

Electrification of a low-income area in Zambia: Evaluation of the Pamodzi project

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EXECUTIVE SUMMARY

Currently, Zambia has an excess generation capacity of 488 MW available, yet the majority of urban households depend on charcoal for cooking and space heating. Although Zambia is endowed with abundant natural vegetation in natural forests, indiscriminate cutting of trees for energy use will lead to deforestation in the long term.

In an effort to increase people's access to electricity, the Zambia Electricity Supply Corporation (ZESCO), the Department of Energy and the Stockholm Environment Institute (SEI) have implemented a pilot low-cost electrification project in Pamodzi Township, Ndola. The overall objective of the electrification project is to assist in a more rapid and sustainable electrification of Zambia's low-income urban areas.

This evaluation report assesses the following development aspects of the Pamodzi electrification project.

1. The financial management of the project

While the Pamodzi project aimed to address high connection fees and appliance acquisition problems through a deferred payment system, there are threats to the workability of the system by:

- Unstable economic situation and high inflation rate.
- Increased costs of electricity consumption.
- Problems with payment of two separate bills.
- ZESCO's indifferent approach to enforce the terms of the contract.

2. The community participation and customer interface

The successes and failures of development initiatives often depend largely on the level of community participation in the development process. To facilitate community participation, the Pamodzi project involved the community in implementation and after, through the appointment of the local facilitator and the neighbourhood contact group (LCG). This approach has useful advantages (i.e. building customers' capacity to understand electricity). However, this approach still needs to be improved through better communication between the project target community. This could be done by:

- Constantly updating the LCG and local facilitator about changes in the project.
- Holding public meetings and workshops to inform people and discuss project developments.

3. The impacts of electricity in households' energy use patterns

The social impacts of electricity are difficult to measure within two years of electrification; however, some observable effects are starting to emerge and the general lifestyle of Pamodzi residents has improved significantly. Households possess electricity-powered televisions and one or two other appliances (other than the hotplates and irons). The potential for the development of micro-business ventures resulting from electrification in Pamodzi also does exist. The following were the product of the Pamodzi electrification approach:

- The energy use patterns in electrified households in Pamodzi has changed dramatically and positively after electrification, but these changes are showing signs of being reversed.

- The Pamodzi approach was designed to make the customers full and active users of electricity from the onset.

These barriers to the accelerated and sustained electricity use need to be addressed as a matter of urgency.

- A number of appliances, particularly hotplates, provided with electrification are in state of disrepair and many householders do not have funds to repair them.
- Increased consumption of electricity has led to higher electricity costs and therefore proved to be unaffordable for some households.
- When the new CIS replaced the manual billing system, this created confusion among many households, as it compromised transparency.

The approach adopted by the Pamodzi project could have far-reaching effects in future electrification of other low-income areas in Zambia. The evaluation of this project shows that while the innovative approach holds considerable benefits, there is still scope for improvement if it is to be replicated on a wider scale. The overall management and implementation of the project could be improved by:

- Better project management;
- Improved customer interface and consultation;
- Simplification of payments;
- Investigation and implementation of the prepaid meter option; and
- Introducing appliance maintenance and replacement mechanisms.

The impacts of electrification cannot be sufficiently evaluated within a short space of time.

Therefore, the observations contained in this report should be seen as a progress report. However, this evaluation report can contribute significantly in identifying some possible or potential barriers to project success and the sustainability of electrification initiatives in Zambia.

It is also recommended that the whole electrification programme needs to be evaluated after a longer period to gauge socio-economic and environmental impacts. This evaluation could usefully employ cost-benefit appraisal techniques in assessing the performance of the project.

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1. Introduction

To increase people's access to electricity, the Zambia Electricity Supply Corporation (ZESCO), the Department of Energy and the Stockholm Environment Institute (SEI) implemented a pilot low-cost electrification project in Pamodzi Township, Ndola. The overall objective of the electrification project is to provide a more rapid and sustainable electrification of Zambia's low-income urban areas.

While Zambia has an excess generation capacity of 488 MW available, only 18% of its population has access to electricity (Avidson & Ellegård 1998). The urban households, with a population of 286 000 in three large towns, could benefit from this excess capacity, as 72% of them do not have access to grid electricity (Hibajene 1999). The policy of the government of Zambia, as pronounced in its Energy White Paper, is to electrify most urban households in order to reduce the dependence on charcoal (MEWD 1994). The latest household energy use statistics indicate that about 58% of Zambian households depend on charcoal, with 98% of low-income households depending on it for major domestic uses (Hibajene 1999). This high level of dependence on charcoal has negative impacts on the environment through deforestation, and the health costs (viz. poor indoor and outdoor air quality) are severe. In addition to providing households with a cleaner, more efficient and versatile energy source, the extension of grid electrification to urban households could generate much-needed revenue for ZESCO.

A major reason for the huge backlog in electricity provision to households is the cost of distribution and the reticulation infrastructure. Lessons in Zambia and elsewhere suggest that the electrification costs in outlying areas outweigh the benefits to the utility, as consumption levels in low-income households are too meagre to generate sufficient revenue for the utility.¹ In general, the key constraints to sustained consumption of electricity in low-income areas are low and erratic incomes (which influence the ability to pay), the need for new appliances and poor communication between the utility and residents. The Pamodzi electrification project sought to overcome these challenges through the development and modification of new methods for more cost-effective solutions on both technical and organisational levels. The project brief states that electrification of low-income groups should eventually lead to an improvement in households' living standards and, at the same time, increase the customer base of ZESCO on a sound economic basis.

While this report does not evaluate the technical aspects of the Pamodzi project, it provides only an assessment of the project's main outputs in planning, implementation, management and results, with reference to its objectives. It also assesses future impacts if this approach is replicated in other locations. The main outputs of the project, which are under evaluation, are:

- the electrification of 200 households;
- the provision of electric hotplates stoves and pressing irons;
- community involvement and consultation;
- the training of the local facilitator (LF) and local contact group (LCG);
- the recovery of costs through a deferred scheme of payment and the establishment of the revolving fund; and

¹ This is the case even where tariffs are not constrained by regulatory or Government control. Price structures for electrification customers, designed to recover capital expenditure on electrification, often fail due to low levels of consumption.

- the impacts of electricity on fuel consumption patterns.

