in three rural communities in the Eastern Cape (EC), KwaZulu Natal (KZN) and the North West Province (NW) of South Africa. It will be noted that there is a wide diversity of energy sources used to meet lighting, thermal (cooking and space heating), entertainment and communication energy needs. Note too that for these samples, 77% (NW) to 98% (KZN) of households use wood.

Table 2: Household energy expenditure by fuel<sup>10</sup>

	Eastern Cape		KwaZulu Natal		North West	
	User Ave	Sample Ave	User Ave	Sample Ave	User Ave.	Sample Ave

<sup>10</sup> At the time of the research the Rand/Dollar exchange rate was in the region of R6.50/\$1. The Table includes references to 'User Average' and 'Sample Average'; in the case of the former, this refers to the average expenditure for households that make use of that particular fuel while the latter refers to the average of the total sample group.

Paraffin	R63.07	R56.47	R37.18	R12.08	R77.42	R54.52
Candles	R20.38	R18.03	R22.23	R22.05	R24.38	R23.92
LPG	R135.49	R37.25	R77.00	R37.86	R129.82	R35.96
Dry cell	R30.19	R16.38	R26.90	R14.80	R21.36	R13.51
Car battery	R28.56	R11.46	R33.66	R9.54	R30.78	R11.27
Wood	R16.27	R6.14	R11.66	R0.29	R10.63	R1.40
Generators	R240.16	R6.43	R89.00	R3.71	R97.32	R8.68
Cellular phones	R23.66	R10.71	R22.00	R2.57	R24.96	R7.18
Average monthly exp.		R159.44		R102.90		R152.42

Also of interest is that the sample average expenditure on fuels that could be replaced with a low-power electricity source (such as from a solar home system) is R43. For the sample subset that uses candles, recharge cellular phones and used dry-cell batteries, the 'displaceable' spend is R72. This type of expenditure is compatible with monthly repayments on a financed small solar PV system – and thus indicates a potential market opportunity. Where communities get access to the grid, they can achieve significant savings – if grid electricity is used efficiently.<sup>11</sup>

The remaining expenditure on fuels that expensive (i.e. solar) electricity cannot replace is even more significant, and there is still extensive use of fuelwood. This highlights the critical importance of (and need for) cooking and thermal energy services. In the communities surveyed, Aitken found that the average expenditure on energy was between 6.6% and 18% of the household total expenditure. Energy thus continues to represent a significant spending burden for households.

There are several concerns associated with gaining access to, and using the range of typical energy service options, for poor communities. These include:

- Health and safety concerns (back injury, and personal safety risks associated with fuelwood collection, indoor and outdoor exposure to wood or coal smoke (respiratory illness, as well as eye damage), risks of burning and in particular devastating 'shack fires' in dense communities (candles, kerosene), risk of explosions (e.g. from LPG), and risk of poisoning from accidental consumption of kerosene sold in cold drink bottles)
- Local environmental concerns: pollution, deforestation
- Time – in particular, the collection time for wood (in six communities surveyed in 1991 in South Africa each household spent between 50 and 177 hours every collecting wood - depending on location and season) (Griffen et al, 1992). Furthermore, surveys conducted more recently indicate that time required to collect wood is increasing.
- Productivity limitations imposed by lack of access to modern energy (for example in food processing and preparation, agricultural work, hand crafts, productive activities)
- Inconvenience (lighting fires, delays in food preparation, time to boil water, cold water for bathing etc.)
- Cost issues, including (i) energy affordability (rural communities tend to pay far more per unit energy (and in particular electricity) than grid connected and urban households) and (ii) expenditure required as a percentage of total expenditure.
- Global climate concerns related to emissions - at present low income rural households contribute very little to CO<sub>2</sub> emissions (compared to the far higher fossil fuel consumption of middle and upper income households). However, as countries develop, if rural low income households were to start using energy at similar levels to developed world levels-greenhouse gas emissions would rise significantly.

<sup>11</sup> This calculation includes capital investment costs. If a 50Wp SHS costs R3000 and this was financed over 4 years at an interest rate of 12% the monthly repayments would be R79. With a little deposit, R72 looks reasonable.

As shown in Figure 1, grid electrification of rural households does not necessarily result in a transition from traditional (or dirty fuels) to electricity. Households tend to continue using a range of fuels to meet energy service needs. The example household, located in a rural community in the Drakensberg, KwaZulu Natal) had a prepayment meter based grid supply installed, with some light bulbs and a kettle utilized. However, note that the kettle is standing on a kerosene stove. Another two-plate kerosene stove is being used to cook food in the large aluminium pot – and this stove is standing on a coal stove. Outside an open fire was being used to roast maize on the cob.



Figure 1 Elements of the rural energy dynamic in Africa: Multi-fuel use in electrified South African home

In debates about rural energy supply – there often tends to be a focus on electricity. The following points extracted from a paper recently published on biomass policy in South Africa highlight the critical nature of the biomass energy dimension (Shackleton et al, 2007):

- The national demand for fuelwood was estimated at 13 million m<sup>3</sup>/annum in the mid-1980s and has never been updated since then.
- Nevertheless, fuelwood use is currently known to be widespread, with over 95 percent of rural households using it, to some degree.
- Urban markets are a growing element of fuelwood demand.
- Newly electrified and/or urbanised households tend to continue to use fuelwood for a variety of reasons, including its so called low price or 'free' availability, for cultural reasons, no cash to buy alternatives, limited or no funds to buy appliances for other energy forms, and because of general preference. In the longer term, however, per capita consumption is expected to decline.
- The gross annual value of fuelwood demand to the national economy is estimated to be R3 to 4 billion.
- At the local level, demand is highly variable by location, but does tend to be greater in areas with larger biomass resources.
- Estimates of household consumption rates range from 0.6 tonnes per year to more than 7.5 tonnes per year, typically between 3 and 4 tonnes per household per year.



### 2.3.2 Energy policy

The White Paper on Energy Policy for the Republic of South Africa was published in 1998. It presents the South African Government's vision for the energy sector. The policy is built around objectives to increase access to affordable energy services, to improve energy governance, to stimulate economic development, to secure supply through diversity, and to better manage energy-related health and environmental impacts.

Of relevance to this study, this energy policy seeks, at a household level, to improve energy security through assisting in households securing affordable and safe energy, services, appliances and homes. One of the key thrusts of the policy at this level is increased electrification through grid technologies as well as others. It is also stated that government will create an energy efficiency consciousness.

It is stated that the electricity distribution industry will be restructured into a position that it will be better able to deliver electricity to South African homes, and that gradual steps towards a more competitive electricity market will be supported.

Of particular relevance to this review, the Department of Minerals and Energy outlines key policy objectives including: attaining universal access to energy by 2014; and accessible, affordable reliable energy, especially for the poor. <http://www.dme.gov.za/energy/overview.stm>. The DME seeks to achieve this in various ways, most notably:

- The Integrated Energy Centres (see section 2.3.4.2 below) which involve community driven/community owned energy solutions providing access to affordable safe and sustainable energy services and information;
- Mandate to the Central Energy Fund (CEF) to search for appropriate energy solutions to meet the future energy needs of South Africa, and involving oil, gas, electricity, solar energy, low smoke fuels, biomass, wind renewable energy solutions. The CEF has established the Energy Development Corporation (EDC), which pursues commercially viable investments in renewable energy, in various areas, including developmental and social projects benefiting previously disadvantaged communities.

The National Energy Efficiency Agency (NEEA) is also a division of CEF. This agency seeks amongst other proposed efforts to recommend priority energy efficiency projects, to develop and implement awareness campaigns, to develop strategies to address the growing demand for energy in the country and to stimulate energy efficiency areas neglected in the past. While the NEEA's focus is not solely on electricity efficiency but more broadly on energy efficiency, it is suspected that the current electricity crisis is taking up most of the newly established agencies time. It is hoped that this focus will be broadened, in line with the agency's mandate, to support households' choice in identifying the most appropriate, cost effective household fuel mix.

- Eskom's current focus appears to be on electrification as a contribution towards the energisation of rural areas.
- DME continues to support the Integrated National Electrification Plan (see 2.3.4.1 below), which is the primary delivery mechanism to achieve new grid (and some off-grid connections).

### 2.3.3 Regulatory framework

The electricity sector in South Africa is governed by the South African constitution and more specifically, the Electricity Regulation Act of 2006. This act read with the Electricity Regulation Amendment Bill of 2006 requires that generators, transmitters, distributors and reticulators of electricity be licensed by the National Energy Regulator of South Africa (NERSA). The latter bill includes in the definition of 'reticulation', the trading and/or distribution of electricity and includes services associated therewith. Furthermore, it is noted that no person may without a licence (issued by the Regulator) operate a generation, transmission, distribution or reticulation facility without a licence. On occasion, the Minister of Minerals and Energy, in consultation with NERSA and a stakeholder forum, may determine that a licence may not be required (in which case registration at NERSA with due procedure may suffice). The Minister may also make regulatory decisions on compulsory norms,

standards and provisions related to quality of supply and other matters to be provided for in reticulated areas.

The Electricity Regulation Amendment Bill of 2006 includes a chapter (4) on the role of municipalities in electricity reticulation. In this regard, municipalities must exercise its executive authority and perform its duty to administer the reticulation of electricity within its area of jurisdiction<sup>12</sup> (as stated in the SA Constitution). In the light of the executive authority of municipalities in terms of the Constitution, it could be argued that municipalities are ultimately not subject to oversight by NERSA nor require a license to distribute electricity (as the Constitution gives them the right to do). This is however open to interpretation, and for the most part NERSA is seen as having a regulatory and tariff oversight function. The Bill requires a service provider (say Eskom, or other) to enter into a written service delivery agreement with the relevant municipality in order to provide reticulation services within the municipal area of supply. The off-grid concessions have signed service provider agreements with the municipalities in their regions of operations.

NERSA is responsible for the economic regulation of the electricity supply industry. It achieves this through the setting of tariff guidelines, benchmarks and structures, identification of tariff methodologies, evaluation of tariff applications from licensees and through the establishment of pricing frameworks.

Clause 22 Electricity Regulation Act refers to the regulatory requirements of non-discriminatory access to the transmission and distribution power systems.

Schedule II of the Electricity Regulation Act outlines exemptions from obligations to apply for and hold a licence. These include: any generation plant constructed and operated for demonstration purposes only and not connected to an inter-connected power supply; any generation plant constructed and operated for own use; and non-grid connected supply of electricity except for commercial use.

### **2.3.4 Projects and programmes**

#### **2.3.4.1 *The Integrated National Electrification Programme – grid component***

Since 1994, the primary energy service strategy followed by the South African government and related institutions for rural communities has been the national grid electrification programme. This programme has in many ways been remarkably successful. During the period 1994 to 1999, the emphasis of the programme, which was largely funded by Eskom from an implicit levy on electricity sales to existing customers, was on achieving high connection rates. During this period (1994 to 1999), over 1.75 million new households received a new connection. Electrification targets were achieved ahead of time. The focus during this period was mainly on urban electrification. An additional 600 000 households were then electrified each year between 2000 and 2002. In 2002, the focus shifted to rural electrification, with a broader development focus (Marquard et al 2007). A new target was then established: from a level of around 65 per cent to 80 per cent of all households would have electricity access by 2012. This meant that around 500 000 households would need to be electrified annually during this period. Then, in 2004, President Mbeki announced an expectation that 100 per cent of households would have access to electricity by 2012. While the South African Government remains committed to achieving universal electricity access by 2012 (DME 2007), it seems unlikely that this would be possible (ibid.).

Since 2001 the installation rate of installation of new connections has dropped. This has been in part as a result of changes in the institutional management of the planning and budgeting (the Department of Minerals and Energy took over responsibility for the programme from Eskom), and also because the costs of providing the necessary bulk infrastructure have increased (bulk infrastructure in rural areas was found to be inadequate). These factors meant that there were less funds for household connections left (and as the programme reaches further into rural less dense communities the per connection costs of installations rise). Current capacity shortages may also be causing a decline in installations.

---

<sup>12</sup> This includes areas currently supplied by Eskom, which holds a licence to perform the trading and distribution of electricity in those areas.

In 1991, the average cost of a new electricity connection to Eskom was R4 500. By 2000 this had dropped to around R2000 per connection<sup>13</sup>. The cost of local reticulation and necessary substations and transmission rose to an average of R6 078/hh per household (average) by 2006, with costs projections staying at the same order of magnitude until 2009 (Masemola, 2007).

Implementation of grid electrification is either carried out by South Africa's national electric utility Eskom, or by municipalities. Eskom is responsible for most of the electrification activity in rural areas. Funding for this programme is now provided from the national fiscus, through the Integrated National Electrification Programme, and is now administered by the Department of Minerals and Energy.

An element of the Integrated National Electrification Programme includes the Free Basic Electricity (FBE) Policy, which provides, free of charge, 50kWh of grid electricity per month to all households (with concomitant blocked or stepped tariffs for electricity consumption beyond 50kWh to mitigate the cost implication of the free basic electricity provided). Although this policy has not been applied equally in all regions, it does generally mean that for households connected to the grid, and able to access the FBE subsidy, electricity is an extremely attractive fuel. While 50 kWh is insufficient to complete all necessary cooking, (thus, implying a reliance on other fuels), it does make a significant contribution towards household energy requirements.

Although the South African government is committed to achieving universal access to electricity by 2012, there are currently about 3.4 million households yet unconnected to the national grid. For these households, an instrument called the Free Basic Alternative Energy Policy has been put in place. As Bantsijang (2007) notes, a municipality now:

- has an obligation to identify a suitable energy source(s) for its community and ensure its effective distribution to the identified indigent households;
- may choose various energy carriers as the situation may dictate;
- must give energy to the value of R55 as a minimum to an un-electrified indigent household. The figure should be increased on an annual basis by the inflation rate plus 1,5%. The Department of Minerals and Energy is obliged to revise this minimum on a five-year cycle; and
- must ensure that the FBAE programme reaches indigent households; and has a responsibility to ensure fraud prevention measures are in place.

Thus, this policy allows municipalities to choose fuel and delivery options. The national fiscus' transfers to municipalities that make provision for the above are 'unconditional' grants, indicating that it is up to municipalities to decide how they allocate these funds. At present there is significant variation in implementation methodology, and as far as we are aware, there are many instances in which the FBAE grant is not (yet) available to indigent rural households.

#### **2.3.4.2 Integrated Energy Centres**

In the past few years, the Department of Minerals and Energy (DME) has supported the establishment of Integrated Energy Centres (IECs) throughout the country. These centres are "one-stop energy shop(s) owned and operated by (a) community cooperative(s) and organised as (a) community project(s)."<sup>14</sup> Integrated Energy Centres provide a range of energy services - making energy easily available, promoting awareness of the different energy sources and services, and building capacity through energy provision. Establishment of the IECs has been involved collaboration between various organisations including partner oil companies and more recently the Global Village Energy Partnership (GVEP). The current model involves setting up a community (co-operative) owned retail outlet for liquid fuels and

---

<sup>13</sup> See [www.eskom.co.za](http://www.eskom.co.za)

<sup>14</sup> <http://www.dme.gov.za/energy/planning.stm>

other energy services in rural or even low-income urban areas. In addition, some IECs will offer energy education services. The location and strategic placement of these centres make it easy for the local communities to access the energy services and information without spending money on transport. Furthermore, the IEC orders its products directly from the suppliers thereby eliminating the middleman in order to make the products affordable to the consumers.<sup>15</sup>

Success has been mixed. The initial IEC programme started in 2003 and was supported by Total and SASOL in addition to PASASA, CEF, the Nelson Mandela Children's Fund, the Energy SETA, Bonesa and Amazing Amanzi. By early 2004, 3 IECs had been established in the Northern Cape, KwaZulu Natal (KZN) and the Eastern Cape. Twenty centres were originally planned over the first two-year period. The IEC in KZN was closed down in 2004 due to allegations of corruption at the local level. This, and the motives of the oil companies, raised questions over the viability of the original IEC model and a moratorium was placed on further development, pending the outcome of a review that was completed at the end of 2004.<sup>16</sup> According to Parallax, the "review brought little change to the early IEC approach and failed to identify the underlying causes of the IEC failure". The review report did note that "(a) commitment to consultation and engagement is a critical pillar of building ownership and ultimately a critical variable towards ensuring sustainability".

In January 2005, the IEC programme received support from the UNDP's Global Village Energy Partnership (GVEP). A new business plan for the IECs was drawn up. This business plan sought to change the focus of the IECs, from being a top-down solution involving the provision of liquid fuels and related products by the two high profile oil companies, to one which involved access to other forms of energy including renewable energy sources.<sup>17</sup>

A new generation IEC programme, rolled out as of February 2007 is proceeding well. Five IECs have been established and are now operational. Of the operational IECs, some make large profits while some are just breaking even. They are all located in rural areas and are of the filling station type. The ultimate objective of the programme (which will run until 2015) is to establish some 30 filling station type centres, and just under 300 information type/advisory centres (for each municipality).

#### **2.3.4.3 Other thermal initiatives**

Other initiatives have sought to improve thermal energy service delivery. For example:

- A 2001 cabinet decision to zero rate VAT on kerosene (paraffin).
- The retail price of kerosene is now fixed at a National level by the Department of Minerals and Energy.

There has been very limited direct intervention in the LPG market for rural low-income households – as this is primarily seen as a commercial market initiative. One endeavour resulted in the distribution of several thousand subsidized 6 kg cylinders with cooker tops: Total Gas ran the Shesa programme for several months, working with various off grid concessionaires and others to distribute these cylinders with cooking tops, and Afrocs conducted a similar programme. Continuation of Total Gas' programme stopped when anticipated funding from government did not materialize.

It should however be noted that there have been LPG supply constraints in South Africa for a period of more than 18 months, prompted in part by the electricity supply crisis that the country is facing, as well as supply side hold ups at refineries from time to time.

#### **2.3.4.4 Other rural electrification/energy supply initiatives**

---

<sup>15</sup> [www.parallaxonline.net/IECs.html](http://www.parallaxonline.net/IECs.html)

<sup>16</sup> [www.parallaxonline.net/IECs.html](http://www.parallaxonline.net/IECs.html).

<sup>17</sup> [www.parallaxonline.net/IECs.html](http://www.parallaxonline.net/IECs.html).

Other major programmes related to rural electrification in South Africa are summarized in Banks (2007):

- Clinic Electrification
  - Extensive grid electrification has been undertaken, mainly by Eskom, with SWER lines being used for more remote installations
  - Approximately 530 PV installations have been undertaken at health centres over a period of ten years in different projects (many of which have subsequently been grid electrified)
  - There are plans at government and utility levels to ensure electricity access for all health centres by mid 2008. Some of these installations will be PV based.
- School Electrification
  - 2800 schools were provided with PV prior to 2004 (many of which were funded through an EU grant)
  - 1150 PV installations were achieved in 2005/6
  - There has been extensive grid electrification of schools
  - The school PV electrification programme has been widely critiqued as problematic due to mismatch between supply offer, and 'on the ground demand' as well as maintenance affordability. Regrettably large numbers of systems have been vandalized. Several have also now received grid supplies. However, each phase of this ambitious programme has evolved and leaned from past experience – with more recent activities being more successful. There have also been significant recent maintenance activities undertaken, and it is understood that a medium term maintenance budgeting and management framework is now in place.
- Mini-grid electrification: In 2003, the NER (now the National Energy Regulator of South Africa, NERSA) funded two very large PV/wind hybrid systems at Hluhleka and Lucingweni in the Eastern Cape (5.3kWp plus 5 kW Wind and 50kWp PV plus 36 kW Wind respectively). These have had both technical and institutional/ maintenance problems, and are the subject of a DME evaluation at present. As with the concession process, the shift of primary responsibility from the NER to the DME has added a layer of complexity to resolution of institutional and ownership problems.
- Mini-grid electrification: At least two feasibility studies for mini-grid electrification have been undertaken in South Africa.
  - Banks & Aitken (2004) provides a detailed overview of the site selection criteria, design approach, socio-economic surveys, productive use investigations and water supply improvement analysis conducted as part of an NER funded feasibility study for mini-grid based electrification of a settlement in northern KwaZulu-Natal. The process explored institutional and tariff options for the service delivery. Concerns about long-term sustainability of the installation, lack of a clear institutional home, and changes in the funding institution mandate meant that the project did not progress to implementation. The report provides insights that are generally applicable to community electrification using hybrid mini-grid systems.
  - The E7 group of international utilities, lead by Scottish Power spent considerable time identifying and exploring various sites for mini-grid electrification, primarily in the Eastern Cape. They also decided not to go ahead with implementation – in part because the prime sites for mini-grid electrification also seemed to be probable grid electrification opportunities (in the South African context). Indeed in one community identified as a prime target – the feasibility study team went back after six months to do the next phase of their research, only to find grid lines approaching the community (this despite prior consultation with grid authorities).
- Productive use of renewable energy: Restio Energy and Winning Business Systems, in a programme funded by the Dutch Government, Novib and Nuon Foundation, have implemented 'Productive Use Containers' (PUCs). This programme, which involved the establishment of five enterprise hubs powered using PV systems, has established or supported several micro-enterprises and co-operatives in rural areas. The initiative

specifically aimed to address the key barriers through local market opportunity assessment, entrepreneur training, business start-up finance, energy service and appliance acquisition support, facilitation of market linkage development, and entrepreneur development support. Typical business activities include ICT and business services, retail (including refrigeration), shoe repair, hair salons, cell-phone charging, and sewing groups.

