2011:6 Sida Review

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Final Report

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The views and interpretations expressed in this report are those of the authors and do not necessarily reflect those of the Swedish International Development Cooperation Agency, Sida.

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Acronyms

ADMD	After diversity maximum demand
ERB	Energy Regulation Board of Zambia
GRZ	Government of the Republic of Zambia
IAES	Increased access to electricity services
M&E	Monitoring and evaluation
MTR	Mid-term Evaluation and Review
REA	Rural Electrification Authority
REF	Rural Electrification Fund
REMP	Rural Electrification Master Plan
RGC	Rural Growth Centre
SHS	Solar home system
Sida	Swedish International Development Cooperation Agency
SNDP	Sixth National Development Plan
SPP	Small power producer
SSA	Sub-Saharan Africa
SSMP	Sustainable solar market packages
TA	Technical assistance
TOR	Terms of reference
USD	United States dollar
ZESCO	Zambia Electricity Supply Corporation Limited
ZMK	Zambian kwacha
ZPPA	Zambia Public Procurement Authority

1. Executive summary

The Mid-term Review and Evaluation of the Swedish and Dutch Support to the Rural Electrification Programme in Zambia was undertaken in the month of September 2011. Its objective was to assess progress and advise if there is any need for adjustment in the ongoing cooperation between Sweden, the Netherlands and Zambia in the implementation of the latter's rural electrification programme, specifically Swedish and Dutch support to Zambia's Rural Electrification Agency (REA) and the Rural Electrification Fund (REF).

At the policy and institutional levels, with regard to its overall procedures and coordination mechanisms, the following were the key issues identified with corresponding observations:

- The Rural Electrification Master Plan was not an implementable plan in its current form, given REA's capacity and resources. While it gave a comprehensive view of the ideal progress and resources required to achieve a rural electrification rate of 50.6% by 2030, its role is to serve as a guide, which needed to be adapted according to the situation on the ground.
- Three years after the Assessment Memorandum was produced, a number of assumptions made hold valid, while a number of others do not do so.
- The current monitoring and reporting capacity of REA is weak. At the same time it is noted that REA is making efforts to improve this through recruitment of dedicated monitoring and evaluation staff. REA is also finalising a list of an updated version of its key performance indicators, which are broader than those agreed upon with Sweden/Netherlands and also those contained in its 2009–2013 Strategic Plan. While financial recordkeeping is sound, a project information database had been developed by the Sida-funded TA and had never been used.
- Zambia's energy policy broadly supports rural electrification, and there is good coherence among the government's planning documents and with the Sida support programme to REA through the Specific Agreement.
- The laws governing the electricity sector provide an adequate framework for rural electrification in Zambia. However, at this stage, there is little experience with off-grid systems, and the relevant laws and the new regulatory framework that the ERB developed in 2010 are largely untested.
- REA is only performing some of the activities it is tasked to undertake under the Rural Electrification Act. It needs to improve its capacity if it wants to expand its current activities to include designing and offering of smart subsidies for capital costs, recommending policies for enhancement of access to electricity, facilitating the formation of appropriate institutions to generate, distribute or supply electricity, and providing technical guidance and consultancy services.
- For the work it is currently doing, the technical capacity of REA is very good but overloaded. This has meant, on the one hand, that technical assistance cannot be optimally provided and, on the other hand, there are delays experienced in providing guidance to contractors or producing deliverables.
- One reason for the alarmingly low level of rural connections is the low level of ZESCO involvement during implementation. This results in rural households lacking information about how much connection charges are and ignorance about the recently initiated deferred payment scheme.

- In the next two years the ZPPA decentralization process will go ahead and will require REA to demonstrate that it has capacity to assume full responsibility for procurement, subject only to periodic checks by the ZPPA.
- There is very good scope for synergies among the interventions by the cooperating partners in the rural electrification programme of REA. At the moment, management of the different donor programmes appears compartmentalized as there is no specific framework of consultation among the cooperating partners during implementation.

In terms of strategy of implementation and the efficiency with which it undertakes rural electrification, the important issues and observations are:

- Grid extension is the cheapest way in Zambia of improving rural electricity access. Only a limited number of sites were identified in the REMP as having hydropower potential, and both solar and wind energy are currently expensive options with limited potential.
- However, where grid extension is not possible, in combination with a tariff policy that covers all the operating costs, plus some of the investment costs, the REA can provide capital subsidies to make otherwise non-commercial projects "commercially viable". The Rural Electrification Act, 2003, aims at this, but this involves correcting some discrepancies or omissions between the Operational Manual and the Rural Electrification Act 2003.
- In its present form, the Operational Manual basically does not cater for commercially oriented, sustainable service delivery for rural electrification outside the utility ambience as the Manual lacks descriptions of typical vehicles for such service deliveries, e.g., provision of performance grants, matching grants and technical assistance.
- Affordability of electricity is a key issue in the rural areas of Zambia. Options to make connections more affordable could include targeted subsidies or a variety of deferred payment options when a connection fee is paid over time, pre-financed directly by the utility/service provider or through cooperation with a microfinance institution.
- The design and supervision of Sweden/Netherlands-funded grid extensions has been professionally carried out and the contracts, specifications and supervision are fit for purpose for standard ZESCO grid extensions. The unit costs of the REF-supported projects are not outside any reasonable cost realm for standard three phase grid extensions without low cost design.
- The connection rate is much lower than what was envisaged in the REMP but the ZESCO deferred connection payment scheme, which allows staggering of the connection fee over 36 months, has resulted in a tremendous increase of connection rates.

The key recommendations are:

- After 2012, it is expected that the first of the 5-year rolling plans will have been developed with the support of JICA and this should then be used as the basis for identifying projects for inclusion in annual work plans.
- There should be one consolidated list of KPIs that is acceptable to its cooperating partners, the board and parent ministry. The KPI on CO_2 emissions, i.e., KPI No. 9, should be removed as it is merely a guess.
- The review meetings with Sweden/Netherlands should be split into two: one meeting held early in the year to review the progress of the previous year and the second later in the year to discuss the following year's work plan.

- The Rural Electrification Authority and ZESCO should be encouraged to explore technological options for reducing the cost of connecting households. An explicit policy statement for such innovations would help to mobilize additional resources for household connections.
- The strategy being adopted to decentralise monitoring and implementation of field activities through the appointment of field officers is supported. It is expected that gradually the number of field-based staff will increase, as well as their powers to make decisions and give approvals.
- There is a need to assess the salary structures of REA to make them more attractive to retain staff.
- As the workload increases and taking on permanent staff takes time, expertise should be contracted when needed and as allowed under the Specific Agreement.
- REA should involve ZESCO more in its community mobilisation activities to disseminate information on connection charges and schemes, and user tariffs. A formal memorandum of understanding with ZESCO should be considered to engage its various relevant departments more.
- At least twice a year, spearheaded by REA, the cooperating partners and REA should meet to discuss common issues specific to the implementation of the rural electrification programme.
- A continued emphasis on extension of the grid, complemented by supply to isolated rural communities through mini-grids powered by mini-hydro generators and other renewable energy sources, is recommended.
- REA should assist unsolicited projects with information and awareness-raising, capacity-building of consultants and of local construction companies, providing grant-financing for the preparation of feasibility studies, and assisting local developers and electricity cooperatives in the creation of viable electrification entities, capable of managing the operation after the investment phase.
- If there is a financial reason for the delay in supplying prepaid meters, it is recommended that Sida consider financing part of them.
- ZESCO should provide more information to the public about its deferred connections payments scheme and should clarify what other categories (if any) than the three types of residential categories will be eligible.
- Sida should support Zambia in initiating a process to establish specifications for and promote the use of standardised designs, structures and materials for low cost rural electrification projects in Zambia.
- ZESCO and REA need to sensitize and educate the communities on (a) internal wiring of buildings, alternatively the use and availability of ready boards, (b) the cost of electricity connections.

2. Introduction

2.1 Purpose of the report

The objective of the Mid-term review and evaluation (MTR), which was undertaken in the month of September 2011, is to assess progress and advise if there is any need for adjustment in the ongoing cooperation between Sweden, the Netherlands and Zambia in the implementation of the latter's rural electrification programme, specifically Swedish and Dutch support to Zambia's Rural Electrification Agency (REA) and the Rural Electrification Fund (REF). This MTR is, thus, supposed to make an assessment on the implementation of the programme from 2008 to date, taking into account rules and regulations as agreed to in the Specific Agreement. The consultant team was expected to look into:

- Efficiency and effectiveness of the supported programme in relation to the specific agreement.
- Validity of work plans in relation to the guidelines of the specific agreement.
- Results (output) achieved so far, and, in particular, in the Swedish/Dutch supported programme.

Based on this the consultant team was expect to make conclusions and make recommendations to the parties.

The Terms of Reference (TOR) is attached as Annex 3 and includes a detailed Scope of Work.

2.2 Background

2.2.1 Rural electrification in Zambia

As part of the reform of the power sector, the Zambian government in 2003 enacted the Rural Electrification Act and established the Rural Electrification Authority (REA) as an institution dedicated to the rural electrification programme. REA was also expected to be a vehicle for increasing the resources available to the programme and improving its management. Before the establishment of REA, the rural electrification programme lacked a system for selecting projects. The funds that were collected from electricity consumers through a rural electrification levy charged on electricity consumer bills were not only insufficient, but were often diverted to other government priorities. The decision to establish REA was also consistent with other reform measures towards commercializing the operations of the national utility, ZESCO Limited, which hitherto had implemented the electrification programme. The programme imposed a financial burden on the utility because often the projects were underfunded and ZESCO could only implement them by dipping into its operational funds, thus diminishing its capacity to maintain the existing supply system. Under these conditions, and with an annual population growth rate of about 3%, the electrification programme made slow progress and for many years the average rural electricity access rate remained static and in some regions, like the Western Province, showed a regression.

REA would derive its funding from the Rural Electrification Fund, which received the electricity levy and would now pool resources contributed by government and cooperating partners. The board of the Rural Electrification Authority oversees the REF, supported by the management and staff of REA. To date, apart from treasury subventions and the electricity levy, the Rural Electrification Fund receives funds from Sida and the Embassy of the Kingdom of Netherlands.

Other cooperating partners, notably the World Bank and the Japanese Government, fund electrification projects through direct disbursements to REA. At the time of the review, both the World Bank and JICA had independent ongoing projects on Increased Access to Electricity Services (IAES). These projects have a broader target than rural electrification, which would explain why the funds were not channelled through the REF.

2.2.2 The Rural Electrification Master Plan

Zambia's Rural Electrification Master Plan (REMP), developed with the assistance of the Japanese Government and officially launched in April 2010, was expected to guide REA in the implementation of the rural electrification programme. The REMP sets out to increase the rural access rate from 3.1 % in 2006, to 51% in 2030, a target that supports Zambia's *Vision 2030* to be a "prosperous middle-income country". After a nationwide multi-faceted study, the REMP formulated and prioritized a list of core areas designated as Rural Growth Centres (RGCs), which, when electrified, had potential to catalyse social and economic development in the contiguous villages, thus expanding the opportunities for escaping the worst forms of poverty. The average estimated cost of undertaking these projects was USD 50 million per year, every year up to 2030. In addition, REA inherited ZESCO's ongoing pipeline grid-extension projects in rural areas.

2.2.3 Sida support to REA

Since the 1970s Zambia has benefited significantly from Sida's support to several areas of the energy sector. These include:

ZESCO generation capacity: Sida participated in the financing of the Kafue Gorge Power Station, commissioned in 1976, which, originally designed for 900 MW and later refurbished and upgraded to 990 MW, is Zambia's biggest power station. It has been key to the continuity of supply to the copper mining industry, which earns Zambia the highest amount of foreign exchange.

Energy Service Companies for rural communities: Sida funded three energy service companies in the Eastern Province of Zambia, through which more than one thousand solar systems were installed to provide electricity for lighting and for small household loads.

The Energy Regulation Board: Sida had provided continuous support to the Energy Regulation Board from its inception in 1998. The support built the regulatory capacity of the Board and enabled it to develop important regulatory instruments, including a cost of service study, the system grid code and an off-grid regulatory framework. On the whole, Sida has strongly supported reforms in the electricity sector targeting the participation of the private sector.

Capacity Building of the Rural Electrification Authority: Sida's support to REA was critical to the build-up of its capacity to fulfil its mandate to roll out the rural electrification programme in Zambia.

The Sida Assessment Memorandum, which preceded the signing of the Specific Agreement, concluded that these interventions were generally successful, even if in several specific instances implementation challenges were experienced and the results did not always meet the full expectations.

In December 2008, Sweden and Zambia signed the Specific Agreement for the "Support to the Rural Electrification Authority and the Rural Electrification Fund" for the period 2008–2013.

The agreement pooled together contributions from Sweden (SEK 250 million) and the Netherlands (ZMK 37.8 billion) which would support REA to implement the projects in the REMP. The agreement sets out various covenants and pre-conditions for annual fund releases, and outlines the general and specific obligations of the partners.

Before the two governments signed the Specific Agreement, Sida in February 2008, had commissioned a "Pre-Award Audit of the Rural Electrification Authority", to assess REA's readiness to fulfil its mandate and to make the best use of the support provided under the Specific Agreement. The study focused on (a) financial systems and capacity; and (b) accounting and reporting systems. The study also reviewed earlier reports of studies commissioned by the World Bank and JICA, institutions that already provided support to REA. The Pre-Award Audit was followed up in February 2010, examining the same issues.

2.3 Methodology

The strategy for the evaluation was to apply multiple methods in the form of semi-structured interviews with project personnel, government officials, donors and contractors; observations; and record and literature reviews; to obtain sufficient quantitative and qualitative data for reliable conclusions to be drawn concerning the evaluation.

The following activities were undertaken during the evaluation:

Desk review
The desk review included an analysis of the key project documents supplied by Sida and the REA, before fieldwork commenced. Other documents became available during the field visit in Zambia, supplied by the various stakeholders including Sida, ZESCO and the Energy Regulation Board (ERB). A complete list of documents consulted is attached as Annex 8 to this report.

Inception Report
Based on the documentation review, an Inception Report was submitted to the embassies of Sweden and the Netherlands. The Inception Report highlighted the key observations noted by the MTR and listed issues that needed to be probed during assignment. In addition, a checklist for site data collection and a detailed work plan was produced. Following approval of the Inception Report, the team began its in-country work.

Briefings in Lusaka
Separate briefing sessions were held with the embassies of Sweden and the Netherlands and with REA on arrival in Lusaka. During the briefing with Sweden and the Netherlands, outstanding issues were clarified including comments made in the Inception Report. The expectations of the embassies and the future strategies of the two countries vis-à-vis their cooperation with Zambia were discussed. In the briefing with REA, which was attended by its CEO and senior management present in the country at the time, REA clarified issues in the proposal submitted by Indevelop. The schedule of the mission over the next three weeks was discussed and the MTR team put forward a number of requests to REA, which it hoped would facilitate the review.

Meetings with stakeholders
A series of meetings with key stakeholders were held during Week 1 and Week 3 of the 3-week in-country visit. The meetings were with the management and relevant staff of REA, the Ministry of Energy, government institutions, REA's cooperating partners, contractors and independent power promoters. A complete list of institutions and people met is attached as Annex 7 to this document.

Field visits with focus group discussions and key informant interviews
During Week 2 and part of Week 3, members of the team visited 8 grid-extension projects in four of the country's nine provinces. The projects were those that had been targeted for construction during 2009 and 2010, i.e., the two years of Swedish/Dutch support. During these field visits, contractors (where implementation was still taking place) and ZESCO branch staff were met along with staff of electrified and non-electrified health centres and schools. Discussions took place with owners of business entities (both electrified and non-electrified), as well as villagers dwelling in the area.

A map showing all the 2009 and 2010 sites that REA targeted for grid extension is displayed in Annex 1. Also identified in this map are the sites visited by the MTR team. The visited sites were selected considering two factors: a) To use time efficiently, areas where there were 2 or 3 sites clustered close to each other and b) The urgency to compete the fieldwork before the national elections of September 20th and the expected increase in tension in the country following those elections.

Debriefing
The debriefing with REA scheduled for the end of the field visit had to be cancelled on the request of REA following the tense climate prevailing in Lusaka following the September 20th national elections. However, a debriefing was able to be held with the Embassies of Sweden and the Netherlands during which the key issues, observations and recommendations of the mission were shared and discussed. A 12-page debriefing note was also shared with both the embassies, as well as with REA.

Draft and Final Report
A draft report was submitted two weeks after the debriefing and following comments of Sweden, the Netherlands and REA on the debriefing note. Detailed comments on the draft were received from Sweden/Netherlands. REA sent its comments separately to the MTR team. After review of the comments, the draft report was revised and this final report is being submitted.

3 Key issues and observations

The following are the key issues and observations that the MTR identified during the assignment. They follow closely the tasks set out in the Scope of Work listed in the TOR. This will be followed by Chapter 4, which lists the key recommendations of the MTR.

3.1 REMP and its targets

At an average annual cost of USD 50 million, the implementation of the REMP was expected to increase rural electricity access rates from the initial 3.1% in 2006, to 50.6% in 2030. To deliver this result, the REMP designated 1,217 Rural Growth Centres as focal points of economic and social growth which, when electrified, would stimulate the spread of connections to contiguous village households. Figures 1 and 2, extracted from the Rural Electrification Master Plan show, respectively, how the rural access rate would grow from the progressive electrification of the Rural Growth Centres in the plan.

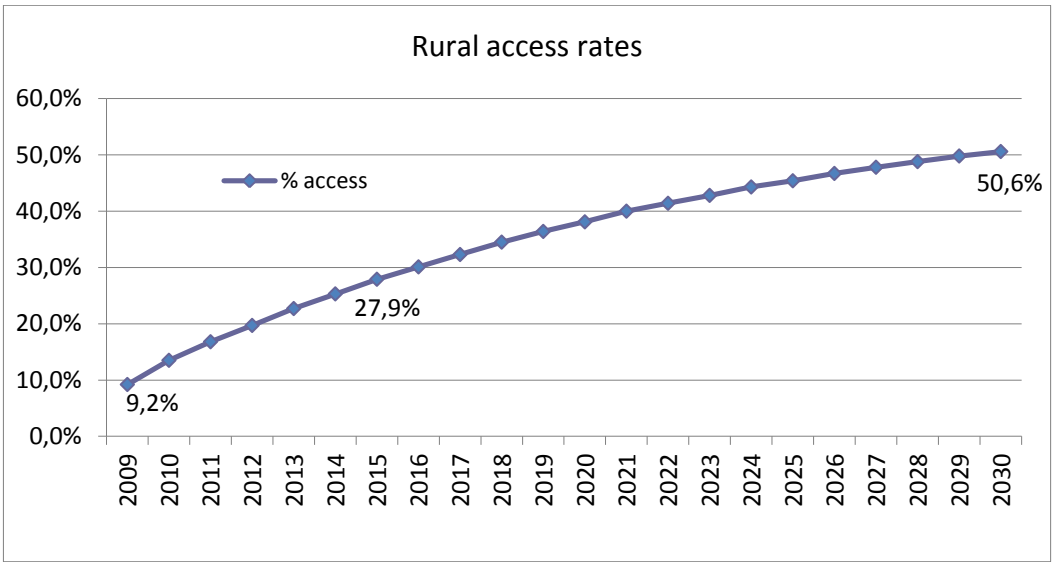


Figure 1: Targeted growth of rural access rates

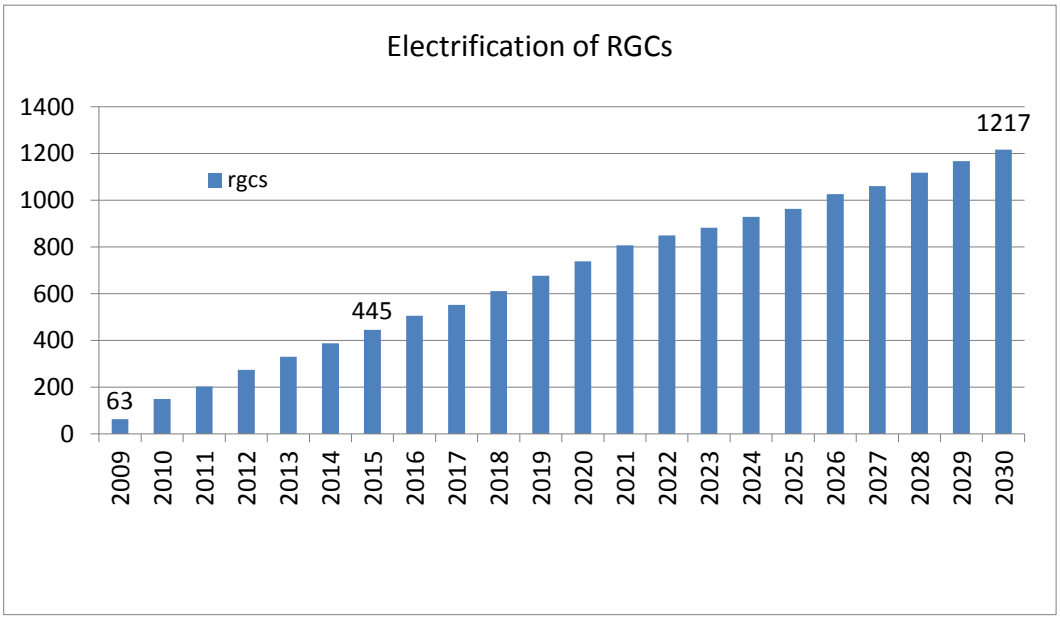


Figure 2: Projected cumulative growth of electrification of RGCs

The rate of implementation of the REMP and the resulting growth of rural electricity access rates was unrealistically optimistic. It was particularly unrealistic in terms of expected funding (USD 50 million a year) and capacity of REA. In 2010, the Sixth National Development Plan (SNDP) estimated that the rural electrification access rate in 2009 was 3.5% compared to the REMP forecast for then of 9.2%. The SNDP went on to say that "this was due to the slow implementation of the Rural Electrification Programme."

REA had assumed responsibility for rural electrification in 2006, taking over many projects from ZESCO. According to its 2009 report to the Annual Review Meeting with Sida, REA had completed 53 grid-extension projects up to 2008. As the REMP had not been formulated at this time, these projects were outside the concept of Rural Growth Centres. For the 2009 and 2010 Work Plans, REA used the following criteria for the selection of projects:

- Completing outstanding projects or those handed over by ZESCO;
- Undertaking at least one project in each province;
- Projects included in REMP;
- In 2009, a project from the Gwembe-Tonga area to benefit people displaced by the Kariba Dam.