In reading the report, the following points should be kept in mind:

- Some impacts of electrification take time to be felt at the household level. In particular, its social impacts are difficult to measure in the short and medium terms. Therefore, the evaluated impacts are the 'results to date'.
- An often-held assumption is that electrification projects provide employment during and after the implementation, particularly through the development of small, medium and macro enterprises. Although this issue is largely excluded from this report, a snapshot view is given of whether households have engaged in income-generating activities because of electrification.
- This evaluation does not provide a formal financial or economic cost benefit analysis of the electrification project. It examines how the financial arrangements work, where problems lie and what could be done to improve the current situation.
- The time-constraints and unavailability of certain key personnel during the evaluation made it difficult to cover some issues to the depth planned. Despite this, it is judged that the information gleaned in a week's visit to Zambia is sufficient to make a detailed and informed project evaluation report.

The rest of the report covers the following aspects. Section 2 details the methodology used in the evaluation. It provides (a) the list of stakeholders that were consulted, (b) the key questions and issues that were explored and (c) the timeframe of the evaluation. Section 3 provides a discussion of the developmental and organisational aspects of the Pamodzi project. It looks at the financial management of the project, community consultation, impacts of electrification on the lifestyles of Pamodzi residents, as well as the benefits of providing households with electrical appliances at the time of electrification, and the barriers to sustained and increased electricity use. Section 4 suggests areas and issues that can be addressed and improved if the project approach is to be adopted as the implementation strategy by ZESCO. The last section summarises the main points discussed and issues deserving further investigation.

2. Methodology

The evaluation methodology closely followed the stated terms of reference provided by the SEI (see Appendix). Relevant project documentation (including project proposal, project documents, contracts, terms of reference, work plans, reports, surveys and reports of previous related projects in Zambia) was reviewed. The review of these documents was followed by in-depth interviews in Zambia with project personnel and other relevant experts and stakeholders. The fieldwork in Zambia included a site visit to view the achievements and carry out interviews with householders and other participants. Key personnel at the SEI and Bioquest were also contacted in writing.

2.1 Stakeholders consulted

While most stakeholder groups were consulted during the evaluation, it was not possible to meet all the key personnel that are directly involved in the project, as the evaluation visit coincided with their absence in Lusaka or Ndola. Therefore, some key personnel such as Mr

Simbeya (ZESCO), Mr Sichone (ERB) and Mr Hibajene (MEWD) were not interviewed.²

The personnel consulted and their roles in the project are listed below:

1. ZESCO - Lusaka

- Mr Francis Mwale (Project Leader)
- Mr Charles Mboma (Senior Manager, Distribution Development)

2. Standard Chartered Bank (SCB) - Lusaka

- Mrs Sherry Thole (Senior Manager, Development Institutions & Cash Management)

3. Department of Energy

- Ms Clotilda Mwanza

4. ZESCO (Accounting Department) - Ndola

- Mr Ivor Yambayamba (Chief Accountant)
- Mr Kasemba (Accountant)
- Ms Katongo (Accountant)

5. ZESCO (Billing Department) - Ndola

- Mrs Kalunga (Billings Manager)
- Mr Shimba (Systems Controller)
- Mr Mwila (Billings)

6. Local Facilitator - Pamodzi

- Mrs. Irene Lukupesa

7. Neighbourhood contact group member - Pamodzi

- Ms Charity Mushanko

8. Pamodzi households

Seven households were randomly chosen and visited. Interviews were held with the adult members of the households. In all households except for one, interviews were conducted with the women owners of the dwellings.

- Mr Mukonka
- Mrs Angela Chada
- Mrs Tembo
- Mrs Nkole
- Mrs Kabwe
- Mrs Banda
- Anonymous household

2.2 Key questions explored during the evaluation

Two sets of questions were prepared: one for the key stakeholders and another for the householders in Pamodzi. The interview framework was based broadly on the following topics:

² An effort was made to consult these important stakeholders by phone/mail. In addition, a copy of the draft report was made available to them for comments.

2.2.1 Impacts of electricity on households

- ❑ To what extent do the social circumstances of Pamodzi facilitate the success or otherwise, of the electrification project?
- ❑ What are the immediate impacts of the project at the household level for addressing energy poverty and broadening of household energy options?
- ❑ What mechanisms are put in place to ensure that electricity use (including appliance acquisition) is affordable to all households?
- ❑ Examples elsewhere in the Southern African region suggest a very low uptake of electricity in low-income households. How has the provision of basic electrical appliances increased the consumption of electricity by households (thereby increasing the financial viability for the utility)?

2.2.2 Community involvement and participation

- ❑ How has community participation in the project assisted in the successful implementation of the project?
- ❑ How has the education campaign been handled and how effective has this been?
- ❑ Since the idea of neighbourhood service contact point (or local contact group) is an innovative one, how successful is it in improving service delivery of electricity and its components?
- ❑ What are consumers' responses to the project, the use of the readyboard, and the pricing of electricity?

2.2.3 Project management

- ❑ How has the funding mechanism been managed?
- ❑ What are its current problems?
- ❑ What can be done to improve its functioning?

2.3 Period of evaluation

Below is the summary of the evaluation methodology and schedule. The evaluation (including planning) began on 6 April 1999 through to 14 May 1999.

	METHODOLOGICAL STEPS	MILESTONE DATES	PERSON-DAYS
0.	Project initiation	6 April	
1.	Preparation & review	12 April	5 days
1.1	Review of documentation		
1.2	Preparation of fieldwork		
2.	Interviews	19 April	5 days
2.1	Key stakeholders		
2.2	Pamodzi community		
3.	Production of report	14 May	14 days
3.1	Report preparation		
3.2	Internal review (EDRC)		
3.3	Report submission		

3. The development and organisational aspects of the Pamodzi electrification project

While Zambia currently has excess generation capacity, the majority of urban residents are dependent on charcoal, notably for cooking and space heating. Although Zambia is endowed with abundant natural vegetation in natural forests, continued cutting of trees for energy use will lead to deforestation in the long term. Deforestation would have adverse effects on the environment, such as soil erosion, and could lead to energy insecurity if steps are not taken to control it. As the Chief Accountant of ZESCO (Ndola) puts it:

The use of firewood and charcoal has a negative impact on the environment. If this continues the way it is now, there could be more danger. Even if in monetary terms, there may not be immediate benefits [of the electrification programme], that we will be contributing to the environment is a good enough justification for electrification (Yambayamba 1999).

