ENERGY SECTOR PROFILE

December 2005

SELECTED EXPERIENCE

ESI RESTRUCTURING IMPLEMENTATION (NAMIBIA)

The restructuring of the Namibian electricity supply industry (ESI) was initiated in 1997 with the development and evaluation of options, to rationalize the industry and improve efficiencies so as to keep electricity prices affordable. The key recommendations of the initial study were:

- To establish a single buyer market structure, as a first step towards the liberalisation of the electricity supply industry
- To implement Regional Electricity Distributors (RED's)
- To review and implement key policy issues pertaining to the ESI
- To amend the regulatory framework to accommodate the requirements of the new ESI structure.

Subsequent to Cabinet approval of the recommendations in November 2000, the implementation phase commenced early in 2001 and focuses on the establishment of a maximum four RED's in the country and the development of key policies to guide the future ESI. Three distinct RED development processes were initiated in northern, western and central/southern Namibia.

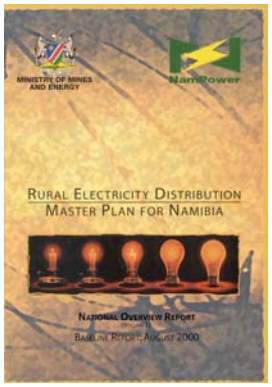
During the inception stage the specific requirements of each of the three RED processes as well as the key policy issues have been defined in consultation with the various stakeholder groups, the Ministry of Mines and Energy and the Electricity Control Board (ECB).

The consultation stage is currently underway and entails consideration and debate of key policy and process issues. Stakeholders in all three RED processes have appointed a Technical Committee to consider the details and develop recommendations that will be tabled to the wider stakeholder forum for approval. Various discussion papers have been developed and are presently under consideration. The ECB's ring-fencing process is being monitored and its implications for the ESI restructuring are being considered. An industry-wide ESI Strategic Meeting in February 2003 has evaluated the RED approach and endorsed it unanimously.

The implementation stage follows once consensus has been reached on the RED boundaries, the RED ownership and governance structures, and key policy issues (e.g. Local Authority revenue). This stage will be mainly concerned with transitional arrangements (e.g. asset and staff transfer), and with practical aspects such as management and control systems.

RURAL ELECTRICITY DISTRIBUTION MASTER PLANNING (NAMIBIA)

Namibia's Rural Electricity Distribution Master Plan has been conceptualised and developed under the leadership of EMCON. This master plan includes a dynamic software-based planning tool that enables the utility and infrastructure planners to re-evaluate electrification programmes, as circumstances and priorities change. Scenario analysis is possible at any time and updates can be done on a continuous basis to ensure that the master plan always remains current.



A unique feature of the Namibian Master Plan is an integrated approach that considers both grid and off-grid options for rural electrification. A computerised prioritisation tool has been developed to enable an objective ranking of electrification projects, based on electricity demand and electrification costs.

This ensures that cost-effectiveness and well-defined planning guidelines direct the national objective of development through electrification.

This master plan has in the meantime been operationalised and is being used in 2002 for the third year by the Namibian Ministry of Mines and Energy as the baseline for determining electrification priorities, allocation of funds on a regional basis and selection of actual localities to be electrified during the year.

RURAL GRID ELECTRIFICATION (NAMIBIA)

EMCON has pioneered rural grid electrification in Namibia. The group has developed an appropriate rural electrification concept as well as the associated technical standards for Namibia, introducing prepayment metering to the country as part of this process. More than 70% of all rural electrification projects to date have been designed and executed by EMCON. EMCON has introduced the concept of base-line household energy surveys, to enable the assessment of the impacts of rural electrification.

OFF-GRID ELECTRIFICATION BUSINESS PLAN AND IMPLEMENTATION STRATEGY (NAMIBIA)

EMCON conducted this study for Namibia's national utility NamPower in an endeavour to ensuring that even communities living far away from the national electricity grid are given the chance to satisfy their basic electrical energy needs.

The study develops a utility-centred off-grid electrification business plan, which includes a detailed financial model and a step-by-step implementation strategy. Operation, sustainability and risk criteria of such a programme are investigated, creating a coherent framework of appropriate responses to prevailing off-grid issues. Guidelines have been developed, describing realistic utility activities in a field that holds many opportunities for the pro-active player, but can also imply the acceptance of considerable risks.

A utility driven off-grid programme is only one of several ways in which large-scale rural electrification, in areas far from electricity networks, can be delivered to rural beneficiaries. The off-grid electrification and energy service delivery strategy proposed represents a bold initiative to deliver a range of services to an often difficult and remote market. There is relatively little local or international experience to draw from. The approaches suggested are new, and although several of the elements have already been tried in Namibia, they have not all been put together before. Implementation of the programme will therefore require the effective collaboration between a number of different role players, funders, the Government and communities.