The issue of REA's non-adherence to the REMP led to the development of misunderstandings between it and Sweden/Netherlands. Matters worsened when the Kasaba Bay controversy arose. This was a project included on the list of projects to be funded by Sweden/Netherlands. Opposition to it by the latter resulted in REA funding it solely through the resources provided by government. The electrification project of Kasaba Bay, a relatively sparsely populated area, was in line with the government's aim to develop the area to attract tourism. REA maintained that Sweden/Netherlands had approved the project. Sida stated that the project had been approved, assuming it fell within the results that its support to the electrification programme was expected to achieve.

JICA supported the production of REMP by providing technical assistance for its preparation between May 2006 and January 2008. It states that the REMP was not meant to be a definitive rulebook on how rural electricity should be rolled out. Rather, it was supposed to be used as a guide, adapted to reality, including availability of technical and financial resources. Indeed, currently JICA is supporting REA in the development of 5-year rolling plans where it is expected that the 180 REMP electrification packages will be repackaged into more realistic and smaller projects and in which both REMP and non-REMP RGCs will be considered for inclusion.

Bundled as they are in 180 electrification packages, the electrification projects in REMP were so large that if they had been implemented, only a handful could have been managed a year within REA's financial resources. Several RGCs are grouped together in each package. For an organisation such as REA, answerable to parliament which approves its annual budgets, it would have been difficult to justify why the annual work plans did not include a spread of projects across all provinces of the country.

The SNDP revised downwards the projected rural access rate in 2015, from the REMP figure of 27.9% to 15%. The basis for the revised figure is not clear, but a number of aspects of the REMP contribute to the original exaggerated or unreliable projections:

1. Programme Commencement

The programme assumed that by 2009, 65 project packages would have been implemented raising the access rate to 9.2%. However, since by that date, the government had not even launched the REMP, the projections were already off course. In hindsight, it may have made some sense to extract from the REMP, after its launch, a shorter range plan that would set more realistic targets, taking into account, not only the late start, but more importantly, a gradual build-up of capacity in the financial and administrative institutions and in the third-party agencies involved in the programme.

2. What does access mean?

The REMP associates each RGC with a number of villages and a corresponding number of households. Thus, for instance, when a line is extended to a RGC, the REMP considers the households within the vicinity as having access to electricity. But the reality is that a connection to the RGC is only the start; a much more intractable challenge is how to stimulate household connections. In the 2009 Annual Review Meeting with Sida, REA acknowledged this point by saying: "From experience, it has been established that the rate of connections in newly electrified areas is usually very low due to, among other things, (i) lack of internal wiring of most buildings in target communities, and (ii) lack of capacity to meet connection charges, especially among ordinary villagers." The report also notes the difficulties of gathering statistics regarding the status of connections since these include off-grid schemes like solar home systems. The field visits during this MTR confirm that line extensions to RGCs have rarely translated to household access.

In the MTR's view, REA should review the targets of the REMP by distinguishing between the electrification of RGCs and the connection of households. This will help to focus attention on the true measure of the success of the programme, which is the number of households with electricity.

3. Population assumptions

The source of the population projections used by the REMP is the Population Projections Report produced by the Central Statistical Office in November 2003. On this basis the REMP projects an overall decline in the population growth rate from 3.0% per annum between 2005 and 2010, to 2.8% between 2020 and 2025. This decline will occur mainly because of the decrease in the urban population growth rate from 2.3% to 1.4% during the same period, while the rate will remain constant at about 3.3% in the rural areas. With these trends, the population in urban areas relative to that in the rural areas will decline from 34.6% in 2005, to 28% in 2025.

The results of the 2010 census do not support the trend of a declining proportion of the urban population. On the contrary, the percentage of the urban population went up from 35% in the previous census of 2000, to 39% in the 2010 census. The industrialization that accompanies economic growth would tend to support increasing urbanization trends rather than a reduction.

As the population trends drive the forecasts of electrification progress, it is important to have confidence in the reliability of the underlying assumptions. Furthermore, a strict distinction between rural and urban areas cannot be maintained over time. Many RGCs, especially those close to major centres like Lusaka, in time shed their rural characteristics and are subsumed in an expanding metropolis.

3.2 Monitoring, Evaluation and Reporting

Currently there is no dedicated monitoring or evaluation unit in REA. It is expected that during this MTR a new Monitoring and Evaluation Officer will join to oversee this function. He will be housed in the Support Services Section. The reporting currently to both Sida and the government is consolidated/compiled by the Finance Department.

Sweden/Netherlands have often expressed concerns over reporting and indeed one can find that they are wanting. The reports contain little or no analysis of issues confronting REA, either at the organisational or field level, whether it be about grid expansion, community mobilisation, environmental management or about the organisation as a whole. They also contain little analysis of achievements against targets and are quite bland. Of the three progress reports submitted to Sida by REA, it was only the 3rd which began to discuss issues and also give numbers on the targeted beneficiaries of electrification in terms of schools and their staff, health centres and their staff and business entities. The improvement in reporting was partly because of the technical support provided by Sida in the form of a monitoring and evaluation consultant.

Reports have often had to be revised a number of times before being deemed satisfactory for approval by Sweden/Netherlands. REA states that it would prefer a template for a report so that it knows exactly what is expected from it. However, templates cannot prevent reporting being done in a perfunctory manner. At the same time, the level of engagement REA currently exercises with Sweden/Netherlands should increase. Along with an increased number of informal interactions, the review meetings should be split into two: one meeting held early in the year to review the progress of the previous year and the second later in the year to discuss the following year's work plan.

Field monitoring is undertaken regularly by REA staff as confirmed by contractors and the contents of project files which contain contractual correspondence, site visits, monthly reports of contractors, reports on HIV/AIDS training, surveys and approval of payments, as well as other documentation pertaining to a particular site. Nowhere, however, is there a consolidated database giving details of the projects, their targeted beneficiaries (in terms of schools, health centres, staff houses, business areas, catchment areas) and the state of implementation.

Under Article 4 of the Specific Agreement, a set of nine key performance indicators was agreed upon between Sida and REA. It was expected that reporting would be undertaken using these nine KPIs which all focussed on field-level activities.

The nine KPIs were:
For increased access to electricity services:

1. Rural electricity access rate (%)
2. No. of rural households connected annually
3. No. of Rural Growth Centres connected annually
4. No. of public facilities connected in rural areas annually
5. No. business entities connected annually

For increased generation capacity from renewable energy sources:

6. Capacity of solar PV system installed annually in KW
7. Capacity of mini hydropower plants installed annually in KW
8. Capacity of biomass power plants installed annually in KW
9. Tonnes of CO_2 reduced annually

These KPIs were reported upon in the first of the two progress reports submitted to Sida but were dropped from the third. Even between the two, the achievements stated for 2009, and the targets for all years, are changed without any explanation being offered. REA has now stated that it wants to develop a set of KPIs which would a) be organisation-wide rather than only focussing on field implementation and b) be acceptable to all its cooperating partners and government. The draft list of new KPIs that the organisation itself has developed is a good start, as the KPIs were ratified by

the departments themselves and attempted to capture issues such as staff retention and production of payrolls, though there is no indicator assessing financial efficiency aspects. The dropping of the indicator regarding CO_2 emissions is understandable as it was merely guesswork, while REA should also give thought to removing indicator no. 2 regarding the number of households connected, as this is not within its current mandate (it is ZESCO's), and it cannot be held accountable for performance on it. REA is about to deploy a monitoring and evaluation consultant to facilitate the process of developing a new list of KPIs.

However, there is a divergence now between these KPIs and those formulated in REA's Strategic Development Plan 2009–2013. The draft version of this plan that was available to the mission does not appear to be a core document, which the organisation regularly consults to formulate plans for the future or to monitor where it is going. There are a few indicators of achievement common to both the new list of KPIs being considered and the Strategic Plan, but many are different and it appears that if the new list of KPIs currently under consideration is adopted, they will demand more rigorous monitoring than the Strategic Plan ones:

<table>
<tr><td colspan="2"><u>Indicators common to both the Strategic Plan and the draft list of KPIs:</u>
Projects implemented/completed;
Number of projects adopted outside the REMP;
Number of M&E reports produced;
Promoting stakeholder awareness;
Preparation of audited reports;
Staff trainings;
Number of project implementation contracts signed.</td></tr>
<tr><td><u>Indicators only in the Strategic Plan:</u>
Guidelines for institutions to generate, distribute and supply electricity;
Mobilisation of resources;
Developing & implementing a communications strategy.</td><td><u>Indicators only in the draft KPI list:</u>
Number of initial connections;
Increase in generation of renewable energy;
Grant applications received and evaluated by REA for renewable energy projects;
Number of annual reports to the ministry;
Number of community mobilisation activities undertaken;
Preparation of annual work plan & budget;
Conducting of internal audits;
Site inspections;
Staff performance assessments;
Number of staff loans applications processed;
Number of tender documents submitted to ZPPA;
Staff retention;
Number of board sub-committee meetings.</td></tr>
</table>

The financial information management is very good and financial reporting is sound except that REA has tried to report on the respective contributions of the Zambian government and Sweden/Netherlands project-by-project. This is a futile exercise as the contributions are pooled as they are received.

An internal taskforce set up by REA in 2010, consisting of six staff members reported that a) the M&E system needed considerable improvement, b) a project information database had been developed by the Sida-funded TA to REA, but that it had never been used and that c) post-project data for evaluation purposes should be collected quarterly. The third observation needs to be reconsidered. While data on impact of rural electrification may be important, REA does not currently have the resources to undertake such an exercise on a regular basis. It should rather be focussing on the more immediate need of reporting on inputs, processes and outputs.

Connecting rural households to the electricity grid does not currently fall within its mandate. Thus, it is not clear why REA has been collecting information albeit on a pilot scale, of the amount of expenditure, by households, on candles. Such information adds little to improving the organisation's performance at the same time as diverting attention and resources for more immediate M&E needs.

Finally, while departments meet as and when needed, recently organisation-wide review meetings have been initiated (to be held once a quarter) in which all REA staff participate. These meetings have been dubbed "Town Hall" meetings. So far, one had been held until the time of the MTR, though since they were instituted, the number should have been three. These meetings provide an opportunity for departments to share progress made in the last quarter and activities planned for the coming quarter. They provide an opportunity to synchronise activities and reinforce the organisation's progress towards a shared goal.

3.3 Policy level issues/legal environment

3.3.1 Zambian national policies

In 2008, when Sweden and Zambia signed the Specific Agreement for support to rural electrification, Zambia adopted a new National Energy Policy. The policy seeks to fulfil the aim of the National Vision 2030 for the energy sector:

> *"To provide well developed and managed, reliable and sustainable energy services for the improvement of the quality of life of all Zambians"*

For rural energy provision, the policy objective is *"*to increase access to affordable energy in rural areas to reduce poverty and to promote economic growth". To support the objective, the policy proposes four measures as follows:

1. Increase supply of cost-effective energy for rural income-generation activities;
2. Promote the development of energy enterprises in rural areas;
3. Integrate energy in development programmes; and
4. Promote the dissemination and utilization of modern energy services to rural households.

For specific energy forms, the following objectives bear directly on rural access to modern energy services and to the protection of the environment.

Electricity: To expand generation and transmission capacity and also increase access to electricity.
Renewable Energy: To address barriers to wider dissemination of Renewable Energy Sources and also to increase their deployment.
Biomass: To ensure environmentally sustainable exploitation of the biomass resources by ensuring efficiency through better management and introduction of new sources such as biofuels.

Also relevant to rural electrification are the following:
Household Energy: Reduce the dependence on wood fuel and ensure sustainable provision of affordable, reliable, modern energy services to rural and urban households as a means of reducing poverty and raising the standards of living.
Energy Pricing: To ensure that energy prices reflect the cost of providing energy and also take into account the principles of fairness and equity.
Gender: To promote gender balance in energy planning, management and utilization to ease the burden of poverty on all vulnerable groups, especially women and children.

Observations on policies
Zambia's energy policy broadly supports rural electrification. While targeting higher standards of living for the rural areas where poverty is acute, the policy also recognizes the need to pay attention to the crosscutting issues of gender equity and the protection of the environment. The Sweden/Netherlands–Zambia Specific Agreement seeks to contribute to economic growth and reduced poverty through increased access to electricity "for productive, social and household use in rural areas." Therefore, the Agreement is in line with the objectives and strategies of Zambia's energy policy, which enhances the likelihood that Sida's investments in the programme will be sustained.

While in many respects the policy is comprehensive, it appears to side-step the critical issue of the cost of household connections. The measures outlined by the policy exclude direct financial relief for households. There is an implicit expectation that electrical supplies for productive uses will lead to household connections in a trickle-down fashion. While it is plausible that electricity connections aimed initially at productive uses would raise the levels of incomes in the RGCs, such increases will be concentrated in a small minority of people. It will take much longer for the benefits to spread widely enough so that the majority of the village households can pay for connections. The view of the MTR is that such open-endedness weakens the policy objective "to increase access to affordable energy in rural areas to reduce poverty and to promote economic growth."

REA has observed that in most areas hardly any household connections result from the extensions of the grid. The MTR reinforces this observation through the site visits. It is in this context that one has to note REA's plans for a USD 10 million pilot programme funded by the World Bank to subsidise connection fees for 30,000 households. Another innovation in 2011 was ZESCO's efforts to reduce the upfront cost of connections through a deferred payment scheme, which is consistent with the recommendations of the REMP. This subject will be further dealt with later in this report.

National development plans
The Rural Electrification Master Plan (REMP), adopted in 2010, came at the end of the Fifth National Development Plan. The Sixth National Development Plan (2011–2015) adopts the strategies and the targets of the REMP and commits the government to providing the resources needed for implementation. During the plan period, the government expects REA to implement 62 REMP electrification packages raising the rural access rate to 15% by the end of the plan period in 2015. The plan also says: "Furthermore, the Rural Electrification Master Plan will continue to be implemented and will utilize other technologies such as isolated mini-grids."

There is good coherence among the government's planning documents and with the Sida support programme to REA through the Specific Agreement. However, it should be noted that isolated mini-grids have not taken a noticeable role in the electrification programme, the immediate emphasis of which is on grid extensions.

3.3.2 Legal and regulatory environment

The Electricity Act and the Energy Regulation Act, both amended in 2003, govern the electricity industry in Zambia and, therefore, the work of the Rural Electrification Authority. The establishment of REA followed the passing of specific enabling legislation, the Rural Electrification Act of 2003. The MTR concurs with the conclusion of a previous Sida-funded TA, which found that there were "no gaps in the legislation and there is no need for amendment of the sector laws." The effect of the 2003 amendment to the Electricity Act was to remove the Minister's role in determining requirements for the operation of an electricity undertaking; a role that was subsequently made the sole responsibility of the Energy Regulation Board. However, in the Energy

Regulation Act, the minister retains the power to issue a statutory instrument exempting an undertaking from the requirements of the Act. This is generally interpreted to mean that this power provides a legal means for reducing the burden of regulation for rural undertakings.

In 2010, the Energy Regulation Board, with support from Sida, developed guidelines for technical standards and tariff methodology for off-grid systems. By relaxing the normal standards of installations and the technical quality of supply, both of which have an impact on the costs for the consumer, these measures should promote the development of off-grid systems and contribute to an increase in household connections. Furthermore, using this framework, the ERB has the full legal mandate to issue generation and distribution licences. In its discretion, the ERB can determine the applicability of the framework to any undertaking above an installed capacity of 100 kW that is intended for supply to the public. Therefore, the MTR concludes that the minister's power to decide whether or not an undertaking should fall under the Act would be invoked only in exceptional circumstances. The threshold of 100 kW preserves an absolute safety standard to ensure that the design and construction of off-grid systems minimize the risk of injury to consumers and operators alike.

The MTR concludes that the laws governing the electricity sector provide an adequate framework for rural electrification in Zambia. However, at this stage, there is little experience with off-grid systems and the relevant laws and the new regulatory framework that the ERB developed in 2010 are largely untested. This is mainly because at this stage the implementation of the REMP gives the highest priority to grid-extension projects.

3.4 Human resources and capacity at REA

REA is undertaking some of what it is mandated to do under the Rural Electrification Act. The Rural Electrification Act, Section 4, on the functions of the Authority states that the REA would manage the REF, undertake work related to electrification master plans, including their development, implementation and updating, mobilise funds for rural electrification, tender out construction of rural electrification projects and finance project preparation studies. All this REA is doing, but Section 4 also states that REA will design and offer smart subsidies for capital costs and recommend policies for enhancement of access to electricity.

Section 15 of the same act goes further. On the role of the Secretariat, it states the Secretariat will facilitate the formation of appropriate institutions to generate, distribute or supply electricity, in conjunction with ERB will develop appropriate tariff structures for electricity supply, provide technical guidance and consultancy services to rural communities, entrepreneurs and others involved in rural electrification, and build and maintain a comprehensive public-awareness campaign. REA has a long way to go if it is to fulfil all the responsibilities it is tasked with and does not currently have the organisational structure, nor the technical capacity to undertake many of them.

Between 2006 and 2009, Sida assisted REA to develop systems and procedures for the implementation of the electrification programme, in general, and in particular the REMP, which was also finalized during this period. With its technical assistance programme, Sida aimed " *…to support institutional development of the REA to facilitate increased access to energy services by the rural population in Zambia, thereby stimulating income-generating activities and improving public social service provision."* (Report: Technical Assistance to Support the Establishment of the Rural Electrification Authority (REA) and the Rural Electrification Fund (REF) in Zambia, April 2010)

Among the outputs of the programme, REA produced the following documents:

a) Revised Strategic Plan 2009–2013;
b) Operational Manual: Guidelines for Accessing Smart Subsidies in May 2008, which in February 2009, was revised as Operational Manual: Guidelines for Financing Rural Electrification Projects;
c) Operational Manual: Procurement and Supply;
d) Operational Manual: Finance and Accounting;
e) The Code of Ethics.

At the time of this MTR, 18 months after Sida's TA support ended, there is evidence of continuous growth of technical and administrative capacity at REA through new appointments and continuous training. Currently the staff strength of REA stands at around 30, but the board, in December 2009, approved a revised organisational structure whereby the full complement of staff would rise to 71. Notably, the staff strength in technical services would rise from 4 to 30 and in support services from 3 to 14. However, based on preliminary estimates, the operational budget of REA would be reduced from ZMK 13 billion in 2011, to ZMK 12 billion in 2012, meaning that reaching the full staff complement may take even longer than being envisaged. REA is expecting to open up offices and station staff (initially one staff member) in the provinces so that supervision and monitoring functions can be more effectively performed. This would also be more cost-efficient as those functions would no longer have to be undertaken from Lusaka saving both time and the cost of travel. However, this will take time. The recruitment process has begun and the provincial officers will be inducted soon, but it is expected that they will spend several months at the headquarters in Lusaka to be oriented before being deployed in the field.

REA cannot match the more attractive salaries and perks offered by organisations such as ZESCO. It does not run along commercial lines and depends upon grants from government and donor funds, rather than profit. This is one main reason for the departures of a number of professionals from the organisation. The organisation also suffers on another front: for course of a longer duration, it requires staff to sign bonds committing them to remain with the organisation for a period of time after completion of training. However, the time periods of commitment in those bonds are of very short durations, not reflecting the investment made in the individual.

While cooperating partners, contractors and others have stated that the technical capacity of REA is very good, they have also stated that the professionals are stretched. A few professionals having their attention demanded from several directions, attendance at training events both locally and abroad, and with long distances to travel in Zambia to visit project sites mean that staff is unable to give adequate focus and prioritise its work. Along with this, there is frequent staff turnover, especially amongst newly recruited staff. Cooperating partners have stated that this has meant technical assistance cannot be optimally provided. There may also be delays in the preparation of bidding documents; contractors have stated that the clarifications or approvals sought by them are given with delays. REA has also raised the challenge in preparing environmental project briefs necessary for each tender; currently there is only one Environmental Officer.

3.5 Coordination with ZESCO

When grid extensions are complete and ready to be commissioned, they are handed over to ZESCO for operation and maintenance. ZESCO has a nationwide network of offices. It is also responsible for providing household connections, and obtaining connection charges and payments for electricity consumption from schools, health centres, business entities and the rural households. Currently, ZESCO is co-opted at the start of implementation, when it needs to acquiesce to where the off-take will be, and at the end, when the site is commissioned and has to

be handed over. Little interaction between REA and ZESCO takes place in between as revealed through interviews with both ZESCO and REA staff during the course of this mission.

This low level of interaction is one of the causes for the fact that in a number of project sites visited, rural households lacked information about how much connection charges were and about the recently initiated deferred payment scheme whereby households can pay connection charges in instalments of up to 36 months. While household connections are currently ZESCO's responsibility, and it appears they will remain so in the foreseeable future, the low rate of connections is alarming and reduces the possibilities of reaching the targets which Zambia and its cooperating partners such as Sweden/Netherlands aspire to and which are voiced in Zambia's national development plan and in the REMP. During the field visits undertaken by the MTR to nine different sites during September 2011, it was observed that hardly any households have been connected, even though the nearby grids had been electrified in some cases up to 15 months ago.

The MTR had assessed the possibility of REA involving ZESCO more in supervision and monitoring of grid extension sites during the construction phase to reduce the burden on its own staff. ZESCO's services could be contracted. After all, it has a national network and undertakes grid extensions, as does REA. It also possesses qualified technical expertise based in branch and area offices. Furthermore, it is the body that ultimately manages the operation and maintenance of the grid extensions that REA builds. However, the MTR decided not to recommend such a working arrangement as it appears that ZESCO has priorities of its own and its staff also appear to have considerable existing work pressure.

3.6 Procurement issues

The Zambia Public Procurement Authority (ZPPA) regulates the procurement of goods and services by public sector institutions. Established as a statutory authority, the Rural Electrification Authority is subject to the oversight of the ZPPA, which came into being with the commencement of the ZPPA Act of 2008, replacing the old Zambia National Tender Board. The Act provides for a high-level National Tender Committee to supervise public procurements. The policy intentions were to decentralize the procurement functions to the various user bodies, including statutory bodies like the REA. However the implementation of this Act has not been completed due to adverse reports by the Auditor General on procurements by the Roads Development Agency and the Ministry of Health, even before decentralization. The government responded to these incidents by slowing down the implementation of the new Act through the introduction of a two-year transitional phase. Decentralization will be implemented with a discrimination that balances the objective of efficiency in procurements with the goal of minimizing corruption and abuse.