The last programme of key significance for rural electrification discussed here is the off-grid concession programme. This is described in more detail in the section 2.3.5 below, as it represents an existing implementation activity that has many of the key elements of an Integrated Rural Energy Utility.

## **2.3.5 A case study: The South African off-grid concessions programme**

### **2.3.5.1 Background**

The first phase of the national grid electrification programme (1994 to 1999) indicated that it would not be economically viable for all the targeted areas to enjoy the immediate availability of grid electricity. This was primarily because newly connected households indicated very low consumption of electricity with a concomitant slow growth in this consumption and for considerable periods of time. In the light of the non-viability of grid electricity, other technologies were then considered in order for government's universal access to electricity initiative to be achieved. Solar home systems (SHS) were identified as the preferred electricity system for households in remote rural areas: this technology was regarded as a technically and economically viable alternative for providing basic electricity needs such as lighting and access to electronic media only.

In order for a substantial SHS programme to be launched in remote rural areas, it was deemed necessary that the following barriers be addressed: (i) the unavailability of the necessary infrastructure taking into account the relatively high capital costs of these systems; (ii) very limited hardware installation and maintenance services and; (iii) very limited provision of financial services to poor end-users with irregular income. To overcome this programme, government established REFSA (Pty) Ltd as a subsidiary of the Central Energy Fund in 1996. It was envisaged that this company would set up the SHS programme by means of consumer credit and the use of a revolving fund. This venture was terminated in 1998 on realisation that the cost of creating and maintaining the necessary infrastructure rendered the process uneconomical<sup>18</sup> and the lack of suitable financial institutions in rural areas. A re-think on establishing this programme commenced.

As the provision of services to a large number of customers had traditionally been achieved by utility companies, a utility model was preferred for the implementation of the solar home systems, with the utility expected to procure, install, maintain, own and provide a service to the prospective customers against an agreed monthly tariff (i.e. a fee-for-service model). This model would entail the granting selected private companies the rights to establish non-grid energy services. The private sector utilities would have exclusive rights to government subsidies to cover the capital cost of the installations.

A joint venture between Eskom and Shell Renewables South Africa (trading as Eskom Shell Solar Home Systems) announced in October 1998 it would undertake to provide 50 000 households with solar home systems over a period of five years. The project was launched in March 1999 in the Eastern Cape. This project was initiated without any subsidies in place.

The DME chose to launch a utility-based programme in a limited number of rural areas. In late 1998, it invited the private sector to submit proposals for the non-grid electrification programme. Six companies were subsequently recommended: These six would then be added to the Eskom/Shell joint venture. The ensuing negotiations in brokering this agreement were long and tedious. In the meantime the NER developed a draft regulatory framework<sup>19</sup> for the inclusion of non-grid technologies. Most of the concessionaires were

---

<sup>18</sup> Kotzé, I. A. 1999. National Electricity Programme: Integration of Grid and Non-grid Technologies, Discussion policy paper, Department Minerals and Energy, Pretoria

<sup>19</sup> NER, Regulatory Framework for Non-grid Electrification in the RSA, Draft 3, November 2000.

operational in their allocated concession area by the time that they signed the Interim Services Contract in May 2002. No consultations with the prospective customers were carried out during the planning stage, this exercise was left to the concessionaires as part of their business mandates.

Clark notes that broadly, “selected off-grid service providers have exclusive rights to receiving subsidies for off-grid electrification in particular geographic areas (called “concession” areas) for a period of five years, although the off-grid service contracts are to remain in force for a period of 20 years. Off-grid service providers are expected to improve access to a range of fuels such as gas or paraffin, in addition to solar home systems and mini-grid systems...Concession companies are granted “permission” areas, which are within the concession areas. Permission areas are those areas in which the concessionaire may annually establish and operate non-grid electricity systems and receive a subsidy”. The reference to the 20-year period for which the off-grid service contract would remain in force is not referred to in the Interim Agreement. It is a statement that is often made”.<sup>20</sup>

---

<sup>20</sup> Clark A, Innovations in South Africa’s off-grid concession programme, draft report for HSRC, Sept 2003.

Table 3: Ownership of concessionaires, concession areas and current installed base (2007)

Concessionaire	Initial Ownership	Current ownership	Concession area	Current installation base
Nuon RAPS Utility Pty Ltd (NuRa)	Nuon Corporate Sustainability Centre (The Netherlands) (80%) and Service Provider KZN (also entitled Raps Utility, a subsidiary of RAPS (Pty) Ltd, 20%)	Nuon (80%) Rural Energy Employee Share Emopowerment Trust (RESET) (20%) – Trust represents employees of NuRa	Northern KwaZulu Natal	10,393
Solar Vision Pty Ltd	SolEnergy AS (a subsidiary of Renewable Energy Corporation of Norway, 85%) and Icon Investments (Namibia, 15%)	SolEnergy REC Solar AS (100%)	Limpopo	8 500
KwaZulu Energy Services Pty LTD (KES)	EDF Development Environment (EDEV, 65%) and Total Energie Development (TED, 35%).		Central KwaZulu Natal	9,000
ESSHS	Eskom and Shell Overseas Investments BV, each holding 50% of the shares	Liquidated	Southern KwaZulu Natal/Eastern Cape	
		Sumer Sun Trading (took over part of ESSSH)	Eastern Cape	1,600
		Shine the Way (took over part of ESSSH)	Eastern Cape	1,600
		Elita Co-operative (took over part of ESSSH)	Eastern Cape	1,700
REA	Owned by five previously disadvantaged individuals (PDI).	Status unknown	KwaZulu Natal and Eastern Cape	Did not start operations



The active involvement of companies from other countries, some subsidiaries of large and well-known energy companies, should be noted. All have an interest in and extensive experience in the use of renewable energy

The South African government's contribution to the capital costs was intended to be 80% of the full cost, with the balance to be invested by the private sector partners (and recouped over time from customers). The tariff and subsidy levels were set by the National Electricity Regulator (now called the National Energy Regulator of South Africa, NERSA) following a review of business plans and financial models submitted by the concession companies. NERSA initially administered and managed the subsidy of ZAR3,500 per system connected, and the maximum tariff for users started at R57 (including VAT). Only one tariff increase has been implemented to date, and it now stands at ZAR61 per month. The monthly fee is payable in perpetuity, and is a effectively a full-maintenance lease plan, typically called a 'fee-for-service' approach.

The six contracted SHS concession companies were each expected to connect 50,000 SHS customers per concession area over an initial period of 5 years. Two of the parties did not ever start operations, in part a result of delays in finalising the deal, difficulties in raising the finance required for their investment, and their more detailed assessment of risks.

Box 1 Summary of off-grid concession programme

- First installations 2000.
- 33 400 installations done and being maintained, 10 000 of which were done by NuRa, northern KZN.
- 6 operating companies, some 6 years old, 4 of which have significant BEE shareholding.
- Of the above 6, 3 are smaller companies that have been allocated some of the installations formerly managed by the Eskom-Shell JV.
- Process has attracted more than R50 million (est.) private sector investment.
- Government capital contribution of R3 500/connection (no generation, bulk supply etc. required) (about R118 million to date).
- Some municipalities have provided operational subsidies (approx. R600 000/month in total). However this is not applicable in all regions (for example: only around 15 per cent of NuRa customers receive the FBE subsidy currently).
- Collectively, the concession companies have 142 employees, 54 subcontractors doing routine operations, and about 100 more doing installations. Significant additional jobs are created in the supply chain. NuRa has 70 employees.
- Significant LPG sales are being recorded by some companies. NuRa sells about 60 000kg per month.
- Distribution points reach close to customers (refer to energy stores – black squares as shown in Figure 2 for NuRa area).
- International funding for an additional concession has been attracted – approx. R100 million for a KfW funded project being established in the Eastern Cape – to electrify approx 30 000 households and several hundred schools and clinics using solar PV.
- Current installed capacity is approximately 1.67 MW (a significant contribution to the South African renewable energy target).
- The systems produce about 2 GWh/annum of renewable energy.
- CO<sub>2</sub> and TREC benefits are not yet being realised.

### **2.3.5.2 Programme Models**

All concessionaires operate a fee-for-service utility. Although the majority of installations have utilized a prepayment meter technology, several thousand installations simply use a normal charge controller, and have no automated way of turning the power off if customers do not pay. Business models adopted by the various concessionaires are similar in concept but differ in detail, especially at the local level.

The standard size of the SHS adopted is 50 Wp, with a 100 Ah battery. This can power 4 to 7 energy efficient DC lights, a black and white TV (or low power DC colour TV), cell phone chargers and has a 9 V radio outlet.

The concessionaires are required to extend the range of services to include thermal fuels such as LPG and associated appliances. In some cases this has become an important component of the business. NuRa (operating in northern KwaZulu Natal) sells approximately 60 000kg of LPG per month, and this generates about 50% of its monthly turnover.

It was further envisaged that the concessionaires would take over responsibility for maintenance of the institutional PV systems within their areas, charging on a fee-for-service basis. One of the operating companies (Summer Sun Trading) has recently maintained several hundred school PV systems, but the others have not yet been actively engaged in institutional system maintenance. NuRa has provided technical support to a productive use project, which has resulted in the establishment of micro-enterprise hubs within the concession service area.

Non-payment has been of significant concern to some of the utilities, (NuRa has about 30% of customers who are in arrears of more than one month). However, it should be noted that in many grid connected regions of the country, non-payment levels are similar if not far worse<sup>21</sup>. A significant reason for non-payment problems has been the variability and in-consistency of the FBE application on the ground (see section 2.3.5.6)

By way of illustrating how the concessions programme has been operating, the remainder of this section focuses on NuRa's operation in KwaZulu Natal.

Figure 2 illustrates NuRa's concession area. The region shown is approximately 150 km in width, and has just over 10,000 SHS installations. It should be noted that many of the SHSs (small green triangles) are located fairly close to the grid. However, in most cases individual homesteads are widely spaced – so the area is typical of those where solar is the least cost option for a large percentage of households.

---

<sup>21</sup> Yelland (2008) indicates that of the electricity supplied by Eskom to residential customers, 27% is stolen (not paid for). If this is an average for the country, then some regions must be far more severe.

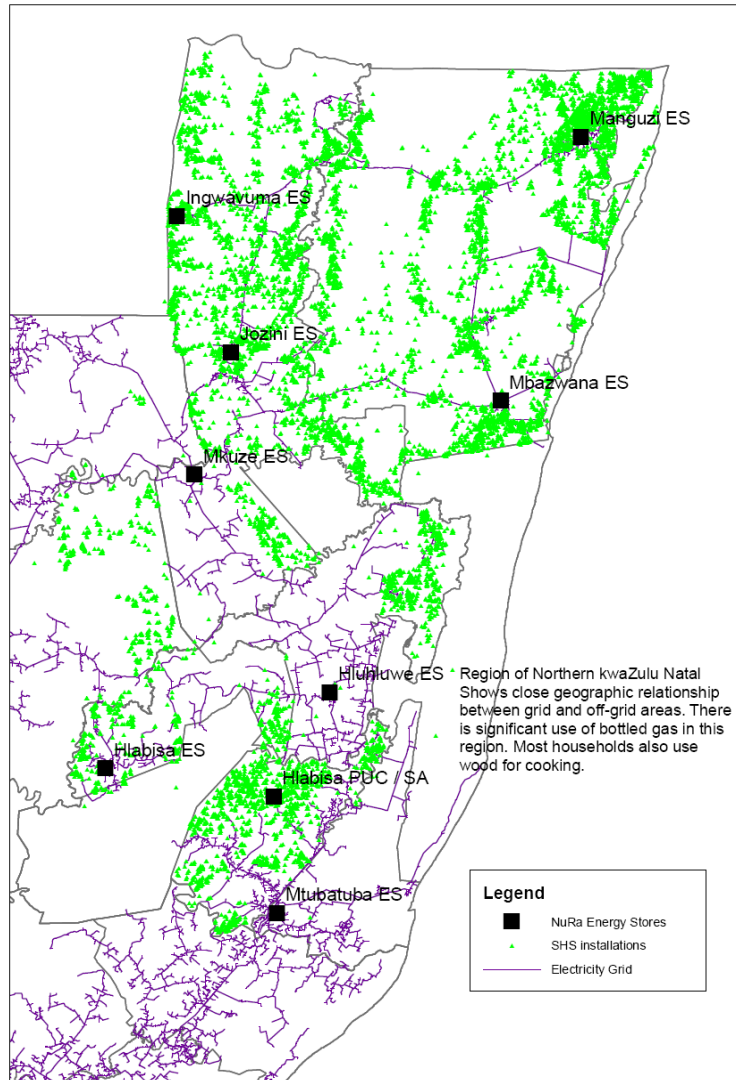


Figure 2. NuRa's area of operations in northern KwaZulu Natal, South Africa

Figure 3 below illustrates in concept format the main operations of NuRa (and this is very similar to the operational models used by KES and Solar Vision). The utility operations are managed through a head office (based in Mkuze – a rural town in the operational area) where a management team deals with issues such as: procurement, human resources management, training, finances and financial controls, data system management and processing, customer records, stock control, vehicle control and maintenance, etc. Eight energy stores fall under this head office, and are scattered through the concession area. .

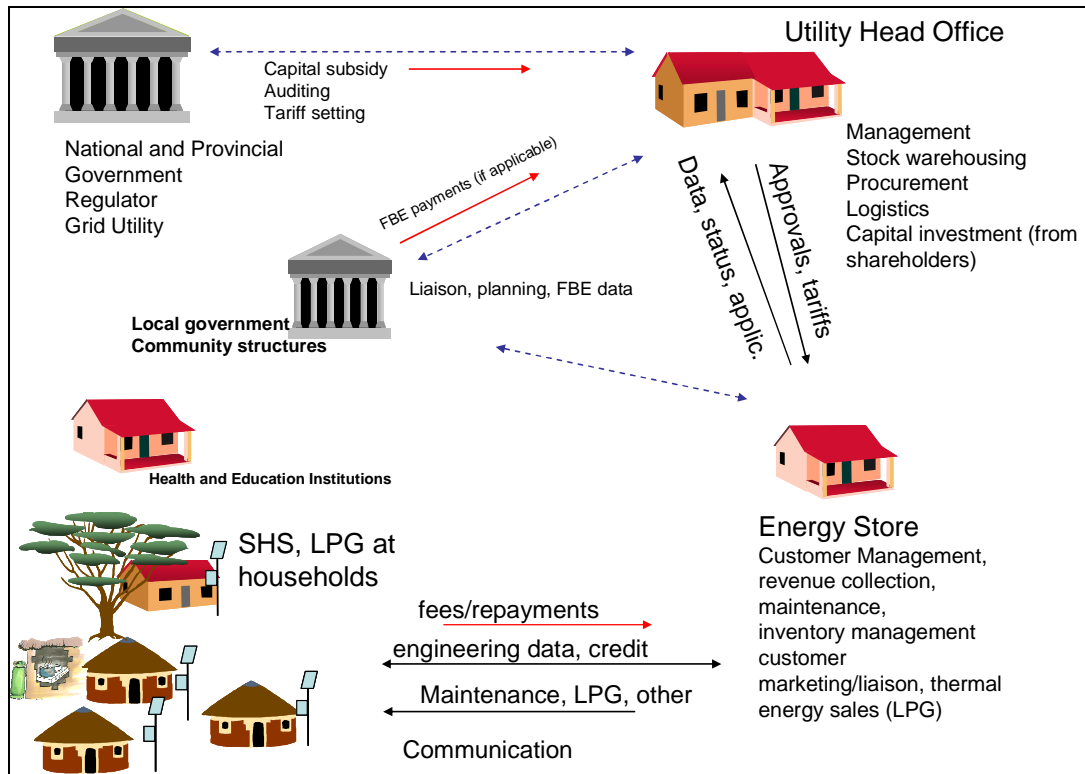


Figure 3 Off-grid fee-for-service utility infrastructure

(Note, the role of shareholders who invest capital and management expertise is not shown, but should not be discounted – especially as capital invested to date is of a similar order of magnitude to the subsidies from government)

NuRa's head office has a seven-person management team reporting to the General Manager. Positions include: Community Liaison and Resources Manager, Development Manager, Finance Manager, IT Manager, Maintenance and Logistics Manager, Stock Controller, System Master Station Management (for data processing and reporting). The General Manager doubles as a Utility Engineer.

Each Energy Store has a manager, one to three 'point of sale' operators, and several technicians. They also have staff who assist with LPG bottle filling and loading of gas bottles. The 'point of sale' operators deal with fee-for-service payments, customer complaints, data management and customer education, sales of other products such as LPG. Technicians are typically in the field carrying out maintenance and customer education. Most of the concession companies use light delivery vehicles (in many cases 4x4). In addition, NuRa has a majority of technicians using motorbikes.

NuRa makes extensive use of an energy services management system. As described in Banks 2000, Banks 2003 and Niemand & Banks 2006, this system provides a broad range of management tools to the utility including: email communications, transaction recording, customer applications and customer revenue control, complaint and maintenance tracking and logging, GIS based prioritisation and planning of technician work flow, stock control and in particular assists with detailed tracking of LPG sales. The software communicates with the household SHS via a small chip carried by the consumers, and thus confirms payment, manages tariff adjustments and even brings some technical information back from the individual households. If customers do not pay the fee-for-service tariff in time, the hardware at their home SHS notes this and turns off the output power from the SHS. Data collected by the system at the energy stores is transferred to a systems master station which is a centralized utility database and which is able to track and report on a number of key data parameters within the utility.

The location of energy stores and customers presents a very significant challenge to the concession companies. This is noticed in several ways:

- It is challenging to recruit senior level staff to stay in remote places.
- Energy stores or other retail outlets are scattered across a large service territory, often with poor road conditions. Provision of management support, on the job training, material and stock supply to these outlets is expensive and time consuming.
- Customers are located in isolated areas around the energy stores, usually with poor road access, and often with no road access. Off-grid areas are almost by definition logistically difficult, if they were easier to service, then the probability of grid electrification would be far higher!
- This problem is compounded by the fact that key components of the energy supply systems are located inside the customer premises. NuRa staff currently estimate that approximately 14% of customer visits have to be repeated because the technicians did not find the consumer at home at the time of the visit.

### 2.3.5.3 Customer base

The off-grid concession companies operate in remote rural areas, and their primary target is rural households. Typical data on the customer base is reflected in Aitken 2007. Impact and consumer surveys on the concession process have been conducted at various levels, including:

- Gothard, E. 2003. NuRa Household Survey Report
- Annecke and Mohlakoana (2006) – “Socio-economic characteristics and impact assessment of the KwaZulu Energy Services programme of Solar Home Systems installations”
- The Energy Research Centre (UCT) conducted a number of surveys as part of an evaluation of the programme. See ERC 2004a, 2004b, 2005.

The overall customer base in the concession areas is large, with the final number of off-grid customers depending to a large extent on the way in which grid electrification is expanded. However, as shown in Table 4 there is significant room for expansion of the NuRa utility. Similar opportunities exist in the Eastern Cape and in the area operated by the KwaZulu Energy Services (KES) concession. In Limpopo Province where Solar Vision operates, the potential for expansion is slightly more limited because settlement patterns are more ‘village like’, and potential for grid electrification is greater.

Table 4: NuRa region: Estimates of the total number of non-grid households<sup>22</sup>

Assumption	Resulting estimate
Total number of households in region of analysis	212 225
30% of total number of households in region of interest	63 600
50% of total number of households in region of interest	106 112
All households more than 2.5km from current or known proposed grid	146 500
All households with less than 15 other households in 1 km <sup>2</sup>	47 000
All households with less than 30 other households in 1 km <sup>2</sup>	108 000

NuRa has however focussed its operations on smaller geographical area within the larger concession region. Using GIS data available in 2001, NuRa estimated that there were 43 000 households in the focus area, of which only a few thousand have been grid electrified. NuRa has now installed more than 10 000 SHS in the region. Furthermore, NuRa has specifically avoided areas targeted for future grid electrification. Following this high level analysis, it thus seems that about 30% of eligible households have taken up the SHS in the region of

<sup>22</sup> Information compiled using HELP household database as a reference. As such the number are based on 1996 information. The number of households seems to have increased since then.

operations. It should be noted that for the last 18 months, installations have been stopped, thus the percentage take up is in part a reflect of a supply constraint rather than a demand constraint.

In the initial stages of the programme, NuRa was able to offer two different SHS system packages<sup>23</sup>

- a standard 50 Wp , 100 Ah battery system that could power between 4 and 8 lights (the tariff and connection fee increases depending on the number of lights).
- And a 100 Wp, 200 Ah battery system with a 150 Wp inverter.

The latter was significantly more expensive for customers (as it received only the basic R3 500 subsidy – the balance had to be financed by the consumer, resulting in a fee for service tariff of R167 monthly). Nevertheless, several hundred households (and small businesses) took up this offer, indicating the demand for higher levels of electricity supply.

