Impact Assessment of Rural Electrification

Final Report

NORAD COLLECTED REVIEWS 4/2014

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Norad collected reviews
The report is presented in a series, compiled by Norad to disseminate and share analyses of development cooperation. The views and interpretations are those of the authors and do not necessarily represent those of the Norwegian Agency for Development Cooperation.

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FINAL REPORT

OCT | 08 | 2013

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EXECUTIVE SUMMARY

Norway has for many years supported Mozambique's efforts to increase the level of access to electricity in rural areas. The primary justifications for these interventions has been to; a) create substantial net socio-economic benefits, including direct poverty reduction, b) stimulate business activity and job creation, and c) provide sustainable and valuable assets to the utility.

The following three electrification projects in Mozambique (the Projects), financed or co-financed by the Government of Norway (GoN) were completed between 2005 and 2008:

- "Assistance to the Gurué-Cuamba-Lichinga Transmission Line Project" (MOZ 0012)
- "Namacurra Electrification Project" (MOZ 2016) (distribution)
- "Namacurra Electrification Project - Extension to Pebane" (MOZ 2016) (distribution)

Because it is expected that mid- to long-term effects of electrification have started to materialize, Norplan AS was contracted by the Norwegian Directorate for Development Cooperation (Norad) in May of 2013 to conduct a study of the impacts of the Projects. The study has aimed to (i) evaluate the impact on development of business activities and income generation; (ii) evaluate the financial and operational impacts on the energy utility (EdM) and (iii) review to what extent the projects have achieved the planned results, thus provide insight into the direct effect projects for rural electrification have on the living conditions as well as lessons learned with regard to prioritization and design of rural electrification projects.

METHODOLOGY

Due to the general lack of secondary quantitative data with the required resolution, a survey was conducted to obtain sufficient data for analysis. To ensure that the results are comparable with similar undertakings, Norplan prepared all survey tools based on a best practice template from Deutsche Gesellschaft für Interntionale Zusammenarbeit (GIZ)[1]. In addition, twelve focus group discussions were held in the Project areas, two of which were entirely composed of women. The Team also conducted a series of meetings in Maputo, and spent one week in the Project areas where interviews were made with local leaders, business owners and EdM officials.

RESULTS AND POVERTY REDUCTION

The number of connections achieved in the Projects have far exceeded those planned for when the Program was approved, representing a key success in terms of the overall objectives. Specifically, the consultant has estimated that some 37,000 connections have been made, compared with about 10,000 planned, at a cost of USD 41.7 million. Primary drivers of this over-achievement have included; a relatively low connection fee, free ready boards and low energy prices. Each community and household connected has and continues to reap direct and indirect benefits.

Some key findings of the study include:

- Disregarding sources of energy, **poorer households pay a much higher price for lower quality energy services**. The result is that "substinence" households spend about 35% of their income on energy, compared with about 5% for "affluent".

[1] *Available at www.produce.org.*

- While there is evidence that wealthier households are disproportionately benefiting from the intervention (as would be expected), it was found that **a high percentage of low income households have also connected** and are thus benefiting from the program.
- Regarding incomes, there is evidence that electrification of **existing businesses has likely improved profits and productivity, increasing the general income level** in the region. However, this is moderated by the very limited impact on generation of new productive activities.
- Electrification has resulted in **a transformation in household lighting and appliance use, but has virtually no effect on cooking**, with 100% of electrified households' surveyed still using charcoal or wood. On the other hand, the majority of surveyed electrified households have bought lighting (98%), mobile phones (77%), TVs (75%) and radios (53%), representing tangible quality of life improvements.
- Communities have reported upon, and emphasized the importance of, the substantial **communal benefits of electricity**, stemming from improved security, health, education and social services.

Implications and recommendations

These findings confirm that the primary benefits to households stem from lighting and social services, with little impact on cooking fuels and its negative impacts. They also demonstrate that low connection- and energy charges allow for even poorer households to connect – albeit at the expense of the utility and/or Government. This specific finding would point to some contradiction between sustainable, and pro-poor equality driven electrification. It is also noted that the pro-poor benefits observed for this Program come despite the lack of mechanisms to finance either connection costs or purchase of appliances. It could be argued that such mechanisms could help avoid this sustainability vs. pro-poor contradiction while also presenting opportunities particularly to female entrepreneurs.

The key recommendation would thus be;

1) In terms of targeting the poor, a subsidized energy tariff should take a backseat to mechanisms that are also (more) consistent with sustainability, such as; low cost technologies, payback schemes or even subsidies on connection charges; credit schemes and training to promote appliance use.

IMPACT OF BUSINESS AND PRODUCTIVE ACTIVITY

The analysis points to an important distinction between benefits to existing businesses, on the one hand, and the generation or revitalization of new productive activities and/or employment on the other.

For existing businesses, there is evidence from both the data and site interviews that existing companies having been connected to the grid tend to perform fare better than those that are not, e.g. higher revenues per employee. This likely has a meaningful economic impact on the region, increasing productivity, profitability and willingness to invest in the region.

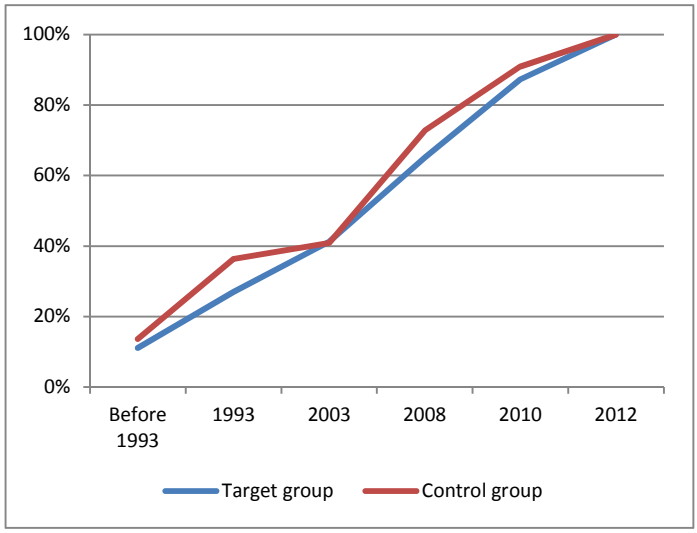

Figure 1: Share of surveyed businesses by year of establishment. Norplan survey data

For new businesses, however, the data and analysis provide no significant evidence that electrification has (directly or indirectly) contributed to the creation of more businesses. It is notable that these two impacts combined (existing and new businesses) provide little-to-no foundation for electrification providing a greater opportunity for formal employment growth in the region in the near- to medium-term. As indicated in figure 1, there is no evidence that electrification in the target group has led to an increased rate of business creation. Further, while a relatively large percentage of connected businesses use electricity for production, the team found no evidence that they employ more people than non-electrified. Despite these findings, the team identified 3-4 industrial users that were likely enabled by electrification.

The field work and analysis revealed a lack of training and/or micro-credit facilities to enable the investment in equipment and know-how required to productively use the improved energy services, which is particularly paralyzing for would-be female entrepreneurs.

Implications and recommendations

The analysis presents a nuanced picture of the impacts of electrification on productive uses, economic activity, business creation and employment. While no evidence of business creation can be observed, there appear to be tangible and anecdotal evidence of meaningful impacts on existing businesses. One would thus expect that this will both provide increase profitability and incomes to the region. It could be expected that this will eventually lead to greater investment, increased employment and eventually business creation in the region, but it is too early to tell. If so, the findings of this study have only registered the early phases of such a cycle.

The key recommendations are:

2) While business creation targets in rural electrification programs should be tempered, there are real economic benefits for existing businesses that could contribute to long-term economic growth. Such aims and time frames should be properly reflected in program designs, objectives and expectations.

3) If business creation is a primary objective of a rural electrification, it is likely a necessary condition that this is coupled by micro credit and training facilities if results are to be achieved in any reasonable time frame. Otherwise, the program will almost surely fail to achieve this objective.

IMPACT ON EDM

EdM is one of the better performing utilities on the African continent in terms of achieving access expansion, with 163,410 new customers in 2011. It would be reasonably expected that by financing a major grid-expansion program, donors would bestow EdM with valuable assets that would help them achieve expansion targets, while also improving financial viability. However, as illustrated in figure 2, the recent past of EdM has been characterized by steadily high losses in excess of 25%, the consistent reduction in

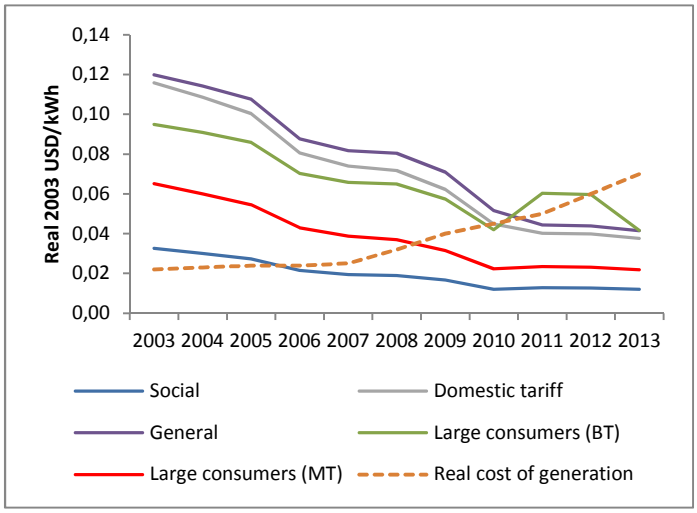

Figure 2: The Teams estimation of EdM's tariff development per kWh for different categories in real 2003 dollars and real cost of generation per kWh

the *real* tariff per kWh sold, increasing generation costs and relatively high network expansion costs.