During this transition, ZPPA scrutinizes all procurements above a defined threshold currently set at ZMK 500 million to ensure that tender specifications and bid evaluations follow the stipulation of the law. Nearly all procurements for the electrification programme were subject to this two-stage procedure, which, according to REA took six to eight weeks in total. However, during this MTR, ZPPA indicated that they often deal with urgent cases in much shorter time, e.g., one or two days, if a case can be made. ZPPA emphasized that, in general, experience showed that where delays occurred, they were caused by deficiencies in specifications and non-adherence to bid evaluation procedures. ZPPA's opinion does not seem applicable to REA, though it did emphasise the importance of adequate capacity in the procurement section of REA. ZPPA seems to be unaware that REA now has a full complement of staff in its procurement section: 1 Manager Procurement & Supply Officer, 1 Procurement Officer and 1 Store Clerk to REA's current portfolio of work.
In the next two years the ZPPA decentralization process will go ahead and will require REA to demonstrate that it has capacity to assume full responsibility for procurement, subject only to

periodic checks by the ZPPA. Only organisations that meet the conditions for full autonomy will be subject to this light-handed method of supervision. As in the subsequent period, the rate of electrification needs to accelerate considerably to meet the set targets, it is essential that REA ensures that it meets the ZPPA future conditions for decentralization.

An issue that was raised in the Sida TA final report concerns the requirement for international bidders to partner with a citizen or local supplier. This requirement arises from the national policy of citizen economic empowerment. The MTR found no evidence that this provision constrained the participation of foreign companies in the rural electrification programme.

3.7 Synergies between the cooperating partners

Currently, REA has three main cooperating partners: JICA, Sida and the World Bank. JICA provided technical assistance to develop the Rural Electrification Master Plan between 2006 and 2008. The Plan provides a systematic basis for the implementation of rural electrification in Zambia given certain assumptions. Sida complemented JICA's work by working with REA to formulate systems and procedures that REA would use for the implementation of the REMP. These major contributions by JICA and Sida appear to have had some coordination.

In the subsequent period, JICA began a 3-year programme ending in August 2012 (but which subsequent to its Mid-term Review has now been extended to December 2013) to enhance the capacity of the Department of Energy and REA in relation to the REMP. In this programme, REA and JICA focus on a number of areas, which include:

- Technical capacity for planning and implementing rural electrification projects;
- Technical capacity for project management;
- Capacities for financial management of the rural electrification.

JICA is supporting the formulation of five-year rolling plans which would comprise the pool of projects from which REA would draw from for implementation with Sida support. The capacities developed under JICA support are of direct relevance to the attainment of the goals and targets of the current Sida-supported programme.

"The World Bank in 2008 initiated a 5-year project: "Increased Access to Electricity Services", which has the following elements:

- ZESCO efficiency improvement, including reinforcement of existing distribution networks;
- Intensification within existing grids in peri-urban areas, and energy efficiency and demand side management;
- Access expansion: grid extension to rural areas (three isolated mini-hydros and six sustainable solar market package (SSMP) projects involving installation of solar systems for schools, clinics, commercial establishment and the household market;
- Technical assistance for both ZESCO and REA; and
- Connection fee subsidy for low-income households.

Thus, the project targets not only rural electrification but also intensification of connections in peri-urban areas, efficiency improvements, access expansion through mini-hydros and solar and a subsidy component. Because of its broad nature, the project is being coordinated by a unit in ZESCO for those components for which ZESCO is directly responsible (e.g., efficiency-improvement, reinforcement, intensification in peri-urban areas), and by a project

implementation unit in REA for those components REA is responsible for (e.g., SSMP, mini-hydros, TA and the administration of the connection subsidy). There is some overlap regarding the element of grid electrification, but the elements addressing generation and reinforcement of distribution capacities effectively complement the rural electrification programme. In addition, the World Bank is also going to be funding the capacity development of REA in monitoring and evaluation and environmental management, albeit with a focus on the projects it funds.

During the preparations of the World Bank *Increased Access to Energy Services (IAES)* project, the World Bank team provided comments to the "Rural Electrification Bill 2003". The World Bank basically found the proposed structure workable and created the required arms-length relationships to the minister. This consequently meant that the Ministry of Energy has a very minor role in coordination of the REA.

JICA, the World Bank and the EU have been invited by REA to at least one of the Annual Review meetings with Sida. However, in that forum only activities funded with Sida/Dutch support are discussed. In reality, there is very good scope for synergies among the interventions by the cooperating partners in the rural electrification programme of REA. At the moment, management of the different donor programmes appears compartmentalized, as there is no specific framework of consultation among the cooperating partners during implementation. This has the potential to overload REA's administrative capacity to answer to all participating cooperating partners.

3.8 Extensions of the existing grid extension versus other methods of electrification

To extend the distribution grid is often the cheapest way to extend electricity access, as such investments usually have lower costs per connection and are relatively easy to implement. This is certainly true for all urban and peri-urban areas, but it is also the least-cost solution for many rural areas. In most countries, the majority of the unserved communities are targeted through grid extension. Off-grid technology options – mini-grids or individual systems – are appropriate when the unserved community is too distant from the existing grid and/or their demand is too small to justify the high fixed cost of extending the grid.

It is relatively easy to make a decision to opt for grid extension or an off-grid solution based on economic criteria (i.e., the least cost of meeting incremental demand), but often country-specific factors, including equitable regional development, also have to be factored in.

Until a couple of decades ago, grid extension, diesel-powered mini-grids and mini-hydropower generators were basically the only electrification options available to rural communities. With the commercial maturation of various small-scale renewable, energy-based technologies – from solar photovoltaic (PV) systems to small wind generators and micro hydropower – along with the evolution of innovative service delivery models, off-grid has emerged as a viable alternative for increasing electricity access, especially in remote and dispersed communities (World Bank 2008, "Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices") or when households' consumption levels are very low and are expected to grow slowly.

The last decade and a half has also seen a shift from a typically donor-driven "supplier" approach, which has proven to be unsustainable, to a "service" approach that aims at greater local involvement and focuses on arrangements to guarantee the operational and commercial sustainability of off-grid projects.

The appropriate choice of technology will vastly differ depending upon the characteristics of the site, the availability of resources and the electricity demand of the project. It is important to build

flexibility into the system design in order to ensure that the system implemented best meets the needs of the project. For most off-grid village electrification scenarios, stand-alone solar PV and/or small hydro are likely to be preferred. Both can provide services at a substantially lower cost than diesel or solar mini-grids and both are independent of the delivery of externally produced fuel – always a problem for remote villages.

When considering the technological options for off-grid rural electrification, the comparative costs of renewable energies are obviously paramount. Coal is the cheapest source of energy for electricity generation. In 2010, the World Bank estimated the levelled generating cost for coal-fuelled power plants for the year 2010 to be 3.86 cents/kWh against 36.6 cents/kWh for solar-PV, 11.7 cents/kWh for solar-thermal (with thermal storage), 5.1 cents/kWh for wind (ultra-large wind generation plants of 100 MW and above) and 5.2 cents/kWh for large hydro. Concentrated solar power (CSP), a sub-category of solar thermal energy is now receiving a lot of attention and is now predicted to step out of the shadow of wind and photovoltaics (PV) and to play an increasingly important role in sustainable power generation.

The chart in Annex 4, based on IEA figures, illustrates that costs for producing electricity through hydropower, and biomass in some cases, may be competitive with coal. New renewable energy (solar and wind) need larger markets and better technology to reduce unit costs to compete, but this is not expected to happen in the coming decades. International climate financing can play a role in subsidisation of the introduction of solar and wind – low-carbon projects.

The REA's Operational Manual provides for two broad classes of electrification that may qualify for subsidies from the Rural Electrification Fund: a) grid extensions and b) mini-hydro and other renewable energy mini-grids. Sida's Specific Agreement with Zambia provides for support to electrification in line with the provisions of the Operational Manual.

The Operational Manual bases the selection of projects on the Rural Electrification Master Plan (REMP) developed with the support of the Japanese Government through JICA. A table in the Operational Manual summarising the contribution of each of three electrification methods to the planned total shows the following contributions: grid extension – 94.5%; Solar Home Systems – 4.6%; mini-hydro power development – 0.9%. Therefore, the first point to note is that the REMP assigns a relatively small role to mini-hydro power development and solar home systems as options for the electrification of households.

The second point is that the REMP identifies only four (4) Rural Growth Centres that have potential for mini-hydro development, all in the North-Western Province, where a total of 122 RGCs are defined. This means that even though the potential mini-hydros is confined to one province, the projected contribution to that region is still small, the majority contribution still coming from grid-extension. Of the four potential sites, three are ranked 7^{th} or 8^{th} in the province, and one has a ranking of 2. The analysis shows that the contribution of hydro-based mini-grids was always envisaged to be small and this was not the preferred mode of electrification.

With regard to mini grids by other renewables, PV has good potential. However, previous experience in the Eastern Province before the formulation of the REMP produced poor results, especially in terms of long-term sustainability. The user perceptions after the initial excitement altered significantly when the limitations of PV became too apparent. This is coupled with pressure on Zesco and REA to extend the national grid to all parts of the country, more so in an increasingly important economic region like the North-Western Province.

Furthermore, the mid-term review team found no evidence of interested potential private developers who had the financial capacity and the technical know-how to develop mini-grids based on renewable energy.

3.8.1 REA progress so far

The REA Operational Manual contains the following table, which envisages the method of electrification to be adopted till 2030:

Electrification method	Rural growth centres	Households
Transmission/distribution line extension	972 (80%)	1,008,622 (94.5%)
Solar home systems	241 (20%)	49,405 (4.6%)
Mini-hydro power development	4 (0.3%)	9,702 (0.9%)
Total	1,217 (100%)	1,067,729 (100%)

Grid extensions to rural areas

In addition to the Sida/Dutch support, grid-extension projects are supported by the World Bank IAES Project, the European Union and JICA. Sida/Dutch financing has covered 12 grid- extension projects in 2009, and seven grid extension projects in 2010, according to the REA. All of these projects have been implemented by REA and have/will be handed over to ZESCO for operation and maintenance.

The IAES project comprises three components: (i) Efficiency improvement, which aims at improving distribution efficiency and capacity, and improving efficiency in energy use and is implemented by ZESCO, (ii) Access expansion, which aims at increasing availability of electricity services in target rural areas and is implemented by REA and (iii) Technical Assistance: Improved performance of actors in the energy sector. In addition, REA is responsible for the administration of the connection-fee program.

The World Bank Project Paper for the Restructuring and Additional Credit, dated September 2010, spells out the division of labour between ZESCO and REA for IAES:

Both ZESCO and REA have designated project coordinators to manage the implementation of the IAES. ZESCO and REA have independent financial management and control arrangements for the project. ZESCO concentrates on the effort to increase connections within the existing grids in the peri-urban areas. ZESCO will hire, supply and install contractors for construction. REA is responsible for grid extension to rural areas through the provision of a capital subsidy to ZESCO. For isolated grids, the private developers would be responsible for construction, operation and maintenance. REA will also concession out solar packages to the private sector, which will in turn supply, install and maintain solar PV systems in public institutions, schools, clinics and households/businesses.

The progress of IAES to date has been slow and behind schedule. The delays are primarily due to the long lead times required for site surveys and other assessments for the design and implementation of grid extension, reinforcement and intensification activities. Survey work is expected to be completed during 2011, with actual rollout of grid extensions in 2012 and 2013. The European Union is contributing to the IAES project with USD 4 million budgeted for grid intensifications. The EU has also supported two grid-extension projects: a 68-kilometre, 33kV line to Kaoma and a 175 kilometre, 33 kV line to Mumbwa. The contractors commenced work during March 2011.

Under a Yen Loan agreement, JICA is supporting 12 grid-extension projects in six provinces. The project has been delayed and the original 2013 completion date is likely to be changed to 2014.

Solar

A number of conventional solar PV systems have been installed. The first progress report presented to the Sida-REF Annual Review meeting reported that solar PV was installed in 21 basic schools, 104 staff houses and 21 chiefs' palaces. The Annual Work plan 2011 reports that 10 schools and 49 staff houses, one health centre and three staff houses had solar PV systems installed in 2010.

Although solar PV systems are a practical option for serving electricity needs in remote areas, the maintenance of the institutional PV systems is a major issue. To address this issue, a number of countries have embraced the Sustainable Solar Market Packages (SSMP) project concept. The SSMP project strategy is to aggregate solar PV systems in schools, clinics, enterprises and households in one or more contiguous districts to ensure commercial viability and reach economy of scale.

The IAES includes a SSMP component, but it has been delayed because of the extensive groundwork needed for the preparation of the project. Four SSMP contracts have recently been signed. Tender for consultancy services for three more SSMP packages are at the evaluation stage.

REA has also received USD 640,000 co-financing from UNIDO for a 60 kW solar PV mini-grid. With an anticipated contribution of some USD 400,000 from REA/GRZ, the project size is around USD 1 million. Some 617 houses in a fishing village are targeted. Five cooperatives in the area were investigated on a competitive basis and one cooperative has been singled out as a potential operator of the system. Further work is under way and an alternative is to tender out the project, and once constructed, be managed by a private company on behalf of REA.

Box 1. Renewed interest in power cooperatives in the region

- Urambo Rural Electric Consumers Cooperative (UECCO) in Tanzania was formed and registered as the first power co-operative in Tanzania in 1993. UECCO was set up with Swedish aid funding via Swedish universities and the Stockholm Environment Institute, and was based on US cooperative rules and regulations transposed on Tanzanian conditions.
- REA, Tanzania, is embarking on a revival of the power cooperative concept. Tanzania established a new Cooperative Societies Act in 2003, and enabling rules in 2004, which greatly restrict the government's role; a reform and modernization movement, begun in 2005, is making an effort to restructure and revitalize the cooperative institution.
- In addition, the Rural Electrification Authority of Uganda has recently finalized a power cooperative report in Uganda.

Mini hydro

The recent Annual Work Plan 2011 reports though that the design and feasibility for a 4 MW hydro plant at Chavuma Falls and 1 MW hydro plant at Chanda Falls was awarded to a consulting firm in May 2010, and a draft report on its findings was expected from the firm by end October 2011. Under the IAES project, feasibility studies and detailed design will be carried out for Kasanjiku Mini hydro power station, Chikata Falls Mini hydro power station and Zengamina II Mini hydro power station. Implementation of the mini hydros has been very slow and only reached the stage of inviting expressions of interest for consultants to undertake feasibility studies. The delays are

reported to be primarily due to the long lead times required for the site surveys and the extensive groundwork needed.

Under the delayed JICA Yen Loan Agreement, JICA is supporting a 1.4 MW Mini hydro project at Mujila, Mwinilunga District in North-Western Province. The original agreement was to run from March 2009 to December 2013, but due to delays is likely to be extended. Only in July 2010, did ZESCO contract a consultant, Nippon Koei, for detailed design and assistance in tendering and supervision.

3.8.2 REA: Quo Vadis?

The power sectors in most Sub-Saharan African (SSA) countries are in a transition phase due to recent regulatory reform processes, the main objective of which has been to open the sector to new operators. Although the power sector reforms have overall been constrained by lack of country commitment, macroeconomic and political crises, and lack of experience with political economy factors, the desired outcomes of the power sector reforms have been partly achieved: better service quality for electricity consumers, improvement in the Government's fiscal position and affordable access to electricity for the poor. However, there are many bad experiences for investors and, in the general perception, the bad experiences probably outweigh some good experiences. (Remember ENRON, AES, etc.)

Most SSA countries have recently created Rural Electrification Agencies/Authorities and Funds (REA/REF). Although the REA/REFs have been built up along similar patterns, they serve quite different situations, policies and practices from one country to another. Unleashing multiple private actors in rural electrification (RE) was supposed to bring extra capital, higher efficiency, new actors into RE: what happened?

Some countries (e.g., Senegal and Mali) are indeed building up rural electrification with new utilities characterised by public-private participation, independent distributors, tenders either centrally planned projects, top-down or call for proposals (local initiative, down-top), BOT contracts, initial public investment subsidy (50–70%) and no further operation subsidy. On the other side, there are countries like Zambia, where the laws and regulations accept rural electrification through new actors or utilities but where the majority of the REA financing is still going to extend the grid of the national utility. This involves centralised tendering and heavily subsidised (often 100%). In between there are countries with some sort of mixture of these two "extremes", e.g., Tanzania.

The challenge to increase electricity access in rural and peri-urban Zambia to productive enterprises, service-delivery facilities (in health and education), and to households with the capacity to pay for electricity, lies in establishing a functioning institutional framework for commercially-oriented, sustainable service delivery for rural electrification that can be scaled up; and, possibly, in so doing, also to exploit Zambia's renewable energy potential. This institutional framework needs to cater to small power generation and distribution, which could be combinations of (i) grid-connected [renewable] generation projects, (ii) grid-connected mini-grids and (iii) isolated mini-grids. To achieve this, technical assistance is required for all off-grid electrification stakeholders (Government, private sector, NGOs, users) including support preparation and options to secure financing.
it is true that in most countries between 80%–95% of un-served communities are targeted to receive electricity supply through grid extensions, but ZESCO cannot extend the grid to the whole of Zambia in any reasonable timeframe. ZESCO has a dismayed history of rural electrification and now that it's being commercialised, its mind set is even less suitable for non-commercial rural

electrification. Rural electrification at a large scale is initially a non-commercial activity: investments are high-cost and long-term, and revenue potential takes time to develop. The conventional approach of reaching small demands at long distances, at the same tariff levels as in urban areas, implies heavy implicit, continuing cross-subsidies. Such cross-subsidies are not viable for large-scale expansion, and carry a strong disincentive against expanding the market – every kWh sold is sold at an operating loss.

The two criteria – *rural* and *non-commercial* – call for REA and REF assistance. In combination with a tariff policy that covers all the operating costs and some of the investment costs, the REA can provide capital subsidies to make otherwise non-commercial projects commercially viable.

The Rural Electrification Act 2003 aims at this and the MTR team concurs with this approach and recommends that REA continue to move in this direction. This involves correcting some discrepancies or omissions between the Operational Manual and the Rural Electrification Act 2003.

Clause 1.2 "Functions of the Authority" in the Operational Manual leaves out the following functions defined in PART II of the Rural Electrification Act 2003:

(d) mobilise funds from within and outside Zambia in support of rural electrification
(g) in conjunction with stakeholders, develop mechanisms for the operation of grid extension networks for rural ***electrification and other rural*** energy supply systems

As the REA is actively involved in mobilizing funds, perhaps the omission of (d) is purely accidental, but the next omission is more interesting, as leaving out the text in italics has the effect of lifting out other rural energy supply systems, which presumably would include off-grid projects and isolated grids, etc.

Paragraph 15 in PART III of the Rural Electrification Act 2003, establishes the Secretariat of the Authority and its functions, but these functions are not repeated in the Manual. The following left-out sub-paragraphs support the above arguments:

(b) facilitate the formation of appropriate institutions to generate, distribute or supply electricity to specific localities in rural areas;
(c) monitor rural electrification institutions, organisations or companies funded from the Rural Electrification Fund to ensure that they fulfil their obligations and perform in accordance with standards set by the Authority;
(e) provide technical guidance and consultancy services to rural communities, entrepreneurs and other organisations involved in rural electrification;

In its present form, the Operational Manual basically does not cater to commercially-oriented, sustainable service delivery for rural electrification outside the utility ambience as the Manual lacks descriptions of typical vehicles for such service deliveries, e.g., provision of performance grants, matching grants and technical assistance. However, the Manual might still be Work in Progress[1], as under the IAES Project the REA is preparing ToRs for consulting services for (i) implementation support to the REA, (ii) promotion campaign for renewable energy, (iii) matching grants to project developers and (iv) monitoring and evaluation. The MTR strongly supports such updating of the Operational Manual.

[1] The Preface of the Operational Manual states that the Guidelines are among a series of covenants being prepared to ensure a rational decision making at the Authority.

3.9 Promoting initiatives with the private sector

3.9.1 General

Rural electrification at a large scale is initially a non-commercial activity: investments are high-cost and long-term, and revenue potential takes time to develop. In combination with a tariff policy that covers all the operating costs plus some of the investment costs, the REA should provide capital subsidies to make otherwise non-commercial projects commercially viable. The subsidy should cover the gap between the (a) potential revenue that can be obtained from initial customers (not necessarily the majority), and (b) the revenue needed to provide full-cost coverage, if all finance were on commercial terms.

Making the projects commercially viable should by implication make projects bankable/financeable, capable of attracting sufficient investor equity and long-term loans to reach financial closure (project finance covering the total cost of investment until commissioning). REA subsidies are to be paid during the investment phase and thus reduce the required amount of equity and debt.

So far, REA has paid a ZMK100 million (US$25,000) subsidy to the US$2.9 million 750kW Zengamina private mini-hydro power station and distribution network system in North Western Province.

3.9.2 REA's operational procedures

REA's Operational Manual spells out procedures for projects in the REMP for project promoters covering (i) transmission/distribution line extensions; (ii) mini-hydro and other renewable energy mini-grids (up to 100% capital support) and (iii) solar photovoltaic (PV) systems and other solar applications (up to 100% capital support depending upon source of funds).

For projects under (ii) REA shall package and invite bids in accordance with applicable procurement regulations for project developers who shall not only construct but also operate and maintain the resultant power station and the associated power distribution network, on the basis of a contract to be entered into between REA and the project promoter. Although some of the project promoters may have capacity-building needs[2], the manual only says that REA shall work with the developer to ensure that the works meet the public good objectives.

The REA Operational Manual allows unsolicited project proposals from project promoters. Projects outside REMP may be considered for financing based on the following priority ratings:

Project type	**Priority rating**
Stand-alone grid (mini-hydro)	Very high
Stand-alone grid (other renewable source)	Very high
Solar	Very high
Transmission/distribution line	High

The REA Operational Manual specifies that the REA may grant financing for up to 50% of the capital cost; the rest has to be secured through investor equity (at least 20%), debt finance and consumer contributions (connection charges). The projects must have a FIRR of less than 10% before grants and meet an EIRR of not less than 10% and be financially viable after the support.

[2] REA signed an agreement in 2008 to provide financial support of ZMK100 Million to the 150kW Chitokoloki Mini Hydro Project in Zambezi. District, North- Western Province, but the beneficiaries never lodged a claim for the funds.