HYBRID MINI-GRID SUPPLY FOR GOBABEB (NAMIBIA)

A hybrid system was designed for the Gobabeb Research Station based in the Namibian desert. The Station has operated on two diesel generators for more then 30 years. Technical specifications were drafted for a hybrid system based on a three phase mini-grid, with 25kWpeak solar PV, 200kWh battery storage, 30kW power converter size and the two existing diesel generators. Detailed power transfer and dynamic characteristics were specified.

In order to ensure sustainable operation an energy management system was established with the use of electrical energy meters and a manual reading schedule. An Energy Manager was trained with analysing the information as well as creating energy awareness.

Financial sustainability is ensured through charging for electricity. For this purpose the tariff has been calculated based on a twenty-five year project lifetime. The revenue collection is supported by the energy management system. The funds are used to finance operating, maintenance and replacement costs.

PROJECT MANAGEMENT FOR GRID CONNECTED WIND TURBINE (NAMIBIA) - ONGOING

A pilot 220kW refurbished wind energy converter was erected at Mile 7, Walvis Bay to become the first grid-connected wind turbine in Namibia. Furthermore this project represents the first distributed renewable generation run by a Local Authority. The project encompasses a strong capacity building element, to pave the way for a larger scale, economically viable wind park. Project components include wind resource assessment, business plan, generation license application, Environmental Impact Assessment, Quality of Supply measurements, technical design for wind turbine to be supplied, tendering and contracting.

Besides the project coordination of the various activities, the project aims at building capacity in Namibia and regionally in terms of research and wind data analysis, operations and maintenance, regulatory compliance, financial assessment and viability, administrative systems for operating distributed generation at a Local Authority level, performance monitoring to guide a future, large scale wind park implementation.

TRANSACTION ADVISOR SERVICE FOR THE CONCESSION OF RURAL ELECTRICITY SUPPLY WITH SOLAR HOME SYSTEMS (SOUTH AFRICA)

The assistance to the transaction process of awarding a concession for decentralised rural electricity supply using Solar Home Systems (SHS) in areas of the Eastern Cape and North West Provinces (referred to as the 6th concessions) of South Africa through private-public partnership. The goal is to provide the inhabitants of remote rural areas which will not be connected to grid in the foreseeable future with basic electricity through SHS.

A demand assessment model was built to provide bidders with forecasts on the potential customer base, based on a number of scenarios. This included the impact of grid encroachment on the concession area.

RURAL OFF-GRID ELECTRIFICATION (NAMIBIA)

Two off-grid energy provision concepts are utilised in Namibia, both of which are based on solar home systems. The ownership-based systems have been in operation since 1996, however with limited market penetration. In 2001 an alternative concept, the fee-for-service model, was introduced to make energy more affordable and remove the capital burden (deposit). Issues considered were the policy framework for off-grid electrification, requirements of energy service companies, operating framework of the service provider, technical requirements of systems to protect the investment and optimise project life versus benefit. Technical specifications were provided and critical features were requested for the systems implementation.

The technical specifications of the ownership SHS were revised to address system problems, especially for larger SHS's. System responsibilities were shifted from the solar technician to the supplier.

Emcon Consultants were tasked with the development of the fee-for-service concept for the Namibian off-grid market, the system specifications for the ownership-based and the fee-for-service SHS systems, the investigation into the technical problems experienced with ownership SHS systems, the testing of a prototype fee-for-service system (PowerCan) and with the critical feedback in terms of essential mechanisms required for the successful implementation of a fee-for-service concept.

COMMERCIALISATION OF ELECTRICITY SUPPLY SERVICES (NAMIBIA)

With the establishment of the first rural electricity networks in the densely populated northern regions of the country in the early 1990s, and the lack of suitable structures to manage and administer these networks, Government decided to investigate the possibility of involving the private sector to provide this service. EMCON conducted the feasibility study, developed the terms of reference for an international request for proposals, and evaluated the proposals. As transaction advisor, EMCON led the negotiations with the successful bidder, culminating in the establishment of one of Africa's first private electricity distribution companies, Northern Electricity. With the introduction of appropriate management systems, the strengthening of the networks and the implementation of effective customer services, the company has during its five-year contract achieved payment levels in excess of 99%! At the same time electricity tariffs have effectively been decreased.

ACCESS-TO-ELECTRICITY STUDY (LESOTHO)

The Access-to-Electricity Study forms an integral part of the World Bank-funded initiative to privatise the Lesotho Electricity Corporation (LEC), defining the scope and costs of rural electrification within and outside the future service territory of a privatised LEC. Different electrification options (including network extensions, grid expansion and off-grid electrification) have been evaluated and terms of reference for a pilot electrification project have been developed.

