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**Increasing Electricity Access While Ensuring
Financial Viability: A Perspective from the African
Electricity Industry**

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Abstract

In developing countries the challenge of increasing electricity access in a sustainable manner is a problem of balancing the need to set prices to cover cost while keeping them low enough for the poor majority to afford. These are not easy objectives to achieve because they are inherently contradictory where the achievement of one objective is often at the expense of the other. Based on recent experiences from the Zimbabwe electricity supply industry, this brief presentation aims to draw lessons for dealing with this difficult challenge.

Zimbabwe Electricity Supply Industry – A brief introduction

The following table provides an indication of the current size of the industry:

TABLE 1: Statistical Highlights of Electricity Supply Industry in Zimbabwe

Indicator	2002 (Audited)	2004 (Unaudited estimates)	Comments
Installed capacity (MW)	2045	2045	37% hydro; 65% coal; 1600 MW available, balance imported
Maximum Demand (MW)	2028	2045	
Energy Sales (GWh)	10771	10616	65% local production;
Population (million)	13	13.3	
Consumption per capita kWh	828	798	
Turnover (Z\$ billion)	37	1093	
Net Income (Z\$ billion)	2.4	(2264)	() Denotes negative #
Z\$:1 US\$ (official rate): Dec.	55	6200	
Z\$:1 US\$ (parallel rate): Dec.	1500	12000	
Number of Customers	540051	566000	About 88% are Domestic
Population with access			Each domestic connection estimated to serve at least 10 to 12 people
– Million	5.1	5.5	
– -% of total	39%	41%	
Rural Access (%)	22%	25%	20% of domestic now rural
Urban Access	84%	85%	
Source: ZESA Annual Report (2002), Central Statistics Office, author's estimates			

The legislation that governs the electricity supply industry in Zimbabwe is the Electricity Act (*Chapter 13:19*) and Rural Electrification Fund Act (*Chapter 13:20*) of 2002. The Electricity Act created the Zimbabwe Electricity Regulatory Commission (ZERC) and provided the legal framework for the on-going unbundling of the state-owned utility, the Zimbabwe Electricity Supply Authority (ZESA), into five companies responsible for generation, transmission, distribution, telecommunications and support services.

The Rural Electrification Fund Act created a Rural Electrification Agency that has the mandate for the total electrification of all the rural areas. The main functions of the

Agency are the planning of projects, raising and accounting of rural electrification funds and monitoring of project implementation.

Pre-Masterplan Electrification for the Urban and Rural Poor Since Independence

At independence in 1980 the distribution and supply of electricity in Zimbabwe was the responsibility of the municipalities in the four major cities of Harare, Bulawayo, Gweru and Mutare and the Electricity Supply Commission (ESC) for the rest of the country. At that time there was almost 100% electrification of the areas where the white and black urban elite lived while the bulk of the poor black population had little or no access. This deficiency influenced the national energy policy of the government to give priority to the electrification of the urban and rural poor.

It was relatively easier to connect the urban poor as most of their residential areas were close to the existing grid. Not many rural poor were in that fortunate position except those peasant farming areas that were adjacent to electrified white commercial farms. Rural electrification also presented another major challenge because rural Zimbabweans do not live in compact villages but in scattered homesteads where each family lives next to their farming plot. The cost of building a distribution network to serve such isolated homesteads was beyond the financial capability of the utility and the Government. Even if such capacity was there the income levels of the rural poor were too low for them to afford the electricity.

In an effort to accelerate rural electrification a new Electricity Act (*Chapter 13:05*) was enacted in 1985. This created the national utility, ZESA, from an amalgamation of the ESC and the municipal electricity departments. One of the principal objectives of creating ZESA was to increase financial resources for the electrification of the rural areas by enhancing the financial viability of the industry through the removal of duplication of functions among the utilities and improving efficiencies through economies of scale.