Combined, these drivers have resulted in a situation whereby every connection made and kWh delivered to rural communities, including the Program area, results in a net loss to EDM. The team estimated that in order to achieve a relatively neutral financial impact on EDM (NPV=0), an immediate tariff increase of 14-18% would be required. The effect of this situation is clearly present in the Program area, as illustrated in the figure below. The result is that while the public spending intervention by donors is found to be socio-economically viable (see Cost-benefit analysis), the negative financial impact on EdM (NPV of - USD110 million) is significant and alarming.

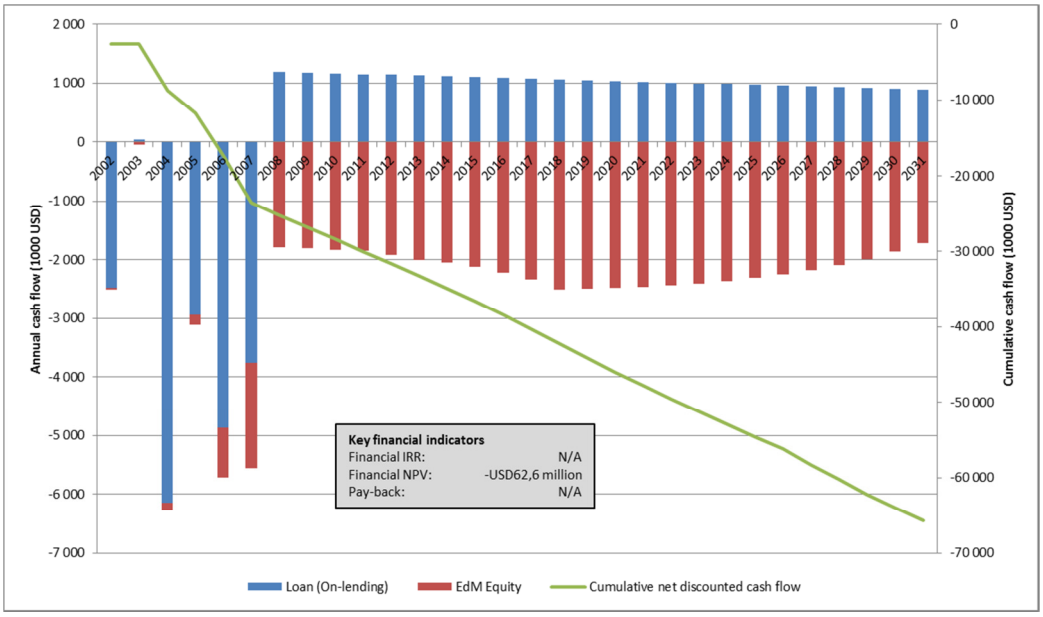

Figure 3: Cash-flow and NPV of the distribution network of the Gurué - Cuamba - Lichinga Extension in real 2002 USD. Norplan

On the technical side, it was found that while EdM is able to maintain the assets in a rather ad hoc manner, they should urgently establish a comprehensive preventive operation and maintenance program. The quality of supply suffers from lightning strikes due to the lack of earth wires on the 110kV transmission lines and design of the distribution lines.

Implications and recommendations

This analysis confirms and provides actual estimates to the widely held recognition and simple logic that access expansion, especially to rural communities, using non-cost-reflective tariffs is not financially sustainable for a utility. While the cost-benefit analysis confirms some justification for subsidization in the sector, the size of the negative effect on EdM from this particular intervention is simply out of proportion and cannot be justified nor sustained over time.

For Norwegian development assistance, this finding points to a need for stepped-up efforts to follow-up and ensure that its funding is not going into fundamentally unsustainable grid expansion programs. While the public use of funds can be justified, *who* reaps those benefits is important. Donors and a limited local urban tax-base simply cannot bank-roll large expansion programs that lead to financially weak utilities unable to maintain its assets or invest in further expansion. Donor contributions should help lead to

financially sound utilities serving more customers, rather than serve as a means to achieve politically driven expansion that leaves the utility in weakened financial condition.

The key recommendations are:

4) In the selection of priority countries earmarked for grid extension programs, the expected net financial impact on the utility should be established as a *key* criterion.

5) In implementation, GoN must systematically follow-up and hold government counterparts accountable to plans for achieving (near-) commercially viable grid extension. This involves everything from tariff levels, proper prioritization of projects, low-cost technologies and off-grid solutions.

6) These recommendations point towards a need to concentrate efforts on a limited number of countries or programs so as to properly follow-up with other partners progress in the country towards such sustainable use of investment funds. This also points to the importance of true institutional ownership and accountability (by GoN) to ensure consistency between the planning, funding decision and implementation phases.

7) There are alternative options to (large) grid extension programs available to GoN. Especially in large and relatively sparse African countries, there is a strong push towards low-cost and mini-grid technologies. Further, a recent Norplan policy brief prepared for Norad underlined the fact that off-grid renewable options are providing a range of service types/levels for various users at increasingly competitive costs. This trend will only continue and, in terms of achieving value for money, Norway must look to other technology options if it wishes to continue to target the rural poor.

COST-BENEFIT ANALYSIS

The team has carried out a cost-benefit analysis in order to determine the socio-economic viability of the use of public funds for this specific intervention. In carrying out this analysis, all efforts are made to quantify *real* benefits and costs for relevant stakeholders. That is, when relevant, prices paid, financing costs, taxes, etc are disregarded, as is the financial impacts, as these are nominal impacts – not real. Here, we have applied consumer surplus and alternative-cost measurements of benefits to end-users, and real (primarily capital) costs of the Program to the analysis. The key results, including estimated distribution of benefits are illustrated in figure 4.

It is striking that despite limited business creation and a detrimental effect on EdM's financial situation, the public investment in the infrastructure can be justified and proves economically viable – i.e. life-time benefits outweigh the costs – with an EIRR of 19%.

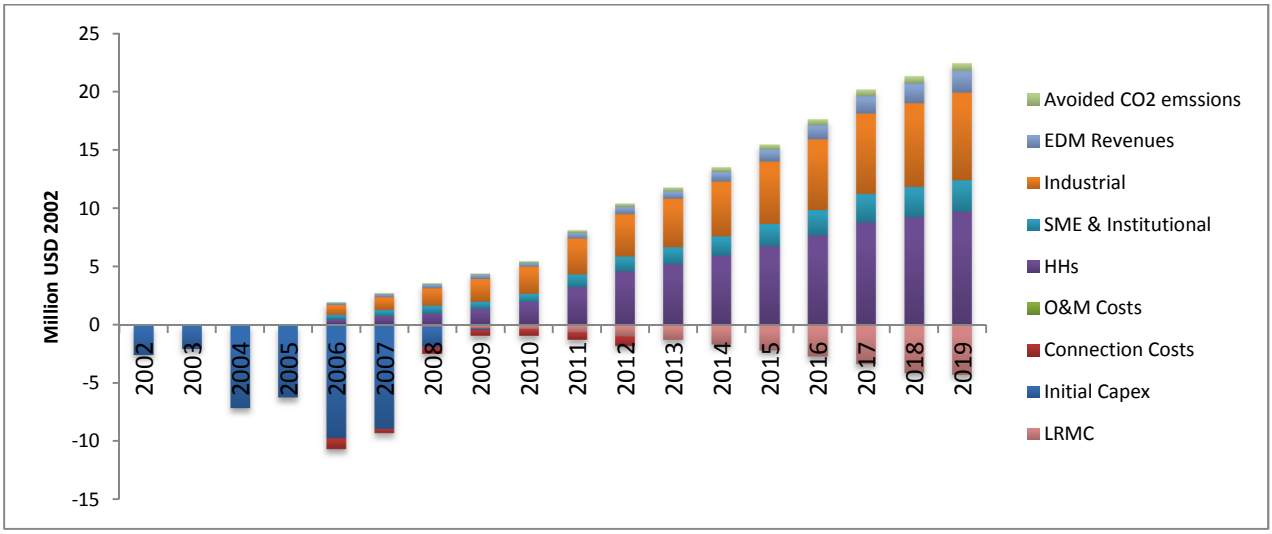

Figure 4: Illustration of the economic costs and benefits of the project in the base case. Distribution of costs and benefits of first 10 years after CAPEX (IRR = 19%). Norplan

There are several important factors under-pinning these results. First, despite an estimated benefit (net consumer surplus increase) of about $.70/kWh, consumers pay an average price of $.10/kWh. This reflects the high costs and low quality of alternative energy sources and implies that consumers are reaping significant benefits, partly at the cost of the utility. Second, and further to the above, while consumers are willing to pay a higher energy price (if so required), they face severe liquidity and credit constraints, putting even the subsidized $117 connection fee out of reach for poorer households. Finally, despite the fact that there is no evidence of the creation of new business as a result of electrification, the provision of electricity to (existing) commercial and industrial users is a key driver of the positive economic effect. This is due to i) the high value placed on each kWh by such users, and ii) the fact that such users make up 0.02% of connections yet 37% of consumption.