#### **2.3.5.4 Institutional set up and key players**

Institutional issues have presented several challenges for the concession programme in South Africa, and as noted in Banks (2000) and Banks (2003), these were the principal reasons for delay in programme commencement. Implementation partners were selected prior to finalization of the contractual framework within which they would operate. During a period of several months different frameworks were explored- with the options considered for contract principal including: Eskom (national grid Utility), Local Authorities, and the Department of Minerals and Energy. The interim 'concession' contract was finally signed by the concessionaires, the National Electricity Regulator and Eskom (operating under a mandate from the DME) in May 2002. NuRa was fortunately able to secure funding from the Dutch Government (PSOM programme) to enable it to commence installations in December 2001, prior to final signature of the 'concession' programme. This funding covered the costs of the first 400 Solar Home Systems, and NuRa was able to move seamlessly from the pilot implementation project into the main programme. The intention expressed in the 'interim contract' was that activities would be reviewed, and longer-term contracts signed prior to expiry of the interim contract. The review was delayed, and thus the contract term (and with it available funds for the capital subsidy) came to a sudden halt just as the concessions were really getting going. There was an eight-month delay before a new 'interim' contract could be signed – this time with the Department of Minerals and Energy as the contract principal. Once again, planned reviews and contract negotiations, which were intended to allow seamless continuation of the programme took much longer than anticipated. At the time of writing (April 2008), the flow of government capital subsidies has been on hold for two years (since April 2006).

An issue here are a number of constraints to public finance processes that have significant implications for the establishment of long term service provider contracts that require certainty and an assured flow of capital funds.

In parallel, the concessions were required to set up "Service Provider" agreements with the local municipalities in their regions of operations. These contracts do not place any financial liability on the municipalities (apart from assisting with planning and definition of grid and off-grid), but they are important from a constitutional and process management perspective.

One of the reasons for institutional uncertainty in the concession programme has been the ongoing Electricity Distribution Industry restructuring process that is underway in South Africa. At present, grid electrification is either the responsibility of local municipalities (or where relevant, the metro), or of Eskom. The municipalities have a constitutionally vested mandate to be the service authority. There are thus several hundred different distribution utilities operating in the country (the different municipalities), with Eskom as the primary (but not exclusive) provider of power. Most low density rural areas do not however fall under licence areas of municipalities, and are currently within the Eskom mandated area. The EDI

---

<sup>23</sup> NuRa's roll-out of larger (100 Wp) solar systems were in part supported by a USAid grant which was motivated on climate change grounds.

restructuring process is seeking to set up 6, or perhaps 7 Regional Electricity Distributors. These would be large, and would include within their borders large metros, towns as well as rural areas. Ultimately, the REDs would have to be an important member of any 'concession' or IREU type contract framework. However, given that they do not yet exist, the uncertainty related to timing of their establishment, powers and capabilities represents one of the most important barriers to establishment of PPP or other smaller 'utilities' in sub regions.

Decision making around definition of off-grid areas has been another important factor that led to delays and significant costs in the concession programme. One of the important reasons for Eskom being included as a signatory to the initial 'concession contracts' was because it was seen as the body best able to allocate so called 'permission areas' to the concessions, thereby defining areas within which the concession companies were free to install SHSs. Later, this role has been taken on more strongly by the local authorities/municipalities. Nevertheless, there have still been several cases in which planning and consultation has not been able to avoid premature arrival of the grid after installation of off-grid systems. Indeed, the Shell Eskom concession ended up removing over 1 000 SHSs because the grid arrived in the region where they had been installed. NuRa, Solar Vision and KES have subsequently all had some experience of grid encroachment into regions that were thought to be 'off-grid'.

In order to try and mitigate these risks, municipalities in some regions have prepared "Energy (or Electricity) Service Development Plans". These comprehensive 'master plans' for a region have sought to set out a time frame for grid electrification to reach different settlements and regions within the municipality. Settlements that were either too expensive to grid electrify at all, or which are slated for grid electrification far into the future (say 5 to 10 years time) can then be targeted for off-grid electrification, either as an interim or an semi-permanent solution. NuRa has used a plan prepared by the Umkanyakude District Council as the basis for its decisions about where to install SHS, and where to refuse installations on the assumption that the households should rather wait for the grid. Even with this locally approved plan, there have still been situations where the grid has arrived within two or three years of SHSs being installed.<sup>24</sup>

The concession contracts include clauses which should allow the operator to move a SHS from a grid connected customer to another new off-grid customer, and claim the expenses from the grid service provider (who should have budgeted for this in setting out original subsidy allocations for the grid connection). These types of claims have however not yet been successfully lodged.

### **2.3.5.5 Financial assessment**

As noted above, the intention for the concession process was that initial funds for establishment of the business would come from the private sector (in the form of equity and loan finance). An 80% capital subsidy from government resources was intended to buy down the cost to households. Consumers contribute an upfront fee of R100 (around USD13.3)<sup>25</sup>, and then pay a monthly fee of R61 (USD8.13). The original intent (see Banks 2000) was that the concession companies would be able generate a return on their investment in the order of 15 to 20% over the project life, taking into account depreciation, tax, etc. Original tariffs were worked out prior to significant operational experience being gained, and on the assumptions that most companies could grow rapidly to a target size of between 15 000 and 50 000 connections (not all companies had the same end size objective). The financial calculations were done on the assumption that there would be an inflation-linked adjustment of the tariffs.

---

<sup>24</sup> As many commentators have observed, arrival of the grid in a region that has previously been SHS electrified is excellent news for the customers (they get a higher energy, lower cost services), and there is a good probability that grid take up in the region will be more rapid than it would have been if the SHS were not installed (as people have learnt about the benefits of electricity) – thus it is good for the grid company too. In a fee-for-service mode of operation, the only party to really suffer is the off-grid service provider, as it takes several years before they recoup the initial investment made in getting an SHS customer on the books and installed.

<sup>25</sup> A ZAR: USD exchange rate of R7.5/\$ has been used for this analysis.

As noted above, tariffs have only increased marginally to date, and the growth in the installations base has been limited to a far slower rate (primarily as a result of delays in contract signature). Furthermore, most of the concession companies have experienced difficulties of one kind or another (as listed above). It is thus not surprising that the companies are struggling to remain cash positive on an annual basis. Although figures are not publicly available, it is understood that NuRa, KES and Solar Vision are all (at current installed levels) either at a breakeven stage, or very close to this. *This is of itself a very positive state of affairs and is unusual for a rural electrification programme in a developing country of any sort.* If the companies were able to grow their installed base further, the financial position would improve. But at present, there is no short/medium term prospect for a return on investment to shareholders. Regrettably, the first company to start installations (the Eskom Shell JV) ran into significant financial difficulties, and eventually the shareholders decided to pull out of the programme. The remaining systems were divided into three groups, and handed over to smaller companies to operate. Although these have benefited from direct government support, they remain in a very vulnerable position, primarily because of their low customer base.

### **2.3.5.6 Discussion of key issues related to the concession process**

The concession programme has not met its initial ambitious connection targets. The installation rate has been on average of only 0.34 MW/annum, and a total of 1,67MW are installed after 5½ years, representing about 33,000 connections, which is still very significant in SHS terms. The main problem areas have been:

- The question of political will and support for the process at national level. There were initially long delays in getting up and running, then after a two year period, a planned review started late, and it took 18 months before a second phase of installations was started (following a very similar formula to the first phase, and thus implying that the review results were relatively positive). This second phase stopped in February 2006, and despite significant negotiations, during which officials indicated that the programme would enter a third phase, the installation programme has still not been restarted. Concessionaires, with established infrastructure, responsibilities and systems remain in the field, maintaining their existing base, but for the present unable to expand the programme.
- The complexities of dealing with several local municipalities to set up service agreements, and access the operational subsidy (FBE) have led to delays, and subsidy inconsistencies. The operational subsidy has in some cases been R40, but has been applied for only part of the period. As a result, some customers have seen effective tariffs start at around R18 for several months (while the service provider received balance from the subsidy), then suddenly climb to R61 (when the subsidy is no longer available). For example, in the NuRa area, most customers do not currently receive any FBE subsidy, as their municipalities have decided to allocate the funds to other services. About 15% live in an adjacent municipality that has decided to support the programme, and these customers thus pay a significantly reduced tariff. This geographical and time based variation in tariffs obviously contributes to significant non-payment problems.
- Slow and ongoing RED restructuring has led to institutional uncertainty for all contracting parties, as well as a diversion of focus for key decision makers.
- In addition, the concession companies have had to deal with challenges of establishing a new large-scale delivery and maintenance infrastructure with both technical and human resource development requirements. New 'utility companies' have been established from scratch.
- The programme has also enabled development of an innovative revenue management system and solar pre-payment meter technology. However, the stop/start nature has made it difficult for the developer to properly plan production and ongoing product improvement, and the recent 2-year stoppage in installation roll-out has significantly compromised the long term viability of the company which developed and supplies the system.



- An additional challenge to off-grid electrification in South Africa is the strength and unpredictability of the grid electrification programme. Even the Eskom-Shell JV (which had the grid utility as a 50% shareholder and thus could be expected to have better access to planning information) had to remove more than 1,000 SHSs because they were rendered obsolete by the arrival of the grid in the communities. Some of the other concession companies have also had to remove tens to hundreds of systems as the grid arrived at what were thought to be off-grid households.

There have however been some very important successes:

- long term maintenance has been addressed, and is paid for by consumers (in some cases with help from the FBE). The systems are still being maintained – 7 years into the programme and despite the current delay in new installation roll-out
- LPG is being distributed by some of the companies in high volumes and at competitive prices – addressing the critical thermal energy needs of households
- Significant long-term job creation has occurred in the target areas as the companies have established their operations
- Critically, several of the companies are either big enough, or very close to being large enough to reach operational profitability – so there is reasonable expectation that they will continue to operate and deliver services – irrespective of the outcome of further subsidy deliberations
- The companies now have very significant management, technical and retail staff skills and resource bases in rural areas of South Africa
- There is a reasonably founded expectation that the service providers will diversify their funding resources and business strategies to continue building up sustainable energy service companies.

There have been several questions raised regarding the ‘unacceptability’ of the SHS as an electrification option in South Africa. On the one hand – it does seem unreasonable to expect people to pay R61/month for a 50 Wp solar system that delivers enough power for lighting and small TV’s, when other households receive a 220 V grid connection that is far more flexible and useful, and at a far lower cost. Nevertheless, it should also be noted that most people *are paying*, and that the companies have long paid-up waiting lists for installations. The fee-for-service option allows consumers to adopt a low risk alternative while they wait in hope for the grid to arrive. When/if the grid does arrive, the consumer can return their SHS to the supplier. Furthermore, given the relative slow-down in grid installations over the last few years, many communities have realised that it is unlikely they will receive grid in the near future, and they are thus keen to receive the solar systems.

The South African concessions, and in particular NuRa as a primary case study have encapsulated many of the elements of an IREU as defined in Section 1.2. The core element missing from the current concessions is that *they do not distribute grid electricity within the concessions area*.

Other key elements that are missing include;

- lack of mini-grid implementation in regions where this would be more appropriate than SHS (although NuRa did undertake a feasibility study for mini-grid in its region of operations)
- no significant support of school and/ or clinic electrification (or other social services)
- no significant support of targeted productive use activities (although NuRa has assisted with the PUC project)
- Lack of attention to other energy services and energy efficiency (heat retention cookers, solar cookers, solar water heaters, biomass products), although again note that NuRa has worked with some of these on a small scale (solar stoves, heat retention cookers, 220 V compact fluorescent lights)

In our view the concessions represent a very interesting opportunity for the establishment of IREU(s), depending on stakeholder interest, and validation of other assumptions (such as business rationale) to be explored in subsequent phases of this project.

### **2.3.6 Conclusions**

As noted above, the South African energy context is quite different to that in other African countries, particularly because of the extent of the energy infrastructure that has been built up. Of particular relevance to this study is the reach of the electricity grid and the relatively high number of customers connected to it. If an IREU were to be established in this country, there is far more likelihood here, than in any other African country (case study countries included), that the utility would be able to offer a grid as well as off-grid service. This argument is made on no other basis other than that the grid network extends fairly deep into rural areas, and would thus tend to co-incide with the operational area of a possible IREU. It would be of great interest to observe how a process of integrating a grid and off-grid offering might evolve.

It is difficult to say whether the reform that has been initiated – and which is now inching along – in the electricity distribution industry in South Africa would be a positive development for the possible establishment of a IREU or not. The formation of REDS may possibly make it easier for an IREU to be established: the rules of the game will have changed thus creating space for new service delivery methods, and there may be increased financial and HR viability to support an IREU. It maybe easier for an IREU to enter into negotiations with a RED rather than with a legacy laden Eskom department. But perhaps the process will take too long to evolve and will freeze any moves towards new/different service delivery developments. And perhaps, as is currently happening (albeit on a relatively small scale now), the IREU will lose the opportunity to work with progressive municipalities (with established electricity/energy service development plan) currently open to the notion of an integrated service delivery option. Regulatory and other government authorities may be loath to support the establishment of an IREU without a full understanding of how the process will fit into the current reform initiatives.

The uncertainty that is emanating from the EDI restructuring processes, and indeed from fluctuating government (policy) positions does little to encourage private sector investment in rural energy. Indeed, these uncertainties have discouraged such investment in the South African energy sector on numerous occasions in the last few years. This is a worrying element for the possible establishment of an IREU, which will most likely to based on a public private partnership arrangement. As is noted in the conclusions sections of this report (section 3 and section 4), it is likely that some form of public sector subsidy will be required, at least in the early stages of an IREU.<sup>26</sup> Private sector investors are unlikely to become involved without a fairly certain path towards financial viability.

Notwithstanding the above, the South African government's policy with regard to rural energy is indeed, in its parts, supportive of the concept of delivering an integrated energy service. In fact, the objectives of the government's Integrated Energy Centres are quite similar to those of the IREU. The existing concession process is a DME initiative. An IREU would be supportive of government's goal of achieving universal energy access. Indeed, government needs all the support it can get if it is to reach its goals in the time period committed to. And, an IREU would also assist the government, and Eskom, in alleviating the serious capacity constraints the country now faces: the climate for investment in distributed and/or renewable energy generation has been improved. While the concept of an IREU fits well within government's vision for rural energy, it is probable that new (electricity) regulatory support will be required in this area – particularly if Eskom contracts directly with IREUs for the retail (and possibly distribution) of electricity (and perhaps some routine servicing and maintenance of distribution infrastructure) in deep rural areas.

---

<sup>26</sup> Various recent offerings of partnership and associated financial support from municipal electrical undertakings would not appear to support a sufficiently large customer base to make financial and economic investment sense. Indeed, this is one of the team's key reasons for suggesting that an IREU is built out of an existing initiative – such as NuRa in KwaZulu Natal. The IREU customer base would not have to be built up from scratch.

As for other fuels, South Africa has also a relatively well-established thermal energy distribution network, even in remoter areas of the country. As has already been demonstrated by at least 2 of the off-grid concession companies, as well as government-initiated IECs, and small distributors, product is fairly readily available and at reasonable cost.

It is probable that an IREU will find it difficult, particularly in its early stages of its establishment to attract and retain sufficiently skilled personnel to manage and drive the initiative. While it should be accepted that this issue is likely always to be a constraint (in rural areas and in a field such as this), our team again suggests that it will be necessary to aim for a significant scale of operation in order to build the necessary ‘critical mass’

To conclude this section, Table 5 below outlines various possible routes for the establishment of an IREU in South Africa.

Table 5 Analysis of opportunities to establish and IREU in South Africa

Method	Comments	Possible actions for IREU team
(A) Add grid mandate to responsibilities of existing off-grid concession (e.g. NuRa is doing thermal and off-grid already)	Would require buy in from NuRa, Eskom, local municipalities and DME. Many of the elements are already in place (thermal and off-grid). Also note that share holders of both KES and NuRa have significant grid expertise. NuRa shareholders also have Mali mini-grid/off-grid expertise. If RED's come into being, this IREU entity would presumably remain distinct as a contracted service provider for a region	Prepare case, and follow up with NuRa and others interested parties
(B) Add off-grid and thermal to existing operations of a municipal electricity undertaking	When Durban Alternative Energy Company <sup>27</sup> was established this might have been a possibility, but at that time they still were going to keep grid and off-grid operationally distinct Preliminary discussions indicate that some smaller municipalities with large rural constituencies may be interested in this approach. We are not certain whether a municipality would take on operation of off-grid component. They may prefer to outsource the operations. Such an operation may be taken over by a RED during restructuring	Prepare similar case to above, but primary discussion would be with municipalities that have shown interest in managing both grid and off-grid.

<sup>27</sup> Durban Alternative Energy Company was set up by the metro to undertake off-grid electrification. However, it did not commence operations.

(C) Add off-grid and thermal energy service delivery to the responsibilities of Eskom in a rural region that they currently serve	Eskom have experimented with off-grid in the past (the Eskom Shell JV, and the KwaBhaza project), and currently manage off-grid school electrification. However, they currently have a range of national level problems to deal with, and their prior experience with off-grid SHS has not been all that positive. They are thus very unlikely to want to take this on	This option is not considered worthwhile exploring further. However, once EDI restructuring complete, then this option becomes similar to (B) above - and will thus come into the picture again
(D) New IREU established- which takes over some Eskom (or municipality grid customers) and undertakes to extend grid (INEP) and do off-grid, thermal	This option has advantages (an appropriately organized/owned/managed entity could be set up from the start with right vision, aims etc.) However it would need to 'start from scratch'	Once a significantly more detailed picture of an IREU has been obtained – if it differs too much from existing organisations in (A) or (B) above, then option (D) becomes the most attractive.

In summary – it seems that an IREU could be established in South Africa, there would be benefits to having such an entity responsible for rural energy services. However, there are a number of institutional and regulatory hurdles that would need to be overcome. The suggested approach would be to engage with options (A) and (B) above. Depending on how discussions with stakeholders progress, only one of these could proceed to the next level. If, on doing more detailed work it seems that a new entity would be better, then option (D) would become the primary focus.

## 2.4 Review of policies, programmes and projects in Tanzania

### 2.4.1 Background

Tanzania is rich in natural energy resources, notably natural gas and hydropower (but also coal, biomass, geothermal, solar power and wind power). This broad potential however remains largely undeveloped.

Over 30 million Tanzanians live in rural areas – well over 70 per cent of the entire country population. Yet, only 2 per cent of rural households have access to electricity. The country's rural electrification programme has been on going since 1963 (the year of independence), with the Tanzania Electric Supply Company Ltd (TANESCO) being responsible for its implementation. Rural electrification progress has been very slow mainly due to the significant and ongoing heavy financial burden associated with it.

Kerosene is a popular fuel amongst poor households, generally because it is readily available and affordable. It is commonly used for lighting and cooking. Fuelwood is also very popular with large amounts available. Indeed, it is estimated that firewood provides up to 90 per cent of Tanzania's energy consumption. Gas supplies and appliances are not readily available, thus limiting its use in rural areas of the country.

### 2.4.2 Energy policy thrusts and direction

#### 2.4.2.1 Electricity Act 2007

Electricity generation, transmission and distribution activities were governed by the Electricity Ordinance of 1931 up until 22 April 2008 when the new Electricity Bill was passed by Parliament. The Electricity Act is a straightforward set of guidelines for the regulation of the

electric supply system and clearly outlines the role of private sector participation and cost reflective tariffs.

The new Electricity Act is complementary to the Rural Energy Act on issues related to rural electrification and addresses planning, Monitoring and evaluation and Implementation. In addition, it has several measures relating to “light-handed” regulation of rural electrification – not all of which are located under the Rural electrification section.

#### **2.4.2.2 The Energy Policy for Tanzania**

In Tanzania, about 80% of the population lives in rural areas and only 2% of those people have access to electricity. As with many African countries, it is assumed that many of these households will not be connected to the national electricity grid in the near- or medium-term so off-grid technologies will need to be employed. The Tanzanian energy policy now allows independent power producers to tap into renewable energy resources to supply rural populations.

The most recent National Energy Policy was issued in 2003. It states as the policy objectives: “The national energy policy objectives are to ensure availability of reliable and affordable energy supplies and their use in a rational and sustainable manner in order to support national development goals. The national energy policy, therefore, aims to establish an efficient energy production, procurement, transportation, distribution and end-use systems in an environmentally sound and sustainable manner.”<sup>28</sup>

With regard to rural energy policy, the National Energy Policy is to<sup>29</sup>:

- Support research and development of rural energy.
- Promote application of alternative energy sources other than fuelwood and charcoal, in order to reduce deforestation, indoor health hazards and time spent by rural women in search of firewood.
- Promote entrepreneurship and private initiative in the production and marketing of products and services for rural and renewable energy.
- Ensure continued electrification of rural economic centres and make electricity accessible and affordable to low income customers.
- Facilitate increased availability of energy services, including grid and non-grid electrification to rural areas.
- Establish norms, codes of practice, standards and guidelines for cost effective rural energy supplies

#### **2.4.2.3 Rural Electrification Strategy and Plan**

Tanzania plans to provide 750,000 new grid connections and 370,000 off-grid connections by 2015. If achieved, this will mean the percent of rural households with access to electricity will increase to 22%. The interim goal for the program is to achieve 8% access by 2008<sup>30</sup>. The proposed strategy for implementing this plan is to use Rural Energy Fund (REF) funds to pay some of the capital costs and therefore reduce the risk of investing in rural electrification projects. The government has identified two types of sub-projects, which it plans to use for achieving the electrification targets. The first involves new grid connections that require little or no investment in additional transmission infrastructure. The second is isolated grid connections, supplied by independent power producers<sup>31</sup>.