The application must contain sufficient information to enable REA to appreciate the nature of the proposed project, the renewable energy technology involved and the intended benefits. Thus, the proposals must contain a business plan complete with technical and financial feasibility studies and the HIV/AIDS Policy.

The MTR team received a list of 13 entities that expressed interest in mini-hydropower development. The team was able to contact four companies and they were all disappointed that REA did not show any enthusiasm for their projects. REA informed the MTR team that it had received a couple of proposals this year and last year, but that when it spoke with the proponents, it judged that they were not sufficiently experienced or serious enough to implement the projects. This is understandable as the Final Screening in the Operational Manual is quite onerous and requires, as mentioned above, that proponents produce, among other things, a business plan with technical and financial feasibility studies.

3.9.3 Proposed incentives to raise the interest of the private sector

The REA should assist the unsolicited bottom-up process by (i) information and awareness-raising about the possibilities and requisites for getting a rural electrification project proposal accepted by the REA for part-funding, (ii) capacity building of consultants and of local construction companies, (iii) providing grant-finance to the preparation of feasibility studies, and (iv) assisting local developers and electricity cooperatives in the creation of viable electrification entities, capable of managing the operation after the investment phase.

Matching grants

It is suggested that a Matching Grants Provision[3] is included to assist private proposals for: (i) grid-connected renewable energy power projects (with capacity not more than about 10MW); (ii) grid connected mini-grids; (iii) greenfield mini/micro-grids; (iv) solar PV systems; (v) other off-grid energy initiatives including hybrid systems.

Performance grants

It is recommended that REA should consider a performance grant provision for private enterprises, the NGO community, co-operatives or individuals for investment proposals for: (i) grid-connected mini-grids; (ii) isolated/greenfield mini/micro-grids; (iii) solar photovoltaic (PV) systems; (iv) other off-grid energy investments including hybrid systems. The performance grant would be an amount per new connection for eligible project promoters (tentatively USD 500) with a maximum amount up to 80% of total investment cost.

Guidelines for small power producers

Conditions for small power projects intended to be connected to Zambia's main grid (national grid) are different from those projects connected to small isolated grids. The MTR team has learnt that there is work under way in Zambia aiming at a "feed-in-tariff". Tanzania has adopted an approach that provides for a Standardized Power Purchase Agreement (SPPA) and a Standardized Power Purchase Tariff (SPPT) for grid-connected Small Power Projects, which could be of interest to Zambia as well. The SPPA and SPPT serve to streamline the development and interconnection of Small Power Projects to the grid, and to set in place arrangements that are fair to all parties and reduce risks to all parties as much as possible.

[3] Eligible activities would include: (i) Market development activities (e.g., market studies, promotion, education), (ii) Business improvement (e.g., staff training, business plan preparation), (iii) Product development activities (e.g., assembly optimization study, testing), (iv) Pre-investment and preparation activities (e.g., preparation studies for licenses), (v) Market entry (e.g., establishing new outlets and networks, demonstrations), and (vi) New initiatives (e.g., new alliances and partnerships, new territories).

Additionally, Tanzania has developed a set of guidelines intended to help Small Power Producer (SPP) developers to understand the step-by-step procedures for acquiring necessary permits, license (if applicable) from the Regulator and other governmental entities, as well as other technical, commercial, and regulatory requirements for bringing a SPP into operation.

3.10 Options on connection charges

Affordability of electricity is clearly a key issue in the rural areas of Zambia. A high connection fee, in particular, is a main barrier for the many low-income households. A prospective residential customer has been expected to pay a connection fee within three months of the quotation from ZESCO, and the customer will not be connected until the full connection fee has been paid. The current connection fees for residential customers are in three categories:

Customer category	*Capital contribution (ZMK)*
Demarcated areas (peri-urban)	769,000.00
Un-demarcated areas (site service)	1,709,000.00
Low-density areas (high-cost townships)	2,800,000.00

The three-months period has proven to be a barrier to most prospective residential customers, as they cannot afford to pay the required amount within such a period.

Both grid and off-grid electrification schemes are looking for new ways to make connections more affordable. This may include targeted subsidies or a variety of deferred payment options when a connection fee is paid over time, pre-financed directly by the utility/service provider or through cooperation with a microfinance institution.

Standard utility-style grid-extension projects which target schools, health clinics, other government functions and commercial entities in rural growth centres, without giving special attention to households in the area, are unlikely to achieve high household connection rates.

3.10.1 ZESCO's deferred connection payment scheme

ZESCO has now increased the time within which these customers can pay the fee whilst allowing them to be given the service. The customer is allowed to pay his/her connection fee over a period of 36 months through electricity purchases on a prepayment metering system.

In order to be eligible for the scheme, a prospective customer should fall within the above three categories, and all premises connected on the scheme will be on the prepayment metering system. A ready board is to be made available for customers who cannot afford the house wiring cost.

3.10.2 IAES connection fee subsidy program

The World Bank-financed Increased Access to Electricity Services (IAES) project was restructured in February 2010, to reduce the complexity of some activities, which had delayed the project progress. The restructuring also included a new facility of USD 10 million to disburse subsidies to approximately 30,000 new households, providing to each about USD 125 for a "standard" connection comprising a drop wire, a single-phase prepayment meter, a circuit breaker and three compact fluorescent lights or CFLs. The programme will also grant about USD 155 for an "enhanced" connection, which besides the elements of the standard connection, will include a pre-fabricated wiring system, such as a ready board. The subsidies to the standard and enhanced connections amount to about 71% and 69% of the total costs, respectively. The MTR team made some observations during the field trips:

- There is a delay in supplying the prepaid meters. However, as ZESCO is partnering with the prepaid meter manufacturer/supplier, the team understands that the delay is only due to the current high demand. ZESCO is changing all customers over to prepaid meters.
- Although ZESCOs deferred connection payment scheme is supposedly only covering the three types of residential areas, some ZESCO officials appeared to believe that also other customer categories could benefit from the scheme.
- Although the deferred connection payment scheme was announced in May 2011, some ZESCO field staff was surprisingly ignorant about the details and the applications. The general public was even more unaware.

3.11 Cost efficiency

3.11.1 Context

Several factors contribute to the cost of rural electric distribution systems. Rural electric standards in most developing countries are adaptations of standards that were used in electric utilities in Europe, the United States, and other countries. Although there are many variations of design standards, it is possible to generally divide design philosophies into two broad categories: the European and the U.S. configurations. The rural electrification programme in the United States, while much more expansive in terms of total area electrified, had a much lower load density than its counterpart programmes in Europe. Population patterns in Europe resulted in much higher population densities, which explains a great deal of the difference in the engineering solutions that were promoted by these two electrification configurations. Historically, systems employing European design standards used three-phase construction almost without exception. The U.S. design standard revolved around cost-minimization and arriving at high market penetration. To achieve these goals, this standard employed single-phase construction wherever possible, extending ruling spans to over 120 meters between poles and minimizing LV distribution by using small, single-user transformers with service drops not exceeding 40 meters.

A rural distribution systems typically begins at the transmission substation and ends at the consumer's service entrance and includes (i) Medium-voltage (MV) Lines supplying from 600 V up to about 35 kV, (ii) Poles and pole hardware, (iii) Line apparatus and equipment, (iv) Step-down transformers from MV to low voltage (LV), (v) An LV network to distribute power to a number of consumers; and (vi) Service entrance to the consumers' energy meters.

The design configuration and the standards employed by the utility will determine the extent of these components and thus the system cost. European systems use large transformers, which each serve a fairly large number of consumers through an extensive LV distribution network. This results in larger energy in the lines (or requires the use of a larger conductor to keep these within acceptable bounds) and facilitates the theft of power from these long lines. U.S. rural electric distribution systems normally use much shorter LV lines supplied by relatively small transformers that usually serve no more than a few consumers and, generally, employ single-phase line construction, which reduces LV system losses.

In addition to the design configuration, the estimates of the electrical load greatly influence the total costs. Rural residential consumers use electricity sparingly and few rural communities have significant growth in residential demand. In most countries in Africa, rural residential demand is not more than 30 kWh – 40 kWh per month. In countries with relatively high disposable income, demand can be higher.

Comparative electricity consumption in Africa

Country	GDP per capita 2010[1] (in USD)	Electricity consumption 2007 (kWh/year)[2]	Tariff: single phase, domestic use (centsUS/kWh)[3]
Angola	3,960	259	4.48
Kenya	780	128 (2008)	13.50
Malawi	330	116	3.78
Mozambique	440	486	10.25
Mauritania	410	600	0.2147
Zimbabwe	610	540	0.04
South Africa	6,100	5,487	4.62
Tanzania	530	81	8.88
Uganda	490	68	24.79
Zimbabwe	460	885	1.46
Zambia	1,070	770	2.04

[1] World Bank Africa Database 2010: Atlas Method.
[2] Electricity consumption (per capita) by country, CIA World Factbooks, 18 December 2003 to 28 March 2011. Retrieved from http://www.NationMaster.com/graph/ene_ele_con_percap-energy-electricity-consumption-per-capita
[3] UPDEA Comparative study of electricity tariffs used in Africa – December 2009

Thus, in most cases it is safe to assume that residential consumption in rural areas will be low, will not grow very quickly, and will be limited unless the rural utility makes a concerted effort to promote sales through productive uses programmes. However, the last point needs amplifying. Studies have shown that most small business activity in rural areas occurs in the home, not in commercial business establishments. This means that residential energy consumption can, in fact, grow but only if users understand how to use electricity productively with appropriately-sized and priced end-use equipment. Experience with productive-use programmes has been mixed and success appears to be most greatly dependent upon two factors (i) the level of effort exerted by the utility to promote productive-use programmes and (ii) the presence of credit-to-purchase end-use equipment.

3.11.2 REF-supported REA grid-extension projects

During the MTR, REA presented financial information for 18 RE projects during 2009 and 12 RE projects during 2010. Most of these rural electrification projects are relatively small scale and basically cover the construction of short-span distribution lines and the installation of on-site transformers, and the projects' target of electrification is limited to public facilities, such as schools, hospitals, as well as chief's palaces in some projects. On top of that, not all the projects literally deal with "rural electrification" as some obviously aim to strengthen the electricity supply grid.
The projects are all standard ZESCO grid-extension projects. ZESCO's standard rural distribution configuration is a three-phase 33kV or 11kV line with three wires and no neutral, feeding relatively large three-phase transformers of 50, 100kVA or 200kVA located on the outskirts of a village or housing cluster. Low-tension (LT) lines at 400/230 volts extend into the village for service to consumers. MV lines are generally not extended into the inhabited portion of the village due to practices regarding compensation for impacts due to infrastructure construction. Under Zambian law, compensation must be paid to those individuals impacted by the construction of government infrastructure, even when those impacts are beneficial.

The team visited eight of these REF-financed REA grid-extension projects, which have all progressed quite rapidly in comparison with the grid-extension projects financed by the World Bank, the EU and JICA. REA has issued turnkey solicitations for these projects. Under a turnkey solicitation, the contractor purchases equipment and materials in accordance with a technical specification and then carries out the construction. The MTR team inspected project files and contracts including bills of quantities and concluded that the design and supervision has been professionally carried out.

The design is based on ZESCO standard designs, includes standard ZESCO design drawings for common items and refers to ZESCO's detailed design drawings for details. The MTR found that the contracts, specifications and supervision are fit for purpose for standard ZESCO grid extensions.

The MTR team has been asked[4] to analyse the perceived large differences in terms of cost per/km between some of the projects. We have confined the table below to the projects REA considers received subsidies from Sida/EKN.

No	Project	Sida/ EKN fin (%)	Cost (ZMK)	kV	km	Trafo cap. (kVA)	Range cost (ZMK)/ km	Eq. cost/km (US$)	BoQ cost/km (US$)
	2009 Grid Extn. Projects								
1	*Kasaba Bay*	*2*	*86,969,016,600*	*66*	*115*	*1,100*	*756,252,318*	*158,877*	
6	**Kaparu**	43	2,300,454,684	11	12	150	191,704,557	**40,274**	24,913
7	**Mabonde**	43	1,013,554,944	11	2	150	N/A	**N/A**	22,709
8	**Chibale**	43	9,729,481,509	33	45	850	216,210,700	**45,422**	26,960
9	**Madzimawe**	43	1,689,452,374	11	7.5	100	225,260,317	**47,324**	19,714
10	**Madzimoyo**	43	1,077,103,885	11	1.5	300	718,069,257	**150,855**	21,370
11	Mwaze II	43	1,572,166,321	33	3.6	850	436,712,867	**91,746**	32,441
12	Mano	47	3,477,852,158	11	22	300	158,084,189	**33,211**	
14	Mukamba	43	367,116,376	33	0.2	50	N/A	**N/A**	
15	St Maria	43	2,900,639,658	11	15	250	193,375,977	**40,625**	
16	Sikongo	43	10,432,120,015	66	60	0	173,868,667	**36,527**	
17	Luampa	43	4,172,231,740	11	17	400	245,425,396	**51,560**	
18	**Buleya Malima**	43	5,905,387,015	33	29	200	203,634,035	**42,780**	24,164
	2010 Grid Extn. Projects								
1	*Kasaba Bay*	*2*	*86,969,016,600*	*66*	*115*		*756,252,318*	*158,877*	
2	Kaputa	70	19,815,930,976	33	34	500	582,821,499	**122,441**	
3	Shiwangandu	70	8,808,311,792	33	45	550	195,740,262	**41,122**	
4	Kawimbe	70	6,344,945,735	33	30	500	211,498,191	**44,432**	
5	Sichili/Mulobezi	70	25,918,246,513	33	144	6,450	179,987,823	**37,813**	
6	Sanjongo School/Lukolwe	70	7,195,610,459	11	22	650	327,073,203	**68,713**	
7	**Mtowe/Kanyanja**	70	1,802,114,643	11	11	150	163,828,604	**34,418**	16,200
8	**Shantumbu Basic School**	70	1,257,522,244	11	5	200	251,504,449	**52,837**	19,033

The issue at hand is the result of dividing the total cost of projects "Cost (ZMK)" with the distance "km" and arriving at substantially different "Range cost/km".

Fundamentally, the cost of the projects can be divided into five categories, as indeed the standard bill of quantities in the contracts also do. They are:

1. Preliminary and general Items, including such items as mobilisation, demobilisation, site establishment and general obligations, insurance, HIV/AIDS, testing and commissioning
2. 11 kV or 33kV Network, including such items as poles, lines, stay wires, insulators, accessories, cables, transformers, lightning arresters, earthing, survey, bush clearing, excavation, circuit breakers, auto reclosers, ring main units, etc.
3. 400V Distribution Network, including similar items as under 2, but in addition specific low-voltage accessories.
4. Special accessories and hardware Contingency, usually 10%, but at times 5%.
5. VAT @ 16%.

All of the projects have certain peculiar differences from each other, which makes the above attempted concept to compare project km line cost difficult. There are different transformer capacities, some projects have circuit breakers or auto-reclosers, others have not, etc.

[4] The request referred to a spreadsheet labeled "REA Grid Extension Projects approved for funding 2010 (from Table 5 in Revised 2009 Progress Report, dated 17 August 2010)". The MTR Team has opted to use the information provided by the REA during the MTR.

The MTR team has looked in detail into nine projects for which it was provided with copies of contracts, bill of quantities, etc. A column with "BoQ Cost/km (US$)" was added, which is the cost of the distribution line summarised from the BoQ, with proportion of the overhead added. Neither VAT nor the contingency was included; these varied between 5%–10%.

Perhaps the largest contributor to the perceived difference in project cost/km is the 400V distribution network, as the extent of the 400V network and the associated cost varies considerably from project to project. In Madzimoyo, the cost of the 400V network is larger than the 11kV network, as there is 3.2 km 400V lines, as compared to 1.3km 11kV line. In Kaparu, the 400V network is only 10% of the 11kV network. There are also other site specifics that make the above simple division a rather blunt tool. If we compare the spread of the cost/km for the projects for which we were not provided with copies of contracts, with the spread in the contracts for which we were provided with contract copies, there is nothing that suggests that these differences are any more notable.

3.11.3 Unit cost comparisons

A recent EU study (SOFRECO 2010, Best Practice of Rural Electrification Funds in Africa), observes that there are considerable differences in rural electrification unit costs between countries, between programmes and between buyers (major utilities, independent rural producers) and suggests that this phenomenon should be more thoroughly analysed. The same report lists unit costs for different rural electrification technologies (including installation) as follows: MV lines (including poles) range from 8 to 13,000 Euros (USD 11,200 to USD 18,200) per kilometre, LV lines between 6 and 13,000 euros (USD 8,400 to USD 18,200) per kilometre, a diesel generator around 400–500 euros (USD560–USD700)/kW, a SHS around 10–15 euros (USD 14–USD 21) per Wp. Recent work by the US National Rural Electric Cooperative Association (NRECA) in Tanzania indicates that those figures are on the low side, at least in Eastern and Southern Africa.

The basis for the unit costs used in the REMP are ZESCO costs from 2000 or 2003, adjusted to take into account the price escalation. The REMP uses the following unit cost for distribution lines:

- 33kV distribution line (including poles and accessories) USD 36,000/km
- 33/0.4kV transformer on the pole (100kVA) USD 13,700/unit

The MTR Team was provided with copies of the contracts, including bills of quantities for the visited projects and have analysed the costs and compared them to some other neighbouring African countries[5]. Refer the chart below for the distribution and LV line costs.

No	Project	Project cost (US$)	Cost / km (US$)		
			Distribution lines		LV lines
			11kV	33kV	400V
09-8	Chibale	2,044,009		26,960	23,864
09-18	Buleya Malima	1,240,628		26,164	21,999
09-6	Kaparu	483,289	24,913		28,530
10-7	Mtowe/Kanyanja	378,596	16,200		27,960
09-9	Madzimawe	354,927	19,714		22,593
09-11	Mwaze II	330,287		32,441	
10-8	Shantumbu Basic School	264,185	19,033		31,271

[5] Following comments received on the initial draft report, the MTR team has only used 2011 cost figures, although few are available. NRECA is currently carrying out a cost analysis for REA in Tanzania, so there is likely to be additional cost figures available shortly.

09-10	Madzimoyo	226,282	21,370		22,593
09-7	Mabonde	212,932	22,709		23,052
	SOFRECO Study 2010		<18200	<18200	<18200
	TANZANIA (TANESCO)		26,492	36,293	36,913
	MOZAMBIQUE/EDM		27,860	30,000	
	UGANDA (UMEME)		13,873	15,232	12,997
	REMP			36,000	

The MTR team has also analysed different types of equipment and found that the only meaningful comparison that can be made is between different types of transformers, refer below:

No	Project	Project cost (USD)	Installed cost per transformer					
			11kV			33kV		
			50 kVA	100 kVA	200 kVA	50 kVA	100 kVA	200 kVA
09-6	Chibale	2,044,009				7,330	9,770	
10-8	Buleya Malima	1,240,628						20,485
09-8	Kaparu	483,289	8,054	10,411				
09-10	Mtowe/Kanyanja	378,596	6,944					
10-7	Madzimawe	354,927		15,850	23,897			
09-11	Mwaze II	330,287				14,631	18,690	
09-7	Shantumbu Basic School	264,185			17,136			
09-9	Madzimoyo	226,282		16,874	25,440			
09-18	Mabonde	212,932	9,664	12,492				
	TANZANIA (TANESCO)		15,733	22,464	35,621			36,293
	MALAWI (ESCOM)					11,500	12,000	18,000
	UGANDA (UMEME)		5,520	6,405	8,505	6,332	7,538	9,101
	REMP						13,700	

It can be concluded that the unit costs of the above examined REF-supported projects are not outside any reasonable cost realm for standard three-phase grid extensions without low-cost design.

3.11.4 Contract packaging

To ensure economy and efficiency, contract packaging needs to examine whether it is possible and sensible to combine similar or related items in a single package. In the past, conventional wisdom held that substantial savings could be achieved by bulking orders for similar goods and getting economies of scale. With present order processing and shipping methods, significant price differences occur only with very large differences in quantities.

The ability of local suppliers of goods and services to meet project needs and the likely interests of foreign bidders to participate in a project are factors to be considered when making contract packaging decisions. The smaller 11kV contracts package sizes, in particular, appear to match local capabilities and the larger contracts, especially the 33kV packages, have attracted foreign firms. The approach with making basic bid “lots” and then awarding contracts for a number of lots in the same bidding process has been flexible and allowed budgets to be matched and would also appear to match local bidding capacities.

The smallest scale projects also have relatively high overheads as shown in the table below:

No	Project	Cost (ZMK)	Cost (USD)	Cost (ZMK) less contingency and VAT	Preliminary and General Items (ZMK)	Preliminary and General Items (%)
09-8	Chibale	9,729,481,509	2,044,009	7,988,080,056	312,535,740	4%
09-18	Buleya Malima	5,905,387,015	1,240,628	4,848,429,404	674,124,566	14%

09-6	Kaparu	2,300,454,684	483,289	1,888,714,847	276,374,580	15%
10-7	Mtowe/Kanyanja	1,802,114,643	378,596	1,412,315,550	120,000,000	8%
09-9	Madzimawe	1,689,452,374	354,927	1,387,070,915	177,750,000	13%
09-11	Mwaze	1,572,166,321	330,287	1,290,777,193	177,750,000	14%
10-8	Shantumbu School	1,257,522,244	264,185	985,519,000	70,000,000	7%
09-10	Madzimoyo	1,077,103,885	226,282	884,321,745	177,750,000	20%
09-7	Mabonde	1,013,554,944	212,932	832,146,916	312,535,740	38%

Although the results are not straightforward, the above would seem to indicate that the smaller contracts have higher overheads and a tendency towards higher equipment costs. It is understood that for future projects, REA is suggesting projects selected from the REMP and also of a size that is larger than previous projects. This should improve cost efficiency.

Given a larger contract size a prequalification process should be considered. Prequalification is aimed at ensuring that only contractors and suppliers who have the required experience, as well as technical and financial resources, bid for a contract. Prequalification screens potential bidders and is designed to attract leading contractors and suppliers, particularly the international ones, to bid, knowing that competition is confined to only those who are qualified. This also benefits the borrower. However, prequalification may increase procurement lead time and the procurer is required to review all prequalification applications. With post-qualification, the procurer only reviews the qualifications of one bidder, and the names of all prequalified bidders are known in advance of bid submission, making it easier for bidders to collude and fix prices.