A carefully executed electrification programme does not only benefit the environment, but also has long-term socio-economic benefits, such as improved energy security, better living conditions, and an enabling environment for small businesses. While electrification has the above developmental benefits, the initial cost required (*viz.* new appliances and connection fees) tend to limit take-up rates and undermine the project's success and sustainability. In low-income residential areas (such as the one in Zambia), this poses a major threat to the economic viability and financial sustainability of electrification (Hibajene 1999).

The key challenge, therefore, is not only to bring electricity infrastructure within easy access of households, but also to ensure that electricity is used in a sustainable manner. Key issues that the development approach, as adopted by the Pamodzi electrification project, addresses are as follows:

- ❑ To overcome the cost barriers of electrification in order to make a programme self-sustainable.
- ❑ To ensure sustainable and increased electricity consumption in the face of cash-flow problems faced by many households.
- ❑ To put in place mechanisms to assist households, which would not normally be able to afford to use electricity, to derive the benefits that it brings.
- ❑ To develop a developmental approach that empowers the community through an emphasis on wider participation and capacity building of first-time electricity users.
- ❑ To transform energy-use patterns, from relying on charcoal to electricity use.

This section addresses the above issues by assessing (a) the financial management of the project, (b) community participation and customer interface, (c) the impacts of electricity in domestic energy use patterns, and (d) the impacts of provision of basic appliances (cookers and pressing irons) on household consumption of electricity. These issues are looked at in terms of how current arrangements work, where the problems and barriers lie, and what can be done to improve them.

3.1 The financial management of the Pamodzi project

The Ministry of Energy and Water Development (MEWD) recognises that the conventional approach to electrification makes it difficult for many urban households to gain access to electricity (Hibajene 1999). Connection costs, home wiring, appliances and taxes make

electricity unaffordable for a large proportion of households. In addition, increasing economic insecurity and escalating inflation levels in Zambia, as well as the 'poor financial status of the utility' act as further barriers to the sustained use of electricity (Arvidson & Ellegård 1998). Moreover, electricity has to compete with other energy sources, such as charcoal, candles and kerosene (Arvidson & Ellegård 1999). Consequently, even after households have been connected to the grid, the average electricity consumption is unlikely to reach a level sufficient for the utility to recover the costs of electrification. This is not unique to Zambia. Other utilities in the southern African region face similar challenges.

3.1.1 The management and operation of the deferred-payment revolving fund

The Pamodzi project was conceived to address the questions of high connection fees and problems relating to appliance acquisition. By providing households with appliances (cooker and pressing iron) upon connection, the initiative aimed to facilitate the use of electricity beyond lighting. This was expected to benefit both the utility (through increased electricity sales) and households (the convenience and benefits of using electricity).

The Pamodzi project adopted a deferred repayment system for connection fees and appliances (a cooker and an iron). This is advantageous for mainly two reasons. Firstly, customers are able to get electricity (a two-plate cooker and a pressing iron) in an affordable manner. Secondly, the utility is able to receive customers that would not be electrified if a conventional approach was adopted. The market survey conducted in 1994 established that about 70% of the surveyed households could afford a down payment of ZMK 135 000 (about 25% of the total capital costs). The remainder of the capital cost (ZMK 340 000) would be repaid in fixed monthly instalments of ZMK 9 267 over a period of five years (an effective interest rate of 23.5% p.a.) (ZESCO 1997; Arvidson & Ellegård 1998).

These repayments received by ZESCO would then be used to repay ZESCO's debt to the revolving fund, which is managed by Standard Chartered Bank. The fund has a board, which determines future use of the fund, presumably for other electrification projects.

While ZESCO takes the risk of repaying the loan, the sustainability of the system is ultimately dependent on customers making payments on their contracts with ZESCO.

The existence of the revolving fund, if managed and implemented effectively, has the potential to contribute towards a self-sustainable electrification programme. While the system of contracts adopted for Pamodzi initially worked well, recent developments threaten the sustainability of the mechanism.

It is difficult to know how the revolving fund works now because it has just been established.... Expanding the customer base is Zesco's priority, where you have other people [customers] providing a source of capital is a good thing. In the past, whatever we received from our customers was pooled to our general resources. Now we have something that will go towards the expansion of our customer base. If you want to expand a customer base, you need a special fund for it. It is a good thing to have [a revolving fund] (Yambayamba 1999).

As Mr Mwale (ZESCO) and Mrs Thole (SCB) noted, 'the revolving fund *can* [their emphasis] work, if it is sufficiently supported'. Initially the contract system was (said to be) working excellently and the repayment schedule in its early period shows that the customers were making regular payments. Lately, however, there have been problems with payment of the capital cost portion of customer's bills with a number of outstanding payments, where the customers do not honour their contract with ZESCO (Mwale 1999; Kalunga 1999).

While ZESCO payments to Standard & Chartered Bank are not contractually linked to customer payments to ZESCO, Mrs Thole of Standard Chartered Bank observed that 'at present, the revolving fund is not working too well ... the money [from ZESCO to the bank] does not come consistently on due dates and has fallen behind'.

As it is, it appears that the funding mechanism, which is one of the two defining characteristics of the project (the other is community participation) is not functioning according to expectations. For the project to be replicated, it is important that the underlying causes of non-payment need to be addressed.

The wider economic well being of Zambia, particularly the high and fluctuating inflation rates, has implications for sustained payment of electricity bills. High inflation means that prices of other household commodities increase substantially without a corresponding increase in household incomes. Faced with dwindling disposable income, householders are likely to prioritise expenditure on household needs. As shown in Section 3.3 below, the payment of electricity, particularly the capital cost repayments, has moved down the priority list of some households in Pamodzi. A household would rather pay the consumption and not the capital costs. The implications of this for the electrification project are further illustrated below.

Inflation has other impacts on the performance on the fund mechanism. Firstly, given the fixed payment system, household's contributions to ZESCO actually decrease in real terms over time. If currency depreciation is matched to inflation differentials, then ZESCO will find that payments from customers are inadequate to cover its loan commitments. Since ZESCO takes the currency risk, it will have to draw on additional resources to cover its commitments. On the other hand, if inflation is matched by some increase in household income, this would tend to make the repayments more affordable. As noted above, this effect has not been significant to date partly because in the time since electrification, increases in consumer prices have not, in general, been matched by household income.