EMCON consultants were responsible for the entire project except the household energy survey that was conducted and evaluated by Sechaba Consultants. The services provided by EMCON staff included information gathering, data compilation and management of the database, load forecasting and high-level network development planning, identification of technical constraints, evaluation of electrification options, and preparation of terms of reference for a pilot electrification project.

RURAL ELECTRIFICATION ACTION PLAN (MOZAMBIQUE)

This project centred around the development of a concession approach for electricity supply and network development in three district capitals in the Inhambane Province of Mozambique.

EMCON consultants were responsible for the technical aspects of the projects. This included the evaluation of the existing networks and generation plants, determination of the extent and costs of electrification, load forecasting and identification of system constraints, and consideration of various electrification options.

BARRIER REMOVAL TO THE DEVELOPMENT OF COMMERCIALLY, INSTITUTIONALLY AND TECHNICALLY SUSTAINABLE ENERGY SERVICES (NAMIBIA)

The project entailed the development of a UNDP/GEF Project Brief for a full-size project, and its objective was the identification, evaluation and prioritisation of barriers preventing the sustainable development of solar energy service systems in Namibia, and designing activities for their reduction or removal. Indicators and a methodology for monitoring and evaluation of the GEF intervention were developed, and co-financiers of the project have been identified.

EMCON consultants were responsible for the following aspects of this project:

- Renewable energy technology assessment by sector and energy service
- Assessment of current and potential market potential of solar energy services Identification and evaluation of technical barriers
- Identification of social and human barriers
- Development of demonstration and pilot activities
- Risk assessment and strategies to address sustainability
- Stakeholder participation and project implementation strategy
- Co-authorship of the Project Brief

SOLAR HOME SYSTEM PILOT PROJECT (NAMIBIA)

The *HomePower!* Solar Home System pilot project in Namibia was launched by the Ministry of Mines and Energy and supported by the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit). The aim of this project was the sustainable provision of basic and affordable energy to rural households in the off-grid areas. A revolving fund was created for this purpose by the Renewable Energy Section at Ministry of Mines and Energy in order to facilitate loans to the rural customer at reduced interest rates.

Ninety-six SHS's were installed in the pilot phase, spread over six regions of Namibia. In this process eleven solar technicians were trained in the field to perform SHS installations. The SHS consisted of one 50Wpeak PV module, a charge regulator, a system status indicator, a maintenance-free battery, four lights and a socket outlet.

The tasks involved project co-ordination during the implementation phase with stakeholders, being the clients, the solar technicians and the revolving fund administrators. Documentation was provided to the user in the form of a User's manual and guide sheet. The system integration of the charge regulator, the system status indicator, the battery and the lights was optimised.

SOLAR HOME SYSTEM PROGRAMME ASSESSMENT (NAMIBIA)

The *HomePower!* Solar Home System Programme and the Indian Solar Home System villages are being surveyed to assess the socio-economic impact of electrification through SHS technology on rural households. In addition the survey is evaluating the

technical performance of the Solar Home Systems installed. Next to the SHS survey, grid electrified and unelectrified households are being surveyed to assess the impact of SHS relative to these households.

Specifically, the study is investigating issues such as:

- Benefits experienced in terms of energy services
- Economic implications and its sustainability
- Loan repayment profiles
- Long term impact on households (income generation, empowerment education)
- Energy usage patterns and system utilisation
- SHS awareness of the customers
- Technical problems experienced
- Delivery mode and stakeholders
- Programme sustainability

The recommendations of the study will provide guidelines with respect to the continuation of the programme as well as changes to the approach, methodology of implementation and the technology utilised.

URBAN ELECTRICITY DISTRIBUTION MASTER PLANNING (NAMIBIA)

Urban electrification planning in developing areas requires the evaluation of priorities in order to compile an electrification programme based on financial and socio-economic factors. EMCON has developed a specialised planning software tool to assist electricity distribution planners in urban areas. The software application provides guidelines and establishes priorities for the extension and upgrading of existing electricity distribution networks.

Being software-based, this planning tool enables easy scenario analysis and the creation of an initial baseline master plan that will remain relevant as long as the datasets are kept up to date. A prioritisation tool enables an objective ranking of electrification projects, based on demand for electricity and electrification costs. This ensures that cost-effectiveness and well-defined planning guidelines direct national objectives of development through electrification.

The software comprises five modules:

- Urban Prioritisation Tool (to objectively prioritise potential customers who are not yet grid connected)
- Geographical load forecasting module
- Network database, graphical interface, creation of load flow and fault study files
- Capital expenditure plan
- Financial analysis

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