---

<sup>28</sup> The National Energy Policy. 2003. The United Republic of Tanzania Ministry of Minerals of Energy.

<sup>29</sup> Ibid

<sup>30</sup> This goal has not (to our knowledge) been achieved

<sup>31</sup> ECON Analysis. 2004. Pre-feasibility study: Potential rural grid connections. Memo 2006-079, Project no. 39253.

### 2.4.3 Regulatory framework

The regulatory framework has been specifically opened up to allow for competition to TANESCO, and to allow greater private sector participation in the electricity sector. President Kikwete is quoted as stating<sup>32</sup> the following regarding the National Bill”

‘The bill will be tabled in the National Assembly in October this year. We want to provide room for the private sector to participate in electricity production and a more competitive business environment for the state-owned Tanzania Electric Supply Company (Tanesco) and other private players’, he said, in remarks at the inauguration of a power project at this Serengeti District township.

President Kikwete also said that government is ‘pushing for more effective participation of the private sector, in the production, distribution and sale of electricity to make Tanesco benefit from competition’.

On 22 April 2008, this bill was passed through Parliament.

### 2.4.4 Identification of Stakeholders

#### 2.4.4.1 Ministry of Energy and Minerals

The stated mission of the energy branch of the Tanzania Ministry of Energy and Minerals (MEM) is: “to provide an input into the development process of the country through establishment of a reliable and efficient energy production, procurement, transportation, distribution and end use system in an environmentally sound manner.”<sup>33</sup>

In recent years, the MEM has created a national energy strategy with a focus on improving access to modern energy service in all areas of the country. As part of this strategy, a Rural Energy Agency (REA) and Rural Energy Fund (REF) were set up and are being operationalised.

#### 2.4.4.2 Rural Energy Agency

The Rural Energy Act of 2005 established the framework for the Rural Energy Agency (REA) and the Rural Energy Fund (REF). According to the concept regarding these institutions, the REA will be active in: policy and strategy related functions, project related functions, and administrative functions. REA is not in place with 10 staff. The functions are more explicitly outlined below<sup>34</sup>.

Policy and strategy related functions include:

- Policy advice: Advise the Minister of Energy and Minerals on policy matters related to rural energy provision;
- REF procedures and guidelines: Develop procedural guidelines, selection criteria and terms and conditions, based on the policy mandate provided by the Ministry, for the application of REF funds;
- Facilitate the co-ordination of the rural energy programme activities with other rural development activities;
- Training and capacity building: An additional strategic function of the REA would include training and capacity building. This is necessary to upgrade skills inside the organisation, as well as disseminating information and skills to key stakeholders;
- Research & development: Conduct, promote and support research and development in appropriate rural energy technologies and dissemination strategies, and disseminate positive results.

Project related functions:

---

<sup>32</sup> This Day, IPPP Media, 28 July 2007, <http://www.ippmedia.com/ipp/guardian/2007/06/28/93413.html>

<sup>33</sup> <http://www.tanzania.go.tz/energy.htm>

<sup>34</sup> ECON Analysis. 2008. REA REF concept paper. Memo 2008-61, Project no. 39250.

- Project identification and planning: This includes awareness raising, promotion of project concepts, and early-stage identification of potential projects. It would include the preparation of socio-economic baseline material, market surveys, load forecasts and indicative planning.
- Project facilitation: Activities will include working with stakeholders to conceptualise projects; facilitating contact between communities and developers, and with project financiers; and assisting district and other rural government officers to conceptualise and engage in rural energy project development.
- Technical assistance to project developers: This includes provision of support for project preparation activities, such as surveys, pre-feasibility and feasibility studies and general business development services.
- Project appraisal: This includes the appraisal of applications made to the REF and preparation of recommendations on whether support should be provided, and the level of this support.
- Project supervision: Once a project is ready for implementation, the REA would undertake some supervision activities, ensuring that milestones and targets are being met, and recommended intervention and possible solutions should problems arise.
- Monitoring and evaluation: Once the project has been implemented, the REA would continue to monitor performance and evaluate the success of the project. The evaluation function would extend to examining the strengths and weaknesses of different strategic approaches.

Administrative functions:

- Reporting: Preparation of annual reports for submission to the Ministry and other stakeholders;
- Trust Agent selection: Select the Trust Agent for the REF, based on a competitive selection process clear set of selection criteria;
- Procurement: Competitively procure services as required to implement annual workplan;
- Board secretariat: Keep all records of the affairs and the meetings of the Board and follow up and ensure the proper implementation of Board decisions and directives;
- Annual budget & workplan: Prepare an annual budget and workplan for the activities of the REA;
- Rural Energy Database: Maintain a database of information on rural energy service provision and technologies; or liaise with the Ministry of Energy and Minerals to ensure that such a database is established and maintained;
- Auditing: Ensure that the accounts of the REA and REF are audited;
- Staff and office management: Ensure office routines are established and functional.

It is clear from the above that the Rural Energy Agency would be a key partner and liaison agency for an IREU activity that might take place in Tanzania

#### **2.4.4.3 EWURA**

The Energy and Water Utility Regulatory Authority (EWURA) is the national independent energy and water regulatory authority and is in charge of licensing, tariff review, monitoring performance and standards with regards to quality, safety, health and environment in the electricity, natural gas, petroleum and water sectors. EWURA also promotes effective competition and economic efficiency, protects the interests of consumers and promoting the availability of regulated services to all consumers including low income, rural and disadvantaged consumers in the regulated sectors.<sup>35</sup>

EWURA staff interviewed regarding the possible establishment of an IREU indicated:

---

<sup>35</sup> <http://www.ewura.com/>

- There are no regulatory barriers to an IREU, but there may be issues
- Some parts of IREU would be regulated (electricity), but other activities may not be (e.g. thermal energy sales – gas retail is not regulated business).
- Because of the need for tariff reviews on the regulated business, it will be necessary to maintain separate accounts for the regulated and non-regulated business.

#### **2.4.4.4 TANESCO**

The Tanzania Electric Supply Company Limited (TANESCO) is a state-owned, vertically integrated monopoly supplier of electricity in Tanzania. The Government vision of the electricity sector is to sustainably provide adequate, safe, reliable, efficient, cost-effective, and environmentally compatible electricity services to as much of the population as possible.<sup>36</sup>

TANESCO's self-stated business imperatives are to:

- Ensure financial viability through revenue improvement and reduction of energy losses.
- Increase customer satisfaction by putting in place processes that meet customer care needs.
- Employee satisfaction through competitive employment package and good working environment.
- Support the National Energy Policy through appropriate company policies.
- Accelerate the pace of electrification for economic growth.
- To increase generation capacity so as to avoid load shedding.

Although TANESCO was the host institution for a recent (2003) master planning exercise in Tanzania, and has participated in pilot rural electrification projects, it is clear through interviews with TANESCO staff, as well as from the above institutional developments, that they are not the sole agency responsible for implementation of rural electrification. Indeed it seems that many rural electrification responsibilities previously undertaken by TANESCO will move across to the REA and the REF.

TANESCO could presumably be a partner in an IREU project (if they see it as a wise investment decision), and there are no immediate barrier to considering TANESCO as a potential supplier of bulk electricity to an IREU.

#### **2.4.4.5 Songas**

Songas is the primary gas processor in Tanzania and is also a power generator. It is an internationally owned company that extracts natural gas that was discovered at Songo Songo island off the coast of southern Tanzania. The business consists of two operations, Gas Processing and Transportation and Power Generation. Gas from Songo Songo is piped 225km to Dar es Salaam where it is used in Songas' Ubungo power plant, which, at 190 MW, is the largest gas fired power station in East Africa. Songas' mission is stated as: "[to] safely provide clean, reliable, cost effective electricity, creating sustainable returns and supporting the development of the electricity [sic] power sector in Tanzania".<sup>37</sup>

#### **2.4.4.6 Independent Power Producers**

Electric power generation in Tanzania is unbundled and there are several independent power producers operating in the country. Private oil and gas-fired generators include Independent Power Tanzania Limited – IPTL (100MW), Songas (190MW) and Artumas Inc. (18MW). The other independent power producers are Aggreko (40MW), Dowans (100MW) and Alstom (40MW), which are leased emergency electricity suppliers.<sup>38</sup>

---

<sup>36</sup> <http://www.psrctz.com>

<sup>37</sup> <http://www.songas.com/>

<sup>38</sup> <http://www.ewura.com/electricity.html>,  
[http://iis-db.stanford.edu/pubs/21076/TanzaniaIPPfinal\\_March2006.pdf](http://iis-db.stanford.edu/pubs/21076/TanzaniaIPPfinal_March2006.pdf)



#### **2.4.4.7 TaTEDO**

The Tanzanian Traditional Energy Development and Environment Organization (TaTEDO) is a national development organization dedicated to the scale-up of modern energy services in rural Tanzania<sup>39</sup>. Its mission statement is to “advance popular access to sustainable modern energy technologies in marginalized communities in Tanzania through technological adaptations, capacity building, community mobilisation and advocacy for increased access to sustainable energy”<sup>40</sup>.

As noted on the TaTEDO website, “TaTEDO with support from the European Union and HIVOS through their programme on Increasing Access to Sustainable Modern Energy Technologies and Services will install multifunctional platforms in more than 100 villages located in eleven districts of six regions in Tanzania. The programme aims to improve living conditions, boost economic activities and provide better social services in rural communities of Tanzania. (Furthermore), (t)he programme will also increase access to modern energy services in rural areas where the conventional energy infrastructure such as national grid network doesn’t reach. The programme will provide business development services to entrepreneurs and also develop and create linkages with financial institutions, who could extend loans to the action target enterprises and beneficiaries. It will further, enhance communication through networking and information exchange among the beneficiaries, target groups and collaborating stakeholders. It will also further build the capacity of TaTEDO and associates to facilitate improved working environment that will foster development of appropriate rural energy access strategies, programmes and related institutional framework. Therefore the modern energy services in these areas will be useful inputs for social and economic development of the beneficiaries”.

#### **2.4.4.8 Other stakeholders**

LPG is supplied in Tanzania by the petroleum companies. However, according to the SPARKNET (2004) country synthesis report the use of LPG by low-income households is negligible, as it is more difficult to obtain in urban and rural surroundings, is more expensive, and requires relatively expensive accessories and appliances. Non-users also tend to be concerned about LPG specific risks, such as possible asphyxiation or explosion accidents. LPG suppliers would be potential stakeholders if an IREU were to retail LPG.

There are several solar companies operating in Uganda, and there have been specific projects to try and improve rural energy service deliver (or promote solar electrification) – these stakeholders are identified in section 2.4.5 below.

### **2.4.5 Projects and programmes**

#### **2.4.5.1 Mwanza market transformation project**

The UNDP/GEF sponsored project “Transformation of the Photovoltaic (PV) Market in Tanzania” has been operating in Mwanza, Tanzania since March 2004. The five-year project is divided into two phases, an initial pilot phase in the Mwanza region, followed by a replication and dissemination phase. The project aims at reducing Tanzania’s energy-related CO<sub>2</sub> emissions by introducing photovoltaics (PV) as a substitute for fossil fuel (kerosene) utilized for lighting in the rural areas remote from the electricity grid and at slowing down the rate of additional diesel-based captive generation or grid extension schemes for providing basic electricity services to the unelectrified rural households, specifically in the Mwanza region. In addition, the project will substantially decrease the growing number of rural poor, adults and children alike, who contract respiratory and eye problems due to prolonged exposure to kerosene smoke and soot (poor indoor air quality).

The activities proposed in the project are designed to remove barriers to the wide-scale utilization of PV to meet the basic electricity needs of individual households. The project will develop local capacity to identify technical and financing options and to formulate the regulatory, institutional, financial and marketing instruments necessary to demonstrate the

---

<sup>39</sup> <http://www.tatedo.org>

<sup>40</sup> <http://www.tatedo.org/>

technical, economic, and financial viability of using the private sector as a vehicle to deliver basic electricity services to rural households and community users.

As such, the Mwanza PV project is not focused on the installation of systems, rather developing the private market for selling the systems. The project team supports PV dealers in the region by providing workshops, training sessions, and promotional materials to the public. They also offer grants for systems for health centres, schools, and entrepreneurs in order to establish non-household demonstration sites. Additionally, the project is seeking new ways of financing purchase of PV systems by households and developing training courses for PV technicians in local technical schools.

The sustainability of the program will be seen when the project ceases these activities and the market must operate on its own. If the work has been successful, there will be enough of a base market for word of mouth and private advertising to continue to bring customers to the PV dealers, installers, and technicians.

This project was focused on a specific region of Tanzania, which has low penetration of grid electrification. The project planners estimated the potential market by district, seen in:

Table 6: Potential customers for Mwanza PV project

District	Connected customers	Unconnected (potential off-grid customers)	
	Number	Rural	Urban
Mwanza	24,430	15,874	63,343
Magu	1,300	62,527	6,599
Sengerema	1,168	70,151	6,019
Geita	1,200	102,179	13,603
Kwimba	553	47,151	2,757
Missungwi	918	36,284	3,363
Ukerewe	0	34,610	5,988

The target market also included schools, businesses, and health clinics, primarily as demonstrations sites. The health and education facilities were provided with PV systems primarily for lighting, but also for radios and small appliances. The businesses used PV for a variety of uses, including cell phone charging, sealing milk containers, aerating fisheries, and playing music.

Since the project is aimed at market transformation, another key group is the PV dealers and educators. The project website lists seven PV dealers in the Mwanza region, including Zara Solar, which recently won an Ashden award for its contribution to sustainable energy.

The Mwanza project is funded by the United Nations and Global Environment Facility, who hired international and local managers to implement the program. The PV businesses are all privately operated and most existed prior to the onset of the project.

The nature of the Mwanza project has benefits and detriments in terms of financial feasibility. The benefit of the program is that it does not interfere directly with the PV market. For household consumers, there are no subsidies or “free” installations. The PV dealers are also not given any subsidy, except in the form of free advertising and training. Ideally, this should make a smooth transition to a fully unsupported market when the UN/GEF program ends. On the other hand, this significantly limits the potential number of installations due to low affordability in rural households.

One of the project objectives was to establish partnerships with financial institutions and micro-finance organisation to allow consumers (or groups of consumers) purchase solar systems on credit. This however proved difficult to achieve, (and as of October 2007) very few

credit sales had been achieved. The lack of available financing could greatly reduce the potential market seen in Table 6 if only wealthier households are able to access credit or pay cash for the systems.

In addition to the Mwanza project, the Swedish International Development Agency (SIDA) has been funding a very similar initiative, the Solar PV Market Development in Rural Areas of Tanzania. It is being implemented by the UK based consultancy Energy for Sustainable Development (ESD), on the behalf of the Ministry of Energy and Minerals.

During the IREU consultations in October 2007, D Banks met with Umeme Juma (a PV system wholesaler in Tanzania). Company personnel indicated that they, in partnership with another major wholesaler are bringing in approximately 8000 modules per year (14 Wp or less). This represents a significant commercial market for PV. In addition, they indicated that the market for larger systems is active.

#### **2.4.5.2 Village electrification cooperatives**

In areas where the population is highly decentralized, cooperatives can be good organizational structure for managing public services. A pilot study for village electrification cooperatives was established in Tanzania in 1993. Although there has been no scale-up of the cooperative model, the isolated case illustrates some of the benefits and challenges of this approach.<sup>41</sup>

The village selected for the pilot study of cooperative electrification was Urambo, located in the Tabora region. In 2001, the estimated population was 80,000 people, with 20,000 living in Urambo township. As with most of Tanzania, agriculture is the primary economic activity. There is some small-scale industry and there are also more than 100 shops, a post office, a bank, and about 20 restaurants and bars. For public services, there is a hospital, two dispensaries, a college, and police station. Prior to the project, none of the village had access to electricity, except some use of small diesel generators in the hospital, college, bank, and some of the small industries.

The original institutions responsible for electricity in Urambo were the Ministry of Works, the Urambo District Council (UDC) and TANESCO. In 1985, three diesel generator sets and a distribution system were installed to provide electricity for street lighting. The UDC was charged with covering the costs of the electricity, but this only lasted until 1992 when funds ran out. This led to the formation of the Urambo Electricity Consumers Committee, which collected funds for the fuel needed to run the system. However, after a year this informal system was deemed unsustainable because of questions over maintenance and responsibility to the electricity consumers. The concerns were justified, as at the time only one of the generators was operational due to poor maintenance of the system.

The cooperative management system established in 1993 was supported by TANESCO and SEI. They rehabilitated the system, provided training, and helped set up the bylaws for the cooperative. In September 1993 the Urambo Electric Consumers Co-operative Society (UECCO) was registered and was licensed by the Ministry of Energy and Minerals to generate and distribute electricity. Regular operations under the cooperative started in June 1994.

Iliskoga *et al* (2005) indicated that UECCO was managed by an Executive Committee of ten members, who are elected and nominally paid for their service. Initially, UECCO hired two men to operate the system and make small repairs, but later expanded that job to include making customer connection and disconnections, meter reading, and bill distribution. The Co-operative also employed one accountant. As of 2004, the operational staff had turned over once and the accountant had changed twice.

---

<sup>41</sup> Information for the village cooperative case study found in Iliskoga, E. and B. Kjellstroma, M. Gullberg, M. Katyegac, W. Chambalad. 2005.

The start-up costs of the project were covered by TANESCO and the Ministry of Works, as described in the previous section. However, the customers in the system now need to cover the eventual cost of capital replacement. It was advised that the group should try for 30% capital recovery and this cost is included in the tariff rate. Also included is the cost of metering, maintenance, and fuel. Although initially rates were set based on a fixed monthly charge, customers of the UECCO electricity cooperative in 2004 paid rates based on their metered consumption. In some cases, the number of customers has exceeded the meters available, making it necessary to charge those customers a flat rate based on estimated consumption. Table 7 shows the rates charged to metered customers between 1995 and 2002.

Table 7: UECCO electricity tariffs compared to TANESCO

	Electricity tariff in Urambo after meters were installed compared to TANESCO tariff and fuel price			
	1995 October	1996 September	1997 July	2002 October
Energy charge in Urambo:				
-TAS/kWh	200	260	350	450
- USD/kWh	0.33	0.44	0.56	0.47
TANESCO tariffs:				
-Households, USD/kWh	0.031	0.034	0.037	0.030
Diesel price				
-TAS/l	300	328	425	650
-USD/l	0.49	0.55	0.68	0.68
Exchange rate				
TAS/USD	613	596	625	950
A TANESCO pan-territorial rate for the first 100kWh consumed per month.				

The Table shows that UECCO customers pay on average 10 times the cost of TANESCO service. The high cost reflects the real cost of generation and distribution in Urambo and should help ensure the sustainability of the system if the money collected is managed appropriately.

UECCO has demonstrated well that a village in Tanzania can manage its own electricity supply if it is given adequate technical, financial and management support. As noted by Iiskog et al (2005), important reasons for the success in Urambo have been:

- Strong local leadership
- Training of the co-operative's staff
- Utilisation of well proven technical solutions
- Initial financial support for investments and or covering of initial problems with recovering operational costs
- Ability and willingness to pay for at least the full operating cost of the service; and
- Availability of an organisation that can and is prepared to provide technical support, when needed, and without much delay.

Interestingly, several additional villages have been encouraged by the Urambo experiences, to form electricity co-operatives or are planning to do so. And, there have also been plans to expand the transmission line out of Urambo in order to increase installed customer base and this assist in the lowering of the electricity tariff.

#### **2.4.5.3 World Bank Energy Access Expansion Projects**

Through 2006, the World Bank/GEF funded an initiative aimed at transforming access to energy and ICT in rural Tanzania<sup>42</sup>. The project was funded through a Sector Investment Loan made to the Government of Tanzania and was intended to provide capital subsidies, business development and operational support, and technical assistance to build the capacity of the existing and new service providers.

The rural electrification component of the project focused on increasing electricity access in rural and peri-urban areas, with the aim of correcting the imbalance in access across the rural-urban divide. It aimed to target “transformative entry points” in relatively densely packed rural areas (towns), which are both close to the national grid and have potential for productive industry.

The most recent World Bank involvement in Tanzanian electrification planning is the Tanzania Energy Development Assistance Programme (TEDAP)<sup>43</sup>. The project is currently (2008) in its early stages and will focus on improving electricity services in the main economic regions (Dar es Salaam, Arusha, and Kilimanjaro), as well as expanding access across Tanzania. The project has three components: (1) improving the transmission and distribution lines on the TANESCO grid, (2) support for the Rural Energy Agency to improve off-grid electrification, and (3) technical assistance funding.