Implications and recommendations

The findings confirm that even with relatively high cost electrification technologies, the large benefits of electricity result in positive social-economic net benefits. The success of the program in connecting large numbers benefits the socio-economic result of the project (economies of scale), while at the same time severely weakening the utility. The findings also provide further confirmation to the conclusion from the Norplan policy brief that electrification of industrial and commercial users is key to ensuring an economically viable rural electrification intervention – even if the direct business creation effect is moderate.

One should not confuse net socio-economic impacts with distributional effects, which would incorrectly lead to the conclusion that electrification is not a justifiable use of public funds. Instead, the findings of this study confirm a justification for public spending, but emphasize the importance of policy and technology choice in ensuring a sustainable distribution of these economic benefits between end-users and service providers (e.g. EdM).

The key recommendations are;

8) The study confirms an economic justification for funding rural electrification while highlighting the true negative financial and sustainability impacts of distorted policies and lack of supporting programs.

9) The study confirms that pre-existing commercial and industrial loads, rather than business creation, will be important drivers of economic viability of a rural electrification intervention. This should be reflected in prioritization of projects and funding.

CONCLUDING REMARKS

Traditionally, the provision of improved energy services to the rural poor is seen as a means of reducing poverty. However, the analysis in this report highlights some important "secondary" impacts as well as to dilemmas for an institution such as Norad. On the one hand, the analysis demonstrates that two of the key drivers for economic viability, sustainability and value for money in electrification programs are not generally pro-poor; target areas with pre-existing industrial loads, and; look for and contribute to (higher) cost-reflective tariffs. On the other hand, low cost grid solutions and the recent explosion of off-grid renewable options provide a good basis to target the most important needs of rural populations, albeit with solutions that are slightly inferior to full grid-electrification.

This summary would point to a need to differentiate the Norwegian portfolio between; i) sustainable grid-expansion programs aimed at high economic impacts and sustainable utilities, and; ii) pro-poor programs in support of low-cost non-grid technologies. Whether or not Norad would intend to target both segments of the portfolio, such a differentiation would require a recognition that access by means of grid electrification is not always the most cost effective, most appropriate or sustainable means for providing improved energy services to the rural masses. This systematic differentiation would also allow GoN to engage a diverse set of countries with an appropriate set of tools to achieve an appropriate set of objectives.

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LIST OF ABBREVIATIONS/ACKRONYMS

B/C	Benefit Cost Ratio
BIL	Basic Insulation Level
CAPEX	Captital Expenditure
CBA	Cost-Benefit Analysis
CEMPRE	INE Establishment Cencus
CMI	Christian Michelsens Institute
CNELEC	Conselho Nacional de Electricidade
DNE	Direcção Nacional de Energia
EdM	Electricidade de Moçambique
EIRR	Internal economic rate of return
FGD	Focus group discussions
FUNAE	Fundo de Energia
GDP	Gross domestic product
GIZ	Deutsche Gesellschaft für Interntionale Zusammenarbeit
GoM	Government of Mozambique
GoN	Government of Norway
HCB	Hidroeléctrica de Cahora Bassa
HH	Household
INE	Instituto Nacional de Estatística
Jica	Japan International Cooperation Agency´s
KfW	Kreditanstalt fur Wideraufbau
kV	kilo volt
LV	Low voltage
LRMC	Long Run Marginal Cost
MoE	Ministry of Energy
MV	Medium voltaje
MVA	Megavolt ampere
MOTRACO	Companhia de Transporte de energia eléctrica de Moçambique
NGO	Non-governmental organization
Norad	Norwegian Directorate for Development Cooperation
OPEX	Operational Expenditure
PETROMOC	Petróleos de Moçambique
Sida	Swedish International Development Agency
SME	Small and medium size enterprise
ToR	Terms of Reference

1 INTRODUCTION

1.1 Background

Norway has for many years supported Mozambique's efforts to increase the level of access to electricity in rural areas. The justification for the strong focus on rural electrification has been the assumption that access to electricity would contribute to increased economic activity and enhanced living conditions – i.e. poverty reduction.

The following three electrification projects in Mozambique (the Projects), financed or co-financed by the Government of Norway (GoN) were completed between 2005 and 2008:

"Assistance to the Gurué-Cuamba-Lichinga Transmission Line Project" (MOZ 0012)
"Namacurra Electrification Project" (MOZ 2016) (distribution)
"Namacurra Electrification Project - Extension to Pebane" (MOZ 2016) (distribution)

Because it is expected that mid- to long-term effects of electrification have started to materialize, Norplan AS with COWI Mozambique as a sub-consultant was contracted by the Norwegian Directorate for Development Cooperation (Norad) in May of 2013 to conduct a study of the impacts of the Projects.

1.2 Study objective

The study aims to (i) Evaluate the impact of the Projects on development of business activities and income generation; (ii) evaluate the financial and operational impacts on the energy utility (EdM) and (iii) review to what extent the Projects have achieved the planned results. Based on these findings, the Report provides lessons learned with regard to prioritization and design of rural electrification projects.

1.3 Structure of the Report

The Report follows the following structure:

- Chapter 2 describes the Study Methodology;
- Chapter 3 presents the Project Context and Energy Sector Framework and the Projects;
- Chapter 4 deals with the Impact on EDM, including an analysis of the Projects´ impact on EdM´s financial standing;
- Chapter 5 discusses Business Creation and Revival;
- Chapter 6 studies the Impact on Poverty Reduction and Equality;
- Chapter 7 contains the results of the Cost-Benefit Analysis (CBA);
- Chapter 8 the projects are assessed utilizing the OECD evaluation standards.

Chapter 4 (impacts on EdM) and chapter 5 (business creation) are stand-alone chapters that can be read independently.

2 METHODOLOGY

2.1 Data collection and document review

In addition to a number of documents provided by Norad, the Team has collected and reviewed background documentation from EdM, relevant Mozambican Institutions on the local, regional and national level, the World Bank and other Donors. A complete list of documents reviewed can be found in Annex H.

2.2 Survey

Proper use of statistical techniques is required for deriving solid findings on impacts of electrification efforts. Due to the general lack of secondary quantitative data with the required resolution, a survey was conducted in order to obtain sufficient data for the analysis. To ensure that the results are comparable with similar undertakings, Norplan prepared all survey tools based on a best practice template from Deutsche Gesellschaft für Interntionale Zusammenarbeit (GIZ)[2]. All survey tools can be found in annex D of this Report.

Two survey teams from COWI Mozambique worked in parallel in the Project areas during the Month of July 2013. They interviewed a representative sample of 86 businesses owners in commercial centers, 20 schools and health centers and 300 randomly selected households in the program areas, and adjacent control areas with similar characteristics.

Niassa	Zambézia
Chimbonila	Nicoadala
Lago	Maganja da Costa
Cuamba	Pebane

Table 1: Districts where the survey team worked

[2] *Available at www.produce.org.*

In determining the survey sample size and stratification, the Team has specifically balanced its expectations as to size of the area with the need to allow for robust statistical analysis. To account for the fact that the Project areas are different in terms of economic activity, efforts have been made to ensure that the selection of villages and barrios for interviews has been geographically and socio-economically balanced. The survey data are thus representative of the population and small and medium sized businesses in the Project areas. Due to the limited number of major enterprises in the Project areas it was deemed inappropriate to include these in the survey. Rather, the Projects´ impact on major industries is covered by interviews and observations made by the Team during their expert field visit (see section 2.4).

The data input process was conducted according to COWI quality assurance policy, and supervised by Norplan. All data analysis has been conducted by Norplan.

2.3 Focus group discussions

Experienced members of the COWI survey team lead 12 focus group discussions, two in each of the districts listed in Table 1. Each group consisted of local leaders, business leaders and representatives from the educational and health sector. To ensure that the views of women were appropriately captured, two women only focus group discussions were held.

Detailed focus group discussion guides, re-worked by Norplan based on GIZ best practice templates, can be found in Annex E to this report. In keeping with the Terms of Reference (ToR) for the assignment, the focus groups were mainly focused on impact on business, but other issues, such as impact on social services and gender balance were also covered discusses. Write-ups of the focus-group discussions can be found in Annex F.

2.4 Expert field visit

Following completion of the survey, Mr. Ralph Kårhamar and Mr. Ingar Flatlandsmo (the Team) carried out a field work visit from August 4th to August 17th 2013. They met with, and were briefed by the survey team in Maputo. They also met with key EdM officials, before proceeding to the Project areas, to:

i) review design, solutions, installations and maintenance of the Projects;
ii) conduct interviews with local leaders and business owners regarding the impact of electrification on the business environment, with particular focus on major industries;
iii) gather information on the Projects´ impact on EdM.