The problem of scattered homesteads was avoided by a Government decision to focus rural electrification on rural business or government administration centres that were designated as growth points. Tax and other incentives were given to promote investment at these points. The idea was to create nuclei of rural towns that would generate employment and reduce the drift to established urban areas. The growth points were also planned with provision for residential stands to cater for those who could afford to pay for household electricity.

Rural Electrification Masterplan

In 1993 ZESA adopted a performance improvement programme as part of the Government's macroeconomic structural adjustment programme. The programme was based on explicit performance contracts that the Government established for the utility and its board and executive management.

One of the major areas of performance improvement was the adoption of explicit economic and financial viability criteria in project selection. This approach had a profound impact on rural electrification that was suspended pending review of its financial and economic impact. The review concluded that priority needed to be given to the electrification of those rural centres that had potential for increased agricultural

production and had a good road network for easy market access. Such centres would be able to quickly benefit by using electricity to increase agricultural productivity and for agro-processing industries. The resultant increase in income levels would then encourage the electrification of households. Using these criteria a rural electrification masterplan study was launched in 1994.

The study identified 415 rural service centres, business centres and growth points to be given priority attention for electrification. To finance the programme the study recommended the introduction of a levy of 1% of every customer's bill. The purpose of the levy was to provide capital subsidies only. As explained in more details in the next section, consumption subsidies were to be provided by the utility through cross-subsidies.

Collection of the rural electrification levy started in 1996 and the rural electrification programme was relaunched in 1997. To get additional funds for the programme a scheme was introduced for mobilising community contributions. The masterplan was publicised so that communities would be able to plan ahead to raise funding for projects that would productively use electricity soon after connection of a centre to the grid. To promote household electrification at centres already electrified the RE levy was used to provide a 50% to 60% subsidy to villagers who could raise the balance of the capital costs for electrifying their households.

To ensure financial sustainability of projects the level of subsidies was established through financial and economic feasibility studies. The studies assumed that completed projects financed by the RE levy would be handed over to the distribution utility. The utility would then assume responsibility for operation and maintenance and had to establish tariff levels that ensured breakeven financial performance at a minimum.

Implementation of the masterplan study recommendations involved an extensive stakeholder consultation programme that included the potential beneficiaries as well as government and political leaders. These consultations confirmed the soundness of the strategy of focussing on grid extension for productive activities and to improve service delivery by rural health and educational institutions. Consultations also established that off-grid options such as PV were not popular especially with women because these installations did not lessen the domestic burden of fetching water and firewood.

The programme was a great success. In contrast to the pre-masterplan phase that failed to meet its target the masterplan phase exceeded expectations. The response from the rural communities was so overwhelming that within three years the number of community initiated projects exceeded the number of masterplan projects. A total of 768 centres had been electrified by the beginning of 2001 compared to 415 centres that had been planned. In contrast the pre-masterplan phase completed the electrification of only 28 out of 48 growth points that had been planned.

Because of the overwhelming demand the utility's construction crews could not cope. It was therefore decided to hire private contractors. Many of the contractors were former utility employees who had taken early retirement as a consequence of the manpower rationalisation undertaken as part of the performance improvement programme. Not only did this improve the project implementation rate but the competitive tendering also reduced construction costs by as much as 50%. This was achieved by the bulk

purchasing of materials by the utility and the contractors providing the labour, transport and construction equipment.

The success of the masterplan programme attracted a lot of political interest. Every Member of Parliament wanted an electrification project in their constituency before the next parliamentary elections scheduled for 2005. This interest had both positive and negative consequences. While the pace of rural electrification has increased significantly this has been done at the expense of the financial viability of the utility.

Impact on Electrification Access

The positive result of the increased political interest was the approval to increase the rural electrification levy from 1% to 6%, the enactment of the Rural Electrification Fund Act and establishment of a dedicated Rural Electrification Agency (REA) in 2002.

Electrification targets were raised. An expanded electrification programme was launched in which a total of 9906 rural institutions, irrigation and village schemes were identified for electrification by the end of 2005. A unique feature of the expanded programme was the financing of both electricity and end-use infrastructure, mainly irrigation equipment, by the REA. Although the 2005 target is unlikely to be achieved the rate of connection of rural institutions has increased dramatically. As shown in Table 2 below by the end of June 2005 a total of 3992 had been electrified.