3.11.5 System design

Electricity load estimation is central when planning electrification systems as the load forecasting is a very important basis for the subsequent design. Load forecasts that are too optimistic about load growth in rural areas lead to oversized and expensive systems.

1) Traditionally, utilities have aggregated “predicted” consumption and use coincidence factors to estimate peak power demand.
2) Another method to estimate the peak power demand from a group of customers is the use of various formulas. The Velander formula has been used extensively in Scandinavia. This formula relates the yearly energy demand to peak power value using a non-linear relationship. The Velander formula has been quite reliable for medium-voltage network load calculations in Scandinavia when the number of customers has been large. However, the load estimates for a small number of customers in low-voltage networks have been quite unreliable. The National Rural Electric Cooperative Association (NRECA) in the United States has developed a similar formula.
3) Available literature has increasingly complex forecasting methods for larger distribution systems in developed countries. More reliable load estimates allow utilities to decrease investment costs by reducing the planning margin.

Annex 5 shows ZESCO’s standards for load forecasting. It appears that a major cost in ZESCO’s currently adopted rural construction is over-provisioning for future load growth. In practice, the magnitude of load growth is often uncertain. Over-provisioning for growth adds costs without benefit. Therefore, to minimize first costs, rural lines may need to be built only for the immediate prospective load – or for limited growth – and designed to enable simplified upgrading in the future. Utilizing the available capacity to its maximum will support the economic justification for expansion.

Zambia has like many other African countries inherited European standards for its distribution networks, standards that were adapted for high-density, high-demand centres in continental Europe. When applied in rural areas of Africa, this has often resulted in poorly adapted oversized networks carrying unnecessarily high costs for connecting rural loads. For example, existing technical standards allow for snow- and ice-loading in places that never experience such weather conditions.

Although there are many low-cost methods that are worthy of consideration, there are four low-cost methods, described in Annex 6, with significant cost-reducing impact:

- Appropriate design engineering,
- Developing an institutional cost-cutting culture,
- Single phase systems, especially Single Wire Earth Return (SWER), and
- Shield wire systems.

For MV grid extensions cost reductions of 25% to 40% of typical three-phase networks in Sub-Saharan African countries are attainable.

In the view of the MTR, there are a number of areas where Rural Electrification could be made more efficient and at lower cost. Such areas include the following:

- Building rural lines for immediate prospective load, or for limited growth, and designed to simplify upgrading in the future,
- Introducing low-cost technologies, and
- Designing and sizing contract packages to reduce overhead costs.

3.12 Beneficiary willingness to pay/ability to pay

Expanding access to electricity is particularly challenging in rural areas. The costs and benefits of rural electrification have been examined by two World Bank reports: ESMAP 2002, “Rural Electrification and Development in the Philippines: Measuring the Social and Economic Benefits” and IEG (Independent Evaluation Group) 2008, “The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits”. The two reports arrive at similar conclusions, including the finding that rural electrification investments can generate sufficient benefits for the investment to be warranted from an economic standpoint. The ESMAP study yielded a range for the willingness to pay of grid-connected households of USD 0.10–0.40 per kilowatt-hour (kWh) for lighting and operating a television set alone. This figure, in its upper range, is in excess of the average long-run supply cost. The REMP estimates the ability to pay for monthly electricity tariffs is ZMK 35,485 for households and ZMK 60,252 for business entities, respectively.

The MTR Team observed the following:

- The connection rate is much lower than what was envisaged in the REMP.
- The ZESCO deferred connection payment scheme, which allows staggering of the connection fee over 36 months, has resulted in a tremendous increase of connection rates, from 3,000 per month to up to 6,000 per month. ZESCO has had to introduce mobile offices one region at a time to combat the long queuing for new connections. This seems to indicate that the connection fee has been the largest hurdle to electrification for many and that the monthly consumption cost is manageable.
- There are two current moves aimed at reducing the peak demand that are likely to reduce the monthly consumption cost for some consumers. Under the Increased Access to Electricity Services project, 1,000,000 CFLs will be procured and distributed free of cost to customers, and ZESCO is likely to expand this scheme further on its own. Also, ZESCO intends to install 100,000

solar hot water heaters free of charge to customers. The intention is to follow this up with an additional 150,000 units.

3.13 Amendments to the Specific Agreement

The Specific Agreement signed in December 2008 remains relevant, however, it requires modifications on matters that have come to the fore since it was agreed upon. The MTR supports the following revisions to the Specific Agreement:

- Revisions taking cognizance of the development of 5-year rolling plans that would then replace REMP as the source from which projects for implementation are identified annually.
- An amendment stating that projects targeting public institutions, and thus financed on a full grant basis, will be at 100% subsidy level, which is what is happening on the ground. The subsidy levels indicated in the Specific Agreement between Sweden and Zambia are not in line with the levels in the Operational Manual. Virtually all projects at this stage have been targeting public institutions, and thus financed on a full grant basis in accordance with the Operational Manual. There is a need to amend the Specific Agreement, as the maximum 90% agreed subsidy stated there is not applied.
- In the last paragraph of Article 1 there is a need to clearly itemize the costs that will be eligible for funding under project preparation.
- A list of consultancy services that shall be funded by the contribution under the preparatory work for projects to be tendered should be included in Article (2)(i)(a).
- Article 7 should be modified to take into account the holding of two scheduled formal meetings per year between Sida and REA – one being a review meeting held early in the year to review the previous year's progress and issues arising, and the second being a planning meeting held later in the year for the forthcoming annual work plan. This modification in the Specific Agreement depends upon the MTR's recommendation of splitting the annual review meeting into two being accepted.
- The timeframe for signing the minutes following the meeting should be revised to within one week of holding the meeting in Article 7(1).
- It should be established in Article 7(3) that the timeframe for submitting the agreed Annual Work Plan to the REA Board should fit into the schedule of Board meetings set by REA.
- The payment schedule for release of Swedish/Dutch funds was according to the following table:

Year	Sweden (SEK)	Netherlands (Kwacha)
2008	25,000,000	3,800,000,000
2009	40,000,000	6,000,000,000
2010	60,000,000	9,000,000,000
2011	70,000,000	10,500,000,000
2012	55,000,000	8,500,000,000
Total	**250,000,000**	**37,800,000,000**

Halfway through the agreement, it is now time to revisit this schedule to align it with the actual situation on the ground.

3.14 The Assessment Memorandum, follow-up of the Pre-Award Audit and Follow-Up Audit

The Assessment Memorandum of September 2008 made a number of assumptions while considering Swedish/Dutch support to REA and REF. Three years later, a number of assumptions remain valid, while some others do not. These assumptions are discussed in the different sections of this report but in summary, the key ones that remain valid include:

- The current level of funding raised by GRZ and the levy remains insufficient, and the provision of external funding therefore continues to be essential.

- The contributions from GRZ through the electricity levy did increase substantially due to the increase in tariffs
- The legal and institutional framework is clear and considered suitable.
- The memo noted that the marginal cost was low for connecting additional customers and that the application of high connection fees by the power utility ZESCO will be a barrier. This continues to remain valid.
- The procurement capacity of REA remains sufficient.

The key assumptions that proved not to hold true include the following:

- All subsidies for rural electrification would be channelled through the REF, replacing, e.g., the then separate project financing and the inefficient project supervision from each separate donor. Donors continue to support REA separately.
- The contributions from GRZ through the electricity levy would increase substantially due to the possibility to include the levy in the fees paid by CEC (the mines). Levies are still not imposed on mines.
- During the implementation phase the dialogue regarding pro-poor connection fees would be continued and deepened. Swedish/Dutch support has not been used towards this aim.
- The private sector was expected to play an important role as promoters and operators of electric distribution systems. This was foreseen particularly with regard to the off-grid schemes and the solar system packages. This did not occur.
- Agreement still has not been reached with other cooperating partners on how to perform coordinated missions and to strive for joint monitoring and evaluation, as well as reporting. The risk, foreseen in the memo, that there would be lower (budgetary) allocations in the future to REA has not been realised. They have on the contrary substantially increased.
- Annual review meetings of REA/REFs operations, planned to be organized jointly between cooperating partners as part of the Energy Sector Advisory Group (ESAG) activities, still haven't taken place.

The report of the Pre-Award Audit, dated February 2008, assessed the state of REA's financial systems and capacity, and reviewed the accounting and reporting systems used. This Pre-Audit Award was followed up in February 2010. A number of observations were made, and the current position on the key ones both reports noted is:

1. The Board of REA: The Board of REA was appointed, but the Act of 2003 has not been amended to provide for staggered terms of appointment. The amendment of the Act is outstanding and will require REA to develop wide consensus around the issue. Continuity in the board is currently hampered by the stipulation that casual vacancies can only be filled for the remainder of the term of the outgoing member.
2. Capacity: In general the capacity of REA has grown over time and the establishment allows for eventual build up from the current 30 to 71. The Procurement Section now has three staff, which is considered adequate for current needs. An issue related to the staff establishment concerns the remuneration of staff. It is a matter of continuous attention and in some specific technical areas, such as engineering, continues to pose challenges. In general, the staff is stable, but will be tested by an expanding establishment.
3. Systems and Procedures: The procurement procedures have been in a fluid state for the last two years owing to an ongoing reform of the national procurement laws governing the Zambia Public Procurement Authority. REA has adjusted its procedures to be in line with the current ZPPA stipulations. With regard to the financial control and accounting systems and procedures, these were found to be adequate by the MTR team.

3.15 Effectiveness of Sida/Dutch support and the impact of electrification

The developmental outcome of the Sida/Dutch support and of the entire electrification programme is a higher standard of life for rural communities through improved livelihoods and access to health and education. A higher rate of rural household electrification will contribute to this outcome based on the specific outputs of the electrification programme in relation to the number of projects implemented under the various modes. The Sida support has financed a number of grid extension projects, some completed and others ongoing at the time of the MTR. This report details the status of these projects. The financial analysis of the projects yields costs that are consistent with international and local norms. The rate of delivery has been hindered to some extent by the initial low capacity by REA, but this is expected to improve during the latter half of the support period. Based on this expectation, the MTR's assessment is that the project will yield the expected results, even though the overall results and outcomes cannot be assessed at this time.

During the MTR, a total of 11 sites of 8 projects were visited and data collected from them. Staff of schools and health centres, owners of business entities and homeowners dwelling near grid-extension sites were interviewed. The profile of each site is presented separately in Annex 2, where detailed findings are given. However, in summary:

Education: School teachers and school children report being able to study for longer hours. Evening classes have been introduced in a number of cases. In one case, the labs are functioning more effectively. The interest of prospective teachers to work in the school and the retention of teachers has been positively affected.

Schools generally have meagre budgets from the government and rely on additional funds from parents, from whom they are allowed to seek funds. In two cases schools complained of the high fixed monthly usage fee they had to pay. In one of these cases the school was now disconnected because of its inability to pay. One school had been disconnected because it did not have the ability to pay the fixed monthly bill of ZMK 238,000, and another was finding it difficult to continue payments on its bills.

Health: Health centres, where connected, reported positive effects on the retention of staff. They stated that working during evenings had become easier because, for example, tasks such as injecting into veins had become easier. Previously, finding a vein in the dark was a problem. Though the simple equipment used in rural health centres does not rely on electricity, refrigeration of vaccines and other drugs was now possible. Previously, vaccines had to be imported, by bicycle in some cases, on a weekly basis from the nearest town.

Business entities: The arrival of electricity has seen a mushrooming of shops and hammer mills for grinding of corn. Within existing shops, refrigeration and mobile phone charging was taking place. New businesses that have opened up include welding and hair salons. Potential businesses include bars, guest houses, video stores, etc.

Households: The connection of households is dismally low. Hardly any have connected and in some cases electricity reached the area more than a year ago. The distance from the lines may be one issue, but in the east and south households are not generally aware of the cost of connection and about the deferred payment scheme. This is in contrast to project sites visited in Serenje, where the local ZESCO official has taken active steps to sensitise the locals, resulting in a flood of enquiries. The deferred payment scheme is only available if a user has a prepaid meter installed, but ZESCO is unable to procure enough pre-paid meters to meet the need.

4. Recommendations

Overall, the Mid-term Review and Evaluation finds the performance of REA until now, under the rural electrification programme supported by Sweden/Netherlands, as satisfactory and recommends that Sweden/Netherlands continue their support of the organisation. At the same time, both parties are encouraged to increase their engagement with each other, both formally and informally. The specific recommendations pertaining to each issue discussed in Chapter 3 of this report are the following:

REMP

- REMP should be used merely as a guide to assist in the preparation of the 5-year and annual work plans. REA has now drawn up a list of projects to be funded for 2012, all of which are said to be from the REMP. After 2012, it is expected that the first of the 5-year rolling plans will have been developed with the support of JICA, and this should then be used as the basis for identifying projects for inclusion in annual work plans.
- REA must ensure that the projects packaged in the new 5-year rolling plans are of a manageable size and reflect both the financial resources and requirements to spread projects across the provinces.

Monitoring, evaluation and reporting

- While REA's suggestion that Sida provide it with a reporting template for the annual reports should be considered, REA should revamp its reporting style so that it is more analytical and provides its cooperating partners with the necessary comfort that REA is aware of and able to respond to challenges it faces.
- The MTR recommends that there be one consolidated list of KPIs that is acceptable to its cooperating partners, the board and parent ministry. The KPI on CO_2 emissions, i.e., KPI No. 9 should be removed as it is merely a guess.
- Along with an increased number of informal interactions, the review meetings with Sweden/Netherlands should be split into two: one meeting held early in the year to review the progress of the previous year, and the second later in the year to discuss the following year's work plan.
- In reporting on the contributions for projects by the government and by Sweden/Netherlands, REA should abandon the practise of reporting by project. This is a futile exercise that contributes nothing, as funding is pooled in one account before it is used for expenditure. Instead, the funding contributed overall by Sweden/Netherlands and the government, respectively, should be highlighted, and special cases like Kasaba Bay, which Sida has refused to fund, treated separately.
- A revised M&E system should be manageable and data entered into it must be easy to collect. Trying to record the amount and value of candles or kerosene a household consumes does not serve REA's immediate needs and if impact studies are needed, they can be conducted every three years by an external body with donor support.
- Information that should be regularly recorded and reported includes the intended start and end dates of project implementation, the current status versus targeted status, number of schools, health centres, businesses and households that can likely be connected, number of schools and health centres that were connected, as well as the number of students in the schools and catchment areas of health centres.
- At the organisational level, staff meetings should be held more frequently (once a month is proposed) and could be shorter in duration than the current Town Hall ones. As the organisation grows, information-sharing and coordination will become increasingly crucial and this forum would be well placed to serve that role.

Policy and legal issues

- There should be a policy statement by the government that promotes pro-poor subsidies and encourages consumption of electricity by rural households. It is accepted that the principle of cost-reflective tariffs protects the utility from the risk of insolvency and contributes to effective management of the network. However, government should extend the rural electrification programme to include strategies for household connections.
- The REA and ZESCO should be encouraged to explore technological options for reducing the cost of connecting households. An explicit policy statement for such innovations would help to mobilize additional resources for household connections, especially from the cooperating partners who need such a signal. The results of the World Bank Capital Subsidy pilot project will be an important learning opportunity, and the Single Wire Earth Return systems which ERB has permitted will help to lower the cost of connections to the consumer.

Capacity of REA

- The MTR supports the strategy being adopted to decentralise monitoring and implementation of field activities through the appointment of field officers. It is expected that gradually the number of field-based staff will increase, as well as their powers to make decisions and give approvals.
- While REA appears to provide a good work environment, there is a need to assess the salary structures of REA to make them more attractive to retain staff.
- As training forms a major component of REA's strategy for improving organisational capacities, more stringent bonds should be considered for those attending training courses with differing penalties being applied depending upon whether courses or attendance at workshops was in Zambia or abroad and also according to the duration of attendance.
- For the preparation of Environmental Project Briefs, REA should use funds allowed under the Specific Agreement Article 4.2: consulting services for preparatory work undertaken for projects. This work can be contracted out on case-by case basis.
- REA is allowed under the Specific Agreement Article 4.2 to engage consultants for monitoring and evaluation. As the workload increases and hiring permanent staff takes time, expertise should be contracted when needed.

Engagement with ZESCO

- REA should involve ZESCO more in its community mobilisation activities. HIV/AIDS and commissioning events, among others, can be good forums for disseminating information on connection charges and schemes, as well as user tariffs.
- There should be greater involvement from ZESCO's various departments. Suggestions are as follows:
    - At the planning stage, involve the Engineering Development Department, the Environmental Unit and the Construction Unit to confirm that power is adequate where the line is to be tapped.
    - At the implementation stage, involvie the Distribution and Construction units so that the contractor conforms to ZESCO standards.
    - At the implementation and closing stages, involve the Customer Services Unit so that new connections are promoted and awareness is raised. At the final stages, also involve the New Connections Unit for the same purpose.
- To achieve the above, a formal Memorandum of Understanding with ZESCO should be considered.

Procurement

- In the short term, REA should be proactive in its relationship with ZPPA to minimise possible delays in the securing of a no-objection to the proposed specifications and the evaluations of the bids.
- In the medium- to long-term, REA should do what is necessary to attain an autonomous status for the procurement section.

Synergies between REA's cooperating partners

- At least twice a year, spearheaded by REA, the cooperating partners and REA should meet to discuss common issues specific to the implementation of the rural electrification programme.

Alternative sources of energy

- A continued emphasis on extension of the grid, complemented by supply to isolated rural communities through mini-grids powered by mini hydro-generators and other renewable energy sources is recommended. Individual solar home systems (SHS) are considered suitable when grid extension and mini-grids are not viable and the expected consumption of households is very low.

Promoting private sector and community/cooperative involvement

- REA should assist unsolicited projects with information and awareness-raising, capacity-building of consultants and of local construction companies, providing grants for the preparation of feasibility studies and assisting local developers and electricity cooperatives in the creation of viable electrification entities, capable of managing the operation after the investment phase. This can partly be arranged by introducing matching grants and performance grants.
- It is recommended that Zambia follows Tanzania in developing a set of guidelines to help Small Power Producer (SPP) developers to understand the step-by-step procedures for acquiring necessary permits, licenses (if applicable) from the regulator and other governmental entities, as well as other technical, commercial, and regulatory requirements for bringing a SPP into operation.

Options on connection charges

- If there is a financial reason for the delay in supplying prepaid meters, it is recommended that Sida consider financing part of them, as the absence of meters is holding up connections in certain areas.
- ZESCO should provide more information to the public about its deferred connections payments scheme and should clarify which categories (if any) other than the three types of residential categories will be eligible.

Cost efficiency

- Sida should support Zambia in initiating a process to establish specifications for and promote the use of standardised designs, structures and materials for low-cost rural electrification projects in Zambia. The standard should cover requirements for the distribution of electricity to be utilised, whether the supply is from a local generator or from the national grid. The process should initially determine the most cost-effective electrification technologies for Zambia, but it is envisaged that single-phase distribution, SWER, shield-wire distribution and appropriate engineering would be considered. ZESCO, REA and ERB would in principle all be suitable to spearhead such a process, but a study is likely to be needed to identify the pre-requisites for change.

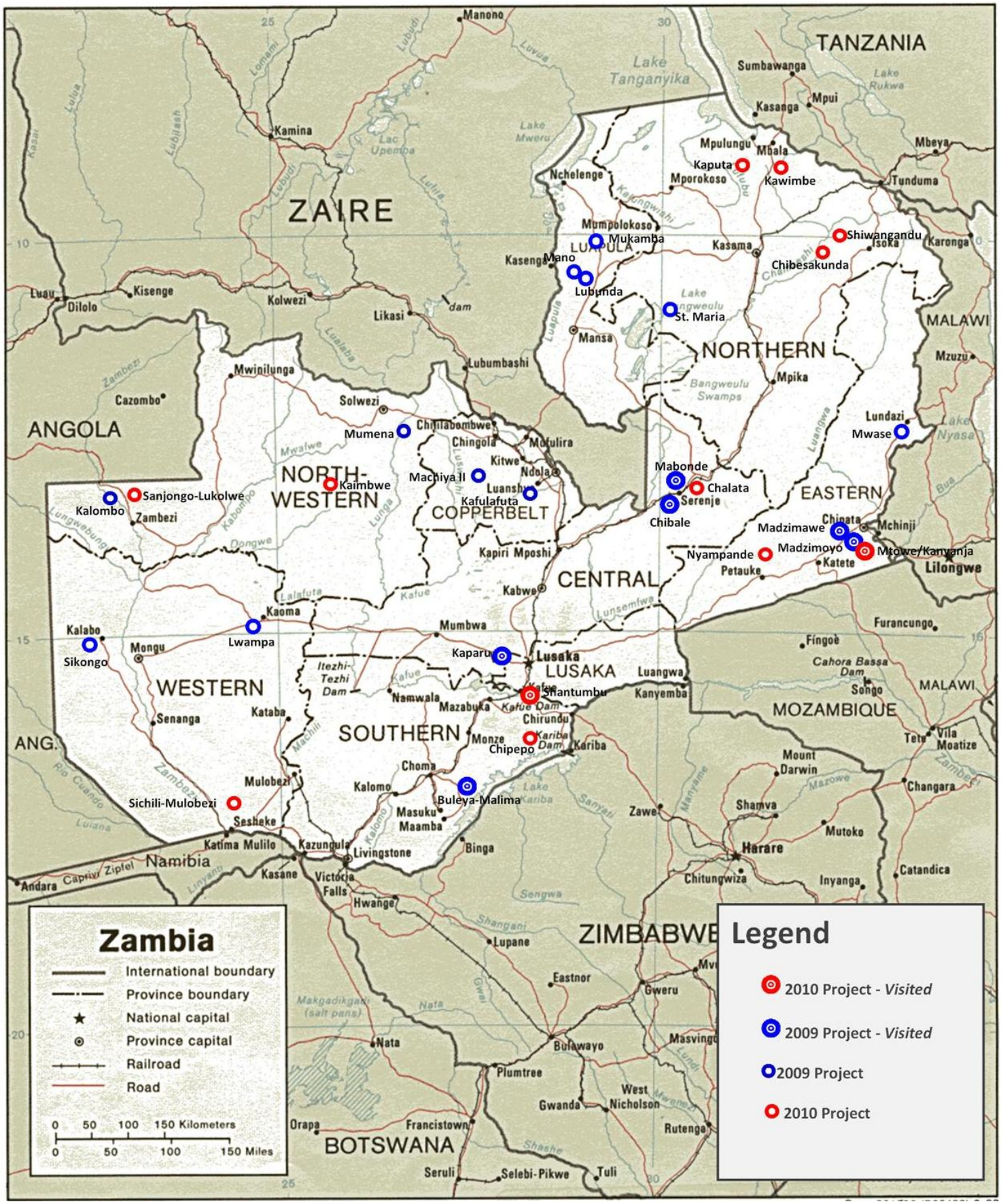
Willingness to pay and rate of household connectivity

- ZESCO and REA need to sensitize and educate the communities on (a) internal wiring of buildings or the use and availability of ready boards, (b) the cost of electricity connections.