EdM was represented during the whole field visit by Project Manager Eng. Abel Chambuca from the EdM Directorate of Electrification and Projects in Maputo. A local survey team enumerator for each area also accompanied the field work to ensure a good transfer of knowledge. The Team held follow-up meetings with EdM, other relevant organizations as well as the Royal Norwegian Embassy in Maputo upon returning from the Project areas.

2.5 Secondary source analysis

A number of secondary sources of information have been used in the analysis, including:

- **2005 baseline studies** from Christian Michelsens Institute (CMI). The baseline studies have been used for background information and comparative analysis. Due to their relative lack of focus on impact on business and EdM they have only been of limited use in these sections of the analysis.

- **Regional level business census data** from Instituto Nacional de Estatística (INE). The business census data have been used for pre and post Project analysis for formal business creation and employment. The consultant cannot verify the quality of these data.

- **Connections and sales data from EdM** has been used for the financial analysis, and to analyze the impact on households and businesses.

- **Other documents** from a range of sources, as detailed in Annex H have been analyzed.

2.6 Data uncertainties and shortcomings

Primary data sources have in many cases not been available to the Team during analysis. In such cases, the Team relies on cross checked secondary data from a number of sources. Where this is the case it is clearly stated in the Report.

The sample size for the business survey makes it challenging to draw definitive conclusions on certain issues where the variance is small. Where this issue arises it is clearly stated in the Report. In such cases, the Team relies heavily on cross checked information from different secondary sources.

The chains of causality for a number of the issues discussed in this report are highly complex. In some cases this makes it difficult to draw definitive conclusions. Where this is the case it is clearly stated.

3 CONTEXT AND PROJECT DESCRIPTION

Mozambique's electricity industry is managed by the Ministry of Energy. The state owned power utility EdM owns shares in most of the other operational electrical institutions. The key institutions active in the electricity sector in Mozambique, including the regulatory and facilitation agencies are listed in Annex I. This Annex also presents an overview of the energy sector framework in Mozambique, including policies, plans and initiatives in the Project areas.

A brief introduction to main features and key information on the three Projects subject to the study is provided below.

3.1 Namacurra Electrification Project

The Namacurra project area is shown in Figure 1.

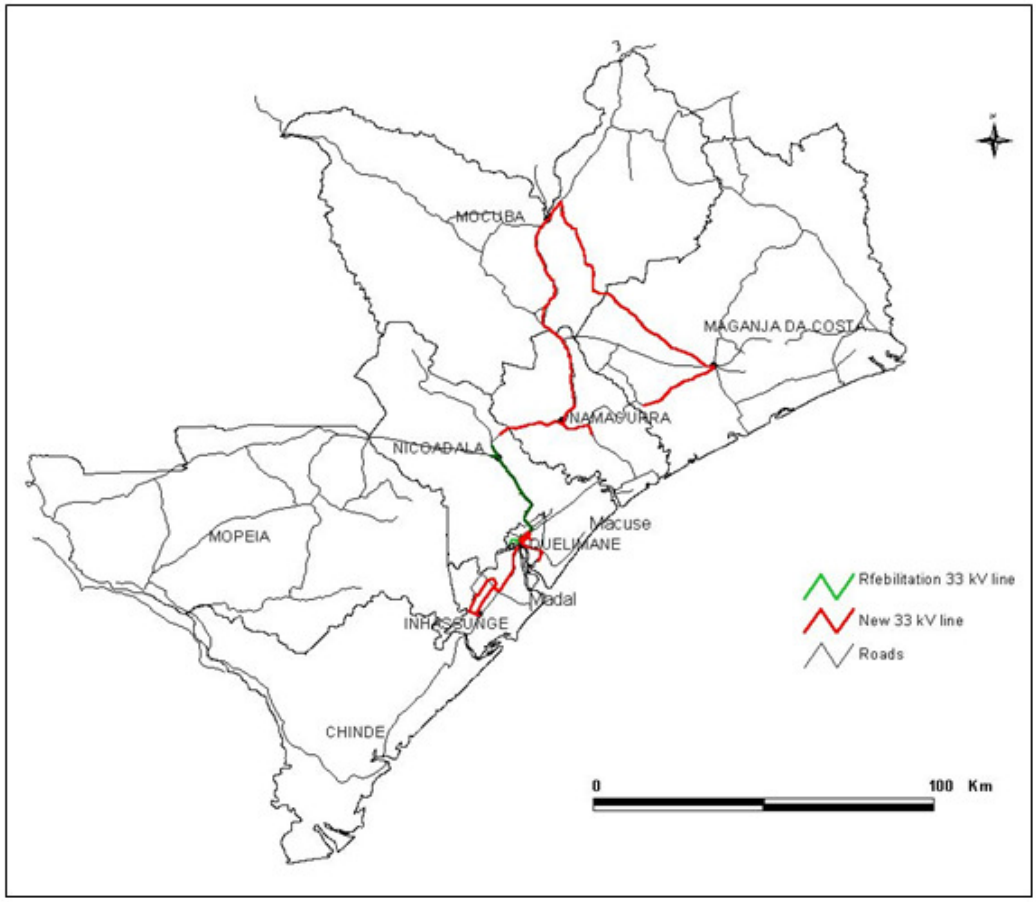

Figure 1: Map of the Namacurra project area

The Project comprised the following lots:

i) *Mocuba - Maganja da Costa*: Supply and erection of a 33kV distribution line from Mocuba 220/33kV Substation to the village of Maganja da Costa, approximately 83 km, and two distribution transformers including LV network and consumer connections.

ii) *Ceramica - Nicuadala -Namacurra (Licuare)*: Supply and erection of a 33kV distribution line from Ceramica 220/33 Substation to Nicuadala, Licuare and Namacurra, approximately 65 km. Dismantling of 15 km existing 33kV line between Nicuadala and Licuare. Supply and installation of three distribution transformers including LV network and consumer connections.

iii) *Ceramica - Central Termica*: Supply and stringing of a second circuit on the existing 20km long 33kV line on steel towers, between Ceramica and Central Termica. Dismantling of 2km conductors. Supply and erection of rehabilitation works in existing 33kV switchyard at Central Termica Substation.

iv) *Central Termica -Inhagulue -Praya Salala -(Macuse):* Supply and erection of 33kV distribution lines from Central Termica Substation towards Praya Salala and Macuse (via a submarine cable), and T-

off at Sampene towards Feira Madal and Inhagulue, total length approximately 70km. Supply and installation of submarine cable to Macuse. Supply and installation of 17 distribution transformers including LV network and consumer connections.

v) *Central Termica -Matulune*: Supply and installation of underground cable from Central Termica past the main market place towards the river crossing to Recamba. Supply and installation of submarine cable for the river crossing. Supply and erection of a 33kV distribution line via Recamba to Matulune, approximately 45km. Supply and installation of one 2 000 kVA and one 630 kVA prefabricated sub stations at Recamba and Licunguma, as well as 9 distribution transformers including LV network and consumer connections.

Project Duration

The Consultants' contract was approved by Norad on 3 April 2002. The supply and installation contract started on 21 January 2004 with a contractual completion date of 18 December 2005. The Contractor's taking over certificate was issued on 30 September, 2005 and the as-built drawings were submitted in March 2006.

Project	**Contract start**	**Contractual completion**	**Actual Completion**
Namacurra	21 Jan 2004	18 Dec 2005	30 Sep 2005

Table 2: Key information on Namacurra electrification project

Project Cost

The total project costs were NOK 56.40 million[3] according to the Final Report[4], broken down as presented in Table 3.

Project Component	**Cost (NOK)[5]**
Environmental study, USD 37,000 incl VAT	294,897.40
Consultancy contract, invoiced	4,142,127.64
Supply and erection contract	51,015,000
Mozambican contribution, MZM 9,435,000,000[6]	2,200,000
TOTAL	57,652,025.04

Table 3: Total project costs for Namacurra

[3] *MNOK 3.80 remained to be disbursed at the time of the Final Report.*
[4] *Electricidade de Mocambique, Namacurra Electrification Project (Original Project, exclusive of Extension), Final Report as of 12 May 2006, Norconsult*
[5] *Exchange rate of July 2006.*
[6] *In 2006, the Government of Mozambique devalued the metical, with one new metical being worth 1,000 of the 'old' meticais.*

3.2 Namacurra Electrification Project - Extension to Pebane

The Namacurra – Pebane Extension project area is shown in Figure 2. The line Manganja da Costa-Nantes is not shown in Figure 2, but is included in the previous map.