TABLE 2: Electrified Rural Institutions as at 30 June 2005

Institution	Average installed capacity kVA	Total number completed	%
Business and Government Administration Centres	100-200	901	22
Rural health Centres	50	331	8
Primary Schools	25	944	24
Secondary schools	50	589	15
Small Farms/Irrigation Schemes	25-300	593	15
Village s/other Schemes	10-300	634	16
TOTAL		3992	100

The positive impact on electrification access rates is evident in the statistics in Table 3 below. The electrification access statistics are based on the proportion of the population who are connected to the grid. Surveys have established that the average number of people who benefit from each domestic connection is at least 10 to 12. This gives the number of people who have the benefit of an electricity connection. This figure is then expressed as a percentage of the population estimated from official census figures.

TABLE 3: Electrification Access Statistics

Year	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Urban %	66	66	67	69	70	72	74	78	80	81	82	84	84	85
Rural %	10	11	11	12	12	12	14	16	17	18	20	22	23	25
National %	20	22	22	24	25	27	29	31	34	36	37	39	41	41

If account is taken of people who are not connected but have a direct and indirect benefit by living within 10 to 20 kilometres of an electrified centre, it is reasonable to assume that three quarters of the population is enjoying the benefits of grid electrification. For example where electric motors have replaced diesel engines for grinding mills, the costs of milling maize that forms the staple diet have been reduced by 50%. Rural health and educational institutions are now able to improve the quality and range of their services because they are able to attract and retain qualified staff.

Impact on Financial Performance

An indication of the financial performance of ZESA during the different electrification phases is given in Table 4 and Figure 1 below.

TABLE 4: Revenue, Profit, Debt Collection and System Losses

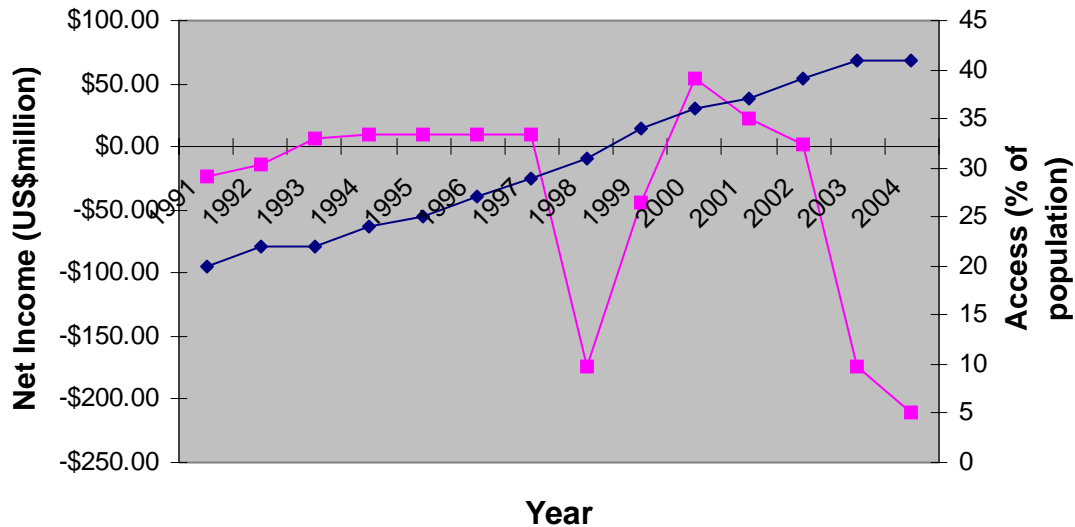
Year	Revenue (US\$ million)	Operating Profit (US\$ million)	Net Profit (US\$ million)	Debtors (Days)	Losses %
1990	223.6	64.1	(0.8)	70	8.7
1991	184.9	62.6	(24.1)	74	10.7
1992	279.2	67.8	(14.5)	85	9.9
1993	305.7	101.8	6.7	99	11.0
1994	234.1	101.3	9.9	61	11.9
1995	265.2	104.3	10.0	50	10.7
1996	303.5	105.7	10.0	56	10.8
1997	331.7	100.3	9.6	32	10.8
1998	260.3	(2.0)	(174.1)	25	11.3
1999	230.9	40.4	(44.1)	32	12.8
2000	428.3	124.6	54.2	33	13.3
2001	521.1	120.8	33.0	39	14.6
2002	349.8	76.2	3.1	52	15.2
2003	178.4	(24)	(173)	52	N/A
2004	176.3	(25)	(210)	56	N/A