Non-compliance with the terms of the contract has other important implications to the working of the funding mechanism and electrification in general. Firstly, some households interviewed during the evaluation period had outstanding bills brought over from previous months. It appears that because all the customers are using a credit meter system (where they are billed after consumption rather than before), they do not keep track of their consumption nor do they pay attention to the efficient use of electricity. Experience in other southern African countries suggests that credit metering is not suitable for low-income households, taking into consideration their cash-flow problems. Low-income households tend to consume more electricity than they can afford. This is one of the main reasons that prepaid-metering technology has been introduced in electrification projects elsewhere.

A second problem that affects the efficacy of the ZESCO's collection of payments is the issue around the payment of two separate bills (see also Section 3.4.3 below). When the project started, the billing was transparent, in that it showed both the consumption and capital costs.

There is a problem as far as the [current] billing is concerned. At first, we were preparing manual bills, where the capital contribution was indicated, until we moved to a new CIS system. I do not think the computer has that provision [to show the costs separately]. I am not sure if the customers understand this (Mwale 1999).

Currently, the customers are not billed for the capital cost, as it is assumed that they will pay in accordance with the terms of their contract, without explicit reminders. However, as

Mr Mboma (ZESCO) observed, 'the human mind is that if you do not show the bill, [customers] will not pay ... you need to remind people all the time; you cannot rely solely on a contract'.

The third reason for the escalation of non-payment is the lackadaisical attitude of ZESCO staff in enforcing the terms of contract. This would create a situation where ZESCO has to generate funds from its other operations in order to make their payments to the revolving fund. The contract, however, clearly states that non-payment of electricity bills would be punished by disconnection. To date, not a single defaulting household in the Pamodzi project has been disconnected, even though some have not been paying for months (see Section 3.3). One of the reasons that make it difficult for ZESCO to disconnect defaulters is that there is lack of capacity within the utility to deal with this. Mr Mwale (ZESCO) observed that:

This means that you need a special crew here that is going to do the disconnection and going back to reconnect [after payment]. If we are able to press ... if someone is used to electricity for quite some time and you switch him off, at least he is going to look for some money and come to pay. The problem is that we have not carried out the terms of the contract yet. More so at my side, as I have other projects that I am also doing.

The failure to act against defaulters creates a situation where a household accumulates debts (consumption and capital costs) which reach a point where it becomes impossible to repay without an especially negotiated debt repayment plan. Nevertheless, it should be noted that payment levels in Pamodzi have, on average, been significantly higher than in other areas (see Table 3.3 below).

3.1.2 How to strengthen the financial management of the project

Having mentioned all the above problems regarding the collection of repayments, it would be *wrong* to suggest that the approach is a failure. As Mrs Thole (SCB) noted, the benefits of the funding system are far-reaching. The current account of the fund 'is healthy, never goes into debit and only earns interest'. According to the ZESCO accounting department, the account has some ZMK 14.5 million compared to the capital costs in Pamodzi of about ZMK 190 million (Yambayamba 1999). While it is too early to announce the obituary of the fund system, it is imperative that steps be taken to improve its management and operation.

In summary, the key issues to address are:

- Improved billing services to customers, with explicit billing of the capital repayment element of the tariffs;
- The possible use of prepayment meters to prevent households building up excessive debts to the utility (see Section 4.5 below);
- Enforcement of disconnection where capital payments are not made, possibly in conjunction with "life-line" supplies for small amounts of electricity use;³
- Improved reporting procedures so that late payers can be quickly identified and contacted;

³ Electronic prepayment meters can be configured to provide a certain amount of electricity free or at low charge. When this runs out, households must purchase a new prepayment card/number or the meter will not allow any further consumption.

- Extension of the role of the local facilitator to include follow-up of customers who struggle and devise emergency solutions.
- As the utility takes the risk when customers do not pay, there is a need for it to become more proactive in detecting incidences of non-payment and act quickly to contain them.
- A proactive approach to allow households currently behind in payments to catch up without imposing excessive strains on the household budget (i.e. extending the repayment period for these cases).

3.2 Community involvement and participation

The successes and failures of development initiatives often depend largely on the level of community participation in the development process. The benefits of a participatory approach to developmental projects are widely documented (see for example, Akon'ga 1991; Swantz & Vainio-Matilla 1988; Chitere & Mutiso 1991). However, community participation or involvement has been found costly in terms of time and financial resources. For instance, the Pamodzi project took longer to implement (and therefore became more costly) than conventional approaches to electrification. Nevertheless, examples elsewhere point to the fact that the long-term benefits of constructive community participation outweigh immediate financial costs.

3.2.1 The roles of local facilitator and neighbourhood contact group

One of the most important aspects of the Pamodzi project has been the extent to which it has built the capacity of people who never had access to electricity before. An important element has been the presence of a local facilitator and the establishment of neighbourhood contact group.

The important roles that the local facilitator and LCG play is to monitor the use of electricity and appliances; keep 'complaint book' to report to the project leader and contact local ZESCO office for necessary service and repairs of the meters and readyboards (Arvidson & Ellegård 1998).

The strategy adopted has a number of notable advantages:

- The local facilitator and the LCG are within reach of customers and are strategically located to make customer interface less cumbersome.
- There is a gender balance (two men and five women).
- Members are carefully selected based on their literacy level and ability to communicate effectively with customers.
- Members of the LCG identify closely with project beneficiaries since they are also beneficiaries in their own right.
- The LCG are trained in simple maintenance and supervision tasks and act as a link between ZESCO and communities.
- Lastly, the LCG provide ZESCO with an up-to-date assessment of the project through monitoring and reporting the progress of the project.

The lessons from this participatory approach, according to ZESCO officials, have been used in other electrification projects. Notwithstanding these notable successes, the approach to community participation can be further improved.

3.2.2 Challenges that still need to be overcome

Community consultation still needs to be improved through better communication between the project leader and the LCG, and among the stakeholders including the target community. This can be done in two ways.