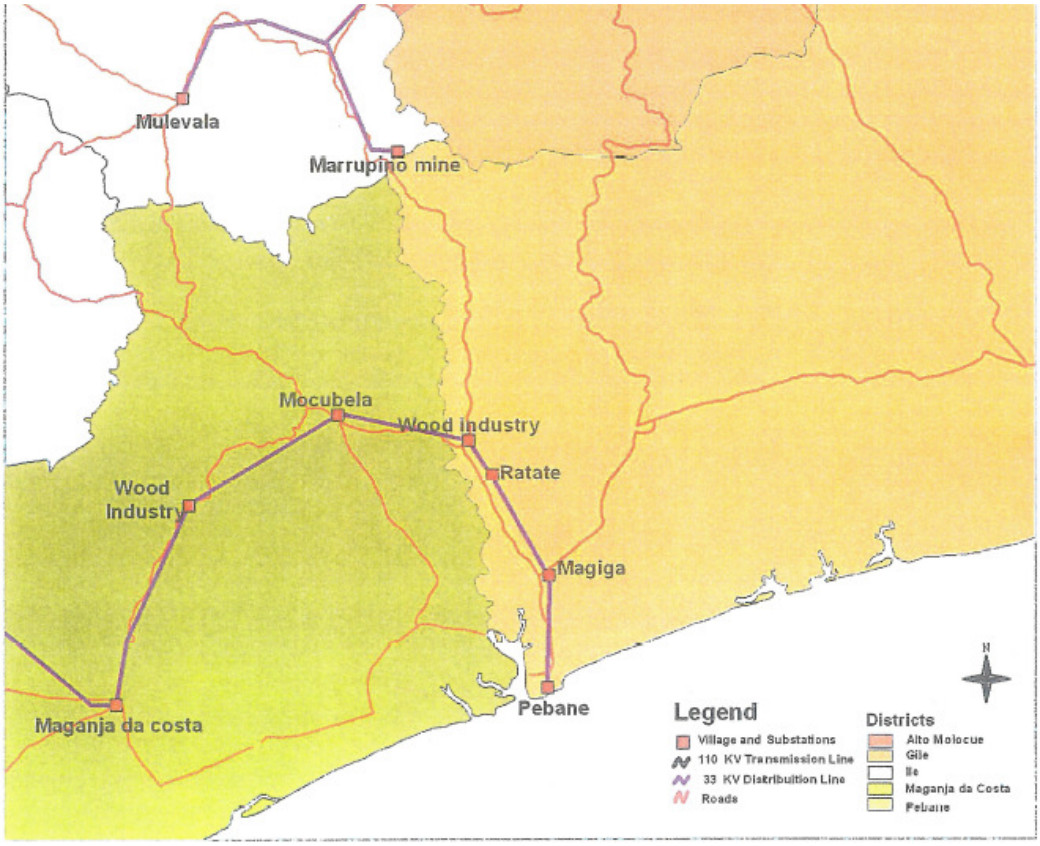

Figure 2: Map of the Namacurra – Pebane Extension Project

The project consisted of the following lots:

i) *Maganja da Costa – Pebane:* Supply and erection of a 33 kV line from Maganja da Costa to Pebane, approximately 144 km and electrification of the villages Serracao Reunida, Mocubela, Ratata, Hamalugo, Impaca, Magiga, all located along the road to Pebane. Electrification of commercial customers at P. Holding Mine and Saw Mill along the road to Pebane. In Pebane Town: Electrification of private and commercial customers through the installation of 9 distribution transformers. Installation of 15km low voltage lines, 1400 customer connections and 90 streetlights.

ii) Extra Spares, *Inhassunge:* Supply and erection of a 33kV line Mucopia - Gonhane - Matulune, approximately 14 kilometers (this was necessitated by the final sum of line lengths in the original Namacurra project totalling 270 kilometers, whereas there was budgetary cover for 255 kilometers. All low-voltage works were covered in the original Namacurra Project Contract).

iii) *Mocuba Rehabilitation:* Upgrading and rehabilitation of the 33/11kV Substation in Mocuba with a new 5 Megavolt ampere (MVA) transformer. Rehabilitating the 7 kilometer 33kV line between the 220/33kV substation and the 33/11kV substation. Rehabilitation of parts of the existing line routes and some extension of the 11kV line network in Mocuba Town (approximately 15 kilometers). Installation of 14 new 11/0.4 kV transformers including fuse-cut outs, surge arresters, low-voltage switchgear and connections plus associated with 35 km of low voltage network.

Installation of 1000 new customer connections and 60 streetlights and rehabilitation of 430 old customer connections.

iv) *Maganja da Costa – Nante*: Supply and erection of a 33 kV line from Maganja da Costa to Nante, approximately 28 km, and electrification of the villages of Limuila and Diba and the rural centre of Nante, involving installation of 3 transformers, 3.6km low voltage lines, 160 customer connections and 35 street lights.

v) VHF Radio Communication to operate the Quelimane - Pebane – Mocuba network.

Project Duration

The Consultants' contract was signed on 25 October 2006, but the Consultant had worked for a year before that on the Project. The supply and installation contract started on 14 August 2006 with a completion date of 14 February 2008. The Contractor had most of the work completed by December 2007, but problems with distribution transformers resulted in an about five months delays.

Project	Contract start	Contractual completion	Actual Completion	Delays	Penalties
Namacurra-Pebane Extension	14 Aug 2006	14 Feb 2008	9 July 2008	5 months	Approx NOK 2 million[7]

Table 4: Key information on Namacurra electrification project – extension to Pebane

Project Cost

The total project cost was NOK 50,595,985.36 according to the Final Report[8].

No figure for the Mozambican contribution was provided[9], but assuming a similar contribution as for the Namacurra project, the pro rata contribution would have been about MZM 10,233,000,000, or around NOK 4.1 million.

Project Component	Cost NOK
Supply and erection contract	47,136,194
Consultancy contract	3,459,791.36
Mozambique contribution	4,100,000
TOTAL	54,695,985.36

Table 5: Project costs for the Namacurra – Pebane Extension Project

[7] *Delay penalties were offset in full against the Contractor's various claims and some outstanding invoices.*
[8] *Final Report, Namacurra - Pebane Extension, Norconsult, 22.08.2011*
[9] *As the Final Report did not include this information, EDM was asked to provide this information.*

3.3 Gurué-Cuamba-Lichinga Transmission Line Project

The Gurué-Cuamba-Lichinga project area is shown in Figure 3:

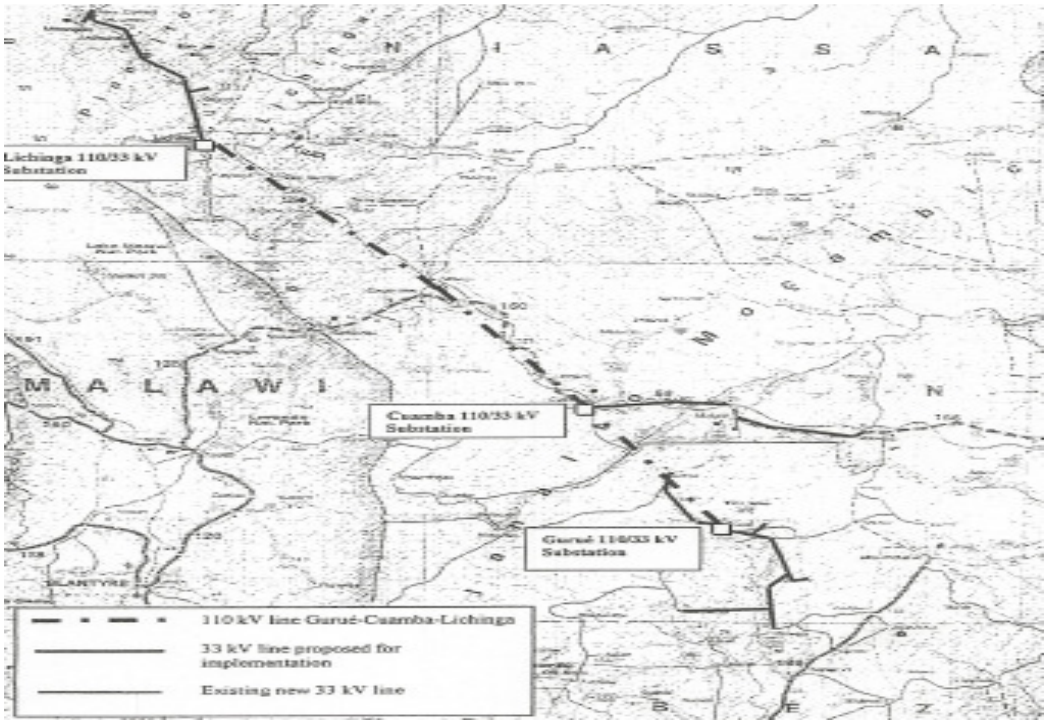

Figure 3: Gurué-Cuamba-Lichinga Transmission Line/Distribution Project Areas

The Project comprised of the following lots:

A. Transmission

i) 1250 kV A diesel power unit in Lichinga thermal power station including 0.4/11 kV generator transformer and new 11 kV switchgear.