Amendments to Specific Agreement

- The MTR supports the amendments to the Specific Agreement listed in Section 3.14 of this report.

Annex 1 – Location of 2009 and 2010 grid-extension projects



Annex 2 – Field-visit reports

Eight grid-extension projects funded by GRZ and Sweden/Netherlands were visited during the MTR. For the project in Chibale, separate reports were prepared for Chibale settlement and basic schools in Kofi Kunda and Waya, while for the Madzimawe project an additional site report was prepared for Kapoko.

Hence, the total number of reports presented below is 11:

1. Mtowe/Kanyanja in Eastern Province
2. Madzimawe in Eastern Province
3. Kapoko in Eastern Province
4. Madzimoyo in Eastern Province
5. Buleya – Malima in Southern Province
6. Shantambu in Lusaka Province
7. Chibale in Central Province
8. Kofi Kunda in Central Province
9. Waya in Central Province
10. Kaparu in Central Province
11. Mabonde in Central Province

1. Site report for Mtowe-Kanyanja

Project	**Mtowe/Kanyanja**
No	**2010-06**
Length of line (km)	**11**
Voltage (kV)	**11**
Contracted Amount (ZMK)	**1,802,114,643**

1. Site description

The Mtowe-Kayanja settlement is an area located south of Chipata, approximately 7km from the Great East Road. The settlement has one (1) Basic School with about 600 pupils and 10 members of staff; one (1) Secondary School and one (1) Rural Health Centre (RHC) serving about 9,000 people.

2. Progress

The electrification project has not been completed, owing to the inability of the contractor, African Brothers, to follow ZESCO's construction specifications in terms of acceptable materials, line tensions and transformer placement (See "Technical Aspects" below). The schools and the RHC have, on the other hand, done most of the required internal wiring in anticipation of grid power. The Basic School, in particular, has finished the internal wiring of staff houses and all but one classroom block.

3. Technical aspects

The area has a combined installed capacity of 200kVA with 100kVA for the Basic School and another 100kVA to supply power to the Secondary School and the Rural Health Centre. Both these transformers are capable of handling the power loads even taking into account the new loads that are anticipated in the near future (See "Other Issues" below).

The power line was fraught with electrical and mechanical shortcomings. ZESCO's construction specifications were not properly followed and, in some cases, ignored. Specifications on placement of transformers, the proper construction of guy-wires and the quality of insulators and fuses were not properly followed.

No.	Description	Value according to REA records	Observed Value
1	Number of transformers	2	2
2	Total installed transformer capacity	150	200

4. Social economic aspects

Mtowe-Kanyanja has eleven (11) schools in total, but only one has access to grid power. The entire area has only one RHC, which at the time of writing is yet to be connected to the grid.

The RHC expressed a hope for longer opening hours and the ability to use medicines, notably vaccines that require refrigeration, when the centre is connected to power. Teachers at both schools expressed a desire to stay at their current postings because of the imminent arrival of power. They also looked forward to a better quality of life when their homes get connected to power.
The table below summarises the social-economic aspects of Mtowe-Kanyanja:

No.	Description	Value according to REA records	Observed Value
1	Number of schools	2	12
2	Total number of students	600	1400 (2 schools)
3	Total number of staff houses	7	19 (2 schools)

5. **Ability and willingness to pay**

As power is yet to be connected to any house, classroom block or the RHC, the ability of the residents and institutions to settle their bills could not be fully ascertained. All the residents did, however, profess a capacity and deep willingness to pay their bills when informed of the amount the residents in nearby Madzimoyo were paying to ZESCO (See Field Report No. 3 for Madzimoyo).

6. **Other issues**

A significant number of residents who have their homesteads near the power line have embarked on construction of better, standard houses with a view to eventually connecting to the power grid. This should result in an overall better quality of life for the residents.

7. **Recommendations**

There is a need for REA to adopt a selection process that will better determine the capacity and experience of the contractors. The tendency of African Brothers to ignore ZESCO's standards of construction has resulted in needless delays with completion of the grid-extension project because the lines have to be redone. It would also be desirable for ZESCO to get involved in the construction of the lines from the very beginning to provide much needed guidance on the correct construction of the power lines.

2. Site report for Madzimawe

Project	Madzimawe
No	2009-13
Length of line (km)	7.5
Voltage (kV)	11
Construction start	14/09/2009
Construction end	June 2010
Contracted amount (ZMK)	1,689,452,374

1. **Site description**

Madzimawe is a settlement east of Chipata located about 8km off the Great East Road. The area has two (2) schools, one (1) Rural Health Centre (RHC) and a chief's palace. The area has 8 businesses and a total population of nearly 8,000.

2. **Progress**

The area has been connected to grid power since June 2010. The school, the RHC and the chief's palace have all been connected. The residents all report a steady reliable supply of power. However, of the two schools in the area, only Madzimawe Basic School has been connected to the grid. The grid was not extended to the other school, which is about 4km from the grid. Of the 8 businesses in the area, 4 businesses are connected to the power grid. The other 4 have already done their internal wiring, but the prohibitive ZMK 2.4 million connection fee is an obstacle.

3. **Technical aspects**

The line is an 11kV line and terminates in an 11/0.4kV, 100kVA transformer that supplies the school, RHC and the chief's palace. The quality of the HV, MV lines – both electrical and mechanical – was high and adhered to ZESCO standards.

The 100kVA transformer is capable of handling all the loads that are currently connected and any households or businesses that may connect to the grid in the near future.

No.	Description	Value according to REA records	Observed Value
1	Number of transformers	1	1
2	Total installed transformer capacity	100	100

4. Social-economic aspects

The Madzimawe area is dominated by the school, the chief's palace and the RHC. There is no private residence of a quality that can be electrified within the vicinity of the MV line.

Electricity has contributed to the increase of profits for the business entities in the area. The business of hammer mills has thrived in the area and lead to a better quality of life for locals who often had to travel long distances to have their grains ground. The RHC has been able to open for longer hours (06hrs - 20hrs) since it was connected to power. Two areas in particular proved beneficial for the RHC: The ability to have safer deliveries at night because of abundant light and the capacity to stock medicines that require refrigeration, notably vaccines.

Staff at both the RHC and the Basic School reported a vastly improved quality of life since the arrival of power. The head teacher of the school noted that staff are now more willing to stay at the school than before the arrival of power.

The table below summarises the social-economic aspects of Madzimawe:

No.	Description	Value Reported by REA	Observed Value
1	School	1	2
2	Students	N/A	900
3	Business entities	0	8
4	Staff houses	N/A	9 (RHC and School)

5. Ability to pay

The RHC, the Basic School, and the chief's palace are all on the fixed, standard non-metered bills of ZMK 278, 000 per month. All three institutions and their staff members have demonstrated a capability to settle their bills on time. There was, however, a demand for ZESCO's prepaid meters so that power customers can more easily manage their bills.

6. Other issues

During the monitoring exercise it came to light that the majority of Madzimawe residents had no information about the new 3-year payment scheme that would allow households to get connected to the power grid at minimal cost of as little as K 21,000.

7. Recommendations

Sensitisation should be conducted in the area using various channels, especially the local chief, to educate the community on the 3-year connection scheme to boost household connectivity. An adaptation of the approach used in Mabonde area to disseminate information about the 3-year payment scheme could be considered. This is likely to increase the number of household connections considerably. The provision of pre-paid meters by ZESCO is necessary to help the institutions and households better manage their bills.

3. Site report for Kapoko

Project	**Madzimawe**
No	**2009-13**
Length of line (km)	**7.5**
Voltage (kV)	**11**
Construction start	**14/09/2009**
Construction end	**June 2010**
Contracted amount (ZMK)	**1,689,452,374**

1. Site description

Kapoko is a settlement located nearly 3km from the Great East Road and about 18km west of Chipata. 3.7km of 11kV overhead line has been constructed from Mutenguleni on Katete-Chipata Road to Kapoko Basic School, Kapoko Rural Health Centre and the market. The 11kV line then runs a further 3.8km to Madzimawe Basic School and Rural Health Centre.

2. Progress so far

The line has been completed and the drop cables connected to houses, classroom blocks, the local health outpost and a church. The school has wired and connected two (2) staff houses and is in the process of wiring two more staff houses for subsequent connection. The classroom blocks, the church and the health centre have not been connected due to lack of funds.

3. Technical aspects

The line consists of 12m standard wood poles with 50mm^2 aluminium conductor steel reinforced (ACSR). The 11kV line has ceramic post insulators for intermediate poles and strain silicon composite insulators for terminal section and through-angle pole structures. A 100kVA 11/0.4kV Transformer is installed at the Kapoko Basic School for supply to the Basic School, the market and the Rural Health Centre. The ZESCO representative indicated that they were aware that the 100kVA transformer was too small for the upcoming load and needed to be upgraded.

No.	Description	Value Reported by REA	Observed Value
1	Number of transformers	1	1
2	Total installed transformer capacity	100kVA	100kVA

4. Social-economic aspects

By the end of the year it is hoped that classrooms will also be connected, provided enough funds are mobilised from the school's Parents and Teachers Association (PTA). Four (4) private households were likely to connect, but they were waiting for ZESCO and pre-paid metres. The market in the area comprises sixteen (16) shops. Of the 16 shops, three (3) shops have been connected to the grid. There are four (4) additional shop owners who are eager to get connected to electricity, but they lack information on how to go about arranging the connections.

The table below shows the numbers of students, schools and business entities in the Kapoko area:

No.	Description	Value as reported by REA	Observed Value
1	Schools	N/A	1
2	Students	N/A	440
3	Staff houses for school	N/A	4
4	Business entities	0	16

5. **Ability to pay**

The three (3) hammer mill owners are currently managing to pay the fixed electricity bill of K 278,000 per month. However, they are waiting for the prepaid meters from ZESCO to be installed, as it is cheaper than the fixed bill. The shop owners that are connected are paying their bills on time and were happy to report increased profits.

6. **Other issues**

As most of the residents in the area have their homesteads an appreciable distance from the power line, there is a need to extend the MV line to accommodate them.

7. **Recommendations**

It is recommended that sensitisation be conducted in the area to educate the community on the benefits and costs of getting connected to electricity. The new users require implementation of prepaid meters for full control of power usage in their buildings. ZESCO should, therefore, install prepaid meters in the shortest period of time to give clients, many of whom have limited resources, more control over their bills.

4. Site report for Madzimoyo

Project	Madzimoyo
No	2009-14
Length of line (km)	1.5
Voltage (kV)	11
Construction start	14/09/2009
Construction end	June 2010
Contracted amount (ZMK)	1,077,103,885

1. **Site description**

Madzimoyo is a settlement located about 16km from Chipata along the Great East Road. The settlement has a Basic School, a Secondary School, a business area and a police training camp. The area is serviced by one 100kVA transformer serving the secondary school and one 200kVA transformer supplying power to the basic school and the market area. The police camp is supplied by a ZESCO line that has been operational for many years now.

2. **Progress to date**

Construction and commissioning of the power line has been done and the settlement has been connected to power. Both the basic school and the secondary school are connected to the grid, although, at the time of writing, the basic school had its power supply cut off due to non-payment of bills. Three private businesses have been connected. The RHC and 4 staff houses are connected. The business area has also had power for the same duration and has seen the rise of new businesses that rely entirely on the availability of grid power (See “Social-economic aspects” below)

3. **Technical aspects**

The 11kV line has ceramic post insulators for intermediate poles and strain silicon composite insulators for terminal, section and through-angle pole structures. The construction of the line was the ZESCO standard 12m standard wood poles with 50mm^2 aluminium conductor steel reinforced (ACSR). The 11kV line is tapped by one11/0.4kV, 100kVA transformer that supplies power to the secondary school and one 11/0.4kV, 200kVA transformer that supplies power to the market and the basic school. The overall quality of the mechanical and electrical aspects was high. The ZESCO staff

indicated that the transformers had sufficient capacity to handle the loads even with the planned expansion of the secondary school and the increase in demand for businesses and households in the foreseeable future.

No.	Description	Value according to REA records	Observed Value
1	Number of transformers	2	2
2	Total installed transformer capacity	300 kVA	300 kVA

4. Social-economic aspects

Apart from the two schools mentioned in this report, Madzimoyo area has twelve (12) other schools that are not connected to power. At the two schools connected to grid power there has been a marked increase in the number of students wishing to enrol since the schools were connected to the grid. The students are now able to study in the evening and school managers report markedly improved results. The secondary school has acquired new equipment, such as computers, a photocopier and a printer. These have enabled staff to work faster and offer better quality lessons to their students. The area has seen three main types of businesses spring up since power came to the arrived: hammer mills, welding shops and barbershops. The table below summarises the social-economic aspects of Madzimoyo:

No.	Description	Value Reported by REA	Observed Value
1	Total number of schools	2	2
2	Total number of students	T.B.A	1,200 (basic & secondary)
3	Total number of staff houses	T.B.A	14 (basic & secondary)
4	Business entities	0	20

5. Ability and willingness to pay

The secondary school has demonstrated a willingness and capacity to settle the power bills on time, while the basic school has struggled to pay the bills and was at the time of monitoring disconnected from power due to non-payment of bills. This is because the secondary school is able to charge up to ZMK170,000 per student in user fees for its senior students (grades 10-12) and, therefore, has access to reasonable income to settle its ZESCO bills. The basic school, on the other hand, is unable to charge more than ZMK5,000 per household due to the government's policy of free basic education. Furthermore, funding from the government is insufficient and often erratic. The basic school, however, indicated that the school would be able to manage its bills if it was given a pre-paid meter. The current fixed monthly bill of K278, 000 is too high for the basic school's limited resources. The households in the area have been settling the bills on time, but they have also expressed a strong desire to have a prepaid meter for better management of electricity bills.

6. Other issues

When asked about the non-availability of meters in the area, the local ZESCO office indicated a problem with acquiring meters because the supplier was overwhelmed with the production of meters for ZESCO's nationwide rollout of pre-paid meters. The local manager explained that the issue of prepaid meters was understood and that a shipment of new meters was expected within two weeks of the day of the interview.

7. Recommendations

ZESCO has to install pre-paid meters as soon as possible to enable clients, such as the basic school, to better manage their bills. As in almost all sites, there is great need to inform the locals about the affordability of connecting households to grid power.

5. Site report for Buleya-Malima

Project	**Buleya-Malima**
No	**2009-16**
Length of line (km)	**29**
Voltage (kV)	**33**
Construction start	**14/09/2009**
Construction end	**July 2010**
Contracted amount (ZMK)	**5,905,387,015**

1. Site description

Buleya-Malima is a settlement east of Sinazongwe, approximately 30km from Maamba Road. The settlement comprises a basic school, a Rural Health Centre (RHC), a business centre and some villages. The area is served by a 200kVA transformer that taps off a 33kV HV line.

2. Progress

The construction of the entire power line was completed and commissioned in 2010. The first buildings were connected to the grid by July 2010. At the time of writing, the line is still under the supervision of REA, but the local ZESCO office maintains the line and is responsible for connecting any new clients to the line. The basic school, the RHC and 11 businesses have been connected.

3. Technical aspects

The 33kV HV line terminates into a 200kVA transformer that supplies power to the business centre, the RHC and the basic school. ZESCO staff indicated that the transformers had sufficient capacity to handle the loads even with the planned expansion for the school and the increase in demand from businesses and houses in the foreseeable future. Judging from the demand that is likely to come from the trading area and the nearby villages, the transformer may need to be upgraded in the near future.

No.	Description	Value reported by REA	Observed Value
1	Number of transformers	1	1
2	Total installed transformer capacity	200kVA	200kVA

4. Social-economic aspects

The Buleya-Malima settlement has seven (7) schools, but only Malima Mission School is connected to the grid. All of the ten (10) staff houses of Malima Mission School and the three (3) houses of the RHC staff are electrified.

The arrival of grid power has brought tremendous benefits to the local population who rely to a significant extent on trading in fresh fish, which require refrigeration. Traders, who had little choice but to sell limited quantities of fish, reported that business increased ten times after the arrival of electricity. Additionally, the business of hammer mills has thrived in the area and lead to a better quality of life for locals, who were often forced to travel long distances to have their grains ground.

The RHC has been able to stay open longer (05hrs-22hrs) since it was connected to power. Two areas have proven particularly beneficial for the local population: The ability to have safer deliveries at night and the capacity to stock medicines that require refrigeration, notably vaccines.

Members of staff at both the RHC and the basic school reported an improved quality of life since the arrival of power. The head teacher of the Mission School noted that members of staff are more willing to come and stay at the school than before the arrival of power.

The table below summarises the social-economic aspects of Buleya–Malima:

No.	Description	Value Reported by REA	Observed Value
1	Total number of schools	1	1
2	Total number of students	T.B.A	773
3	Total number of staff houses	11	13
4	Total number of business entities	0	20
5	Total number of Rural Health Centres(RHC)	1	1

5. **Ability to pay**

The school and the RHC have been paying their standard ZESCO bills of K278, 000 bills promptly since power was connected. They, however, like consumers from every other site covered in this review, expressed a desire to have pre-paid meters so they can better manage their bills. The shop and local business owners had, as confirmed by the local ZESCO personnel, demonstrated a willingness and capacity to settle their bills on time.

6. **Other issues**

Many residents interviewed were under the impression that they could not at this time be connected to power, as the line was yet to be handed over to ZESCO. On being told that they could apply, they were very enthusiastic and the 12 connection application forms the team came with to the area were handed out in the 30 minutes the team was at the site. The local population has more income than other locations because of fishing and farming activities. Both the households and the market boasted better built homes, pointing to relatively high income levels than many sites visited during the review.

7. **Recommendations**

The community in the area should be provided with full information and sensitized about the affordable 3-year connection scheme. In order to allow clients to better manage their bills, ZESCO should provide prepaid meters to its clients in the area as soon as possible.

6. Site report for Shantumbu

Project	Shantumbu Basic School
No	2010-8
Length of line (km)	5
Voltage (kV)	11
Contracted amount (ZMK)	1,257,522,244

1. **Site description**

Shantumbu settlement is an area located in the Kafue District about 40km south of Lusaka. The settlement has a Rural Health Centre (RHC), a basic school and a market area that serves as the main business centre. The settlement will be served by a 200kVA transformer.

2. **Progress so far**

This project has been beset by problems because the contractor, African Brothers, did not follow the ZESCO construction specifications of acceptable materials, line tensions and transformer placement. Nevertheless, the school, the RHC and 6 business owners at the market area have all wired their structures in anticipation of the arrival of power.

3. **Technical aspects**

The construction is the standard ZESCO 11kV construction, consisting of 12m standard wood poles with 50mm^2 aluminium conductor steel reinforced (ACSR). The 11kV line terminates in an 11/0.4kV, 200kVA transformer that will supply power to the RHC, the school, staff houses and the market shops.

The contractor has been asked to rectify the many shortcomings, including sagging transmission line, incorrect placement of insulators on the poles and the incorrect placement of transformers and fuses on the poles. Once completed, the 200kVA transformer will be able to adequately handle the anticipated loads.

No.	Description	Value according to REA records	Observed Value
1	Number of transformers	1	1
2	Total installed transformer capacity	200	200

4. **Social economic aspects**

Shantumbu area has 6 schools in total and none of them currently has access to grid power. The entire area has only one RHC, which at the time of writing has yet to be connected to the grid.

The RHC expressed hope for longer opening hours and being able to use store medical supplies like vaccines that require refrigeration. The teachers at the school expressed a desire to stay at their current postings because of the imminent arrival of power.

The table below summarises the social-economic aspects of Shantumbu:

No.	Description	Value according to REA records	Observed Value
1	Number of schools	1	1
2	Total number of students	1,197	1500 (Approx)
3	Total number of staff houses	0	8

5. **Ability and willingness to Pay**

At the time of writing, none of the structures had been connected. Therefore, the ability of the residents to pay could not be fully gauged. All the residents did, however, profess a capacity and willingness to pay the bills when informed about ZESCO's standard K278, 000 unmetered bills.

6. Recommendations

To avoid delays, during early supervision the REA needs to review construction drawings and make sure that the contractors understand the requirements. It would also seem desirable to involve ZESCO during the construction phase to aid the REA Staff. REA also needs to document the quality of the contractors' work for future procurements.

The provision of pre-paid electrical meters is of prime importance to enable customers with limited resources to manage their bills.

7. Site report for Chibale Settlement

Project	Chibale
No	2009-8
Length of line (km)	45
Voltage (kV)	33
Construction start	14/09/2009
Construction end	Dec 2010
Contracted amount (ZMK)	9,729,481,509

1. Description

Chibale is a settlement comprising a school, a market and a Rural Health Centre located about 45 km from the Mkushi-Serenje Road. The area is served by 4 transformers including three (3) 100kVA from the REA grid-extension project and one (1) 200 kVA from ZESCO, which has been installed for the purpose of supplying power to the new secondary school under construction near the basic school. The basic school, market and the Rural Health Centre (RHC) are all supplied from one 100kVA transformer.

2. Progress to date

Both the high voltage (HV) and the medium voltage (MV) lines have been constructed. Additionally, supply cables to all the staff houses of the RHC and the basic school have been installed. The line is still under the guarantee period and, as such, has not been officially handed over to ZESCO. However, ZESCO does routine maintenance on the line. Six (6) shops at the market area have been wired and two (2) are already connected to power. The RHC has not been connected yet because it is in a process of being upgraded to a larger centre. The school is not connected yet due to lack of funds for internal wiring.

3. Technical aspects

The quality of construction, especially the mechanical aspects, was very good. The inclusion of drop cables (supply cables) was a welcome inclusion in the scope of work. There were, however, problems with the underground cable at the beginning of the line a few kilometres from the tapping point. The cable blew out and cut off power to the downstream settlements, i.e., the settlements of Waya, Kofi Kunda and Chibale.