Firstly, the LCG needs to be updated constantly about changes in the project. Although the LCG links the project to the target community, some new policy directions or changes have not always been properly communicated to the group. For instance, the LCG could not explain the new billing system to the customers, resulting in considerable confusion. One of the causes of reduced capital cost repayments was that the change from the old to the new billing system was not properly communicated to the LCG. When customers approached the local facilitator and LCG for information and explanations, they could not get adequate responses. Ms Mushanko, an LCG member said:

Most of the customers we deal with are not literate and therefore need to be informed in good time of changes. Those who understand continued to pay their bills, but those who did not understand the situation were very angry and could not trust us. Some wanted to withdraw from the project, but it was too late as they had signed the contract. Although ZESCO sorted out the confusion later, the situation we are sitting with now results from that event.

A second way of communicating with customers – which complements the household visits by the LCG – would be to hold public meetings and workshops to inform people and discuss project developments. The implications of such an approach are discussed further in Section 4.2.

3.3 Impacts of the Pamodzi project on households

This report does not contain a detailed evaluation of the social or developmental impacts of electricity in Pamodzi. The social impacts of electricity are difficult to measure within two years of electrification. Some observable effects are, however, starting to emerge. As many households have access to an additional clean and convenient energy source, there are reported decreases in the use of other energy sources, particularly kerosene, candles and charcoal (Arvidson & Ellegård 1998). The impacts of electrification on the environment and on health are also difficult to measure in such a short period.

The general lifestyle of Pamodzi residents has improved significantly. All seven households visited have televisions and one or more other appliances (other than the hotplates and irons), such as refrigerators, music systems and electric fans. The importance of access to television for educational and entertainment purposes for household members is widely documented.

Although there was little evidence of accelerated development of micro-business ventures resulting from electrification in Pamodzi, the potential for this does exist. With the passage of time, people are expected to exploit this new energy source and start up small businesses.

Mrs Chada, one of the interviewed household owners, has expanded her hairdressing business. While she used to depend solely on the sun to dry people's hair, she is now able to use electricity. It is faster and therefore has doubled the size of her business.

Particular areas of interest that this investigation explored concern effects on household expenditure, the benefits of electricity use for cooking and lighting, and the effects of the participatory approach adopted. These are discussed in more detail below.

3.3.1 Impacts on household fuel expenditure

It appears that electricity has not had dramatic impacts on household fuel expenditure, mainly because it is used in conjunction with other energy sources. A pre-electrification survey in Pamodzi showed that households spent an average of ZMK 8 958 on fuels (Table 3.1) – 8% of the average household income in Pamodzi of US\$116 (about ZMK 110 116).

Mean monthly expenditure on firewood	ZMK 196
Mean monthly expenditure on paraffin	ZMK 1 341
Mean monthly expenditure on charcoal	ZMK 7 209
Mean monthly expenditure on other fuels	ZMK 1 843
Mean monthly expenditure on all fuels	ZMK 8 958

Table 3.1: The mean monthly expenditure in the households on different fuels
Source: Market Survey (1995)

Because of high inflation, the above figures do not reflect the current situation, which could be double the above figures. Mrs Banda's consumption of electricity costs her between ZMK 20 000 and ZMK 30 000 per month (compared with a community average of ZMK 10 000 – Mwale 1999). She also buys two bags of charcoal, which costs ZMK 8 000 per month.

The situation in the Mushanko household suggests a marginal decrease in energy expenditure resulting from access to electricity. Ms Mushanko is a project beneficiary as well as a member of the LCG. Before she used electricity, her monthly fuel expenditure was as follows: she used to spend ZMK 16 000 for four bags of charcoal; ZMK 2 000 for 2.5 litres of kerosene; ZMK 18 000 for four packets of candles (six candles in each packet) and ZMK 4 000 for a car battery recharge. Her total household fuel expenditure was ZMK 40 000 per month. After her household was electrified, the fuel expenditure was as follows: ZMK 20 000 for electricity bill; ZMK 9 267 for the capital cost repayment, ZMK 4 000 for one bag of charcoal and ZMK 4 500 for a packet of candles (mainly used to make floor polish). The average monthly expenditure after electrification is therefore 37 767 – a 4% reduction. Ms Mushanko recognised that electricity has resulted in other non-financial and non-quantifiable benefits for her household. They can watch television for unlimited hours, get warm water at any time without having to make a charcoal fire and do not have to spend more time rekindling fire for cooking in the evening.

Table 3.2 shows that, on average, households now use significantly less kerosene, wood and charcoal although candle use has ironically increased.⁴ Whether this has resulted in financial savings for users is difficult to determine from the limited fieldwork conducted. Given that the capital cost component of electricity bills effectively doubles the unit price paid, it is highly likely that the financial savings, if they exist, are small.

3.3.2 The benefits for lighting and cooking

According to a post-electrification study undertaken by the SEI, the energy use patterns in electrified households in Pamodzi has changed dramatically after electrification (Table 3.2).

Charcoal consumption has gone down to less than half of what it used to be, but the majority of households are still using it to some extent (Arvidson & Ellegård: 1998).

⁴ Experience elsewhere indicates that while households often continue to use candles after electrification (for blackouts and for rooms without wiring), the quantity of candles used decreases.

	Before connection (1995)	After connection (1997)
Households using kerosene (%)	97	50
Households using candles (%)	11	80
Households using wood (%)	37	5
Household using charcoal (%)	100	85
Charcoal bags ⁵ per month (average)	2.3	1

Table 3.2: Energy use and charcoal consumption in before and after electricity connection in Pamodzi
 Source: Arvidson & Ellegård 1998)

The study also notes that charcoal is still widely used for space heating and heating large amounts of water for washing. Kerosene use (mostly for illumination) has been reduced substantially, while use of candles has increased (it should be noted that candles are often used for making floor polish rather than lighting).

Though there are observable changes in fuel-use patterns because of electrification, these changes can be reversible. For household applications that use less energy and cheaper appliances, such as lighting, electricity easily replaces other fuels. Lessons from similar electrification projects elsewhere in the region suggest that electricity is commonly used in conjunction with other fuels for energy-intensive activities such as cooking, space and water heating (White et al 1997; Eberhard & Van Horen 1995). The use of electricity for cooking and ironing in Pamodzi was made possible by the provision of appliances for these uses. As noted below (see Section 3.4), however, when these appliances are damaged, households revert to their old patterns of fuel use.

3.3.3 The Pamodzi approach vs. the conventional approach

The Pamodzi electrification project is different to the conventional approach of electrification in the sense that it was designed with a view to make the customers full and active users of electricity from the onset. In other settlements, customers are required to buy all electrical appliances from retailers. Arvidson & Ellegård (1998) note that this constrained appliance acquisition and forced households to prioritise their expenditure on appliances carefully. As a result, electricity consumption in Twapia is less than half of that in Pamodzi.