ii) 110 kV transmission line Gurué - Cuamba - Lichinga. Single circuit overhead transmission line on self-supporting lattice steel towers:

   a) Section 1 - Gurué - Cuamba, 100 km

   b) Section 2 - Cuamba - Lichinga, 235 km

iii) Substations

   a) Section 1 - Extension with one 110 kV line bay at Gurué Substation

   b) Section 2 - One 110/33 kV Substation at Cuamba with two 110 kV line bays, one 110 kV transformer bay, one 16 MVA transformer and 33 kV switchgear with seven feeders

   c) Section 3 - One 110/33 kV Substation at Lichinga with one 110 kV line bay, one 110 kV transformer bay, one 110 kV shunt reactor bay, one 16 MVA transformer, one MVAr shunt reactor and 33 kV switchgear with five feeders.

   d) Section 4 - Extension and rehabilitation of 33 kV switchgear at Lichinga Thermal Power Station and one 33/11 kV 12 MVA transformer

B. Distribution

Gurué Area - 165 km of 33 kV lines, 47 km of LV lines, 19 33/0.4 kV distribution transformers and 1,800 service connections in the Gurué area. This included:

i) Gurué – Namarroi and Errego: Supply and erection of a 33kV distribution line from Gurué to Errego with T-offs to Namarroi, Socone and Muliquela, compact substations in Alverka and Socone and LV installations in Errego, Muliquela, Namarroi, Alverka and Socone. (On the LV portion, the Contractor did not carry out all the installations specified for Gurué Town due to lack of LV materials, which had been moved to Sections 2 and 3. These LV works were later included in the World Bank ERAP Project.)

ii) Gurué to Lioma: Supply and erection of a 33kV distribution line from Gurué to Lioma (approximately 50km), and low-voltage installations in Lioma.

Cuamba Area - 110 km of 33 kV lines, 21 km of LV lines, 19 33/0.4 kV distribution transformers and 1,000 service connections in the Cuamba area. This included

i) *New Substation to old substation in Cuamba*: New 33kV connection between the two substations and 617m of underground 33kV cable to access the old substation.

ii) *Cuamba-Malema*: Supply and erection of a 33kV distribution line from Cuamba to Lurio-Mutuale-Malema, compact substations in Cuamba (3), Mutuale and Malema and LV installations in Lurio (incl.street lights), Mutuare (incl.streets lights), Malema (incl.street lights) and Malema Extension.

Lichinga Area - 125 km of 33 kV lines, 2 km of 33 kV underground cable, 7 km of 11 kV lines,6 km of 11 kV underground cable, 47 km of LV lines, 18 MV/0.4 kV distribution transformers and 3,300 service connections in the Lichinga area. This included:

i) *Lichinga Town:* Rehabilitation of 11kV lines and 11kV underground cables in Lichinga, supply and installation of a new 11kV line to Bela Horizonte and Lichinga Water Works and a new MV connection between the Lichinga substation to the Thermal Power Station.

ii) *Lichinga to Metangula;* Supply and erection of a 33kV distribution line from Lichinga to Metangula with T –offs to College, Missao, Quinta Nor, Maniamba and Chiwanga, compact substations Lichinga (4) and LV installations in Lichinga, Metangula and Maniamba.

The Cuamba Extension included supply, construction and completion in Cuamba Town of (i) Rehabilitation and extension of the existing 33 kV network (ii) Rehabilitation and extension of the existing LV network and (iii) Rehabilitation of the existing 33/0.4 kV substations.

i) *The Cuamba MV network rehabilitation included:* The existing 33 kV network in Cuamba Town was rehabilitated and extended. The work consisted of laying of approx. 1 km of 33 kV cables, approx. 1 km of trenches incl. repair of surface, cable joints, cable terminations and about 40 km 33 kV OH-line.

ii) *Cuamba distribution substations rehabilitation included*: Rehabilitation of existing distribution substations. The work included delivery and installation of 3 new pole mounted transformers and rehabilitation of 12 substations.

iii) *Cuamba low-voltage network rehabilitation included*: The existing low-voltage networks in Cuamba town was rehabilitated using existing poles where that was possible. Concrete poles was

used in the down town areas and wooden poles in the more outskirt areas. All overhead lines were of the ABC type, total length about 50 km and about 400 m LV underground cable was needed.

Project Duration

The consultants' contract was originally signed on 7 July 1999. The main contractor's start date was 15 October 2002. The completion dates for the distribution projects are listed in Table 6. The Cuamba extension was a (smaller) separate contract.

Project	Contract start	Contractual completion	Actual Completion	Delays	Penalties
Gurué	15 Oct 2002	15 Oct 2003 (+4 months)	8 July 2005	510 days	Full delay penalties on all MV works
Cuamba	15 Oct 2002	15 April 2004 (+3 months)	7 Dec 2005	505 days	
Lichinga	15 Oct 2002	30 April 2005	15 Aug 2006	470 days	
Cuamba Ext.	8 Feb 2007	8 Feb 2008	Aug 2009	18 months	Full delay penalties

Table 6: Key information on the Gurué, Cuamba and Lichinga Distribution, excluding the Cuamba Extension Project

Project Cost

The total project cost for both the transmission and the distribution sub-projects was NOK 316,292,034 (including NOK 11,259,528 for the Cuamba Extension), according to the Final Report[10]. The financing was divided between Norway and Sweden[11].

As the transmission projects do not directly relate to the distribution targets, the continued assessment only deals with the distribution components. The Final Report lists the following costs for the distribution part of the supply and installation contract:

Distribution Project Components	NOK
Distribution supply & installation contract Gurué Area	32,995,758
Distribution supply and installation contract Cuamba Area	23,129,686
Distribution supply and installation contract Lichinga Area	45,446,302
Variation orders	14,743,177
Cost Price Adjustment (CPA)	5,604,410
Delay penalties	-5,770,033
Consultancy cost for the distribution part (pro rata)[12]	15,503,984
TOTAL	131,653,284

Table 7: Contract cost of the Gurué, Cuamba and Lichinga Distribution, excluding the Cuamba Extension Project

Distribution Project Components	NOK
Supply and install contract	9,925,794
The Consultancy contract	1,333,734
TOTAL	11,259,528

Table 8: Contract cost of the Cuamba Extension Project

[10] *Electricidade de Mocambique, Gurué-Cuamba-Lichinga Transmission Line Project, Final Report, Norconsult SwedPower, Undated, but the Report makes reference to a Final Settlement in September 2009.*

[11] *Agreement signed 21 August 2001: Norway NOK 189.1 million and Sweden SEK 120 million; Agreement on additional financing signed 12 November 2009: Norway NOK 9 million, Sweden SEK 5.6 million*

[12] *The consultancy services contract has no division into the different sections so it is difficult to establish exactly how much was for the distribution part. Dividing the consultancy services on a supply and install contract pro rata basis gives a total consultancy cost for the distribution part of NOK 15,503,984.*

No figures for the Mozambican contribution were provided[13], but assuming a similar contribution as for the Namacurra project the pro rata contribution for the Gurué-Cuamba-Lichinga line distribution part would have been about MZM 19,430,412,234 or NOK 4,600,000 and for the Cuamba Extension Project about MZM 1,659,489,362 or NOK 400,000.

Distribution Project Components	Cost NOK
Gurué-Cuamba-Lichinga	131,653,284
Mozambique contribution	4,600,000
Cuamba Extention	11,259,528
Mozambique Contribution	400,000
TOTAL	147,912,812

Table 9: Total cost of the Gurué-Cuamba-Lichinga Line Distribution Projects

[13] *As the Final Report did not include this information, EDM was asked to provide this information*

4 IMPACT ON EDM

This chapter presents relevant baseline information and investigates the impact that the Projects have had on the organization, system stability, reputation and financial situation of EdM.

4.1 EdM baseline information

4.1.1 Financial standing

Item	Unit	2008	2009	2010	2011
Total energy (local & import)	GWh	3,032	3,193	3,553	4,025
Electricity sold	GWh	2,404	2,448	2,777	3,186
Losses (excl. exports)	%	26.6%	27.8%	26.1%	25.0%
Total revenues	US$ M	199	210	209	324
Total expenses	US$ M	198	209	220	300
Average tariff	$c/kWh	7.6	7.2	7.0	8.9
Average operating cost	$c/kWh	7.3	7.1	7.0	8.2
Operating ratio	%	97%	99%	99%	92%
Net result	US$ M	1.1	0.5	(11.0)	24.1
Net result without extraordinary items	US$ M	(2.6)	(6.7)	(0.9)	7.1
Investments	US$ M	108.7	111.7	145.4	118.6
Investment subsidies	US$ M	2.0	2.9	1.4	3.4
Depreciation	US$ M	42.1	33.1	38.2	52.3
Operating profit (EBIT/net sales)	%	3.4%	0.9%	1.0%	7.6%
Return on equity (net result/equity)	%	0.5%	0.2%	-2.5%	4.3%

Item	Unit	2008	2009	2010	2011
CF from operations	US$ M	21	60	151	102
CF from investments	US$ M	(107)	(111)	(143)	(114)
CF from financing	US$ M	103	57	9	(29)
Cashflow variation	US$ M	17	7	18	(42)
Closing cash flow*	US$ M	85	78	98	81
Equity	US$ M	231	240	437	562
Supp. capital (subsidies)	US$ M	62	47	14	9
Long term (LT) debt	US$ M	326	342	507	611
LT debt/equity ratio	Ratio	1.4	1.4	1.2	1.1
Debt service coverage ratio	Ratio	1.2	2.0	8.5	3.0
Current ratio	Ratio	1.3	2.0	1.4	1.1
Receivables	US$ M	27	40	38	55
Payables	US$ M	47	56	88	110
Payable to HCB	US$ M	7	14	35	54

* The closing cash flow does not match exactly the opening cash flow plus/minus the cash flow variation because the numbers are taken from the financial statements in MTN and converted to US$ at the rate applicable that year

Table 10: Table 10 Key Financial Data for EdM 2008-2011. EdM audited financial statements and World Bank

EdM has repeatedly made losses in recent years. Although it turned out a profit in 2011 (following a 7 % tariff increase in 2010), the current tariffs are not sufficient to cover all costs, including the expansion of generation and networks. EdM's cash flow remains positive but it is partly at the expense of delayed payments to suppliers, particularly Hidroelectrica de Cahora Bassa (HCB), and non-repayment of loans on-lent by the Government of Mozambique[14].