#### **2.4.5.4 Priority Rural Electrification Projects**

In the period 2004 to 2006, the Ministry of Energy and Minerals (supported through SIDA funded) commissioned a rural electrification study, and several pre-feasibility and feasibility studies for “Priority Rural Electrification Projects” these include:

- Potential 80 000 connections of grid connected projects on the TANESCO grid, covering several regions of the country (Econ/MEM 2006)
- A project on Mafia Island which could see a 2 MVA wood gasification power plant deliver up to a 1000 new connections, (in part replacing some existing diesel generation). This project could take electrification rates on the island to 20%, and in the electrified villages – up to 55%.
- Three other feasibility studies (Malagarasi Hydro, Njome Hydro, Mwenge Hydro (Mufindi Hydro), Mngeta Hydro) have also been conducted as part of the programme<sup>44</sup> and are now moving into implementation phases

The above project studies all focus on ‘grid’ electrification (national or isolated-grid) and do not make specific mention of off-grid (solar home system or similar) electrification or of thermal energy service provision. While this division was made so as to not interfere with existing PV projects, it shows the isolated approach to rural energy services at the planning level. It is also noted that in several cases, the projects will not achieve more than 20% coverage of households, and do not service all villages in the immediate project area. Given that project establishment will require technical, revenue collection and other infrastructure – it may be that this same infrastructure/technical expertise could be utilised for off-grid (SHS) electrification, and/or to help improve thermal energy service delivery. However, this would depend very strongly on the interest from the existing project developers in expanding scope.

#### **2.4.5.5 LPG and biogas distribution**

Every year, the population of Tanzania consumes 40 million cubic meters of wood, but it is estimated that only 24 million cubic meters can be *sustainably* consumed. The fast rate of wood consumption is due to the lack of competitively priced alternatives for cooking and heating. In Tanzania, only 10% of the population has access to “modern” energy services,

---

<sup>42</sup> World Bank. 2006

<sup>43</sup> World Bank 2007

<sup>44</sup> Malagarasi project will be financed by Millennium Challenge account, Mufindi received support from the EU-ACVP Energy facility (Econ Pöyry helped with this) and the Njombe project is going ahead.

defined as LPG and electricity<sup>45</sup>. There has been some investigation into the scale-up of LPG and the potential development of a national biogas programme for Tanzania. This case describes the potential expansion of both sources of thermal energy for cooking and heating.

A UNDP/GTZ assessment showed that the cost of extending LPG service as a substitute of biomass use would be in the range of \$7 to 15 per capita. This was on the low range of potential project options, but was deemed to have a high potential for scaling up in the East African region<sup>46</sup>. The risk that was highlighted was the potential for extended subsidies. This risk is similar to the problems seen with the scale-up of biogas.

In 2007, the GTZ completed a feasibility study on the prospects for a national domestic biogas programme in Tanzania<sup>47</sup>. The study was conducted as part of an initiative to promote biogas use in Africa, titled "Biogas for a Better Life". The initiative is an international effort led by the Directorate General for International Cooperation of the Netherlands. Biogas is not a new technology to Tanzania and at the time of writing there were nearly 3 000 plants constructed. However, the study found that biogas knowledge was not widespread and that the systems that had been installed had mostly been subsidized.

The study found that a family biogas plant (8 m<sup>3</sup> capacity) could be installed for an investment of about USD 1000. At this price point, the system is only attractive to wealthier, urban families, who currently have to pay for charcoal or firewood. For the rural population, who primarily use freely collected wood, subsidies would be needed to make the system affordable. Although this is not acknowledged in the study, this represents a significant technology mismatch since rural areas have the greatest energy need and the greatest biogas resources.

The financial analysis in the feasibility study focused on the subsidy required per digester in order to make the unit a sound investment for a family. It considered subsidies ranging from \$0-\$350 and found that for households which use "free" firewood, even \$350 would not be sufficient to make the system affordable. For households that pay for firewood or charcoal, the level of subsidy needed depends on the cost of the fuels they are currently using. An existing biogas company has successfully used flexible subsidies to meet a range of customer needs.

The market for biogas digesters is estimated to be 276 000 households, with 144 900 households deemed to be likely customers for a national domestic biogas program. On the supply side, the study shows that the market can scale up to produce 100 000 units in the next 10 years, but it will require significant involvement from the donor community.

What is missing from the analysis is a plan for how much the program is going to cost overall, who is going to bear the cost of subsidies and market development, and how the program can realistically be implemented. The implementation strategy outlined is very vague and presents heuristics instead of plans. Given the low existing penetration of biogas and the mismatch in resources and investment potential, it seems unlikely that this initiative will be sustainable in the long-term.

#### **2.4.5.6 Other projects**

In addition to the projects highlighted, there are a number of isolated grid-extension and institutional projects in Tanzania. While these projects are not all necessarily intended for scale-up, they show the widespread interest in energy development in the country. As discussed in the comments section of this report, the map of projects is quite complicated. There appears to be no one coordinating body and a number of overlapping efforts.

---

<sup>45</sup> [http://www.gvepinternational.org/file/14/10861\\_eac\\_scalingup\\_final.pdf](http://www.gvepinternational.org/file/14/10861_eac_scalingup_final.pdf)

<sup>46</sup> UNDP and GTZ. 2005. *Scaling up Modern Energy Services in East Africa: To alleviate poverty and meet the Millennium Development Goals*. Draft document. [http://www.gvepinternational.org/file/14/10861\\_eac\\_scalingup\\_final.pdf](http://www.gvepinternational.org/file/14/10861_eac_scalingup_final.pdf).

<sup>47</sup> GTZ. 2007. Feasibility Study for a National Domestic Biogas Programme in Tanzania.

The Tanzanian Renewable Energy and Energy Efficiency project to Sustain Poverty Alleviation (TREESPA) involves a collaborative effort between TANESCO, the Small Industries Development Organization (SIDO), the MEM, and Danish Energy Management. It is co-ordinated by the Swedish company, AF Process<sup>48</sup>. The goal of the project is to facilitate investments in rural energy infrastructure, with the goal of poverty alleviation.

Enabling Access to Sustainable Energy (EASE) and TaTEDO are facilitating the piloting Multifunctional Platforms (MFPs) for Productive Uses and Services in Rural Tanzania. The project aims to increase access to modern energy services and facilitate rural enterprises development. An MFP is made up of a diesel generator unit powering productive use machines such as oil press, alternator, milling machine, battery charger, welding, or carpentry equipment. It is intended to be a simple way to provide energy for productive use in peri-urban and rural areas of Tanzania.

The MFP will jointly be owned by the partners who will hire an operator based in the village. A Village Energy Team (VET) and private operator will be responsible for management of the MFP. Especially at early stages of business establishment, TaTEDO and other external partners will assist with knowledge, technology and capital while they expect the villagers to provide infrastructure, time and labour, and locally available resources<sup>49</sup>.

In addition to the projects focused on residential electrification, there is a program working on electrification of rural schools and health centres. The ENABLE project has the following objectives<sup>50</sup>:

- Build capacity of ministry staff in renewable energy
- Facilitate cross-sectoral links between energy, health, education and water
- Policy development linking sustainable energy and poverty reduction targets.
- Develop an Electrification Planning Tool for the energy ministries
- Develop Energy Guidelines and Standard Energy Packages for the health, education and water ministries
- Facilitate replication of activities to French speaking Africa.

The project is funded by the European Commission's Directorate General for Energy and Transport (DG TREN) and is implemented by IT Power, Stockholm Environment Institute, and TaTEDO.

#### **2.4.5.7 Informal power sellers**

Although there is no documentation of private, informal power sellers, they do exist as a rural power option in some areas in Tanzania. Figure 4 shows one such power seller, observed by the study authors in rural Tanzania. The generating station consists of a 54kW diesel generator in a locked wood building near the main business buildings in the town. The generator was salvaged by the operator, who then set up a rough distribution network servicing local businesses and homes. Customers pay a daily rate for each light bulb and appliance they operate.

---

<sup>48</sup> <http://www.treespa.eu/Info%20Documents/TreeSpa%20project%20information.pdf>

<sup>49</sup> <http://www.tatedoease.or.tz/mfp.html>

<sup>50</sup> <http://www.enable.nu/>



Figure 4: Generating house and distribution network for unlicensed power seller, inset shows the 54kW diesel generator enclosed in the wood building

It is unknown how many of these small-scale power stations are in operation in Tanzania since they are unlicensed. Operations like this are a strong example of the willingness to pay in remote areas and the suppressed demand for electricity.

#### 2.4.6 Conclusions

Electricity services in rural areas in Tanzania are extremely limited and there is recognition that the grid will not reach all areas in the country. The energy policy acknowledges this fact in its dual emphasis on grid extension and standalone projects. The energy policy also promotes both the expansion in access to energy and the transition to modern energy.

The first case study reviews a UNDP/GEF sponsored project on developing the market for photovoltaic (PV) panels for electricity in rural areas. Although the aim of the project was to offset kerosene use, the true benefit appears to be the lighting provided and the potential for productive use of electricity. While the first case is technology driven, the second is organizationally motivated. It is the case of consumer cooperatives for village electrification. The third case focuses on the second component of the IREU, which is the need for thermal energy. This case reviews the distribution of LPG throughout Tanzania and the potential for biogas to be used as a complement or substitute in that distribution.

The cases show both the opportunities and challenges of implementing an integrated utility in Tanzania. On the positive side, there is a strong private market for energy technologies as evidenced by the informal power sellers and success of the PV market transformation project. These examples show that the integrated utility may be able to operate (perhaps even without subsidy) as long as it is organized around the existing market for pricing. The regional emphasis on scaling up modern energy services shows a focus on integrated rural energy planning, which should provide an excellent framework for the IREU model. Similarly, the establishment of the Rural Energy Agency and the Rural Energy Fund, as well as EWURA's openness to regulation of an IREU indicate a reasonable intuitional and policy framework.

The challenges in Tanzania are similar to those in other regions. While it remains relatively easy to supply a low level of electricity through standalone power systems such as PV, it is



much more difficult to provide modern quality electricity service, which includes sufficient capacity for cooking, or to transition people away from biomass for cooking. Based on the feasibility study referenced in this report, biogas seems to be a difficult option to implement on a wide scale.

Many of the cases reviewed are only in the feasibility stage so do not offer much information regarding best practices. However, the fact that there are so many rural energy-related projects in the pipeline indicates a market that is pushing for expansion of services and may subsequently be ready to try new delivery modes. The map of projects in Tanzania is complicated, but a number of the projects are complementary. It would make sense to identify overlaps with potential partners to find a more exact space to fit the IREU.

There are a number of projects that have already been identified as of potential interest, but that would need more detailed review if Tanzania were to be selected as a country to test out the IREU concept.

## 2.5 Review of policies, programmes and projects in Uganda

### 2.5.1 Background

There are around 28.9 million people living in Uganda, of which approximately 10% of households are supplied with electricity. Around 3 per cent of the rural population have electricity, 33% urban access. Of the estimate 6 million households in the country, only 585,000 have access/are connected to the grid.<sup>51</sup> Interestingly, Uganda has one of the lowest average per capital electricity consumption of less than 55 kWh/annum.

Uganda's power sector today is still recovering from an economic downturn in the period 1971 to 1986 which brought development in the sector to a halt and a deterioration in the electricity supply infrastructure due to a lack of maintenance. There has however been economic growth in the last two decades, which has created excess demand for power. This has resulted in marked daily load shedding of around 100 MW.

The shortage of supply over demand has partly contributed to the low level of grid rural electrification and partly due to the highly uneconomical nature of such projects. This barrier has led to increased private electrification in many rural areas using diesel generation, car batteries and solar PV systems. Over the last few years, the Ugandan Government has been developing a comprehensive rural electrification strategy to bring the demand for electricity into the official supply loop using a number of innovative approaches (which are discussed below). In this and other regards, the Uganda Electricity Distribution Company Limited (UEDCL) has been broken up by the enacted Electricity Act of 1999, which liberalises the power sector by allowing private sector participation in all electricity sub-sectors.

### 2.5.2 Energy policy thrusts and direction

#### 2.5.2.1 *Electricity Act, 1999*

The Electricity Act 1999 allows for the creation of the following instruments and documents:

- The establishment of the Electricity Regulatory Authority.
- The promotion, support and provision of rural electrification programmes through public and private sector participation in order to:
  - achieve equitable regional distribution access to electricity,
  - maximise the economic, social and environmental benefits or rural electrification subsidies,
  - promote expansion of the grid and development of off-grid electrification, and
  - stimulate innovations within suppliers.
- The preparation of a Rural Electrification Strategy and Plan for Uganda.
- The establishment of a Rural Electrification Fund.
- The development and maintenance of a national rural electrification database to assist in the criteria for monitoring of progress and establishing the targets for rural electrification.

#### 2.5.2.2 *The Energy Policy for Uganda*

In September 2002, MEMD published an Energy Policy for Uganda. The overriding policy goal is to meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner. In order to meet this goal, five policy objectives were elaborated as follows:

---

<sup>51</sup> Estimates prepared for the IREMP, based on 2002 Census, growth rates and information on connections done in recent years.

- To establish the availability, potential and demand of the various energy resources in the country through the establishment of a database on all the available energy resources and energy consumption patterns.
- To increase access to modern affordable and reliable energy services as a contribution to poverty eradication through attracting private capital and management in the energy sector, promoting competition between energy service providers and putting in place a conducive environment to accelerate rural energy supply and access by:
  - applying subsidies exclusively on capital investment,
  - applying light-handed regulation to facilitate investment in rural energy projects,
  - having differentiated tariffs for different areas or projects to reflect investment and supply costs,
  - exploring schemes to assist consumers to purchase appliances thereby increasing the speed at which the load of new consumers matures, and
  - formulating guidelines on organising rural communities to enable them access better provision of energy services.
- To improve energy governance and administration in order for the energy sector to operate efficiently and play its role in the socio-economic development of the country by strengthening and streamlining energy sector administration and governance.
- To stimulate economic development by ensuring that energy plays a central role in the economic development of the country and in the region by encouraging competition within the energy markets to achieve efficiency.
- To manage energy-related environmental impacts, through ensuring that environmental considerations are given priority by energy suppliers and users to protect the environment and put in place a monitoring mechanism to evaluate compliance with established environmental protection guidelines.

### **2.5.2.3 Rural Electrification Strategy and Plan**

Published in February 2001 by the Ministry of Energy and Mineral Development (MEMD), the Rural Electrification Strategy and Plan (RESP) was a requirement under the Electricity Act of 1999. The RESP constitutes a formal framework upon which the electrification process will develop within the broad national strategy for poverty eradication and development, the national energy policy, and the power sector strategic plan.

Rural electrification forms an integral part of the GoU's wider rural transformation and poverty eradication agenda. The Government's Poverty Eradication Action Plan aims to raise the incomes of the poor through provision of infrastructure, credit, etc., and to improve quality of life. Increased electricity access facilitates greater income generating opportunities and allows the provision of better public services, especially healthcare.

The primary objective of the RESP is to reduce inequalities in access to electricity and the associated opportunities for increased social welfare, education, health and income generating opportunities.

The RESP aims to achieve a rural electrification rate of 10% by 2010<sup>52</sup>, meaning that 480,000 rural consumers, a net increase of 400,000 over the year 2000 figure are to be serviced<sup>53</sup>. It is estimated that 15% of the increase in serviced households will come from an increased rate of connection to the existing grid outside the urban triangle, 40% from extension of the interconnected grid, 25% from isolated grids and 20% from photovoltaic solar systems. The rural electricity coverage rate, - the percentage of rural households living in the service areas

---

<sup>52</sup> According to REA's Subsidy Policy, this is currently being revised to 2012.

<sup>53</sup> In 2000, the former Uganda Electricity Board (UEB) had some 170,000 customers, of which 80,000 were outside the urban Kampala-Jinja-Entebbe triangle. UEB were adding new connections at a rate of roughly 8,500 a year mainly in urban and peri-urban areas, whilst the number of households is growing at 100,000 every year, more than half of which are in rural areas.

of low voltage distribution grids – to be achieved in the year 2010 is 30%. More than 1.2 million rural households will be living in electrified areas.

#### **2.5.2.4 The Energy for Rural Transformation Programme**

A long-term programme for improving access to modern energy, *Energy for Rural Transformation (ERT)*, has been prepared by the Government of Uganda, with the Ministry of Energy and Minerals Development as the lead agency, and the World Bank, under the aegis of the Africa Rural and Renewable Energy Initiative in the World Bank's Africa Energy Unit. The programme was approved by the Board of the World Bank in December 2001.

The ERT Programme is a ten-year programme divided into three phases, roughly equal in terms of time.

- First phase: development of the framework and carrying out pilots.
- Second phase: accelerating investments and build upon lessons learned.
- Third phase: scale-up and institutional build up.

The purpose of the ERT programme is to develop Uganda's rural energy sector so that it makes a due contribution to bringing about rural transformation. For this purpose, the programme includes cross-sectoral synergies, while remaining firmly anchored within the energy sector. ERT's cross-sectoral linkages build upon facilitating access to energy to be used for the benefit of the rural population.

A key component of the ERT is the development of an Indicative Rural Electrification Master Plan (IREMP). The IREMP deals with conceptual designs only and is supposed to avoid too detailed planning. The plan does however, have implementable packages, which can be advertised to the private sector for bidding.

The IREMP has been developed to reflect various alternatives of future network extensions, taking into account any planning for future transmission lines, sub-stations and distribution networks, industrial projects and international power exchange projects. The IREMP outlines guidelines, describes preferred standards and the phased implementation of future rural electrification in Uganda, as well as giving estimation on costs. It is intended that the IREMP act as a catalyst for the implementation of rural electrification projects.

The IREMP is therefore to be seen as a hybrid version of a traditional electrification master plan utilised by national utilities for network investments and a promotion tool for a newly developed rural energy agency to inform and attract private sector investments in pre-selected areas, based on commercial and subsidy grant financing.

The main objectives of the IREMP are to:

- Package at least five grid connected short-term Priority Rural Electrification Projects for private sector bidding to demonstrate the new policy direction.
- Gather information for the public, potential project developers, the system operator and RE-planners in REA, on regional demand profiles and the costs of on-grid, isolated grid and off-grid electrification projects, to be included into the Rural Electrification Data Base.
- Establish priorities for public and private investments in underserved rural areas, including for "regional equity projects".
- Indicate a ten-year least cost investment plan for the expansion of the national distribution network rural areas.

The IREMP will make provision for a total of 550,000 (grid plus off-grid) connections. However, within this UMEME is obliged to make 20,000 connections per annum of which some 12,000 per annum will be rural connections (or 120,000 over the 10 year IREMP timeframe). Therefore the total number of additional grid and off-grid connections to be identified through the IREMP is 430,000 connections.

The IREMP is currently being finalised and should be published by the end of 2008. The planned network extension under IREMP is extensive – and will reach far into most corners of the country. However, preliminary findings from the IREMP process indicate that for the many (majority of ) households, schools and health centres, off-grid options remain the only option for electrification. Furthermore, given available resources, it will take several years for grid electrification to reach many of settlements prioritized through the IREMP process for grid electrification. In the meantime off-grid (or possibly mini-grid) remain the only short/medium term options for these settlements as well.

There are three main ‘stand-alone’ or off-grid areas identified through IREMP:

- a) those areas away from planned IREMP grid extensions (off-grid regions) (about 3.7 million households)
- b) those areas close to the grid (in settlements that gain grid access), but outside of the immediate access zone within which grid electrification is cost effective for households (about 640 000 hh)
- c) areas prioritized for grid electrification – but which will take many years to be served by the grid (some proportion of the 314 000 hh) identified as having access to planned grid under IREMP

For areas (b) and (c) above, an IREU approach seems to make sense (and even for parts of regions (a) above. This has been mooted in the draft IREMP documents and the concepts are being discussed at time of writing this report.

Another key component of the ERT programme is the BUDS ERT PV subsidy. This is discussed in section 2.5.4.4 below.

#### **2.5.2.5 Rural Electrification Subsidy Policy**

The Rural Electrification Agency’s Subsidy Policy published in March 2007, aims to present the subsidy criteria that will guide the awarding of subsidies for rural electrification in Uganda. The specific objectives of the Subsidy Policy are to:

- Establish detailed guidelines that will ensure that REA uses transparent criteria in its dealings with subsidy applications.
- Ensure that applicants and the public know how to proceed with projects.
- Enable the correct use of the guidelines, which should, in turn, ensure reasonable and equitable treatment of applicants for RE subsidies.

The types of rural electrification projects that will be processed by REA/REB comprise grid extension with electricity supplied from the main electricity generation plants in the country, and mini-grids around isolated generation plants. Project sponsors are either private parties, communities/cooperatives, the Government or individuals, sometimes in combination. REA can also initiate projects by tendering out packages.

The classification of projects that can receive subsidies is as follows:

- The local distribution part of grid-connected generation projects.
- Mini-grid distribution system around an isolated generation plant.
- Grid-connected distribution extension with no own generation.
- Small stand-alone systems with one or few consumers (PV, small diesel or pico hydro).

Projects eligible for subsidies should be in the rural electrification (RE) area of the country, i.e. outside the main urban triangle (Kampala, Entebbe, Jinja), but outside this area there may be interfaces with the UEDCL-owned distribution network that is operated by UMEME.