Since accelerated electricity consumption is directly linked to investment in appropriate appliances, it usually takes a period of five years for electricity use to stabilise in low-income contexts (Africa et al 1997). As Arvidson and Ellegård (1998) note, 'households that have been electrified through the project will be able to start using electricity for conducting everyday tasks in general at a much earlier stage than the households that were connected wholesale' (see also Table 3.3).

⁵ A charcoal bag is a reused 90-kg grain bag. In the Copperbelt, the content of each bag is around 50kg, while in Lusaka it is 40kg.

	Pamodzi	Twapia
Electricity consumption kWh/month	206	87
Connection fee paid (ZMK average)	143 000	9 250
Has received bills (%)	77	22
Has paid bills (%)	98	13

Table 3.3: Electricity consumption and payment of bills in the project households (Pamodzi) and non-project households (Twapia)
Source: Arvidson & Ellegård (1998)

The benefits of the Pamodzi approach are two-pronged: firstly the households are able to experience the benefits of electricity, other than for just lighting and entertainment at an earlier stage than households that received electricity in the conventional way. Secondly, the utility benefits from increased electricity use, which is facilitated by the presence of energy-intensive appliances, and make electrification of low-income households financially viable (Arvidson & Ellegård 1998). Although the Pamodzi approach is comparatively better than the conventional approach, there remain barriers towards sustainable electricity use that still need to be addressed

3.4 Barriers to sustainable electricity use

Although electricity has generated benefits for many households in Pamodzi, it is also important to mention that for the impacts of electrification to remain sustainable, there is a need to address barriers to continued and expanded use of electricity. A failure to address these barriers may result in households reverting to previous old patterns of fuel use, as evidenced in some households (see below).

3.4.1 Appliance problems

An innovative aspect of the Pamodzi project was the introduction of basic appliances with electricity. This facilitated increased consumption of electricity and helped households to realise the benefits of electricity beyond the advantages of electrical lighting. However, in view of the high initial costs of financing electric appliances and the current economic situation of many households, many households will find it difficult to sustain electricity use. Some of the households visited during the evaluation week had not invested in appliances other than a television and the provided cookers and irons. Mrs Phiri still uses the charcoal brazier for some of her household cooking needs. She does not have sufficient disposable income to buy an additional stove necessary for these tasks. Moreover, one of the plates of the cooker she was provided with is not functioning.

A number of cookers are in state of disrepair and many householders do not have funds to repair them. Mrs Tembo, a teacher at a local private school (her spouse is a bank clerk) has not been using her electric stove since the beginning of 1999 because it broke down, and depends on charcoal brazier for cooking. She has not been able to repair nor replace the stove. She commented:

Life was easier when we had a stove. I would come home from work and not worry about the cooking as I would just switch on the stove and do my cooking. Now life is difficult, especially with the small baby. We cook on the brazier again ... and it is even difficult in the morning. We cannot buy another stove because the money we earn is not enough. We have so many responsibilities.

As the evaluation was underway, ZESCO was conducting an audit of stoves and irons. The findings of this audit will provide essential information about how many appliances are in use and the number of customers that have reverted to charcoal for cooking. Appliance problems, particularly maintenance and replacement cost, are linked to households' ability to pay and the accessibility of repair workshops. As seen below, the limited ability to pay is exhibited in the emerging patterns of electricity payment.

3.4.2 Cost of consumption

Increased consumption of electricity leads to higher electricity costs and therefore makes it unaffordable for many low-income households. Electricity payments compete with other household basic needs. In listing her monthly expenditure priorities, Mrs Tembo did not mention payment of electricity as a major priority. She said:

At the end of each month, a large slice of our income – which is ZMK 40 000 – goes to my husband's parents for their maintenance. The other significant portions go to food, education, medical expenses, clothing and charcoal [her electric stove is not in working order]. There is not enough money remaining to pay for electricity.

Mrs Tembo owes ZESCO ZMK 149 000 in arrears. The last time she paid was in January 1999. Even then, she paid only ZMK 30 000, which was less than a quarter of the money she owed since October 1998, the last date she made payment. She has been threatened with disconnection a number of times. 'Everyday when I come from work I pray that I do not come home to find my house without electricity'. Her main concern is that when she is disconnected, the food in the refrigerator would be spoiled.

I only use electricity for lighting and television. I can live without electricity for lighting but I need it for the fridge. I buy food and milk in bulk and store in the fridge. This is my only worry.

Mrs Nkole, whose husband is a deputy headmaster in a local primary school, is also in arrears. The household's February bill showed that ZMK 195 000 is owed to ZESCO. At present, this household is doing nothing to settle the bill and Mrs Nkole is adamant that they cannot settle the amount in full. In the meantime, she continues to use electricity without paying for it. She claims that she is not alone in this, as other household she knows are also not paying for their electricity consumption.

The Kabwe household owes ZESCO ZMK 343 848 in unpaid bills. Mr Kabwe is the only income-earner in this household of seven. When money becomes available, most of it is used to buy mealie-meal and repay credit from shops. Mrs Kabwe did not recall the last time the payment was made, but she reckoned that her husband last paid 'sometime last year and once this year'. The billing department in Ndola attested to this growing non-payment of electricity consumption. According to its status report for February 1999, most customers were in arrears - the lowest figure being ZMK 8 000 and the highest ZMK 690 000. None of the defaulting customers (at least in the Pamodzi Project) have been disconnected.

The inability of to pay for the consumption of electricity has significant implications both for ZESCO and the households. When households find it difficult to pay bills, it becomes even more difficult for them to pay the capital cost. Most of the interviewed households admitted that they do not even think of paying the capital charge. If they could manage to pay anything, the energy bill is the first priority.

3.4.3 Problems with the billing

When the CIS replaced the manual billing system, this created confusion among many households. The customers were used to seeing the fixed amount of capital together with the monthly consumption costs in their bills, but the new billing system shows only consumption cost. Although households are required to make separate payments for the capital cost, they are not billed for this. Apparently, this created confusion amongst households, as the change of policy was not sufficiently communicated to them (see Section 3.2.2).