The following table summarizes the values of the major technical details reported by REA contrasted with what was actually observed in the field:

No.	Description	Value Reported by REA	Observed Value
1	Number of transformers	3	3
2	Total installed capacity	300kVA	300kVA
3	Additional transformer capacity by ZESCO	N/A	200kVA

4. **Social–economic aspects**

The Chibale site was a clear demonstration of the benefits of sensitization of the local population about the three-year payment period in increasing rural household connections. The local ZESCO staff were involved in the dissemination of information, particularly the three-year payment period, right from the start of the grid-extension project and this led to a great demand for electrification of households. The local ZESCO station manager hired Zambia National Information Services (ZANIS) to inform the local households about the three-year payment period and has been rewarded by a great demand for connections by the local households. In the area, there were already two (2) private household connections despite the area having been switched on for less than two months.

The table below summarizes the major Social–economic aspects of the site:

No.	Description	Value Reported by REA	Observed Value
1	Number of schools	1	2 (1 Still under construction)
2	Number of pupils	T.B.A.	900 (Approx.)
3	Number of health centres	1	1

5. **Ability and willingness to pay**

Both the health workers and the teachers at the basic school expressed willingness and a capacity to pay the ZMK 187,000 household fixed charge but also strongly expressed a desire to have prepaid meters so they may manage their bills. Likewise, the business owners expressed a capacity to pay. The school was expected to have some problems in paying the bills as it is a basic school and is severely constrained by the government's policy of free basic education, which limits the revenue the school can get from students.

6. **Other issues**

It was discovered that households (including staff households for schools and RHCs) had to pay around ZMK 3 million for wiring houses, which has proved prohibitive for many rural households. The high cost was attributed to the relative ignorance of the locals about the true cost of the materials used in wiring and a drive by local electricians to cash in on the locals' ignorance.

7. **Recommendations**

There is a need to find a way to help local households wire their houses at a more affordable price than the prevailing ZMK 3 million. This can be achieved by sensitizing the locals to the true cost of the materials or the hiring of an official house-wiring technician who will charge prevailing market prices for materials and labour. There is also a need for ZESCO to install pre-paid meters as soon as possible to enable local households to better manage their bills.

8. Site report for Kofi Kunda Basic School (Chibale area)

Project	**Chibale**
No	**2009-8**
Length of line (km)	**45**
Voltage (kV)	**33**
Construction start	**14/09/2009**
Construction end	**Dec 2010**
Contracted amount (ZMK)	**9,729,481,509**

1. Description

Kofi Kunda Basic School is a medium-sized basic school located near the middle of the Great North Road – Chibale road. It has a student population of about 900 students and has 18 staff members. The school has 11 schoolhouses. A 100kVA transformer serves the school.

2. Progress to date

Both the high voltage (HV) and the medium voltage (MV) lines have been constructed. In addition, supply cables to all the houses and school blocks have been connected. Six of the 11 staff houses have access to power. The rest have been held back by the high wiring cost of around three million kwacha (K 3,000,0000) per household. The classroom blocks have no access to power due to the high cost of wiring which the school cannot manage owing to its low income as a Basic School and a dearth of government grants.

3. Technical aspects

The quality of construction, especially the mechanical aspects, was very good. The inclusion of drop cables (supply cables) was a welcome inclusion in the scope of works. As mentioned above, a problem with the underground cable a few kilometres from the tapping point cut off power to the downstream settlements, including Kofi Kunda.

The following table summarizes the values of the major technical details reported by REA contrasted with what was actually observed in the field:

No.	Description	Value Reported by REA	Observed Value
1	Number of transformers	1	1
2	Total installed capacity	100kVA	100kVA

4. Social–economic aspects

The site is dominated by the school and the staff housing. There were no observed local households within the reach of the MV line. Moreover, there were no businesses observed in the area. The school reported improved grades and the introduction of additional night classes, which have been important in launching a local adult literacy class.

A summary of the major social-economic aspects observed and compared with those reported by REA is presented in the following table:

No.	Description	Value reported by REA	Observed Value
1	Number of schools	1	1
2	Total number of pupils	TBA	800

5. **Ability and willingness to pay**

The teachers expressed willingness and a capacity to pay the fixed charge, but also strongly expressed a desire to have prepaid meters so they can better manage their bills. The school was expected to have some problems in paying the bills as it is a basic school and its income is severely constrained by the government's free basic education policy, which limits the revenue the school can get.

6. **Other issues**

The households at the site complained about the erratic power supply and blackouts, which can be attributed to the faulty underground cables.

7. **Recommendations**

There is a need for ZESCO to install pre-paid meters as soon as possible to enable local households better manage their bills. There is also a need to find a way to help local households wire their houses at a more affordable price than the prevailing ZMK 3 million. This can be achieved by sensitizing the locals about the true cost of the materials or the hiring of an official house-wiring technician by the local ZESCO office who will charge realistic market prices for materials and labour.

9. Site report for Waya Basic School (Chibale area)

Project	Chibale
No	2009-8
Length of line (km)	45
Voltage (kV)	33
Construction start	14/09/2009
Construction end	Dec 2010
Contracted amount (ZMK)	9,729,481,509

1. **Description**

Waya Basic School is a small school offering grades 1 to 7 for a catchment area of about a 7km radius and is located about 2km from the Great North Road along the grid-extension power line. The school has 5 staff houses, 1 classroom block and a total student population of about 200. It is serviced by a transformer with total capacity of 50kVA.

2. **Progress to date**

Construction of the entire line, including the supply cables for staff houses and classroom blocks, has been completed. Of the 5 staff houses at the school, 1 has access to power. However, none of the school's blocks had power due to the limited resources for the school. The school does not have significant revenue streams. It is not allowed to charge its students and the government budgetary allocation is limited.

3. **Technical aspects**

The overall quality of the power line is very high. The construction of the power line met, and in some aspects exceeded, the ZESCO standard construction. The lines consisted of 12m standard wood poles with 50mm^2 aluminium conductor steel reinforced (ACSR). The qualities of the mechanical aspects of the line were very well executed.

There were, however, problems with certain aspects of the electrical components, notably the drop-out fuses (DOFs), which would disintegrate for no apparent reason and had to be replaced by the

contractor. As mentioned above, a problem with the underground cable a few kilometres from the tapping point cut off power to the downstream settlements, including Waya.

The table below summarizes the major technical aspects of the site:

No.	Description	REA Value	Observed Value
1	Number of transformers	1	1
2	Total installed transformer capacity	50kVA	50kVA

4. Social–economic aspects

The area is dominated by the school and does not have many homes within the reach of the power line extension.

The school has reported a desire and willingness on the part of teachers working at other schools to come work at Waya. This has been a welcome change for a school that struggled to attract staff before the advent of power at the school.

The table below summarizes the major social–economic aspects of the site:

No.	Description	REA Value	Observed Value
1	Number of schools	1	1
2	Number of pupils	T.B.A.	500 (Approx)
3	Number of health centres	0	0

5. Ability and willingness to pay

The teachers expressed a willingness to pay the ZMK 187,000 fixed charge but they also, like every other site visited, expressed a desire to have prepaid meters. The household that had been billed for the month demonstrated a capacity to pay.

The school was expected to have some problems in paying the bills as it is a basic school and is severely constrained by the government's free basic education policy, which limits the revenue the school can get. This is compounded by less than adequate and erratic government funding.

6. Other issues

Waya does not have too many buildings. Therefore, a 25kVA transformer would have served the needs of the school site.

7. Recommendations

There is a need to find a way to help local households wire their houses at a more affordable price than the prevailing 3 million ZMK. This can be achieved by sensitizing the locals to the true cost of the materials or the hiring of an official house-wiring technician who will charge prevailing market prices for materials and labour. There is also a need for ZESCO to install pre-paid meters as soon as possible to enable local households to better manage their bills.

10. Site report for Kaparu

Project	Kaparu
No	2009-2

Length of line (km)	**12**
Voltage (kV)	**11**
Construction start	**14/09/2009**
Construction end	**Nov 2010**
Contracted amount (ZMK)	**2,300,454,684**

1. **Description**

Kaparu is a rural settlement located about 12km from the Mubwa-Great North Road in Chibombo District of Central Province. The settlement consists of a school and a Rural Health Centre (RHC). It is serviced by two transformers: a 50kVA transformer for the RHC and a 100kVA for the school.

2. **Progress to date**

The line supplying the settlement was completed and is fully operational. Both Kaparu RHC and Chinyongola Basic School have been connected since June 2011. All of the six houses for Kaparu RHC staff members have been wired and electrified. Similarly, all 18 houses for Chinyongola staff have been wired and connected. Presently, all the buildings in the settlement are on fixed monthly billing. The line has been handed over to ZESCO and has been under the care and maintenance of ZESCO since October/November 2010.

3. **Technical aspects**

The quality of the power line, both mechanical and electrical, is high, and the construction followed the standard ZESCO scheme. The performance of the line has also been exceptional, according to the report of the local ZESCO office. During the period of management, only one fault was reported and that was a fuse that had blown.

The table below summarizes the major technical aspects of the site:

No.	Description	Value reported by REA	Observed Value
1.	Length of 11kV transmission line	13	13
2.	Number of in stored transformers	2	2
3.	Total capacity of transformers kVA	150	150

4. **Social–economic aspects**

The RHC, mission post and the school dominate the settlement. There were not any homes constructed at a standard that can be safely electrified observed. Additionally, no businesses were observed in the vicinity of the power line.

The table below summarizes the major Social-economic aspects of the site:

No.	Description	Value reported by REA	Observed Value
1.	Number of schools	2	1(Grade 1-12)
2.	Number of pupils	TBA	700
3.	Catchment population for school	TBA	13000
4.	Number of Health centres	0	1
5.	Total number of staff houses	17	24

5. **Ability and willingness to pay**

The school has not been billed yet but expressed a willingness and capacity to settle the bills. The RHC sends all its bills to the District Health Office (DHO), which then settles them. This has been

happening since July 2011. The school staff members have not been served with any bills yet, but they also expressed the ability to settle their bills.

6. **Other issues**

The RHC had problems switching to electrical appliances because, among other things, the fridges used to keep medicines were specifically designed to work with solar power and the cost of converting them to work with AC power has been prohibitive.

7. **Recommendations**

There is a need for ZESCO to install pre-paid meters as soon as possible to enable local households to better manage their bills. ZESCO must also start dispatching bills to the area so that its clients can receive manageable bills. As it stands, the cumulative bills that may be served to the residents of Kaparu may prove too high to settle.

11. Site report for Mabonde

Project	Mabonde
No	2009-7
Length of line (km)	2
Voltage (kV)	11
Construction start	14/09/2009
Construction end	Dec 2010
Contracted amount (ZMK)	1,013,554,944

1. **Description**

Mabonde is a settlement located approximately 2 km from the Great North Road, and about 90 km north of Serenje. The area has a chief's palace, some villages, a basic school and a Rural Health Centre (RHC). Mabonde Basic School is medium-sized school offering grades 1-7 to a catchment area of nearly 10 km radius. It's located about 2km from the Serenje–Mpika stretch of the Great North Road. The school has 14 staff houses, 5 classroom blocks and a total student population of about 500. It is serviced by a transformer with a capacity of 100kVA. The chief's palace is located about 1 km along the power line and is serviced by a 50kVA transformer.

2. **Progress to date**

Construction of the entire power line, including the supply cables for staff houses and classroom blocks, was completed by the contractor. Of the 14 staff houses, 9 have access to power and the other 6 were at various stages of internal wiring. However, none of the school's blocks had power due to the limited resources for the school. The school does not have significant revenue streams. It is not allowed to charge its students and the government budgetary allocation is limited.

3. **Technical aspects**

The line was constructed in line with ZESCO standards of 12m standard wood poles with 50mm^2 Aluminium conductor steel reinforced (ACSR), and the quality was high. The qualities of the mechanical aspects of the line were also high. There were, however, problems with certain aspects of the electrical components, notably the drop-out fuses (DOFs) which would disintegrate for no apparent reason and had to be replaced by the contractor.

The table below summarizes the major technical aspects of the site:

No.	Description	Value Reported by REA	Observed Value
1	Number of transformers	2	3
2	Total installed transformer capacity	150	175

The additional 25 kVA in the total installed capacity in the preceding table is owing to an extra 25kVA transformer installed near the beginning of the line to service three multi-structure households that put in a request to be electrified (See Social-Economic Aspects below).

4. Social–economic aspects

The RHC in the area had already been electrified by ZESCO and was, therefore, not considered. The Mabonde site demonstrated the potential for increasing rural household connections for electricity if the local ZESCO staff is involved in the dissemination of information, particularly the three-year payment period, right from the start of the grid-extension project. The local station manager hired Zambia National Information Services (ZANIS) to inform the local households about the three-year payment period and has been rewarded by a great demand for connections by the local households. It was found that one rural household was already connected and was paying the bills on time.

The table below summarizes the major Social–economic aspects of the site:

No.	Description	Value Reported by REA	Observed Value
1	Number of schools	1	1
2	Number of pupils	T.B.A.	500 (Approx)
3	Number of health centres	0	0

5. **Ability and willingness to pay**

The teachers expressed a great willingness and professed a capacity to pay the ZMK 187,000 household fixed charge but also expressed a desire to have prepaid meters. The households that had been billed for the month demonstrated a capacity to pay. The school was expected to have some problems in paying the bill as it is a basic school and is severely constrained by the government's free basic education policy, which limits the revenue the school can get.

6. Other issues

It was also found that households, including staff households for schools and RHCs, had to pay around 3 million kwacha for wiring the houses, which proved prohibitive for many rural households. The high wiring cost has been blamed on the relative ignorance of the local population about the true cost of the materials used in wiring a house.

7. Recommendations

There is a need to find a way to help local households wire their houses at a more affordable price than the prevailing 3 million kwacha. This can be achieved by sensitizing the locals about the true cost of the materials or the hiring of an official ZESCO house wiring technician who will charge prevailing market prices for materials and labour. There is also a need for ZESCO to install pre-paid meters as soon as possible to enable local households to better manage their bills.

Annex 3 – Mid-term Review & Evaluation Terms of Reference

1. INTRODUCTION

Increasing access to modern energy services in rural areas is an important cornerstone in the Government of Republic of Zambia (GRZ)'s efforts to combat poverty and stimulate economic and social development. In 2004, the Rural Electrification Authority (REA) and the Rural Electrification Fund (REF) were established as part of a larger energy sector restructuring. REA is a statutory body under the Ministry of Energy and Water Development (MEWD), with the purpose to increase availability of electricity in rural areas and access to electricity by the rural people.

As a means to assist the establishment of the REA, Sweden financed consulting services for the establishment of the REA and the REF during the period September 2006 – January 2010.

In 2008, a Specific Agreement between Sweden and the Government of the Republic of Zambia on "Support to the Rural Electrification Authority and the Rural Electrification Fund, Zambia, 2008-2013" was signed, covering Swedish support to REA and REF for the implementation of the country's rural electrification programme, with an amount of SEK 250 million. Sweden has also been given the mandate to represent the Netherlands regarding a Dutch contribution to the REA and REF in the amount of ZMK 37.8 billion, as specified in an Arrangement on Delegated Cooperation.

The Specific Agreement stipulates that an independent Mid-Term Review and Evaluation MTR shall be undertaken.

2. BACKGROUND

In its Fifth National Development Plan (FNDP) covering the period 2006 to 2010 for eradication of poverty, Zambia has set a goal of increasing the rate of rural electrification from 3% to 15% by 2015. These goals have been repeated in the Sixth National Development Plan (SNDP) that covers the period 2011 to 2015. With assistance from JICA, a Rural Electrification Master Plan (REMP) has been developed, comprising of 180 electrification packages in order of priority, based on economic and financial indicators. JICA is currently assisting REA in building its capacity for updating the REMP and in developing five year rolling plans. The REMP is intended as a guide for REA when elaborating annual rural electrification plans. The modalities for this are laid down in REA's Operational Manual. The responsibility for implementing the rural electrification programme lies with the Board of the REA, using funds deposited in the REF.

The following results of the rural electrification programme are envisaged:

- The (long term) development objective is economic growth and reduced poverty in rural areas;
- The expected (medium term) outcome is increased use of electricity for productive, social and household purposes in rural areas;
- The expected (short term/immediate) output is the provision of electricity infrastructure in the rural areas through extension of the national grid, development of off-grid systems and installations of solar PV systems in remote areas.

The rural electrification programme has two mechanisms for implementation:

(i) Tendered projects: Provision of a capital subsidy towards the initial investment cost for a priority rural electrification project, which is prepared and tendered for by REA;

(ii) Unsolicited projects: Provision of a capital subsidy towards the initial investment cost for a priority rural electrification project based on an application to REA from private investors.

3. THE SWEDISH AND DUTCH SUPPORT

The Swedish decision to support the rural electrification programme in Zambia was based on extensive analysis of the intervention context, ranging from national strategies and policy frameworks to the capacity to handle the proposed support. It was seen as a natural step to take following the Swedish support to establish the REA and the REF. A set of issues to be closely monitored during implementation of the programme was identified in Sida's decision memorandum, and a pre-award audit to assess the capacity of REA to handle the support was performed. Required conditions were fulfilled prior to the first disbursement in 2009.

The Swedish and Dutch support to the REA and REF was initially planned to be implemented during 2008-2013. However, the Specific Agreement was signed only at the end of 2008. The first tranche of Swedish financing amounting to SEK 25 million was disbursed in 2009 when Technical Assistance support was still implemented, whereas the first tranche of Dutch financing amounted to ZMK 3.8 billion a second disbursement of SEK 62 million by Sida and ZMK 10 billion by the Dutch embassy was made in December 2010.

The principle of the support is such that Sweden/Netherlands are financing up to 70% of the investment cost of rural electrification projects, based on annual work plans. GRZ has committed to financing the other 30% of the programme costs.

The implementation progress of the programme is reviewed during annual review meetings. The Specific Agreement stipulates that a performance assessment framework (Key Performance Indicators, KPIs) shall be in place as a basis for the continuous follow-up. REA is currently building up its capacity for Monitoring and Evaluation.

A monitoring consultant has been assigned by the Embassy to assist in the follow-up of the support and the preparations for the review meetings.

4. OBJECTIVE

The objective of the Mid-Term Review and Evaluation is to assess progress and advise if there is any need for adjustment in the ongoing cooperation between Sweden, the Netherlands and Zambia in the area of rural electrification. The MTR shall thus make an assessment on the implementation of the programme from 2008 to date, taking into account rules and regulations as agreed to in the Specific Agreement. The consultants will look into:

- Efficiency and effectiveness of the supported programme in relation with the specific agreement
- Validity of work plans in relation to the guidelines of the specific agreement
- Results (output) achieved so far and in particular in the Swedish/Dutch supported programme

and based on this conclude and make recommendations to the parties.
The MTR shall provide answers to overarching questions such as:

- Are the original assumptions in the Assessment Memorandum still valid?
- Is the implementation of the programme efficient and effective?

- Is the REMP as it stands providing a realistic basis for REA's work plans?
- Would any adjustments in the design of the support enhance results and impact, and if so in what way?
- Does the Specific Agreement require amendments?

5. SCOPE OF WORK

The task of the consultant shall comprise, but not necessarily be limited to analysis, assessment, conclusions and recommendations relating to the following areas:

5.1 REA´s systems and capacity to implement the REMP, including project selection, planning, procurement, implementation, monitoring and follow-up of results. A follow-up of the "Pre-Award Audit" performed in 2008 and the recommendations in the "Follow-up of the Pre-Award Audit" from 2010 should be made in this context.

5.2 The effectiveness of the Swedish and Dutch support so far; the expected goals and results as set in relation to REA's key performance indicators and the Assessment Memorandum.

5.3 The cost efficiency of the programme considering and describing local specific parameters such as transport distances, market inefficiency, etc. Unit costing of equipment and material, listing of relevant world market standard unit prices.

5.4 Procurement procedures and constraints, with specific emphasis on the regulatory constraints, the efficiency of procurement, supervision, contract management and quality control. In this context an analysis should be made of the cost efficiency in relation to the size of contracts, and the general competitiveness and capacity of the local market – to what extent is the availability and capacity of local contractors affecting the procurement and size of contracts. Ways to improve efficiency and competition should be investigated, e.g. possible award of larger contracts and opportunities for foreign firms to enter the Zambian market.

5.5 Use of electricity in selected projects, number of served people (number of actual connections, total potential connections, and catchment population of social institutions), type of energy sources replaced by electricity, benefits and problems experienced by beneficiaries, as well as expressed opinions on ways to improve the access to electricity. Connection fees, payment of electricity bills/pre-paid metering, and the use of ready-boards shall be specifically addressed.

5.6 Roles and responsibilities between REA and ZESCO in terms of increasing household access to electricity in rural areas and identification of possible overlaps and/or gaps, and the implications for REA's fulfilment of the KPI's.

5.7 Incentives for and engagement by the Private Sector in rural electrification.

5.8 The ongoing and planned interventions by all cooperating partners that have an impact on REA operations, specifically the World Bank and JICA.

5.9 Innovative and complimentary approaches to accelerate the access to electricity,

5.10 Fulfilment of and realism in the conditions in the Specific Agreement, specifically with regard to the following: Article 3.2; Article 3.5 (ii) and (iii); Article 4.2; and Article 4.3.

6. IMPLEMENTATION

The Mid-Term Review and Evaluation shall be based on relevant documents, reports and agreements, interviews with stakeholders in Zambia, as well as technical on-site verifications of projects financed by the Swedish/Dutch contribution.

The Consultants shall as much as possible draw upon other relevant reviews and studies. The assumptions in Sida's Assessment Memo of 2008 need to be revisited as well as the respective agreements.

Prior to the interviews and site visits a study of all relevant documents shall be carried out. A list of some basic documents is provided in Annex 1.

Interviews in Lusaka shall be made with key staff from

- Rural Electrification Authority (REA)
- Energy Regulation Board (ERB)
- ZESCO
- Ministry of Energy and Water Development (MEWD)
- Embassy of Sweden
- Embassy of Netherlands
- World Bank
- JICA
- Contractors

Interviews during field visits shall be made with:

- Local/district authorities
- ZESCO regional staff
- Electricity consumers (public institutions and households)
- Contractors

Selection of sites to be visited should be made in consultation with REA and the Embassy of Sweden. A random selection of at least six Swedish/Dutch financed projects shall be visited on site.