Note: US\$ equivalent based on official exchange rates up to 200. From 2002 to 2004 parallel rates have been used to give more realistic equivalent figures.

Figure 1 gives a clearer picture of the financial viability in terms of the net profit and electrification access as a percentage of the population living in houses connected to the grid. The graph shows a steady growth in access from 20% in 1991 to 41% in 2004. During the same period the financial performance has been mixed depending on the electrification phase. With the exception of one year the utility had positive operating profits until 2002. The operating profit represents the financial viability without taking account of how the utility is financed. Taking account of the utility's heavy debt financing the net profit was negative in the early 1990's, in 1998 and 1999 and since 2003.

Figure 1

NET PROFIT AND ELECTRIFICATION ACCESS



The pre-masterplan programme had limited success because the utility's profits were insufficient to meet the requirements. Further the projects targeted were selected on the basis of political decisions that did not take account of economic and financial viability. While some of the growth points grew rapidly following electrification, some failed to take off and were a heavy drain on the utility's finances.

The masterplan electrification phase was not only effective in increasing access but was also accompanied by the best financial performance of the utility. The net losses recorded in 1998 and 1999 were unrelated to the electrification programme but were due to the revaluation of the foreign currency denominated liabilities following the massive devaluation of the Zimbabwe dollar between November 1997 and early 2000. The adverse effects of the devaluation were reversed within 16 months through a series of quarterly tariff adjustments.

The positive trend in financial performance was reversed in 2002 when political pressure forced ZESA to incur heavy short-term debt to finance the expanded rural electrification programme. Many of the projects were also selected for political expediency rather than on economic and financial viability criteria as recommended in the masterplan. The cost of the expanded programme was estimated at Z\$25 billion which was equivalent to US\$450 million at the official exchange rates at the time. Although there was a six-fold increase in the RE levy, the REA was still only able to raise about US\$18 to 30 million per year. The REA did not have the borrowing capacity to bridge the financing gap.

To go around this constraint the REA continued to operate as a subsidiary of the utility, which was then directed by Government to borrow on behalf of the REA. This was a contravention of the RE Fund Act which states that *"The Board (of the Fund) shall ensure that in any financial year expenditures and commitments from the Fund shall not*

exceed the annual income of the Fund” (section 36). This provision was made to maintain the financial viability of the REA.

By the end of 2004 ZESA had borrowed more than Z\$55 billion on the domestic market and US\$110 million on the international market to finance the expanded rural electrification programme. These were all high interest short-term facilities with maturities ranging from 90 days to five years. Debt service on the loans exceeded the utility’s capacity forcing Government to assume the responsibility of direct financial subsidies to keep the utility from bankruptcy.

Analysis of the Success and Failures in balancing Access and Financial Viability

The rural electrification experience in Zimbabwe shows that electrification access is ultimately a pricing and financing problem. In summary the success in balancing access and financial viability during the masterplan phase was achieved due to the following factors:

- Successful marketing of the project selection based on economic and financial criteria;
- Efficient revenue collection ensured that funds were available for rural electrification;
- Increased use of private contractors helped in reducing the cost of grid extension;
- Explicit capital subsidies for rural electrification supplemented by the mobilisation of community contributions removed the burden of financing from the utility;
- Cross subsidies to support lifeline tariffs for the poor helped to encourage use of electricity as an energy source for the poor households.

