

Eskom's Renewable Energy Experience

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1. BACKGROUND

Eskom is the largest electricity utility in Africa, generating approximately 60% of the electricity consumed on the continent and having installed capacity of some 39 000 Mw. Up until the early 1990's, its distribution business had operated largely as a wholesaler of electricity supplying in bulk to municipal distributors and large industrial customers. Its direct domestic customers, who reside mainly outside proclaimed urban areas amounted to half a million in 1992. This changed dramatically from 1994 when Eskom, along with other municipal distributors, agreed to electrify 2.5 million homes by the year 2000 as part of the Government's Reconstruction and Development Programme. This coincided with the ushering in of the new democracy whereby underdeveloped areas became the focus for development investment. At this stage, 65% of households did not have access to electricity. These households were largely Black, and lived in peri-urban and informal settlements, as well as rural areas. The programme sought to reduce this to 30% by the year 2000. Although the electrification programme envisaged the use of both grid and non-grid technologies, the entire residential electrification programme has been off grid electricity. The main reasons for grid electrification were firstly, that there already existed a well established distribution network in most parts of the country; secondly the relative costs of non-grid technologies were considered prohibitive; and that grid electrification was the more effective way to bring about rapid electrification.

2. THE ELECTRIFICATION PROGRAMME

The electrification programme which began in 1994 was estimated to cost a total of \$2 billion over a 5 year period, with investment peaking at \$333 million. Some of the underlying assumptions of the programme were:

- The programme would be financially viable and sustainable.
- Project selection would be transparent and involve the relevant role players.
- Rural electrification would be a focus area.
- Equity would be maintained between the various area to be electrified.

Eskom committed to electrify 1,75 million households out of the total programme of 2,5 million. The programme has thus far met the targets and will meet the total obligation by the year 2000. As a result of what has been done so far, for the first time in the history of South Africa there are more houses with electricity than those without.

By end of 1997, approximately 59% of homes had access to electricity. Between 1994 and 1997, the percentage of rural people with access to electricity rose from 12% to approximately 27%, an increase of 15% over 2 years. In urban areas, the percentage of people with access to electricity by the end of 1996 was around 79%. As with many such endeavors, it quickly became apparent that the assumptions regarding financial viability would come into question. This led to a number of supply and demand side interventions that were to see the cost per connection reduced from \$711 in 1994 to \$530 in 1998. (Projected to \$465 in 1998).

This has been achieved in spite of the fact that the programme has been moving into less densely populated areas for some time now. This has been achieved by technology optimisation in the following way:

- a) Network designs were optimised to lower load requirements. Initially they were based on 60amps per point of supply and an after diversity maximum demand (ADMD) of 1,5kVa. The standard is now based on 20amps per point of supply and an ADMD of 0,4kVa. Upgradeability is built into the design philosophy.
- b) More appropriate technology has been applied such as single wire earth return and single phase medium and low voltage systems.
- c) Other design improvements related to standardisation and efficiency initiatives. Ratios and indicators were developed to assist in the process of capital release. For example number of structures per kilometre per conductor type, transformers per kilometre and number of connections per transformer.

To further enhance the viability of the electrification programme Eskom embarked on a number of demand side initiatives.

Through interaction with the customer and measurement of consumption patterns Eskom developed a basket of products to ensure that the areas being electrified have a higher take-up rate and therefore reduce the cost per connection through more efficient utilisation of the reticulation network. These products include a 60amp and 2.5amp option in addition to the standard 20Amp option.

Various marketing initiatives to create electricity awareness and demand have also been initiated. These include talks at schools and social institutions on the safe and efficient use of electricity, sponsorship of sporting and cultural events, and the distribution of appropriate literature to customers.

Electricity supply to the various market segments has been branded to enable a more focused interaction between Eskom and its customers.

Through this programme, Eskom has contributed to achieving critical mass in terms of access to electricity. Although overall electrification rates of 70-80% will be attained

through this programme, it is unlikely that more than 30% electrification in rural areas will be achieved through grid-electrification alone.

3. ESKOM'S INVOLVEMENT IN NON-GRID ELECTRIFICATION

Eskom's contribution to the development of non-grid energy provision has been in three main areas: through contribution to the development of national policies for energy and electrification, initiation of the Energisation Programme which develops and implements options for meeting customer's energy requirements in conjunction with other energy suppliers and in implementing the non-grid Schools Electrification Programme.

3.1 NON-GRID SCHOOL ELECTRIFICATION PROGRAMME

The Non-Grid School electrification programme grew from a commitment to the South African Government to manage the electrification of some 16 000 remote schools which would not be grid electrified in the medium term. This programme was to utilise funding from international donors and other government sources who were concerned about developing the country.