7. REPORTING

A First Draft MTR Review and Evaluation Report shall be presented to REA, the Embassy of Sweden and the Embassy of the Netherlands for discussion before the consulting team leaves Zambia. A digital version of the Final Draft Mid-Term Review and Evaluation Report shall be submitted to REA, the Embassy of Sweden and the Embassy of the Netherlands within 2 weeks after leaving Zambia. A Final Report shall be submitted in digital and 5 printed copies within 2 weeks after comments have been provided by REA, the Embassy of Sweden and the Embassy of the Netherlands.

8. PROFILE OF CONSULTANT AND TIME FRAME

The Review team should consist of a team of consultants with the following (combined) academic qualification and experience:

8.1 Well acquainted with Sida's energy support and support to rural electrification, and preferably also that of other donors (bilateral and multilateral).

8.2 Postgraduate degree in Economics, Demography, Statistics or other relevant areas with a minimum of five (5) years' work experience.

8.3 Hands-on knowledge and experience of rural electricity supply in a development context.

8.4 Experience of assessing organisations, including systems and procedures for financial control, procurement, monitoring and reporting.

8.5 Strong ability to determine level of quality of technical installations, equipment and material ; assess cost efficiency of contractor services and electricity supply installations.

8.6 Proven ability to assess complex processes and diverse sources of information to produce a concise report with clear and well-founded recommendations.

8.7 Excellent skills in written and spoken English.

The scope of the assignment is estimated at 12-15 person weeks in total and should start as soon as possible but not later than the end of August, 2011.

Annex 4 – Technological considerations for off-grid rural electrification and comparative costs of renewable energies

1. Technological considerations for off-grid

Micro hydro
Community hydropower systems have been successfully managed by communities in other developing countries (e.g., Nepal, Thailand, India, China, Nicaragua, and Mexico). As community-managed projects have had a mixed history, it is recommended that the programme would seek to implement both community-managed systems and those managed by a private entrepreneur. Small hydro will be limited to villages close to streams that have sufficient flow and fall year around. Such plants have a relatively low capital cost and operation expenditure; they provide sufficient output for productive uses (refrigeration, agricultural processing, power equipment etc.) and require no additional fuel or battery. As Sweden has a history of small hydro-systems, Sida and Sweden would thus seem to have a comparative advantage in providing further assistance for this.

Solar
Individual solar home systems can provide relatively reliable electricity generation for private use. Solar systems have a high capital cost but moderate ongoing operation and maintenance costs. Electricity is stored in lead-acid batteries, which generally must be replaced every several years. The systems are more versatile than most other technologies and can function well in all the environments found in Zambia. Solar home systems generally provide enough electricity for lighting and communication/entertainment appliances, but not enough for refrigeration or power tools.

The Independent Evaluation Group of the World Bank (IEG 2008 "The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits") points out that the benefits from solar home systems (SHS) are usually less than from grid electricity because the capacity available to consumers is usually less, indicating that a solar home system could become a transitory solution – toward a mini-grid or the integration to the national grid – in populations where electricity demand is expected to grow fast.

Wind
Wind power may be useful for some applications, notably water pumping. Wind is not likely to be a cost-effective off-grid development in Zambia, due to low wind speeds of around 3 m/s.

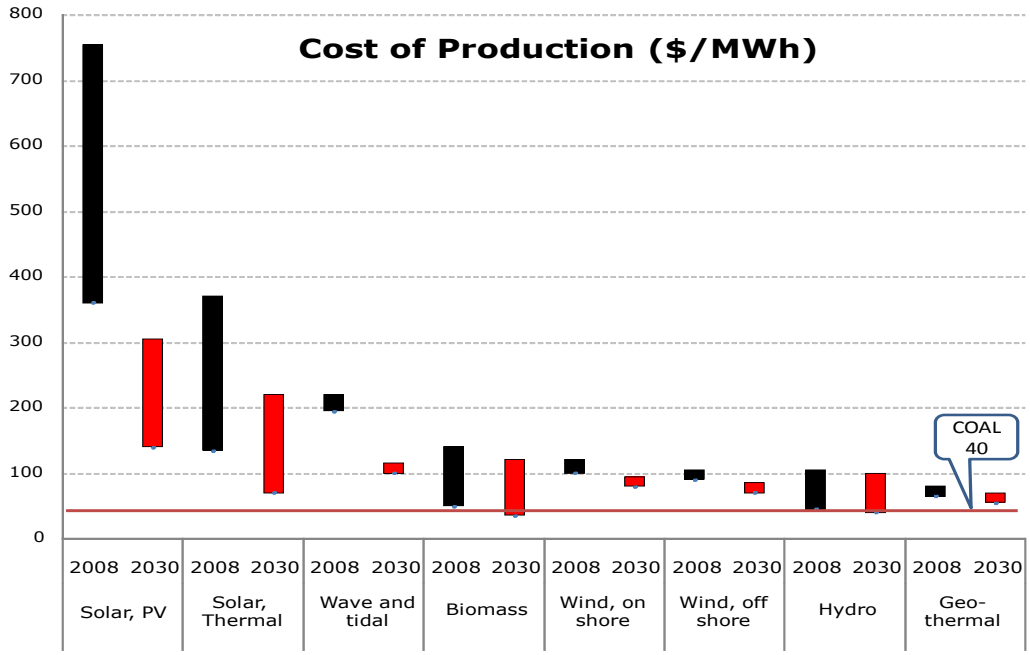
Biodiesel
Biodiesel micro-grid generators have been successfully implemented in other countries, although some have had to overcome significant technical, financial and institutional issues with respect to the operation of the bio-diesel generator systems. Zambia probably needs a pilot project before wider implementation of a bio-diesel generator program.

Hybrids
For some applications a combination of solar PV, bio-fuel operated diesel engines and/or wind generations may be cost-effective, though, in general, the complexity of such hybrid systems prevents them from being sustained in most remote village environments.

Distribution

In general, the provision of individual systems is favoured over the provision of community electricity supply mini-grids. As indicated above, community management often tends to be more costly and ambiguous. However, in communities with a good hydro resource, a basic grid connecting the various community facilities is preferable, as installing multiple turbines in one river will be more problematic and less cost-effective than creating a grid. Households may be connected if they demonstrate sufficient willingness to pay for electricity.

2. Comparative Costs of Renewable Energy Technologies (based on IEA figures)



Annex 5 – ZESCO standard load forecasting method

The ZESCO load forecasting method uses the After Diversity Maximum Demand (ADMD), which is the simultaneous maximum demand of a group of homogeneous customers divided by the number of customers and normally expressed in kVA.

Current literature on load forecasting for rural electrification and, in the absence of other information to guide the planner, sets the default ADMD values to be used for rural network planning to (i) 0.4 kVA for the initial (5- to 7-year design and (ii) 1.0 kVA for the final (15-year design).

The initial ADMD figure is used to determine an initial transformer sizing and zoning. A phased upgrade should be planned for in the network layout by initially considering the long-term ADMD, and then scaling back the investment to cater to the initial time horizon. Implementing a project using the long-term ADMD will result in unnecessary capital expenditure in the initial stages. Transformers will be oversized (or too numerous) and transformer iron losses will be excessive.

ZESCO calculates the total kVA maximum demand for a group of consumers as follows:

$$\text{Total kVA} = aN + D$$

Where a is the diversity maximum demand (ADMD) per consumer
N is the total number of consumers
D is a factor dependent upon the nature of the consumer

	Low cost housing using basically only lighting	Medium cost housing with only limited cooking & water heating	High cost housing with cooking & water heating
a	1 kVA	2 kVA	3 kVA
D	0	3	8

Annex 6 – Low-cost design

Appropriate design engineering describes a number of techniques that are already being used in southern Africa, for example, for reducing the cost of conventional MV and LV distribution networks. The techniques are based on accurate knowledge of the loads, upgradeable networks, making all assets, especially transformers work at optimal capacity and ensuring that every single component installed on a network is really required and contributes to the performance of the network (no frills approach). Each network design and construction should be appropriate for the environment (e.g., rural grassland) and components and standards applicable for other environments (e.g., coastal or urban or desert or forest) should be omitted. In addition, appropriate engineering recognises that revenue is based on consumption and sales and that electricity needs to be marketed like every other product. Construction costs should be lowered by applying innovative engineering and addressing labour costs. Operating and maintenance cost reduction is critical and metering methods and costs have to be addressed. Some of the major capital cost items to be appropriately designed are:

- Network phase: Single-phase, instead of three-phase, networks are likely to be adequate in many situations, with the design permitting upgrading to three-phase in the future. Customers who want to run high-powered three-phase motors could be served by using phase converters.
- Transformers: In many cases, they operate at a fraction of their design output and do so for their entire life. Transformers should be closely sized to the actual load flows, with flexibility, and in some instances it may be beneficial to consider single-phase transformers to be later upgraded to three-phase transformers.
- Poles: The traditional pole design has cross arms on the top of the poles. Modern designs use post-top insulators fixed directly to the side of the pole and there are no cross arms. Pole mounted transformers should be mounted on a single pole instead of using the conventional three pole design.
- Conductors: Instead of following the common practice of using 50 mm^2 and 100 mm^2 conductors, they should be sized for the actual load conditions and smaller conductors used wherever possible. The only exception to this should be where there is a high incidence of lightning strikes.
- House Connections and Ready Boards: Traditional methods provide a circuit breaker with a protective housing mounted on the pole and a cable leading to the house. The expensive circuit breaker and its housing may be replaced by a fuse or even a piece of fuse wire and the cable to the house should be an aerial conductor of flat twin and earth construction (dumbbell) cable.

Cost-cutting culture. A good example of instituting a cost-cutting culture is STEG, the Tunisian power utility. After 30 years the electrification programme (starting at 6%), Tunisia now enjoys full electrification (97%) and the benefits thereof. STEG produced plans and these were prioritised by cost. Each year, the lowest cost projects were implemented up to the level of a pre-determined budget. In 1976, STEG adopted a lower-cost three-phase/single-phase distribution system. Vigorous efforts to cut the capital and operational costs of rural electrification have been undertaken and followed up by continuous technical innovations to develop and adapt technologies suitable to Tunisian conditions.

Single wire earth return (SWER). SWER is an economical solution for extending power supply into more sparsely populated, low load density areas of sub-Saharan Africa. Because it involves the stringing of only one wire, the construction techniques are simple and cheap, long spans can be achieved and maintenance costs are low. SWER has been used in Australia and New Zealand very successfully for over 40 years and in South Africa and Namibia in Southern Africa but with some reluctance and concern about the earth return. There are limitations regarding power capacity and earth points require annual inspection and checking, but there is no good reason why this system should not be applied in Africa, especially in the rural communities.

Shield wire systems (SWS). Ghana recognised in 1985 that the grid had to expand from covering the lower third of the country to full coverage before all their regional towns could have power. It planned and built a 161 kV grid that conveyed power to all but a few remote towns. During construction, the government was assailed by complaints from the communities living close to the transmission lines that they were being bypassed. Why could they not enjoy the power passing so close overhead? The shield wire system was developed and implemented to address the complaints.

SWS uses the existing shield wires on top of the transmission lines as power conductors and shield wires. The shield wires are insulated using standard insulators and Optical Fiber. Composite overhead ground wires may also be used so there is no restriction on using the shield wires for communication. Single wire earth return technology is used to convey power up to 100km from the source along the line and for 20km on each side of the line for use by rural communities. Up to 9.7 MVA of power is transmitted and up to 250 kW motors may be connected to the system. Small communities within 20km of the transmission lines were offered quicker access to electricity using a programme called Self-Help Electrification Programme (SHEP). SHEP ensured speedy access to power if the community could a) provide the poles for their power line, and b) guarantee a minimum number of consumers. SWS costs about 15% of a conventional power line, and Ghana has successfully implemented 526km of shield wire systems, connected over 3000 rural communities since 1985 and achieved over 50% access nationally.

Reduction in costs
An often-used measure of low-cost design implementation is the percentage of realized savings compared to the old three-phase standards earlier implemented. Based on typical three-phase networks in Sub-Saharan African countries, the following savings are attainable:

- MV Grid extensions: Cost reduction of 25% to 40%
  Recommendation includes utilization of SWER, where possible, 2-wire, single-phase, metallic return and low-cost, 3-wire, three-phase systems.
- Shield Wire Systems: Further reductions of 30% to 50% in locations along transmission routes where suitable shield wire schemes are available.
- Low-voltage Network Construction: Cost reduction of 15% to 25%
- Consumer Connections: Cost reduction of 15% to 25%, utilizing suitable meter systems and ready boards.
- Operations and maintenance: Cost reduction of 10% to 20%

There is data and documentation available that describes a range of options for low cost design standards and technical specifications for rural distribution systems. This information, however, is not readily available to a majority of rural electrification authorities/agencies, utilities and local entrepreneurs for designing rural electrification systems. Low-capacity distribution systems and small-scale off-grid systems are often designed based on the design developed for much larger systems, which leads to sub-optimal development.

Annex 7 – List of persons met

Sida, Lusaka
Per Lundell, Counsellor, Head of Bilateral Development Cooperation
Lars Karlsson, First Secretary, Energy
Malila Chisanga, National Programme Officer, Energy and Urban Development
Ann Kampe, Monitoring Officer

Embassy of the Kingdom of the Netherlands
Natalie den Breugom de Haas, First Secretary, Private Sector Development

Department of Energy, Ministry of Energy and Water Development
Ms Langiwe Lungu, Principal Energy Officer
Malama Chileshe, Energy Officer

Rural Electrification Authority
Wilfred Serenje, Chief Executive
Morgan Chiselebwe, Director - Finance
Patrick Mubanga, Power Distribution Development Officer
Felix Munsaka, Manager, Procurement and Supplies
Christopher Chisense, Senior Environmental Officer
Naomie Nachalwe Sidono, Community Mobilisation Officer
Kingsley Matabula, IT Administrator
Susan Nalavwe-Daka, Senior Accountant
Fred Mushimbwa, Senior Renewable Energy Officer

Zambia Public Procurement Authority (ZPPA)
Samuel Chibuye, Director General

Zambia Electricity Supply Corporation Limited (ZESCO)
Augustine Musumali, Director – Engineering Department
Chisanga Mubanga, Senior Manager Treasury and Taxation
Gyavira M. Bwalya, Senior Manager – Distribution Development – Ed
Joe Chiyassa, Director – Distribution and Supply
Monica Mulenga Chisela, Customer Services
Chenda Kalokoni, Commercial Services Manager, Customer Service
Chileshe Luputa, Corporate Customer Service Manager
Chanda Wibroad, Regional Manager, Chipata
Simalimbu. S Leoson, Electrician in Charge – Sinazongwe
Frederick Bwalya, Chief Metering Technician (Eastern)
Lazarous Chungo, Linesman Chipata Eastern
Chinyana Miller Mufaya, Center Manager – Customer Service - Chipata

JICA
Sato Wataru, Assistant Resident Representative
Kabila Ilubala, Infrastructure Development Advisor
Takashi Okuyama, Project Formulation Advisor - Infrastructure
Masanobu Mayusumi, Rural Electrification Advisor
Dr Shiota Akio, Solar PV Specialist, Project on Capacity Development for Rural Electrification

European Union

Sigvard Bjorck, Head of Infrastructure Section
Liso Matanga Simbeleko, Programme Officer - Infrastructure

Energy Regulation Board (ERB)
Dr Mushiba Nyamazana, Director – Economic Regulation
Rodgers K. Muyangwa, Senior Economic Analyst – Electricity
James Manda, Director – Infrastructure & Operations
Nasima Shaikh, Executive Assistant

Office for Promoting Private Power Investment (OPPPI)
Israel L. Phiri, Manager

Staff of Schools and Rural Health Centres, Business Entity Owners and inhabitants of rural communities in:
Shantumbu in Kafue district
Buleya – Malima in Sinazongwe district
Madzimawe, Madzimoyo and Kanyanja in Chipata district
Chibale and Mabonde in Serenje district
Kaparu in Chibombo district

Copperbelt Energy Corporation Plc
Silvester H. Hibajene, Director – Strategy and Regulations

Contractors
Wilson Liambiza Lungu, QSHE Officer, Spencom Polyphase (Zambia) Ltd.
Simon Zimba, British Engineering Services
African Brothers Corporation Ltd.
Chance Mwansa, Managing Director, Chamb Investment Ltd.
Venansio Mutati, Executive Director - Projects

Private Developers/Promoters
A. J. Lungu, Mchimadzi Hydro-Electric Power Ltd.
Charles Rea, Director, HEP *(by email)*
Daniel Rea, Director, HEP *(by email & phone)*
Joseph Kachiliko, Empowerment and Conservation Organisation (*by email)*
Chris Musonda, Surge Kinetic Energy Zambia *(by email)*

Annex 8 – List of documents consulted

No	Document Name	Author	Agency	Date
1	Rural Electrification Master Plan (REMP)	Japan International Corporation Agency (JICA)	Japan International Corporation Agency (JICA)	January 2008
2	Rural Electrification Act	Zambian Parliament	GRZ	2003
3	Audit Report 2010	Goergebaison & Obed Chattered accountants	Rural Electrification Authority (REA)	March, 2011
4	Audit Report 2009	Goergebaison & Obed Chattered accountants	Rural Electrification Authority (REA)	July, 2010
5	Management Audit Report 2010	Goergebaison & Obed Chattered accountants	Rural Electrification Authority (REA)	March, 2011
6	Management letter 2009	Goergebaison & Obed Chattered accountants	Rural Electrification Authority (REA)	April, 2010
7	Management Audit Report 2009	Goergebaison & Obed Chattered accountants	Rural Electrification Authority (REA)	October 14, 2010
8	Monitoring Report No. 1	Ann Kämpe Projektkonsult	Embassy of Sweden	July 10, 2010
9	Monitoring Report No. 2	Ann Kämpe Projektkonsult	Embassy of Sweden	October 10, 2010
10	First Progress Report On The Rural Electrification Programme	Rural Electrification Authority (REA)	Rural Electrification Authority (REA)	December 11, 2009
11	Second Progress Report On The Rural Electrification Programme	Rural Electrification Authority (REA)	Rural Electrification Authority (REA)	August 17, 2010
12	Third Progress Report On The Rural Electrification Programme	Rural Electrification Authority (REA)	Rural Electrification Authority (REA)	July 19, 2011
13	Technical Assistance Final Report	Econ Pöyry AB & Camco Ltd.	Swedish International Development Cooperation Agency (Sida)	April , 2010
14	JICA - MEWD REA Joint Mid-Term Review Report on Capacity Development for Rural Electrification Project – Minutes of Meeting	JICA, MEWD	JICA, MEWD	June 23, 2011
15	Proposed 2010 Work Plan	Rural Electrification Authority (REA)	Rural Electrification Authority (REA)	November, 2009
16	2011 Work Plan	Rural Electrification Authority	Rural Electrification Authority (REA)	December, 2010

No	Document Name	Author	Agency	Date
		(REA)		
17	Operational Manual: Guidelines for Financing Rural Electrification Projects	Rural Electrification Authority (REA)	Rural Electrification Authority (REA)	February 17, 2009
18	Minutes of First Annual Review meeting between Embassy of Sweden and REA	REA, Embassy of Sweden	REA, Embassy of Sweden	November 27, 2009
19	Specific Agreement Between Sweden and the Government of the Republic of Zambia on "Support to the Rural Electrification Authority and the Rural Electrification Fund"	Embassy of Sweden, MFNP	Embassy of Sweden, MFNP	November, 2008
20	The Energy Sector in Zambia (Paper)	MEWD	MEWD	
21	Arrangement on Delegated Cooperation between Sweden, represented by the Swedish International Development Co-operation Agency (Sida) and the Netherlands Minister for Development Cooperation, represented by the Embassy of the Kingdom of the Netherlands (EKN) regarding support to the Rural Electrification Authority	SIDA,EKN	SIDA,EKN	November, 2008
22	Performance Indicators for REA – 2009 to 2013	REA	REA	
23	Appendix 5: Energy chapter from the Fifth National Development Plan 2006–2010	MEWD(GRZ)	MEWD(GRZ)	2006
24	Operational manual: guidelines for accessing smart capital subsidies	REA	REA	May, 2008
25	REA Operational Manual: Procurement And Supply	REA	REA	March, 2008
26	REA Operational Manual: Finance And Accounting	REA	REA	March, 2008
27	REA Code of Ethics	REA	REA	May, 2008
28	Pre award audit of REA	REA	REA	February, 2008
29	Gender Analysis of Support to REA REF	ENERGIA International Network on Gender and Sustainable Energy	REA	2008

No	Document Name	Author	Agency	Date
30	General Environmental Assessment Comments	Department of Urban and Rural Development - Swedish EIA Center	Sida Helpdesk for Environmental Assessment	October, 2007
31	HIV/AIDS Mainstreaming at REA	REA	REA	February, 2008
32	Administration of Sida Financial Support to REA	REA	REA	2008
33	JICA Assistance to Zambia (Information leaflet)	JICA	JICA	
34	IAES – Japanese ODA Loan Project Increased Access to Electricity Services Project (Information leaflet)	JICA	JICA	
35	Rural Electrification – The Capacity Development for Rural Development (Information leaflet)	JICA	JICA	
36	Progress Report No. 3, May 2011, Construction of Two Grid Extension Projects in Kaoma (Western Province) and Mumbwa (Central Province) Districts in Zambia – Lot 1 and 2	REA	REA	
37	Management Audit Report for the period 1st January – 31st December 2009 of the Rural Electrification Authority	George, Baison & Obed Chartered Accountants	REA	October, 2010
38	Management Audit Report for the 2010 of the Rural Electrification Authority	George, Baison & Obed Chartered Accountants	REA	
39	Correspondence between the Embassy of Sweden and the Rural Electrification Authority	Various	Various	2010
40	Monitoring and Evaluation (M&E) Task Force Report	REA	REA	September 2010
41	Connection Fee Payment Scheme for Residential Customers	ZESCO	ZESCO	

MID-TERM REVIEW AND EVALUATION OF THE SWEDISH AND DUTCH SUPPORT TO THE RURAL ELECTRIFICATION PROGRAMME IN ZAMBIA

The number of households in rural Zambia with access to electricity currently stands at less than 4%. Assisting the Zambian government's aim to increase this, SIDA is providing financial support of SEK 250 million for the period 2008–2013. The objective of the Mid-Term Review & Evaluation, undertaken in September 2011, was to assess progress & advise if there was any need for adjustment in the ongoing cooperation. The review found that the Rural Electrification Agency (REA), the body entrusted with expansion of the electricity grid in rural areas was undertaking its tasks in an efficient & transparent manner. However, more cooperation was needed between it & ZESCO, the body responsible for the physical connection of households to the grid.

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