Technical criteria also need to be satisfied: the projects should be technically sound and satisfactory demand studies have been carried out. The design should match the projected load in the case of distribution extension projects, and the grid code should be observed. With regard to projects involving the extension of electricity distribution networks, available subsidies are as detailed in Table 8.

Table 8: Subsidies for rural electrification available from REF

Type of project		Promoter				
		Private (PIP)	LIREP	CIREP	PREP	Existing concessionaire
		Basic subsidies in UGX <sup>54</sup>				
Mini grid generation and distribution						
Hydro	UGX/kW	2 150 000	2 580 000	2 580 000		
Diesel	UGX/kW	640 000	800 000	800 000		
Grid connected & mini grid distribution						
MV	UGX/m MV Route	15 500	18 600	18 600	18 600	15 500
MV/LV transformer	UGX/kVA	125 000	150 000	150 000	150 000	125 000
LV	UGX/m LV Route	11 000	13 200	13 200	13 200	11 000
Connection	UGX/conn.	125 000	150 000	150 000	150 000	125 000

A LIREP (locally initiated rural electrification project) can be initiated by a small private investor without access to finance on international capital markets, whereas a CIREP (community-initiated rural electrification project) can be initiated by a local 'community'. In both cases, the costs of the development of the project are met jointly by the investor/community and the REF. Projects may be either grid extensions or mini-grid electrification and can be within or outside a distribution concession footprint. Communities are also able to form cooperatives to be concessionaires.

#### **2.5.2.6 New External Distribution Networks Agreement**

The New External Distribution Networks Agreement (NEDNA) is a pro-forma Draft Agreement to be signed between a Project Sponsor<sup>55</sup> of any New Electricity Distribution Network (NEDN) and UMEME in the event that the NEDN is to be transferred to UMEME for operation, maintenance and revenue collection. The NEDNA is for an initial period of 5 years after which it is reviewed by UMEME and the Project Sponsor.

The NEDNA places the following obligations on UMEME, inter alia:

- To undertake an initial and final appraisal of the project and advise the Project Sponsor of any non-compliances found in the appraisal, and to determine any capital subsidy payable to UMEME for any infrastructure strengthening that may be required as a result of the NEDN.
- To perform a takeover inspection when the NEDN construction is completed and to provide a list of all defects and indicating whether these should be made good before or after handover.
- To treat the NEDN as a 'modification' to the terms of their concession.

<sup>54</sup> 1 USD = 1750 UGX

<sup>55</sup> The NEDNA implicitly acknowledges that the Project Sponsor is likely to be either REA or UEDCL. However, it is likely to form the basis of any agreement between UMEME and other Project Sponsors.

- At the end of the 5-year term of agreement, to review the financial performance of the NEDN and enter into new transfer agreement based on the results of the review.

The following obligations are placed on the Project Sponsor:

- To submit information data on estimated numbers of connections and loads on the NEDN for initial appraisal at the initial design and planning stage and to provide provisional project timescale.
- To ensure that all non-compliances identified by UMEME in the initial appraisal are corrected.
- Ensure the NEDN is planned, designed and constructed to comply with UMEME's standards.
- Ensure any deficiencies identified during the take-over inspection are rectified
- Pay any sums of capital subsidy that have been identified during the appraisal process for any infrastructure strengthening required as a result of the NEDN.

With respect to the operation of an IREU, the NEDN is not entirely applicable in that it envisages the construction of a network extension, which is then handed over to UMEME to operate and maintain.

#### 2.5.2.7 Renewable Energy Policy

On 2<sup>nd</sup> April 2007, MEMD published a *Renewable Energy Policy*. This document sets out targets for Power Generation, Rural and Urban-Poor Electrification Access, Modern Energy Services, Biofuels, Wastes to Energy and Energy Efficiency. The targets are detailed in Table 9 below.

Table 9 Energy sector targets, Uganda

Policy Action	Base	Cumulative targets	
	2007	2012	2017
<b>Power Generation</b>			
Mini/micro hydropower plants (MW installed)	17	50-70	85-100
<b>Rural/Urban Electrification</b>			
Electrified households through PREPS, LIREPS and CIREPS	250,000	375,000	625,000
<b>Biofuels</b>			
(Ethanol, Bio-diesel) (m <sup>3</sup> /a)	0	720,000	2,160,000
<b>Modern Energy Services for Households</b>			
Improved woodstoves	170,000	500,000	4,000,000
Improved charcoal stoves	30,000	100,000	250,000
Institutional stoves	450	1,500	5,000
Baking Ovens	60	250	1,000
Kilns (lime, charcoal, brick)	10	30	100
Household Biogas	500	30,000	100,000

Solar Home Systems (kWp)	200	400	700
Fruit driers	3	1,000	2,000

Importantly, in a section on Modern Energy Services (MES), reference is made to a District Energy Officer (DEO) and a District Energy Committee and a Village Energy Committee. It is critical to recognise that these targets, particularly those for Modern Energy Service delivery will only be met through the active participation of the District Local Governments.

### **2.5.2.8 Solar PV Targeted Market Approach**

In March 2007, REA published the Solar PV Targeted Market Approach (PVMTA) in response to the slow pace of PV implementation under the BUDS-ERT grant scheme<sup>56</sup>. The approach aims to:

- Promote partnerships between rural MFIs, NGOs, CBOs and private commercial companies
- Strengthen rural infrastructure through specific measures to ensure rural-based solar PV entrepreneurs (agents, franchisees, etc.) can access grants and trading capital
- Include micro-deposit taking institutions (MDIs) and selected SACCOs in the subsidy framework for disbursement of subsidies to rural end-users.
- Introduce a new complementary subsidy paid direct to consumers of 4.4 USD/Wp for SHS between 31 and 50 Wp (equivalent to an average of 28%); and 5.5 USD/Wp for SHS between 10 and 30 watt peak (equivalent to 35%).
- Provide a special grant program that will be implemented by REA through tendering of specific target market segments in areas that have lagged behind in implementing solar PV.
- Increase credit options for consumers, PVTMA will seek to work closely with two types of income-controlling private and public sector companies to offer alternative credit mechanisms. These are: (a) Strong corporations employing large numbers of staff (ii) Private companies engaged in the value chain for a large number of farmers.

## **2.5.3 Identification of Stakeholders**

### **2.5.3.1 Ministry of Energy and Mineral Development**

The mandate of the MEMD is to establish, promote the sustainable development, strategically manage and safeguard the rational exploitation of energy resources for social and economical development. It also provides policy, coordination, monitoring and evaluation of the energy sector. Project Developers/Sponsors should make contact with MEMD at an early stage in the project development process for advice and information.

From an energy perspective, historically MEMD has focussed on the petroleum and electricity sectors, which has resulted in a very centralised approach to energy planning – the MEMD is one of the few ministries without any representation in the District Local Government structure. It has been recognised that broader energy access issues in rural areas of the country are not well served by this centralised approach. As a result the MEMD has recognised the need to decentralise and is in the process of doing so.

The GoU has approved the creation of a Directorate of Energy to be created within the DLG, meaning that the MEMD will be present within local government. Furthermore, the Directorate of Energy will not just be concerned with electrification, but broader energy issues such as sustainable use of wood fuel, agro-processing and productive uses, energy use in the health education and water sectors etc.

<sup>56</sup> Between 2003 and 2006, a total of 3,500 solar PV systems were installed under BUDS-ERT, compared to a projected 80,000 over the lifespan of the ERT Project.



### **2.5.3.2 Rural Electrification Agency**

The Rural Electrification Agency (REA) is responsible for development and promotion of rural electrification projects. The Rural Electrification Board (REB) is the governing body for REA, and controls the subsidies for rural electrification and renewable energy projects, and therefore decides on policy and allocation of the funds. Especially important for the REA and REB is the relationship between new generation and new connections.

The main functions of REA are to:

- Maintain a national data base on rural electrification
- Promote rural electrification
- Facilitate rural electrification projects
- Receive and review applications for subsidy
- Advise Ministry of Energy and Mineral Development on policies pertaining to rural electrification
- Implement Government Priority Rural Electrification Projects and Community Schemes
- Monitor and Evaluate rural electrification projects.

The Government has established a Rural Electrification Fund (REF). The REA's board, the Rural Electrification Board (REB) governs the Rural Electrification Fund. The mandate of the REF is to provide capital grants towards renewable and rural electricity projects. The resources of the REF are primarily targeted towards rural electrification, however there are some funds reserved specifically for renewable electricity generation.]

Funding of the REF is through a levy made on UETCL, GoU and from donor sources.

### **2.5.3.3 Electricity Regulatory Authority**

The Electricity Regulatory Authority (ERA) was set up following the enactment of the Electricity Act 1999. ERA is responsible for receiving, processing and issuing licences for generation, transmission, distribution or sale of electricity, and prescribing conditions and terms of licences, including prices. The licence will be the final go-ahead for any rural electrification project.

ERA issues relevant regulations that are of relevance include the Primary Grid Code, Safety Code and Quality of Service Code. ERA also has the task of advising the Minister regarding the need for electricity sector projects. However, ERA should as far as possible be at arms length during the development phase of a project by any specific developer. This is to ensure its independence during the evaluation and processing of the licence application.

The key functions of the ERA relevant to the RE Sub-component are:

- To issue licences for the generation, transmission, distribution or sales of electricity, and the ownership or operation of transmission systems.
- To receive and process applications for licenses.
- To prescribe conditions and terms of licenses issued under the Electricity Act.
- To establish a tariff structure and to investigate tariff charges, whether or not a specific compliant has been made for a tariff adjustment.

### **2.5.3.4 UMEME**

UMEME is the operator of Uganda's distribution network, which has been leased from UEDCL for a twenty-year period until May 2025. Under the terms of the concession agreement, within the first five years, UMEME is required to make a USD65 million investment in the network and connect 60 000 new domestic customers, as well as reducing technical and non-technical losses to 'acceptable' levels.

Since taking over the concession, UMEME has seen an increase in the number of connections from 180 000 to 296 000 and this number continuing to grow. Of these, some

210 000 connections are in the Kampala – Jinja – Entebbe triangle, of which 180 000 are in Kampala. The majority of the remaining connections are in the urban centres of Mbale, Masaka and Mbarara. Only some 30 000 connections are considered to be 'deep rural' customers. Under the terms of the concession agreement, UMEME is obliged to make an additional 12 000 connections per year.

The concession agreement provides UMEME exclusivity in making connections within a 1 km footprint either side of the existing 11 kV and 33 kV distribution networks – this is an important consideration for the RE Sub-component. In return for this exclusivity, UMEME is obliged to connect anyone who applies to be connected, subject to whether the customer can afford the connection fee. Connection fees for domestic consumers are summarised in Table 10. As UMEME constructs new network extensions (not a current priority) or takes over new lines through the NEDN process, so its area of exclusivity grows accordingly. However, UMEME's exclusivity only applies to grid connections – it does not apply to other technologies such as solar PV.

Table 10: Connection charges for consumers to UMEME network (incl. VAT)

Item	Amount (UGX)	Amount (USD)
Installation Inspection Fee:		
Domestic	41 500	23.06
Commercial	48 000	26.67
3-Phase	88 000	48.89
KVA	118 000	65.56
Capital Contribution:		
No pole (up to 20m)	94 500	52.50
No pole (21m to 30m)	95 000	52.78
No pole (> 30m)	98 000	54.44
1 pole	328 000	182.22
Security Deposit	3 months estimated consumption	
Reconnection Fees		
Single Phase	3 500	1.94
Three phase and kVA	11 800	6.56

Table 11 summarises the end-user tariffs which have been in force since November 2006.

Table 11: Summary of end-user tariffs from 1st November 2006

Supply type	UGX/kWh	USD/kWh
Code 10.1		
LV supply for small general services (domestic) For electricity supplied to residential houses, small shops, kiosks etc. metered at LV single phase, 240 V		
First 15 kWh	62	0.03
Above 15 kWh	426.1	0.24
Fixed monthly service charge	2 000	1.11
Code 10.2/10.3		
LV supply for small general services (commercial). For electricity supplied at 3-phase LV with a load not exceeding 100 A to small scale industries such as mills and water pumps metered with connected load at LV. 415 V		
Time of use		
Peak	464.9	0.26
Shoulder	399.3	0.22
Off-peak	306.6	0.17
Average monthly tariff	398.8	0.22
Fixed monthly service charge	2 000	1.11
Code 20		
For electricity supplied to medium scale industries taking power at LV (415V) iwht a maximum demand of up to 500 kVA		
Time of use		
Peak	434.3	0.24
Shoulder	370.3	0.21
Off-peak	280.7	0.16
Average monthly tariff	369.7	0.21
Fixed monthly service charge	20 000	11.11
Maximum monthly demand charge per kVA	5 000	2.78

### 2.5.3.5 Public Private Partnerships

Given the liberalised electricity markets in Uganda and the favourable regulatory and policy frameworks, there is considerable opportunity for private sector concessionaires to take an active role in the sector. The Rural Electrification Agency has actively promoted private sector involvement in the construction, operation and maintenance of new electricity networks. Furthermore a system of "light-handed regulation" for small (<0.5 MW) electricity generation schemes (either IPPs or isolated grid operators) is designed to further encourage private sector participation.

A broad range of electricity concessions have been licenced by the ERA and subsidised through the Rural Electrification Fund, and the relevant ones are described below.

- Kalangala Mini-grid: Ferdult Engineering Services Ltd was contracted to construct a mini-grid served by a diesel generator; 250 kVA to supply the District Headquarters and the town council totalling 2.5 km of 33 kV and 18 km low voltage. WSS Services (U) Ltd won the concession to operate the grid on behalf of GoU.
- Ngoma Mini-grid: Ngoma is an isolated trading center in Nakaseke District about 80 km from Luwero town. Ferdult Engineering Services was contracted to install a 65 kVA generator and reconstruct the existing dilapidated distribution network. Utility Engineering Services Ltd won the concession to run the grid on behalf of GoU.

- Kibaale: Spencon Services Ltd was contracted to construct 181 km of high voltage and 91 km of low voltage network from Kakumiro to Kagadi. Ferdusult Engineering Services Ltd won the concession to operate the extension.
- Kisiizi Hospital Hydro Power Project: The existing 60 kW hydro power plant which currently supplies the hospital facilities and the staff quarters should be expanded to 300 kW in order to supply a further 370 local consumers.
- Wenreco: Following a protracted tender process, Wenreco secured the license for generation, distribution and sale of electricity within the West Nile region. Having taken over the assets of the former UEB, Wenreco was obliged to upgrade the old generators with a 1.5 MW HFO plant and to develop the Nyagak hydro scheme. Currently, Wenreco serves some 1 700 customers.

#### **2.5.3.6 District Local Governments**

Most of the electrification projects have enjoyed the active support of the District Local Government and in some cases the DLG has contributed towards the capital costs of the project. Indeed a number of DLGs have seen involvement in operating/maintenance concessions as a potential way of raising revenue locally to be channelled into development programmes.

Furthermore, the forthcoming decentralisation of the MEMD, means that the MEMD will be represented at District Level through the District Energy Office (DEO). The DEO will be focussed on broader energy issues (not just electrification) and the remit will cover sustainable use of wood, opportunities for implementation of Multi-functional Platforms for agro-processing etc.

The DEO will take a proactive role in identifying and developing energy projects and programmes and there is the potential for possible IREU projects to be established either solely as a commercial enterprise or as a form of Public-Private Partnership with the DLG. One model the DLG is likely to consider for “energy projects” is that used by the Directorate for Water Development whereby the operation and maintenance of local piped water supply schemes is contracted out through a competitive tender process to the private sector. This model has been generally regarded as having been successful although there has been some resistance to consumers having to pay for water.

### **2.5.4 Projects and Programmes**

#### **2.5.4.1 Locally Initiated Rural Electrification Project – Kanungu District**

It is a GoU priority to electrify the all District Headquarters – an increasingly onerous task given the continuing proliferation of new districts within the country – up from 56 in 2005 to 86 by 2007.

The new District of Kanungu initiated the electrification of Kanungu town and surrounding area through the LIREP process. The DLG project managed the design and implementation of 142 km extension to the existing 33 kV network from Rukungiri to Kanungu. The line was built by the National Constructing Company Ltd with funds secured from the Rural Electrification Fund and operated by Ferdusult Engineering Services Ltd.

The construction project was split into two phases with Phase 1 covering Rukungiri to Kanungu with a tee off to Kayonza at a cost of 7.8 billion UGX (USD 4.45m) and Phase 2 covered the Rukungiri environs of Ruhinda, Byhunga, Ruruku, Kitijo, Nyakiju, Kahoko and Rugondo plus extensions to Rugyeyo – Butogota – Savannah hotel at a cost of about 3.9 billion UGX (2.23 MUSD). Importantly, Kanungu District contributed around 3% of the project cost.

Connection fees are around 360,000 UGX fees (inclusive of meter) and tariffs are 680 UGX (incl. VAT). Wiring costs for around 700,000 UGX and verification of wiring a further Sh50,000. The high tariffs, coupled with the use of pre-payment meters have resulted in low connection rates.

In addition to the successful electrification of Kanungu Town, EDG is working closely with the District Administration to identify energy projects to be included within the Districts 3 year, rolling District Development Plan. The District is also interested in establishing a programme to implement Multi-functional Platforms for agro-processing and a wood-lot programme to provide sustainable fuel-wood.

#### **2.5.4.2 West Nile Concession**

In 2003, Wenreco was awarded the concession to operate the isolated diesel grid serving Arua and Nebbi in the West Nile region. Wenreco a special purpose vehicle company that was set up by the Industrial Promotion Services (IPS) of the Aga Khan Fund for Economic Development (AKFED). Currently the Wenreco concession serves some 1,700 customers.

The isolated grid providing power to Arua and Nebbi is powered by a 1.5 MW Heavy Fuel Oil generator providing power for 18h/day (07.00 to 00.00) and for 24h over weekends. The system is operated by Wenreco, under a license granted by ERA. Under the terms of the license, Wenreco has exclusive rights and obligations within 100 meters of a transformer. A USD 6million subsidy was provided by the REF for upgrading the Arua-Nebbi line and to replace the two old diesel generators with one large 1MVA HFO unit.

Furthermore, Wenreco was obliged to develop the hydro scheme at Nyagak, initially estimated to to 5.5 MW. The scheme currently under development has been reduced to 2.6 MW mini-hydro plant and will be the main source of power after completion with the HFO generator providing back-up supply. The hydro scheme will also mean there is no need for Wenreco to connect their network to the main UMEME/UEDCL network which is some 150 km away (and would require a 132KV interconnection as 33kV would be inadequate over such distance).

Wenreco has focussed on their supply side problems, and as a result have not significantly expanded their customer base (only 10% over the past years), with around 3,000 customers. In addition, Wenreco maintains a very high connection fee, which acts as a significant barrier to new connections. It can be concluded that making new customers has not been a priority.

Interestingly, the Wenreco area is an area of Implementation of ERT Health project of solar clinics where installers will undertake maintenance as part of a long-term 5-year O&M contract.

REA is expanding rural electrification lines in the West Nile area. Once completed, Wenreco will take these over.

EDG is also active in Nebbi District, assisting the DLG identify energy projects for inclusion in their mandatory 3-year rolling District Development Plan.

#### **2.5.4.3 Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE)**

The UPPPRE project started in June 1998, and came to an end in March 2003. It was financed by the Global Environment Facility, United Nations Development Programme, and the Government of Uganda. Originally intended as a three-year project, its goal was to establish the foundations for a sustainable PV market in Uganda. Its objectives were to overcome financial, social and institutional barriers to PV delivery that existed in Uganda. Target consumers were households (individuals), communities and government services that have the ability and willingness to pay real market costs of PV based services. It was expected that rapid scaling up of PV-based rural electrification would commence on or before completion of the project.

The UPPPRE project made significant contributions to Ugandan PV market development in a number of ways:

- Sensitization and awareness of the technology within government departments, financial institutions, rural micro-finance organizations, rural institutions and rural households
- Development of technical standards and installation code of practice
- Capacity and business skills building of technicians, and also within the Ministry
- Establishment of linkages between PV vendors and financial institutions (both for vendor finance as well as consumer finance)
- Development and implementation of a 'Village Bank' delivery and consumer finance modality – using six rural 'Village Banks' or Savings and Credit Co-operatives. This financed 650 SHS. The modus operandi was:
- UPPPRE project lent funds to Village Banks at an interest rate of 8%. Village Banks on-lent to customers at a rate of 1.5% per month (18% per annum) on a declining balance, yielding a net gain of 12% per annum to the Village Bank.
- Customers were required to lodge a deposit of 15%, and furthermore needed to pay an application fee, hold shares in the Village Bank and pay membership fees.
- Contributions to institutional delivery
- Support of a Uganda Renewable Energy Association (UREA)
- Engagement in policy development and contribution to the development of a larger scale programme (Energy for Rural Transformation)

At the time of the ex-post review (Banks & Kihuguru, 2006), several of the UPPPRE initiatives were continuing, with a mixture of UPPPRE and new role players. In particular

- There has been ongoing development of PV standards, as well as international interest in those that were developed with UPPPRE support
- Capacity development has continued on a number of levels- although not all co-ordinated.
- Finance institutions and PV companies have developed further relationships, with a couple of bi-lateral (finance institution plus PV company) rural delivery initiatives underway
- Six financial institutions or micro-credit support organisations have developed PV products or programmes which have been partially or fully implemented
- Most of the Village Banks that participated in the programme have continued to collect revenue from the customers.
- Just under 90% of the original 500 000\$ revolving fund loaned was estimated to be recoverable and available for further investment.
- The Energy for Rural Transformation, working through the Private Sector Foundation (ERT/PSF) programme continues to support PV market development. There are some other programmes targeting more specific niches (for example the Ministry of Health/ERT

programme on rural health centre power supply, or the Integrated Rural Electrification Master Plan process which makes specific allowance for off-grid electrification).