Moreover, some households claimed that the billing was not consistent. Bills would arrive after the month-end when the income has been spent. Other customers complained that bills used to come after three months. Although it is recognised that there are problems in ZESCO's billing system, it is also apparent that the *defaulting householders are using this as a pretext for non-payment*.

4. Replicability of the project and suggestions for improvements

The approach adopted by the Pamodzi project could have far-reaching effects in future electrification of other low-income areas in Zambia. The evaluation of this project shows that while the innovative approach holds considerable benefits, there is still scope for improvement if it is to be replicated on a wider scale. It is clear from the interviews with stakeholders during the evaluation period that the overall management and implementation of the project could be improved.

4.1 Project management

Some of the problems that cropped up during the project could have been avoided, if there was a special project management team in existence (Mwale 1999). It appears that currently there is a shortage of a critical mass in the project, as Mr Mwale pointed out: 'For example, regarding the Pamodzi revolving fund, I am the only one at ZESCO who is pushing for it to work.' One recommendation is that in future projects, a dedicated management team should be established at the planning stage. This team should consist of various ZESCO departments, particularly those for marketing, accounting and billing.

A strong multi-layered management team militates against the occurrence of problems of continuity when one member leaves ZESCO or current portfolio. The current situation is that: 'No one will be there for the duration of the project, and if [the senior manager of the project] leaves, he goes with the information. [Lack of continuity of personnel] has had negative impacts on the project. These are internal constraints within the system which affects the project goals' (Mwale 1999).

4.2 Customer interface and consultation

A major positive aspect of the Pamodzi project has been its emphasis on customer involvement in implementation. While this emphasis may be time-consuming and costly, its long-term economic impacts could be positive. As Mr Mboma and Mr Yambayamba (both of ZESCO) attested, 'it is not in ZESCO's best interests to emphasise electrification targets without sensitising new customers.' They also recognise that the emphasis on consumer education and awareness may slow the progress of the project but as Mr Mboma pointed out, 'we are looking at the long-term benefits. We may not get quick returns now, but after

a longer period, we will start realising them. Most of these people have never used electricity before'.

Although the Pamodzi project has placed the customers at the centre of its focus, there is a need for refining the approach. Firstly, there is a need to involve further the LCG in the project. Since the members of LCG live within the community, they need to be informed about latest developments of the project, especially in matters relating to changes in billing.

Mr Mboma (ZESCO) agreed that:

It is also one of the areas that we definitely need to improve on. Although we have appointed these facilitators, if we make a policy change, they need to be informed so that they can explain this to the people. They are an important part of the [development] chain as they are the in-betweens ... between the customers and us. To involve them is also cost-effective, as we do not have to hire people, or over-stretch our staff to deal with the issues they are dealing with. The facilitators are not yet part of our operations. If we make certain policies changes and we do not inform them, they could be embarrassed. This is one of the things that we are going to look at.

One of the ways of dealing with information dissemination is for ZESCO to facilitate periodic (or whenever it is necessary) workshops of LCG and the local facilitators where latest information and experiences can be shared.

Secondly, there is a need to combine the one-to-one approach of LCGs with community meetings before and after the electrification project. This is an important way of dealing with issues such as non-payment, and of a way of appealing to a 'collective consciousness' in the community. Mrs Tembo, a customer interviewed during the evaluation, agrees that people need to be reminded of the drawbacks of non-compliance with the project contract. They should be informed as a group of the advantages and impacts of non-payment in the sustainability of the project.

Thirdly, the option of paying electricity bills within a walking distance should be investigated. At present, the customers pay their electricity in the city, which is more than 10km away. Some of the customers interviewed see this as an inconvenience as they need to travel to town only on weekdays when they need to make payments. If there is a local pay-centre that is within community reach, the customers will be encouraged to make regular payments.

4.3 Simplification of payments

A further problem, which encourages customers to default, is that they pay two separate bills. Consequently, 'It is too much to expect a customer to pay for capital cost today and consumption tomorrow' (Mwanza 1999). There is an urgent need for ZESCO to recover the unpaid bills from customers to sustain the project. Failure to move quickly may result in the non-payment situation getting out of hand.

While other forms of billing (such as prepaid metering) are investigated, ZESCO should devise a short-term strategy for cost recovery. In discussion with ZESCO's [billing] system controller, Mr Shimba, it appeared that it is possible to build the capital cost component into the overall monthly bill. The combination of these two separate bills will enable customers to understand their bills and ensure that capital cost repayments are made. There may be administrative costs to this plan, but the benefits will certainly outweigh these.

4.4 Prepaid meter option

Examples elsewhere, particularly in South Africa, show that a credit metering system encourages use of electricity beyond people's ability to pay, resulting in high levels of non-payment (Mehlwana 1998). For example, an outside electric light in Mrs Tembo's house is always switched on (even during the day). This is despite the fact that Mrs Tembo is struggling to pay the consumption bill. There are also indications in Pamodzi that non-payment of electricity is becoming increasingly commonplace. Households consume more electricity than they can afford to pay at the end of the month. Coupled with the indifference of ZESCO in enforcing payments, consumers end up with accumulated bills far beyond their ability to pay. Faced with an impossibly high debt, electricity repayments move down the priority lists of many households. At the same time, households continue to consume electricity to such an extent that debt levels simply increase further. The long-term implication of this scenario is that the cost of supplying electricity increases, and this ultimately has an impact on the financial status of ZESCO.

In South Africa's extensive electrification programme, the prepayment meter was introduced to counter problem of non-payment. Prepaid metering system does not only protect the interests of the supply utility; it also assists the households in controlling their debt levels. It allows customers to carefully monitor their electricity use and budget their energy expenditure. Despite its advantages, the prepaid meter option limits the uptake of electricity. Since customers pay for the costs of use up-front, and given that there is generally little disposable income, householders often revert to other fuels (e.g. charcoal) when they are not able to buy electricity. It appears that ZESCO initially considered this approach:

Originally before we started, we considered the prepayment meters, but the question was the funds to set up this facility. ZESCO has considered this option for some time now, but is scared of the initial costs. Maybe the other reason that we did not go for the prepaid meter was that the scope was already set. It was the investigation of the readyboard technology and the money that was released was regarding this. If we had to change, we have to ask for more money (Mwale 1999).