4.1.2 Operational Performance

EdM is one of the better performing utilities on the continent in connection of new customers. EdM added more than 163,410 new customers for a total of 1,070,780 in 2011. The access rate increased from 12 % in 2008 to 18 % in 2011. Sales increased from 2,404 GWh in 2008 to 3,186 GWh in 2011. Collection rate was 97 % in 2011. Prepayment coverage increased from 6 % in 2008 to 81 % in 2011.

The losses, however, remain high. Losses (excluding exports) decreased slightly from 26.5 % in 2008 to 25.0 % in 2011. This comes at a high price for EdM – about USD1.1 million per 1 % of losses[15]. In 2010, 12 % of the losses were reportedly non-technical.

4.1.3 Cost of generation

In its Strategic Plan 2010-2014 (Plano Estratégico da EDM 2010 – 2014) EDM analyzes the likely future scenario of generation costs as the share of cheap hydropower from HCB is reducing and new more expensive IPPs come on line. EdM is likely have to import larger quantity of power in the short term (included at the emergency peak tariff from the South-African utility ESKOM at 25 USc/kWh). EdM assesses that the cost of providing power from new plants will quadruple the current cost of power from HCB.

[14] *The auditor of EDM's financial statements has expressed reservations and qualified opinions during recent years. Several accounting changes make it difficult to compare results between years (e.g. changes in calculating retirement benefits).*
[15] *The World Bank Consultant Gulam Dhalla estimated twice that figure in March 2011.*

4.1.4 Tariff structure

EdM's tariff structure differentiates between the following six main user groups:

- Domestic users
- General users
- Agriculture users
- Large power users (LPU) on low voltage (LV)
- Medium voltage (MV) users
- High voltage (HV) users

The Social Tariff are for customers with a power requirement of less than 1.1 KVA and a consumption not exceeding 100 kWh/month), using a pre-payment meter and with current limited to 5 amperes. The General Tariff serves commercial, schools, clinics, etc. The Agriculture Tariffs are meant for electrical power for agricultural production, particularly pumping and irrigation systems and adjacent localities.

The current EdM tariffs for the different categories are shown in Annex J.

4.1.5 Cost reflectiveness of tariffs

EdM's tariffs are based on a tariff study conducted by KPMG in 2001, adopted by a Decree in 2003 which specified the base tariffs for 2001 based on the then-current accounting costs. An adjustment formula was to allow periodic adjustments for changes in input prices (fuel, exchange rate, inflation). However, the formula was not applied adequately to allow for cost recovery tariffs (CRISIL/CEPA[16], July 2010).

In its July 2010 study, CRISIL/CEPA noted that when EdM was granted price increases as a result of application of the adjustment formula, it applied the resulting percentage increase uniformly across the tariff groups. This has driven the tariffs further away from cost-reflectiveness. Already in the 2003 Decree tariff levels were changed from the KPMG's cost-reflective levels.

To illustrate the precarious impact that the low tariffs have on EdM finances, the Consultant has calculated the real tariff development for different consumer categories since the 2003 tariff adjustments in real 2003 dollars. The result, together with the EdM marginal cost of generation as presented in the company's Strategic Plan[17] is presented in Figure 4. It is underlined that these calculations are made applying average inflation rates for Mozambique, as presented by the World Bank. This may lead to over- or underestimation of the cost increases for this specific sector. It is further noted that the number for cost of generation are based on estimates made years back, and thus are quite uncertain. The graph still gives a good indication of the steep decline in real income that EdM has suffered over the last decade.

[16] *CRISIL is an Indian based consultancy and Cambridge Economics Policy Associates (CEPA) a UK based consultancy*
[17] *Plano Estratégico da EDM 2010 – 2014), Actividades no Âmbito do Plano Quinquenal do Governo 2010-2014*

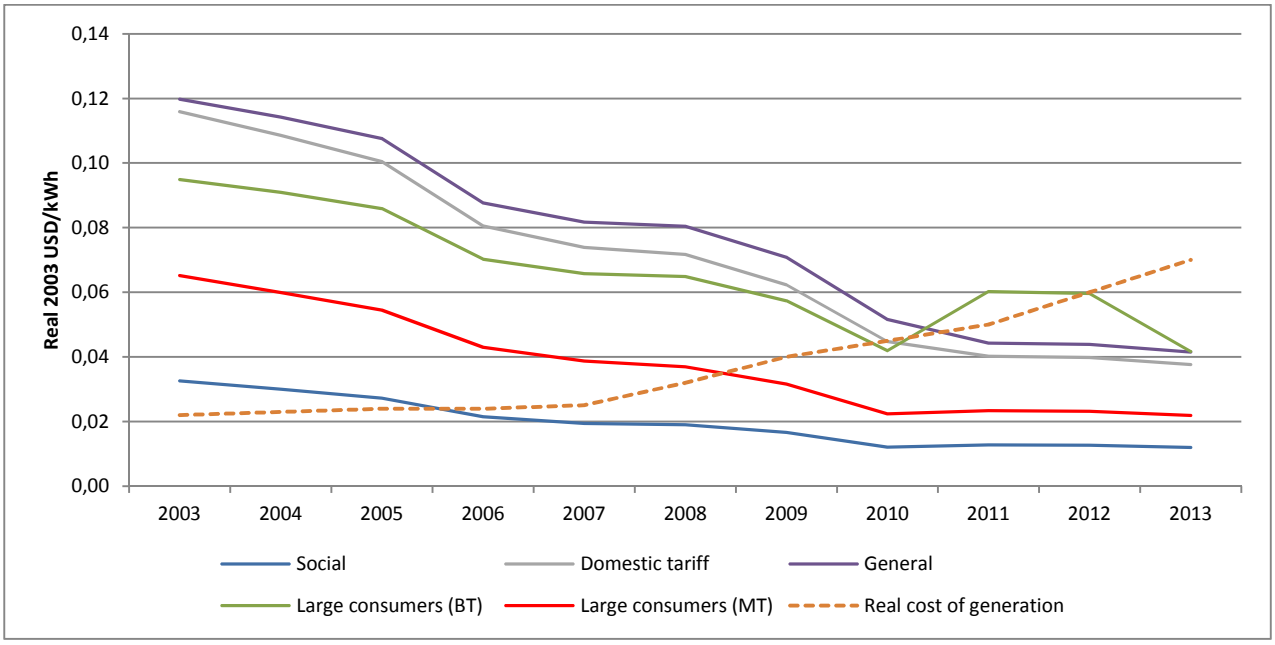

Figure 4: The Teams estimation of EdM's tariff development per kWh for different categories in real 2003 dollars and real cost of generation per kWh

To substantiate this picture, Figure 5 shows the amount of consumed energy invoiced to the different consumer categories in the Project areas.