The rural micro-finance institution linked approach used in the UPPPRE project has been recommended as a way forward for SHS electrification in Uganda, not only in UPPPRE evaluation reports, but also in documents such as a the draft Solar PV target market approach.

As of November 2007, the remaining UPPPRE funds had not yet been reallocated to new solar home system financing. The government and UNDP are exploring different models to effectively roll out follow up activities, and UNDP remain engaged in the sector.

Although the UPPPRE programme has many elements of success – it will be appreciated that the roll out rate has been relatively low (in comparison to the need in rural communities). At the time of 2006 review, although other parties had set up similar finance schemes, the number of systems being installed could be measured in hundreds to thousands, not tens of thousands. In order to address the energy service needs to several hundred thousand households – affordability and delivery issues need to be addressed on a more significant scale.

#### **2.5.4.4 BUDS ERT programme for PV**

The BUDS-ERT service is a component of the Energy for Rural Transformation Programme operated by the Private Sector Foundation. It provides grants in the form of 50% cost-shared finance capped at USD 50,000 to potential developers of electricity generation (e.g., small, mini and micro hydro, energy from waste projects etc) and distribution projects. In addition, the BUDS-ERT project provides grants for solar PV. For Solar Home Systems, grants are USD3/Wp for up to 60 Wp (against an installed price of around USD17/Wp); for institutional systems (i.e., health clinics and schools) grants are 2.5 USD/Wp for system sizes of up to 2,000 Wp (against an installed price of around 14 USD/Wp). Unfortunately, these subsidies have been paid direct to the system supplier and are rarely passed on to the consumer, resulting in very little expansion of the market. However, a review of the programme has been undertaken and other implementation methodologies are being considered (in particular the Solar PV Targeted Market approach discussed in 2.5.2.8 above).

#### **2.5.4.5 MEMD Free CFL programme**

As a reaction to the ongoing power crisis in the country which has resulted in chronic load shedding across the whole country, MEMD procured some 800 000 compact fluorescent lights bulbs which were distributed free of charge through UMEME to urban domestic customers in June to August 2007. Each domestic UMEME consumer was offered 4 CFLs in exchange for incandescent bulbs. Although it was estimated the programme could save up to 24 MW on peak loads, data on the real impact is not yet available. Furthermore, the impacts on shops and traders offering CFLs for sale has not been quantified.

#### **2.5.4.6 Biogas**

In 2000, the Government of Uganda through Energy Resources Department implemented a biogas program with Chinese support. Twenty 8 m<sup>3</sup> biogas digesters were constructed in and around Kampala. Two of the digesters were built at institutions and the rest at households. A further 3 digesters were implemented by Makerere University in Mityana District and various initiatives by private individuals and local biogas engineers/technicians have been made but not very successfully.

The MEMD Renewable Energy policy sets out a target of 300 000 digesters by 2017 – from an estimated baseline of 300 units in 2007. Given the mixed experience to date with the technology, the MEMD targets are ambitious. However, there is potential for the technology to provide gas for cooking particularly in the domestic sector in pastoral communities, but also in schools and possibly health clinics provided a ready source of waste material can be made available.

A recent review of the project (reported in a project proposal prepared for the African Development Bank)<sup>57</sup> indicated the following main lessons:

- Out of the 20 digesters 2 were installed in Institutions and both of them failed when changes occurred in management of the Institutions.
- Out of the 17 demonstration digesters in Zero Grazing farmers at 5 are still operational, the main causes of failure can be attributed to:
- Loss of animals or their transfer from the site of the digester
- Change in the management of the home where skills are not transferred to new people.
- Lack of technicians to provide backup in very simple faults
- Lack of quality appliances like gas stoves and lamps.

It is of interest to note that if a way could be found to deliver biogas through an IREU, many of the above concerns would be address as the IREU would provide a long term management, maintenance and customer support framework for the digesters.

#### **2.5.4.7 Oil and LPG**

Oil has recently been discovered in western Uganda and is being developed by multinational oil companies. It is currently unlikely that a substantial refinery developed, and that there will be much impact on domestic fuel and LPG prices (these are unregulated and subject to international movements).

LPG is readily available in most urban centres and larger towns distributed mainly through filling stations. The market is free and unregulated. Typical prices (Shell) for re-filling a 6 kg cylinder are 22,000 UGX (USD12.5) with a deposit on the cylinder of 48,000 UGX (USD27.4) and for a 15 kg cylinder 52,000 UGX (USD29.7) with a deposit of 78,000 UGX (USD44.6). Costs in rural areas are substantially higher.

LPG is also widely used within the Ministry of Health in the context of the Uganda National Expanded Programme on Immunisation (UNEPI) to provide refrigeration for vaccines. LPG is generally procured at District level through the District Directorate of Health Services.

#### **2.5.4.8 Charcoal**

The proportion of biomass in Uganda's overall energy mix is very high, at 93%. The widespread inefficient use of biomass, especially in cooking, but also in supplying thermal energy for small and medium enterprises, is contributing to the large scale destruction of forests in large areas of the country.

Huge quantities of charcoal are shipped on a daily basis into Kampala and other urban centres for cooking. A typical urban household will use 2 bags per month at a cost of 15,000 UGX/bag (rural prices are around 8,000 UGX/bag), and assuming only half the 400,000 households (based on population of 2 million, 5 per HH) in Kampala use charcoal for cooking, this equates to 400 000 bags per month. It is estimated that some 100 trucks per day, each carrying as many as 150 bags of charcoal each deliver to Kampala alone.

In an effort to control the unsustainable use of wood for charcoal production, charcoal producers are licensed by the Local District Government. However, the license system is widely abused with many producers working under a single license.

### **2.5.5 Conclusions**

The policy and legislative frameworks in Uganda and the political recognition of the importance of the delivery of modern energy services as a critical vector in achieving the country's development goals as set out in the Poverty Eradication Action Plan, have created a very favourable environment for an IREU. The liberalisation of the electricity distribution

---

<sup>57</sup> Dissemination of Biogas Digesters in Households and Industry, (proposal for ADB), no date but assumed to be 2007



system, coupled with the fact subsidies of the order of 50% of capital costs are available for the extensions to the distribution network mean it is relatively straightforward for new market entrants to obtain electricity distribution licences. Furthermore, in the case of an isolated mini-grid, subsidies are also available towards the capital cost of the generation side (diesel, hydro)<sup>58</sup>. Improved subsidies for solar PV under the PVMTA will also assist in the IREU concept, as well as the future availability of maintenance contracts for PV systems installed in the health, education and water sectors under the ERT Programme<sup>59</sup>.

The Uganda Integrated Rural Electrification Master Plans (IREMP) – which has clear projects identified, grid network extension plans, and even several mini-grid projects- provides a very useful framework to help identify possible IREU sites. As REA takes this process forwards, there is good potential for REA to act as a catalyst while negotiating with potential investors in PREPS grid extension projects, introducing them to the concept of an IREU, and at last opening up the opportunity for integrated service providers to develop.

The engagement of five key districts (Kanungu, Lira, Mbale, Masindi and Nebbi) in identifying energy projects with technical support from EDG in advance of the creation of the new District Energy Office gives these Districts a “head start” in their appreciation of wider energy issues and the impact of the provision of modern energy services. Each of these Districts has identified around 5 energy projects that are seen locally as priority issues – projects ranging from electrification of health centres, briquetting of waste rice-husk from large rice milling operations, installation of biogas systems in large secondary schools, the use of Multi-functional Platforms for agro-processing, to the planting of woodlots for sustainable fuel-wood. Districts are very interested in possible partnership arrangements or other operational mechanisms to ensure these projects become a reality, and the IREU concept is one potential vehicle that could deliver.

## 2.6 Other case study material of particular interest

Two non-target country case studies are presented below because of their particular relevance to the IREU concept.

### 2.6.1 UNDP/GEF supported activities in Botswana

Botswana Power Corporation (BPC) is currently implementing a UNDP/GEF/Government of Botswana project “Renewable Energy-Based Rural Electrification programme for Botswana” (Personal communication, Mears, 2007). There are some specific characteristics of their activities that make the programme very interesting from an 'Integrated Rural Energy Utility' perspective:

- The programme will be delivered in the form of a business format franchise where the franchisor is a PPP between BPC and private sector investors. As a principle shareholder in the franchisor, BPC will need to integrate planning of both grid and franchise market development. It is hoped that the involvement of potential local investors at this high level (as well as at the franchisee level) will make that planning a dynamic process with government (who drive spending via their rural electrification programme). The Franchisees will be 100% privately owned
- The franchisees will supply a range of products and services including rechargeable lanterns, solar powered recharging services, stand-alone solar home systems, mini-grid electrification solutions, improved efficiency cooking appliances. These will be delivered via a mixed retail and rental model whereby affordable products will be retailed and others rented out. The target market is rural households, local government and commercial customers in both grid and off-grid areas. Ownership of rental infrastructure (such as the solar home systems) will be retained by the franchise with 60 per cent funded by a

---

<sup>58</sup> The situation for a grid extension that includes a hydro scheme is slightly less clear from a subsidy perspective.

<sup>59</sup> DLGs have tendered contracts for the operation of piped water schemes at District Level and are keen to develop this approach for other sectors.

government grant and the rest provided by the customer and the franchisee. The rental fee will cover maintenance and depreciation and the franchisee margin.

- The franchises will also participate to some extent in grid electrification, as they will be used to deliver the low cost ready boards and improved efficiency appliances that newly grid connected households need. For grid customers there is thus a split in responsibilities. The Energy Act limits BPC involvement to outside the house, and the Franchisees can supply products/do installation work inside the home.
- The programme seeks to address thermal energy services as well. Initially the intention was to utilize LPG as the main cooking fuel. However, given the LPG market structure in Botswana, as well as international fossil fuel price increases, there are concerns regarding affordability. The programme is exploring methods to work with LPG wholesalers, and to involve the franchisees in LPG distribution, perhaps with some measure of regulation. However, improved wood stoves will now be the principle product serving this cooking energy need. The programme is collaborating with the ProBEC<sup>60</sup> to assist the franchise network develop the stover market.
- The programme plans to utilize mini-grid Solar PV products as a pre-grid market building option for villages that scheduled for grid connection in 3-5 years. The energy supply system will be mobile and operated by the local franchisee to provide pre-grid basic lighting and radio/television services for households. This approach is intended to promote a reasonable customer connection rate for new grid extensions thereby mitigating early phase investment losses for the utility. The local reticulation costs will be covered by grid budgets so the combined savings promise to make this PV mini-grid model quite cost effective.
- Stand-alone Solar Home System type products will be available for all other off-grid villages. These will be supplied on a rental basis (and including a maintenance service). Although these are partially seen by BPC as market building (for later grid), it is acknowledged that there will be significant long term PV markets, both in remote communities, and even for more remote households in grid electrified areas.
- Solar water heaters (SWH) have been flagged for inclusion and the project is presently exploring business models, in particular a fee-for-service approach for SWHs, especially for government facilities. This service will be provided by the franchise network and the same ownership model will apply as for solar home systems.

The programme thus has many elements of an Integrated Rural Energy Utility. It also has, in place, some specific mechanisms to try and deal with possible migration from PV systems to grid connections – although in our opinion this element needs to be explored further.<sup>61</sup> This obviously helps to mitigate perceived ‘competition’ between grid and off-grid activities.

The IREU team has informally been requested by the Botswana project Chief Technical Advisor to consider incorporating the Botswana within the IREU scope. However, Botswana is not one of the three focus countries for the IREU Roadmap project, and the REEEP project resources are constrained. Nevertheless it will be appropriate for the IREU project team and the Botswana project to remain in contact and share ideas from time to time.

### 2.6.2 Yéelen Kura – Mali

In March/April 2008, Banks was able to visit Yéelen Kura SSD in Mali. This energy service company supplies electricity to several thousand households in a region about 400 km East of Bamako, Mali. The initial phase saw an investment 2 million € (30% from PSOM, the balance for EDF and Nuon (the shareholders)) to reach about 1000 households using a fee-for-service (or rental) based delivery mode for Solar Home Systems (2 lamps, 1 DC socket, 60 Wp

<sup>60</sup> ProBEC (Programme for Biomass Energy Conservation in Southern Africa, a SADC programme implemented by GTZ)

<sup>61</sup> The business plan for the franchise assumes 20% of PV customers will migrate to grid over the first 10 years that grid is available. This is based on present grid connection rates where initial grid connection rates are about 20% and over 10 years this increases to 40%. Unless there is a substantial and surprising change in government policy which reduced household grid connection costs by at least 90%, then loss of customers to grid is not a major threat.

module, 100 Ah battery). The second phase was larger, and was 71% co-funded by a dedicated national rural electrification agency (AMADER, similar in concept to REA in Uganda) – the balance of capital provided by the shareholders. This phase is particularly interesting in that it involves some SHS electrification, but also several hundred diesel mini-grid connected households. At the time of the visit, Yéelen Kura staff were also commissioning a 70 kWp PV powered mini-grid (with diesel hybrid) that will serve several hundred households. Yéelen KuRa have a number of different tariff options for mini-grid connected customers. Larger users pay a consumption-based tariff. However smaller customers can use a monthly fee option, which is similar to that charged to Solar Home System customers.

During the visit, Banks observed some households electing to switch over from SHS to mini-grid connected service. Given that Yéelen KuRa is an integrated mini-grid/off-grid service provider, this is no problem – the same technicians and customer service staff were dealing with both the SHS and mini-grid connections at the household. Once the mini-grid is properly up and running, the staff can remove the SHS, and deploy it another home.

### 3 Analysis of case study programmes

This section presents summarised observations drawn from the case studies presented above. We see these conclusions as playing an important role in shaping the (nature of) future IREUs in these countries (and for wider application in other African countries).

In each of the case study countries presented above, government policy frameworks express the urgent need for improved energy provision (including in particular thermal energy needs) and services in rural areas, and involving a real transition to modern energies in rural areas. The goals are thought best achieved through integrated energy planning approaches. It is frequently stated that universal (grid) electricity access will not be possible for years to come. This is mainly due to considerable financial constraints, and logistical difficulties. Off-grid offerings are now regarded politically as key to achieving improved rural circumstances, and alleviating poverty. Generally, these frameworks also show that government cannot go it alone here; that private sector investment and participation (either comprehensively or in partnership with government) is critical. In Uganda and Tanzania, in particular, the governments are showing considerable interest in drawing in private sector participation and have gone some way towards creating enabling environments to this end. Though energy policy frameworks and strategies point to (improved) integrated rural energy service provision, bureaucratic positions are not always enhancing of this.

*⇒ Policy, legislative and regulatory frameworks and political recognition of the importance of the integrated delivery of modern energy services as a critical component of a country's national poverty alleviation framework, create very favourable environments for IREUs.*

Given this context, Banks (2004) presents the main types of off-grid energy service delivery models, and expands on the advantages and disadvantages of the different models. This includes a review of various utility approaches as well as credit and cash based delivery options. These issues, which are important to this study, are not presented again below – although the criteria identified will obviously be important as more detailed feasibility study work is undertaken.

As previously mentioned, none of the projects or programmes described in the paper above present fully integrated rural energy utilities in the sense that this project defines i.e. medium to large-scale decentralised entities that deliver a range of energy services to meet thermal and grid and/or off-grid electricity needs to rural households. Yet many of these projects or programmes portray elements of an IREU which are very insightful were they to be advanced into an IREU or were a new IREU to be established. Furthermore, most of the case studies

(aside perhaps from the South African off-grid operations) are still in their infancy with tremendous experience yet to be had.<sup>62</sup>

In these contexts, we are able to present the following generalised findings:

- As noted, our research has not identified a fully-fledged IREU in the countries reviewed. While the concept of an IREU is likely to be one which brings with it various challenges, there does seem to be some openness of mind amongst policymakers and others to explore the possibility of establishing such a utility. This openness of mind is based on the belief that there is a good chance that IREUs would be in a position to significantly enhance/improved energy services in rural areas.

*⇒ While we note that there are likely to be significant challenges ahead, we believe that there is potential to explore the possibility of establishing an IREU in any of the case study countries reviewed in the body of this report.*

- Definition of the grid/off-grid interface is a significant challenge for off-grid projects, and seems to be very difficult to manage in a properly co-ordinated way. This is relevant, particularly in the South African context, where grid expansion investment has frequently moved into areas (even recently) allocated to off-grid energy service delivery.

*⇒ Allocation to one party in a region the responsibility for grid and off-grid electrification planning is likely to assist here – a rural energy agency?*

- A particular area where decision making is difficult is the peripheries of settlements, or the edges of ribbon development zones. As noted in the Uganda IREMP process, and in work undertaken by Banks & Aitken (2004) on mini-grids, even within a single settlement it seems that the optimum is often a combination of grid (or mini-grid) for some, and stand-alone PV electrification for others.

- In the target countries reviewed, both grid- and PV-based electrification are to some extent supported by government and international donors.

*⇒ Some form/degree of subsidy seems to be necessary if a significant portion of the rural population is to be reached, and this is irrespective of the technology (for example: mini-grid, hydro, PV etc.) utilised. To enable maximum penetration in a particular area, subsidies should ideally be available for energy service delivery in various sectors, including residential and small business, as well as in health, education and water.<sup>1</sup>*

- Private public partnerships of significant scale, and requiring substantial private sector investment and entrepreneurship need long term funding frameworks and supportive policy environments to attract private investor confidence and security.

*⇒ Given that an IREU is likely to be of significant scale in order for synergy benefits to be achieved, it will be necessary for such frameworks to be in place if an IREU based project/programme is to take place. To attract investment, it must be relatively straightforward for new market players to enter the market.*

- With or without capital subsidy flows, rural energy service operations tend to work hard to establish customer bases that are large enough to sustain operations. Challenges typical to rural areas, including possible grid encroachment, poor communications infrastructure, increased potential for non-payment, difficulties in drawing and keeping appropriate human resources and skills, high costs associated with long distance travel on difficult roads all mean that a sufficiently large customer base is critical to the financial health of the operation.

*⇒ Considerable care should be given in choosing the location/jurisdiction of the prospective IREU.*

---

<sup>62</sup> For example, outcomes of newly established franchise and rental markets in Botswana may be worth watching over the next few years.

⇒ *Subsidisation may only be required in the short to medium term, until the IREUs customer base has been established – indeed this issue will be explored in more detail during the financial modelling to be undertaken.*

- Logistical challenges are a significant cost burden for off-grid service providers.  
⇒ *Logistical challenges will remain a cost burden for off-grid service providers but may be partially alleviated by establishment of economies of scale, diversification of energy service offerings, and extended experience in rural energy service delivery.*
- Drawing and keeping human resource skills in remote areas is likely to be a significant challenge to IREU managers. And, if appropriate skills can be drawn to these utilities, it may be at the expense of capacity in government ministries, energy utilities or other enterprises where these skills are essential if IREUs are to be supported in the first place.  
⇒ *In the longer term, if multiple IREU's are to be rolled out in several countries, then our preliminary thoughts are that a training programme for IREU staff will need to be established*

In both Uganda and Tanzania, a Rural Electricity (or Energy) Agency has been established. From an institutional perspective, the environment seems conducive to the establishment of IREUs, although in both cases it is relatively 'early days'. Although South Africa has already been able to establish some PPPs for off-grid delivery, it is observed that changes in the institutional environment, (amongst other issues) have led to significant delays and difficulties for the off-grid programme. The EDI restructuring also presents challenges for grid electrification planning and management.

⇒ *(Frequent) changes/fluctuations in institutional environments can lead to significant delays and difficulties in the roll-out of off-grid energy service delivery.*

⇒ *It may be, in countries where a dedicated rural energy agency has been established, that the outlook for an IREU may be stronger. This view is based on the notion that rural energy needs are likely to be given more focused attention and that there will also be (potential for) funding flows that are earmarked for rural energy service delivery.*

Other observations reached include:

- Rural energy utilities may become increasingly viable as energy services and product offerings are diversified;
- Longer-term presence of a utility in a rural area is likely to make positive impact on the service offered, in particular follow up, maintenance-related operations.

## 4 Way forward

### 4.1 Rationale for an IREU

This review highlights numerous instances of rural energy delivery modes, and methods becoming increasing integrated, or is at least moving in that direction, or where the need for such an approach has become increasingly obvious. These experiences indicate to us the relevance of pressing forward with an inquiry in this regard.

This section sets out an initial discussion of the IREU concept possibly going forward. This discussion is based on research and analysis undertaken for the review. The section includes a tabular notes on (likely) strengths of an IREU (including where the IREU will add value, where other utility models/structures have possibly failed). It will also highlight potential problems related to the IREU concept.