The masterplan was an effective tool for depoliticising the rural electrification programme. Publicising the masterplan was an important strategy to prevent politically motivated changes in project priorities. A transparent queue-jumping mechanism through community contributions provided a way to harness political involvement in a constructive way.

The issue of affordability is so important that it requires further elaboration. The grid can be extended and connections made but the poor would still not have access if they were unable to afford to pay for a meaningful amount to make a difference to their lives. It is for this reason that cross subsidies have been used as an integral part of increasing access to the poor.

The creation of a national utility made it possible to adopt a uniform national electricity tariff. Consequently the urban customers subsidised the rural customers. Within the domestic tariff category an inverted block tariff was adopted to ensure that the poor customers were subsidised by the richer customers, consumption bands being used to differentiate the rich from the poor.

The domestic tariff structure that has been used successfully for many years is illustrated in Table 5.

TABLE 5: Domestic Tariff Structure

Block	Relative tariff level	Comment
First 50 kWh	1.000	Lifeline block for lighting and small power applications
51-300 kWh	1.125	Lighting, small power and basic heating (one to two plate stove). The bulk of the poor
301-1000 kWh	2.500	Single middle class home or several poor families sharing single connection
Above 1000 kWh	3.000	Single upper class home or several poor families sharing single connection

Based on observed consumption patterns of the different groups this block structure is to be revised into three blocks of 0 to 250 kWh, 251 to 500 kWh and above 500 kWh. The lifeline amount of 50kWh is too small to justify the expense of a grid connection and 250 kWh is adequate to meet basic subsistence requirements for an average low-income household. The middle and upper classes have also been receiving an unnecessary subsidy and not having sufficient incentives for energy conservation.

In order to encourage the poor to use electricity for cooking the low consumption domestic customers are subsidised by the industrial and commercial customers as well as the higher consumption domestic customers. The rationale for placing the subsidy burden on the industrial and commercial customers is the benefit that these customers derive from increased consumption of electricity by the poor. Their benefit from the increased sale of electrical appliances and demand for other electricity related services far outweigh the cost of the consumption subsidy.

However the affordability levels of the customer groups carrying the subsidies place an upper limit on the level of sustainable subsidies. Each customer category has to bear a significant proportion of the cost of providing supply to the group. To sustain electrification access while avoiding the problem of electricity thefts and other non-technical losses there is no alternative but to enhance the payment capability of the poor. In other words electrification access has to be planned jointly with a poverty reduction programme.

Affordability can be defined in terms of the percentage of net income used to pay for a product or service. If 10% of net income is taken as an upper limit for a household to afford electricity it becomes easy to determine the income threshold for viable electrification access.

Using this affordability test in Zimbabwe there is no electrification of urban informal settlements. Rural households are only connected on the basis of affordability. By promoting the use of grid electricity on productive activities income levels near electrified centres have been increasing to the point where the villagers are able to raise sufficient money to qualify for the 50% to 60% capital subsidy from the RE Fund.

Lessons Learnt

The key lessons that can be drawn from the electrification experience in Zimbabwe are:

- Electrification Access levels for the poor can be increased without adversely affecting the financial performance of the electricity supply industry provided the necessary capital and consumption subsidies are financed in a sustainable manner.
- There is an income threshold level below which electrification for the poor does not make business sense. It is therefore necessary to use electrification access as a tool for poverty reduction in order to enhance affordability through an increase in income levels of the poor.
- Grid extension is the most cost-effective option for the simultaneous achievement of the multiple challenges of increasing electrification access, lessening the domestic burdens of women, reducing poverty through increased economic productivity and sustaining the financial viability of the electricity supply industry.
- Rural electrification is of immense political interest. This interest can have both positive and negative impacts on access and financial viability. Political support is essential in order to have the necessary policy, legal and institutional support for electrification. The major negative impact of politics is on financial viability. Explicit performance contracts based on a transparent strategic plan and performance improvement programme can be an effective tool to minimise adverse political interference.