Nevertheless, it is clear that ZESCO is moving towards the adoption of prepayment meters, not only for low-income customers, but also for medium-income households and business enterprises. Mr Mboma articulated the policy direction of ZESCO with respect to the introduction of prepayment meter:

We are definitely going in that direction. We would not, however, go into that now, because we still have problems with our billing. We have lot of customers complaining about their bills. First, we need to bring our bills up-to-date. Having achieved that, we are then going for the prepayment meters.

4.5 Appliance maintenance and replacement mechanisms

Ownership of appropriate electrical appliances facilitates optimum use of electricity, particularly for energy-intensive applications such as cooking, heating water and space heating. While the Pamodzi project has provided customers with electric cookers and a pressing iron to kick-start accelerated electricity consumption, maintenance and replacement mechanisms have not been considered. Out of the seven households visited during evaluation, four were either not using their stoves, or used only one burner because of faults. Mrs Tembo's example cited above is a case in point. It seems that a major reason

for damage is that the metal rings cannot withstand the weight of the cooking utensils (a solid-plate rather than spiral-plate stove will help address this problem). The faulty stoves are generally not taken for repairs because to do so is very costly and most households cannot afford repairs. This situation is not tenable, as Mr Mboma [ZESCO] commented:

This is a very good observation because ... we have given these people stoves and they break down. As it is the first time for many to use these, when they break they do not have the money and do not know where to take the stove. We might have to look at this and see what recommendations you can come up with. In as much as we like to help them, we do not know what to give away everything to the customers. We need to change the mind of those people to regard these as necessities. We might have to look at how we can help them.

The initial step in addressing this problem is to undertake a snapshot survey of appliance use to determine the number of appliances that are not used and the problems or barriers that contribute to people not repairing them. At the time of evaluation, ZESCO and the LCGs were undertaking such a survey.

Secondly, together with the private sector, ZESCO should assist in establishing repair shops within reach of the community. This will benefit the community in two ways: firstly, it will bring an additional source of income for the locals that will be employed in these workshops; secondly, they will be within easy access of many customers and may charge less for the services. According to Mr Mboma, ZESCO has the capacity to set up these ventures. 'We can even talk to one of the companies in Ndola and teach people those simple things such as replacing the wiring [metal rings].'

Lastly, before ZESCO supplies appliances to households, it needs to test them for durability and quality. For instance, the hotplates that are currently in use are not suited to heavy and frequent cooking. The hotplates are used three to five times a day and heavy pots are often placed on the plates. This causes strains and leads to damage. The option of the introduction of solid plates should be investigated as they are usually more durable.

5. Conclusion and key recommendations

It must be emphasised that the impacts of electrification cannot be sufficiently evaluated within a short space of time. Therefore, the observations contained in this report should be seen as a progress report. However, this evaluation can contribute in identifying some possible or potential barriers to project success and the sustainability of electrification initiatives in Zambia.

In this light, the Pamodzi pilot project contains important lessons for stakeholders and policy makers on the provision of electricity to low-income customers. It is also encouraging that some of these lessons have already been applied in ZESCO's other electrification projects. As in any other pilot project, mistakes and oversights are bound to be made. It is in ZESCO's interests to learn from these mistakes and move forward. The report has provided some tentative suggestions regarding how to improve the current electrification project.

Based on the above assessment on the results of the Pamodzi electrification project, the following recommendations are in order:

- Improve the billing system while ensuring simplicity and transparency.

- Enforce the contract (i.e. quick and swift follow-up of defaulting and disconnection if necessary)
- Strengthening the management and reporting of the project by establishing a multi-layered management team. At least two representatives from various and relevant Zesco departments should form this teams. This guarantees continuity should one team members leaves Zesco or his or her current portfolio.
- The extension of the roles of the local facilitator and LCG to be more proactive in debt recollection (in the follow-ups of defaulting customers and establishment of local pay points) and better communication LCG/ZESCO communication.
- Investigate the use of prepayment meters for customers who consistently default on payments.
- Restructure debt repayment plan, so that customers should not accumulate more debt that they cannot afford to pay.
- Investigate the option of poverty 'tariffs' (and technology that can make this possible) for the more poor households who want to have access to electricity (see Footnote 3).
- Investigate means of involving the business sector's input in the project (such as manufacture and dissemination of appliances) and to build local capacity in appliance maintenance and repairs.

It should be stressed that the financial viability of electrification, and indeed ZESCO itself, depends on the establishment of a functioning cost-recovery pricing and billing system. Current arrangements in Pamodzi are showing worrying signs that, if left unchecked, will undermine the success Pamodzi and electrification in Zambia.

It is also recommended that the whole electrification programme needs to be evaluated after a longer period to gauge socio-economic and environmental impacts. This evaluation could usefully employ cost-benefit appraisal techniques in assessing the performance of the project.

6. References

- Africa M, A Gulati A & D Everatt 1997. Then there was light: a study into the impacts of electrification in Benoni, Etwatwa. CASE: Johannesburg.
- Akon'ga J 1991. Participatory-action research in the development process. In O Chitere and R Mutiso (Eds.) *Working with rural communities: a participatory action research in Kenya*. Nairobi: Nairobi University Press.
- Arvidson A & A Ellegård 1998. Electrification of low-income households in developing countries: experiences from a pilot project in Ndola, Zambia. *Renewable Energy for Development*, 11(2).
- Chitere O & R Mutiso (eds.) 1991. Working with rural communities: a participatory action research in Kenya. Nairobi: Nairobi University Press.
- Eberhard A & C Van Horen 1995. Poverty and power: energy and the South African state. London: Pluto.
- Hibajene S 1999. Low cost electrification. Ministry of Energy and Water Development: Zambia.
- Mehlwana M 1998. The politics of non-co-operation with service providers: exploring stereotypes in electricity delivery in South Africa. Paper prepared for the SARPA 1998 Revenue Protection Conference, 30-31 July, Johannesburg.
- Market Survey 1996. Low-cost electrification in urban areas of Zambia. Draft report.
- Swantz M-L & A Vainio-Mattila 1988. Participatory inquiry as an instrument of grassroots development. In P Reason (ed.) *Human inquiry in action: development in new paradigm research*. London: Sage Publication Ltd.
- White, C, Bank, L, Jones, S & Mehlwana, M 1997. Restricted electricity among poor urban households. *Development Southern Africa*, 14(3): 413-423.
- Zambian Electricity Supply Commission (ZESCO) 1999. The implementation of the Pamodzi pilot electrification project. Engineering Directorate. Lusaka, Zambia.