	South Africa	Tanzania	Uganda	Other interesting insights (from Botswana and Mali).
VALUE ADDERS				
Rural energy poverty can be addressed in an integrated fashion. Funding and other overlaps would be minimised and most cost effective/simple/sensible investments could be made.	<p>Integrated Energy Centres seek to provide 'one stop shops' to this end. New generation IECs lookpromising in this regard.</p> <p>SHS concessions find economic sense in integrating energy service delivery.</p>	<p>Levels of rural electrification are very low and non-grid energy options are increasingly relevant.</p> <p>Policy frameworks and institutional structures are supportive of an integrated approach.</p>	<p>Levels of rural electrification are very low and non-grid energy options are increasingly relevant.</p> <p>Policy frameworks and institutional structures are supportive of an integrated approach</p>	<p>In Botswana, tangible PPP programmes are being established to provide grid and off-grid based energy services in an integrated fashion.</p>
Institutional structures created to effectively channel subsidies for different fuels and services in a consistent fashion	<p>Concession companies have experienced situations in which some customers receive a subsidy while others do not. This is due to municipal control over subsidy flows.</p>	<p>Overlaps and inconsistencies in project approaches in rural energy delivery are evident. One project may offer a subsidy where another similar project may not.</p>		<p>Botswana is establishing a franchise-type business arrangement between government and the private sector to delivery rural energy services most effectively.</p>
“One stop shops” reduce significant administrative overheads from above and below.	<p>This is the aim of the government established IECs. Concession companies have also established energy shops which sell a range of products and services. Both have been relatively effective in this regard.</p>	<p>Numerous projects in Tanzania all with separate planning, subsidy flows, implementation and funding partners create administrative complexities which could be minimised with “one stop shops”</p>	<p>Present approaches are either grid OR off-grid. No thermal service delivery from electricity outlets</p>	<p>Franchisor will supply a range of energy products and services in grid and off-grid market.</p>
Economies of scale become increasingly present as further integration occurs	<p>This is clearly seen in the case of the off-grid concessions programme where concession companies have started to break even when numbers of customers on books increase. NuRa has benefitted from combining SHS and LPG service and</p>	<p>Village co-operative electricity schemes likely to become increasingly viable as scheme grows.</p>		

	South Africa	Tanzania	Uganda	Other interesting insights (from Botswana and Mali).
	logistics			
Focus on energy service delivery rather than technology sales	Concessionaires have found that increasing new energy services on offer does not proportionately augment operational costs.			Experience yet to be drawn from Botswana but this is the intention of the programmes.
Improved community participation in projects		Co-operative models enhance participation.	Participation of community/district councils leads to increased likelihood of priority energy projects being identified.	
Possible cross subsidisation within energy sectors (and possible water) contributes to utility's financial and economic viability.	LPG sales by concessionaire successful, and assists companies in remaining afloat during times of government delay and subsidy uncertainty.			
Scale – attractiveness to shareholders, funders , specialist funds	Larger operations are more likely to be able to attract and maintain interest of high level national and international board members/shareholders, funders. Larger operations also more likely to be able to tap carbon or renewable energy trading type funds	Similar comments as for SA	Similar comments as for SA	
Scale: - human resources	Larger scale operations are more likely to be able to attract and retain skilled technical, financial and other management/staff	Similar comments as for SA	Similar comments as for SA	
<b>VALUE DETRACTORS</b>				
Shareholders/companies prefer to focus on a specific task.  Some may feel that NGO or co-op better suited to diverse role.	Although investors see merits in reducing risk through diversification – there is also a strong drive towards sharp company focus, keeping things simple. IREU may be seen as too diverse/complex. To address this – need to define a simple 'energy service' focus	Similar comments as for SA	Similar comments as for SA	

	South Africa	Tanzania	Uganda	Other interesting insights (from Botswana and Mali).
	and demonstrate commercial value of integrated approach			
Skills are not broad enough to deal with a range of energy service requirements			Similar comments as for SA	
Opportunity for monopolistic behaviour emerges.	This may be seen as a concern with regard to the SHS concession programme. The other side of the argument is that a service is being provided where there was previously a void. Benchmarking across different regions should provide a system of checks.	Similar comments as for SA	Similar comments as for SA	
Funding opportunities for start up may be more difficult due to multi-faceted mandate and activities.	Expected to be more difficult to gather together funds from different resources (although some funders are technology neutral)	Similar comments as for SA	Similar comments as for SA	
Legislative and regulatory amendments required may be too significant	This may be a significant problem in South Africa, particularly wrt integration of grid electricity service with off-grid offerings.	The legislative, policy and regulatory environment in Tanzania is fairly advanced for acceptance of IREU though this largely excludes integration of grid offerings.	The legislative, policy and regulatory environment in Uganda is fairly advanced for acceptance of IREU	
Interaction with grid electricity supplier/parties may be long winded and unbalanced	Concession companies experienced considerable delays in implementation due to long-winded negotiations in establishing service agreements. EDI restructuring process adds a layer of complexity to this	REA has mandate to support establishment of energy service providers- so hopefully will facilitate/reduce barriers	REA has mandate to support establishment of electricity service providers- so hopefully will facilitate/reduce barriers	In Botswana, franchisor can offer services within house while BPC's involvement is limited to outside house. This appears to have been a relatively straight forward negotiation. Supported by the Energy Act.



## 4.2 Reaching the IREU goal

If an IREU were to be established in any of the case study countries reviewed in this report, there would likely be various issues which would need to be resolved before this were to take place. This section provides an initial discussion on this – what the obstacles possibly may be, and then how these obstacles might be addressed. We expect that these issues will be revisited in greater detail in later phases of this project.

	Detail of the obstacles likely to be encountered in moving to IREU			
	South Africa	Tanzania	Uganda	Other
(List obstacles)				
Limited tariff freedom	Rural grid has a low (although rising) cross-subsidized tariff level. Off-grid tariffs are reasonable at present – but much higher than grid. IREU would be supplying across a wide range which will be problematic.	Cost reflective rural tariffs are already applied in some regions using informal diesel mini-grids, and being considered for PREPS (with some capital subsidy).	Under the IREMP process there is greater tariff flexibility, and grid tariffs in some regions are expected to be relatively high	In Mali, diesel mini-grid and SHS tariffs were very close – in many ways – resolving this issue.
Skills difficult to find/attract	Depending on location, can be difficult to source skilled staff. Given range of technologies covered by IREU – may be necessary to have dedicated training	Similar comments as for SA	Similar comments as for SA	In Mali, senior technical staff appeared comfortable with SHS and mini-grid maintenance combination. Sales staff were certainly comfortable with having both grid and off-grid customers
No clear and present initiator	Several approaches possible (see Table 5) but none leaping to the fore.		REA in strong position to initiate. A PREP bidder may choose to diversify Options in Local Government as well	
Legislative, regulatory or policy hindrances or voids	A concern in the integration of grid and off-grid energy service offerings.		Policy frameworks and policy makers broadly supportive of integrated energy service delivery.	
Uncertainty in Electricity Distribution Industry	Of significant concern, as EDI restructuring has been protracted. Relationships between	Clear decisions to involve private sector have been taken. Approaches to PREPS and other delivery	Several modes for electricity service project identification have been identified and regulatory approaches, subsidy levels worked out (PIP, LIREP, CIREP,	

	munics/Eskom and existing/future PPP's will take extensive work to clarify and are a risk area. Nevertheless, there is reasonable urgency to deliver services, and fair access to funds.	models are being tested/explored	PREP, existing concession) <sup>63</sup>	
Grid encroachment reduces positive outlook for an IREU	Of concern in South Africa. Uncertainty remains as to reach of grid under "Access for All". IREU offers mechanism to internally manage planning and risks	Grid networks are very limited. Some defined PREPS and elec project identified. IREU offers mechanism to internally manage planning and risks in areas close to new grid	Grid networks are very limited, although significant expansion planned, this is documented in IREMP framework. IREU offers mechanism to internally manage planning and risks in areas close to new grid	

### 4.3 Moving forward to establish an initial IREU

The review we have conducted in South Africa, Tanzania, Uganda and Botswana suggests the following:

Notably:

- An IREU would likely make sense in each of the three countries reviewed above.
- There is a strong interest from various parties in Uganda to continue with this project with Uganda as a focus area. There is significant sense in doing this given recent IREMP outputs, REA's endorsement of this project and also the project teams strong links with EDG Uganda.
- There is also strong sense in continuing this project – with a South African focus. Project team members have been integrally involved in rural energy initiatives, and are able to extract relevant experience and data from ongoing initiatives. A further 'pull' factor relates to South Africa's extensive electricity grid network, the obvious need for tight integration between grid electricity and off-grid energy services, and an IREUs natural place in this. South Africa has also already been operating a successful 'quasi' IREU with the offering of LPG and solar home systems in rural Kwazulu Natal, by the NuRa utility.

This project's proposal suggests that, out of the review, one case study country will be chosen for an indepth analysis in the next phase of this project. All outputs of further phases of the project would however be sufficiently broad, and hopefully useful, to be of relevance to other countries.

<sup>63</sup> PIP (Private initiated Project), LIREP (Locally Initiated Rural Electrification Project), CIREP (Community Initiated Rural Electrification Project), PREP (Priority Rural Electrification Project) – see Table 8)

Because of the strong relevance of this work for both South Africa and Uganda, we currently propose to develop, in the next phase of this project, generic documents for the establishment of the IREU, and then apply them to both of these countries. More specifically the project team would:

- Utilise NuRa, in South Africa, as the primary case study area: Our team has a lot of information (socio-economic, financial, grid, settlements, local authorities etc.) which we can draw or call upon.
- Utilise a typical region in Uganda (to be identified by EDG (project team member) in consultation with REA and possibly also, local authorities, as a secondary case study.

While this approach will put pressure on our budget, we believe that it:

- Strongly enhances lesson sharing;
- Is more applicable to wider range of circumstances;
- Will require our team to strategic in designing financial models and guideline documents, so that they are more adaptable/relevant to other situations (including hopefully Tanzania, and possibly Botswana)
- Reduces overall project risk (if our team were now to select one case study area, which we find later on not to be an option, then the project would significantly less to offer).

## References

- Aitken RF 2007 'Household energy use: a comparison of household energy consumption and expenditure across three Provinces', accepted for publication in the *Journal of Energy in Southern Africa* February 2007
- Annecke, W & Mohlakoana, N, Socio-economic characteristics and impact assessment of the KwaZulu Energy Services programme of Solar Home Systems installations, Report prepared for EDF-Access Programme
- Banks et al. 2000. Banks DI, Willemse J, Willemse M, Rural energy services: Sustainable public-private partnership based delivery? *In Proc. Domestic Use of Energy Conference*, Cape Town April 2000, pp 93-98.
- Banks DI. 2003. Rural Energy Service Delivery, A Public Private Partnership approach, *In Proc. Domestic Use of Energy Conference*, Cape Town April 2003.
- Banks D, Aitken R, KwaZulu-Natal Mini-grid Feasibility Study, for National Electricity Regulator, RAPS Consulting, June 2004.
- Banks D I 2004, Photovoltaic System Delivery Methods for Rural Areas in Africa, Chapter 3 of Solar Photovoltaics in Africa, Experiences with Financing and Delivery Models, Ed Krause M & Nordström S, UNDP, May 2004.
- Banks DI, Kihuguru G, Uganda Photovoltaic Pilot Project for Rural Electrification UGA/97/G32,Ex-Post Evaluation report, prepared for UNDP/GEF and Government of Uganda, 2006
- Banks D.I. Perspectives on Providing Energy Services in Rural areas, *Proceedings: Hybrid Electricity Systems Powering Mini-Grids: A Southern African Perspective*, Desert Research Foundation, Namibia, 2007, pp 111-127
- Bekker, B, Gaunt, C, Eberhard, A forthcoming. Uncertainties within South Africa's goal of universal access to electricity by 2012. paper submitted for publication in South African Journal of Energy?? CIA World Factbook. *Tanzania*. <https://www.cia.gov/library/publications/the-world-factbook/geos/tz.html>
- DECON – SWECO – Inter-Consult. 2005. *Tanzania Rural Electrification Study: Feasibility Studies and Other Task of Phase 2 – Summary Report*.
- DME 2007. Strategic report 07/08 – 09/10. Department of Minerals and Energy. Pretoria.
- Department of Minerals and Energy, Meeting South Africa's Electricity Distribution Challenges (no date, [..\..\..\..\allhomes\ireu\Literature\South Africa\INEP\electricity\\_challenges.pdf](..\..\..\..\allhomes\ireu\Literature\South Africa\INEP\electricity_challenges.pdf)
- ECON Analysis. 2004. Pre-feasibility study: Potential rural grid connections. Memo 2006-079, Project no. 39253.
- ECON Analysis. 2008. REA REF Concept Paper. Memo 2008-61, Project no. 39250.
- ECON/MEM 2006 "Memo 2006-079, Pre-feasibility study: Potential rural grid connections" Commissioned by SIDA and MEM.
- ECON/MEM 2006a "Memo 2004-083, Pre-Feasibility study Mafia Island", Commissioned by SIDA and MEM.
- ENABLE. <http://www.enable.nu/>.
- ERC, 2005. Solar electrification by the concession approach in the rural Limpopo Province: Phase 1. Baseline Survey, April 2005
- ERC, 2004b. Solar electrification by the concession approach in the rural Eastern Cape: Phase 2. Monitoring Survey, July 2004.
- ERC, 2004a. Solar electrification by the concession approach in the rural Eastern Cape: Phase 1. Baseline Survey, March 2004
- EWURA. <http://www.ewura.com/>
- Griffin N J, Banks D I, Mavrandonis J, Shackleton C M & Shackleton S E, Fuel use in six rural settlements in Gazankulu. *Journal of Energy in Southern Africa*, vol. 4, no. 3, August 1993, pp 68-73.
- Gothard, E., 2003. NuRa Household Survey Report, Prepared for Nuon RAPS Utility. Government of Tanzania. Census. <http://www.tanzania.go.tz/census/>.
- Government of Tanzania. Energy. <http://www.tanzania.go.tz/energy/>.
- Government of Tanzania. 2007. The Electricity Act.
- Government of Tanzania. 2003. The National Energy Policy.
- Gratwick, K. and R. Ghanadan, A. Eberhard. 2006. *Generating Power and Controversy*
- Understanding Tanzania's Independent Power Projects. Working paper of the Management Programme in Infrastructure Reform & Regulation. University of Cape Town. [http://iis-db.stanford.edu/pubs/21076/TanzaniaIPPfinal\\_March2006.pdf](http://iis-db.stanford.edu/pubs/21076/TanzaniaIPPfinal_March2006.pdf).
- GTZ. 2007. Feasibility Study for a National Domestic Biogas Programme in Tanzania. GTZ GmbH, Eschborn (Germany).
- HEDON. 2004. Tanzania Country Synthesis.

<http://www.hedon.info/goto.php/TanzaniaCountrySynthesis>

Helio International. 2006. Energy and Sustainable Development in Tanzania. Sustainable

Energy Watch 2005/2006. <http://www.helio-international.org/uploads/Tanzania-EN.pdf>.

Ilskoga, E. and B. Kjellstroma, M. Gullberg, M. Katyegac, W. Chambalad. 2005. "Electrification co-operatives bring new light to rural Tanzania". Energy Policy. 33(10). Pp. 1299-1307.

Ministry of Energy and Minerals. <http://www.mem.go.tz/index.php>.

NASA. Solar radiation data set. <http://eosweb.larc.nasa.gov/sse/>.

Niemand, FR Banks DI, NuRa – a success story for rural energy service delivery. Energize. P13-16. July 2006.

Marquard, A, Bekker, B, Eberhard, A, Gaunt, CT.2007. South Africa's Electrification Programme: An overview and assessment. www.gsb.uct.ac.ca/mir

Presidential Parastatal Sector Reform Commission. <http://www.psrctz.com/>.

Shackleton, C.M., Buiten, E., Annecke, W., Banks, D.I., Bester, J. & Everson, T., Fabricius, C., Ham, C., Kees, M., Modise, M., Phago, M., Prasad, G., Smit, W., Twine, W., Underwood, M., von Maltitz, G. & Wenzel, P. 2007. Exploring the options for fuelwood policies to support poverty alleviation policies: evolving policy dimensions in South Africa. Forests, Trees & Livelihoods, 17: 269-292.

Songas. <http://www.songas.com>

SPARKNET (2004) Tanzania Country Report Synthesis, <http://www.hedon.info/goto.php/TanzaniaCountrySynthesis>

TANESCO. <http://www.tanESCO.com/>.

TaSEA. <http://tasea.org>.

TaTEDO. <http://www.tatedo.org>.

TaTEDO and EASE. Multifunction platform projects. <http://www.tatedoease.or.tz/mfp.html>.

TREESPA. Project information.

<http://www.treespa.eu/Info%20Documents/TreeSpa%20project%20information.pdf>.

Walter T, Rosa P, Barabas S, Balunywa W, Sserwanga A, Namatovu R, Kyejjusa S (2004), Global Entrepreneurship Monitor Gem Uganda 2004 Executive Report, Makerere Universtiy Business School

World Bank. 2006. GEF Project Brief on a Proposed Grant from the Global Environment Facility Trust Fund in the Amount of USD 6.5 million to the United Republic of Tanzania for an Energizing Rural Transformation Project.

World Bank. 2007. Project Appraisal Document on a Proposed Credit in the Amount of SDR 66.70 Million and a Proposed Grant from the Global Environment Facility Trust Fund in the Amount of \$6.5 Million to the United Republic of Tanzania for an Energy Development and Access Expansion Project. Report No: 40771-TZ. November 9, 2007.

Yelland C, 2008 The impact of electricity theft and non-payment on the generation capacity crisis in South Africa, EE-News, EE Publishers, Issue 21, April 2008

UNDP and GTZ. 2005. Scaling up Modern Energy Services in East Africa: To alleviate poverty and meet the Millennium Development Goals. Draft document. [http://www.gvepinternational.org/file/14/10861\\_eac\\_scalingup\\_final.pdf](http://www.gvepinternational.org/file/14/10861_eac_scalingup_final.pdf).

## Appendix A

Figure 5: Access to electricity by region in Tanzania

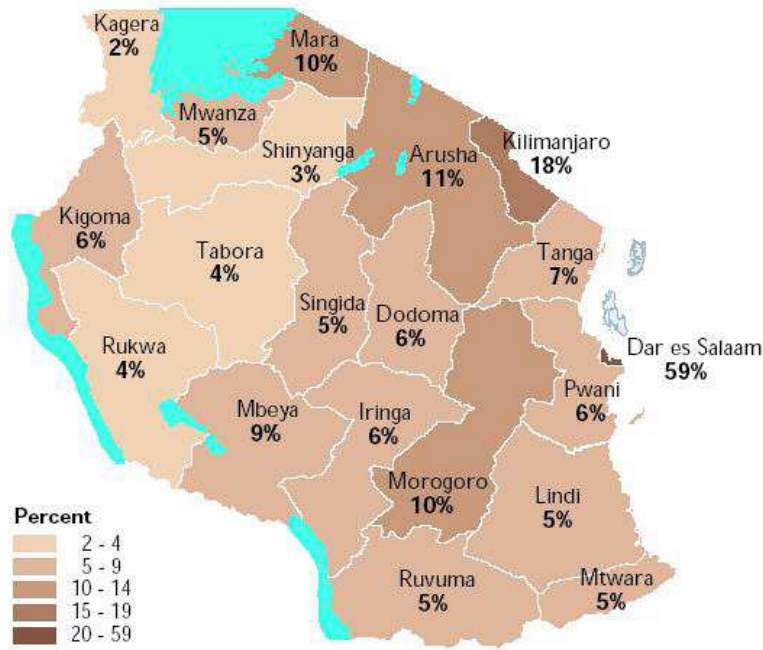
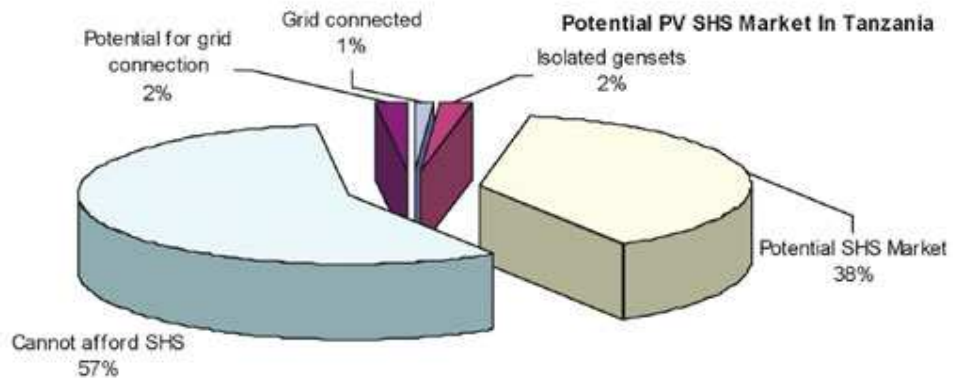


Figure 6: Potential PV market in Tanzania<sup>64</sup>



<sup>64</sup> <http://www.tasea.org>