Eskom has developed a number of procedures and activities in order to make this programme a success. This has included the following:

- Equipment standard specifications.
- Installation procedures
- Commissioning procedures and test equipment
- Component evaluation facilities
- Training programmes for first time installation contractors
- Business training programmes for new contractors
- Evaluation and feedback processes.

This programme is specifically aimed at bringing the benefits of effective educational opportunities to those who previously had to rely on very rudimentary teaching aids. Each school is provided with:-

- Adequate lighting for four hours a day for 3 of the classrooms, the staff room and the headmaster's office.
- 220V AC power for 1 to 2 hours a day to run television, video recorder, overhead projector and computer.

The direct benefits to approximately 400 pupils per school are realised immediately, while the longer term benefits from adult education programmes like literacy training, business skills and upliftment of the community lifestyle will impact many more people.

An integral part of the programme is the employment of local contractors who are given installation training and the employment of local labour for installation. Through this process jobs are created in the community, as well as a sense of ownership developed.

Systems installed are designed for a lifespan of 15 years, with the batteries having to be replaced at regular intervals.

While a number of issues still need to be resolved around the optimum utilisation of these systems by the pupils and teachers a great level of commitment is being displayed by the Provincial Department of Education to the modernisation of all aspects of schooling in the shortest possible time. The one great pity of this exercise is that very little international donor support has been forthcoming and only 1 300 schools have been electrified to date.

3.2 ENERGIZATION PROGRAMME

“Energization SA” is essentially the matching of energy supply side resources with (community) energy demand requirements and optimising to form a combined energy offering which can provide economic growth opportunity for long term viability. As it involves balanced energy solutions, this requires the optimal combination of different energy sources which takes into account their efficiencies, availability and costs. LPGas, for example, is an excellent energy source for thermal applications, such as cooking, while electricity has the competitive advantage in the applications of lighting, entertainment, refrigeration and the running of motors. Energization is therefore a best combination of energy sources to ensure an efficient, cost effective energy package that is available in the community and is within their economic means.

The energization process comprises a number of elements, which can vary depending on the energy resources available and the circumstances of the community.

The start-up product offering consists of LP Gas hardware and a PV system:

- 2 of 4,5kg LP Gas cylinders, filled,
- 2-plate gas stove with connections,
- 49W PV panel, roof or pole mounted,
- Battery with regulator,
- 2 lights of 9W,
- Outlets for a black and white television set and radio (depending on product compatibility)

It is expected that the above system would be used in 95% of the cases, however, there are larger systems to take care of the needs of the customer requiring a more sophisticated system.

The capital to purchase the system is either payable in cash or financed over a period. In the current pilots, Hire Purchase financing is available.

As the Energization offering is seen as one package, one flat rate payment per month will be made and collected by the Energy Agent. For this, the Energy Agent is paid a collection fee. The payment pays off the hardware and entitles the customer to refill one bottle with LP Gas. The charge for extra gas refills will be determined by the Energy Agent (as recommended by LP Gas supplier) and collected on a cash-on-delivery basis.

The selection and training of the Energy Agent is of utmost importance, as the Energy Agent will play a pivotal role sustaining the Energization process.

The agent will be required to offer a full service to the community in terms of their energy needs. This includes:

- The installation of the PV panels,
- Their panels,
- The sale of the LP Gas equipment
- The sale of additional gas and
- The collection of revenues

For each of these duties he will receive an appropriate fee. As part of his customer service and satisfaction programme, he will also provide energy advice to customers as to the most effective use of their energy package.

3.3 JOINT VENTURE PROJECT FOR RESIDENTIAL NON-GRID ELECTRIFICATION

Another development is that Eskom and Shell are in the process of establishing a joint venture agreement whereby a fee for service programme will be implemented in a number of different rural areas. This programme is believed to be a world first on the scale involved and will provide lighting, communication, cooking and heating.

The customer will not need to buy the technology, as the hardware will remain the responsibility of the Joint Venture company, while the customer only pays on a monthly basis for the level of service installed and received.

6 000 installations are planned in phase one to extend to 50 000 if all evaluation points are met. This programme includes newly developed security technology and electronic prepayment devices. The emphasis in the implementation process is on empowerment of local black organisations and on full commercial sustainability.

3.4 OTHER PROJECTS

Eskom is further involved in economic evaluation and technical assessment of larger scale renewable programmes within the context of the South African climatic and economic environment, included in these are:-

- Grid connected wind farm (4.8Mw)
- Solar thermal electricity generation (200Mw)
- Medium size hybrid systems for agricultural application
- Biomass electricity generation

In order to have a reliable foundation on which to make long term decisions, a national renewable energy resource database and evaluation platform is being developed in conjunction with other interested stakeholders in the country.

To conclude, our country is at a stage where viable grid electrification for rural areas is approaching its full potential. We need to continue to pursue renewable energy technologies in order to continue energization in rural areas. I have no doubt that the experiences of other nations grappling with similar problems will assist us in this endeavour.