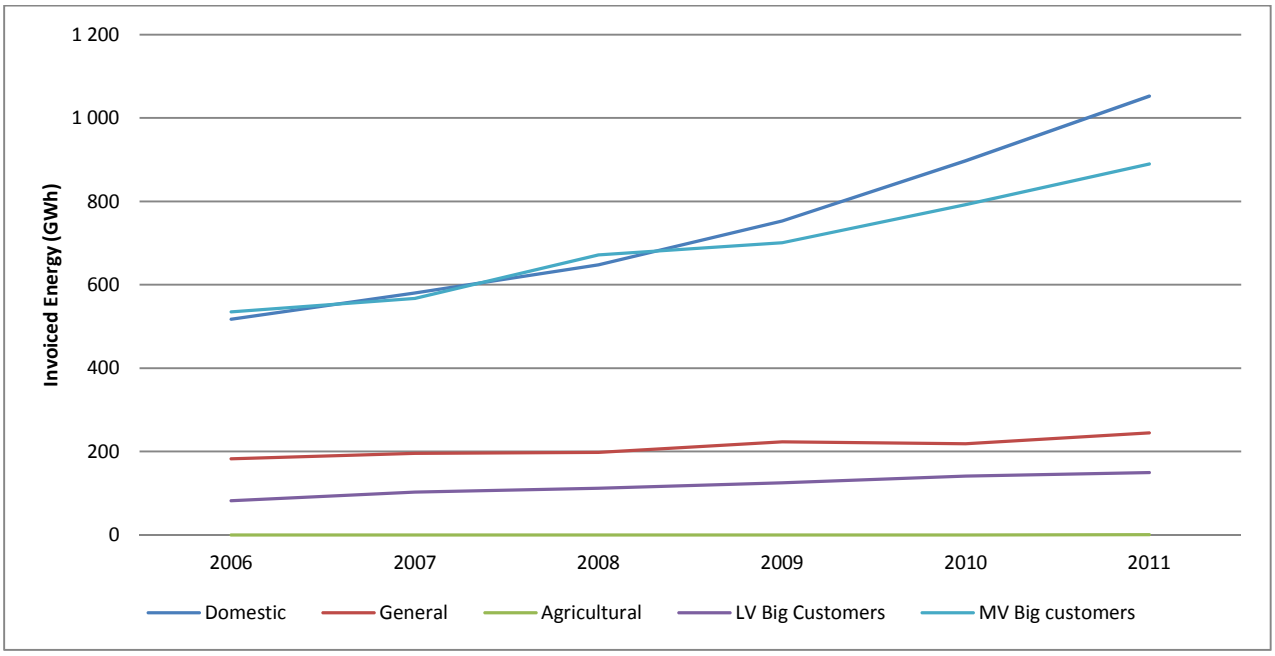

Figure 5: Invoiced energy (GWh) for different categories. EdM

Based on Figure 4, the following can be observed regarding the current tariffs:

i) Because nominal prices have been kept constant while inflation have been in the double digits for most of the last decade, the current tariffs for most categories are hardly sufficient to cover the real cost of generation per kWh. This is before the cost of operation of EdM and maintenance of the system is included.

ii) The room for cross-subsidies that previously existed has evaporated as the marginal cost of generation has increased.
iii) The social tariffs, both for pre-payment and for conventional meters, are heavily cross-subsidized percentage wise. The absolute size of this subsidy is limited due to the relatively small number of customers on the social tariff. There is, however a large number of customers that qualify for the social tariff and this burden could increase.
iv) The rapidly growing domestic customers segment is still heavily cross-subsidized. This is going to become a serious challenge for EdM if not addressed appropriately.
v) The cross-subsidies have for years been funded by General customers and large customers at medium voltage, but currently even these tariffs are scarcely cost-reflective.

The GoM is still considering a tariff study of December 2011, which recommended an approximate 15 % increase per year for the next three years. It also recommended changes to the tariff structure. From EdM's Corporate Performance and Strategic Planning unit the Team was informed about EdM's attempt to apply for an increase in the tariffs by 17 % on average, from June 2013 onwards, divided as presented in Table 11.

Category	**% adjustment**	**Revenue**	
		Current share [%]	**Adjusted share [%]**
Social	2 %	0.003	0.003
Baixa Tensão Agrícola	10 %	0.70	0.65
Domestica	12 %	51.00	48.71
Geral	20 %	17.00	17.40
GC de Baixa Tensão	25 %	6.00	6.40
Consumidores de Media Tensão Agrícola	10 %	1.00	0.94
Consumidores de Média Tensão	25 %	21.30	22.70
Consumidores de Alta Tensão	25 %	3.00	3.20

Table 11: Proposed tariff adjustments, currently being considered by the GoM

EdM explained the differentiated tariff increases by the need to (i) keep tariffs for residential and agricultural consumers low, thus safeguarding electricity access for development of low income households: (ii) adjust tariffs for commercial, services and industry closer to the Long Run Marginal Cost (LRMC) of supply and (iii) increase should be made annually, until all categories are at the level of LRMC.

The proposed tariff increase would improve EdM's financial situation (income statement, balance sheet) if/when it is approved by 8 % in terms of revenue for 2013, making EdM's financial result in 2013 positive. However, it was observed that the process was already running several months behind schedule.

If continued, the observed tariff trend will undermine the financial viability of EdM on both a short- and long-term basis. The Team has assumed in the subsequent analyses that the tariff levels will be substantially increased.

4.1.6 New connections

This section presents the number of connections for each Project, along with the pre-project objectives.

Namacurra project

The Final Report noted that it was difficult to install as many customer connections as initially planned before demobilising the Contractor. However, the number of customer connections would continue to grow and over a period of 2-3 years and the target was expected to be reached and even exceeded. The total number of consumer connections for the Project was estimated at 1,000 domestic, 1 medium and 10 small industrial and several commercial consumers.

According to EdM Statistics the customer connections in the Namacurra project areas (Nicuadala, Namacurra, Inhagulue, Zalala and Macuseare) have been:

Tariff	2006	2007	2008	2009	2010	2011	2012	Total
Social	116	49	64	21	0	1	1	252
Domestic	359	423	767	831	913	1081	917	5291
General	204	68	97	59	17	50	48	543
LPU LV	0	0	0	0	1	2	0	3
MV	2	0	0	0	2	1	4	9
HV	0	0	0	0	0	0	0	0
TOTAL	681	540	928	911	933	1135	970	6098

Table 12: Annual connection numbers for the Namacurra Project area. EdM

Large customers included a rice factory in Namacurra, a beach hotel in Zalala, some small wood industries and a vehicle inspection depot in Inhagulue. **It can be observed that the actual number of connections have surpassed the planned connections.**

Namacurra – Pebane extension

According to the Final Report, the Project has provided distribution network facilities which allowed for the connection of 3,000 new customers. However, only about 1,800 (60 %) were connected by the contractor during the contract period. In addition, all existing customers in Mocuba (prior to this project) have had their supply quality improved.

	Planned	Implemented
Maganja da Costa – Pebane	1,400	628
Mocuba	1,450	1,128
Maganja da Costa Nantes	166	40
Total	3,016	1,796

Table 13: Number of costumers connected before the Final report was submitted for the Pebane extension. EdM

The Team received EdM statistics for new connections per year from project completion date, but the statistics did not include connections in Mocuba and Nanates. The total numbers of connections have therefore been estimated as described in Annex A.

The estimated total number of connections for the Namacurra Extension to Pebane project is outlined in the Table 14. **It can be observed that the actual number of connections have surpassed the planned connections.**

Tariff\ Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	833	0	52	0	0	0	0	885
Domestic	527	578	1031	837	650	1036	910	5569
General	46	130	175	24	25	107	64	571
LPU LV	6	0	4	0	2	0	0	12
MV	0	2	1	0	0	0	0	3
HV	0	0	0	0	0	0	0	0
TOTAL	1412	710	1263	861	677	1143	974	7040

Table 14: Total annual customer connection in the Namacurra Extension – Pebane project. EdM

Gurué – Cuamba – Lichinga project

According to the Final Report, the project had planned 8,200 new connections, but only about 5,226 were achieved.

	Gurué	Cuamba	Lichinga	Cuamba Ext.	Total
Planned service connections	1,800	1,000	3,300	2,100	8,200
Achieved	546[18]	554	3,112	1,600	5,812

Table 15: Number of costumers connected before the Final report was submitted for the Gurué – Cuamba – Lichinga Project. EdM

The Team received EdM Statistics for new connections per year from the project completion date supposedly covering all the Project areas. However, the statistics received did not include Lichinga Town, Cuamba Town or the whole Gurué Area. The Team has reconstructed and estimated the new connections as outlined in Annex A.

The estimated total number of connections for the whole Gurué-Cuamba-Lichinga Line Distribution Projects is outlined in Table 16. Also for this project **it can be observed that the actual number of connections have surpassed the planned connections.**

Tariff\ Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	100	18	9	8	28	16	179
Domestic	5041	1425	2428	2155	2790	2814	4721	21374
General	760	246	279	620	392	385	359	3041
LPU LV	12	0	5	8	1	37	6	69
MV	0	0	0	0	0	0	1	1
HV	0	0	0	0	0	0	0	0
TOTAL	5813	1771	2730	2793	3191	3264	5103	24665

Table 16: Total annual connections for the Gurué-Cuamba-Lichinga Line Distribution Project Area. EdM

4.2 Impact on EdM financial performance

The financial sustainability of EdM is essential to ensure a continued expansion of electricity access in Mozambique, and to secure proper maintenance of the existing infrastructure. It is also crucial for the creditworthiness that is required in order to attract private investors in power generation. The following sections analyze the financial sustainability and impacts the Projects' have had on the financial performance of EdM.

4.2.1 Financial Project Analysis

This section contains the financial analyzes the Projects´ impact on the financial situation of EdM. For the Gurué – Cuamba – Lichinga Project, the transmission components are excluded, to allow for a credible analysis of costs and benefits on project level. The key assumptions, in accordance with the project specific data presented above are presented in Table 17:

[18] The difference of 1,254 were installed in the World Bank ERAP project

	Namacurra	**Pebane extension**	**Gurué – Cuamba – Lichinga**
Currency	All numbers in real 2002 dollars	All numbers in real 2006 dollars	All numbers in real 2002 dollars
Economic life of distribution system	25 years	25 years	25 years
Deprecation of capital goods	Linear	Linear	Linear
Weighted Average Cost of Capital - WACC (On-lending interest rate)	5 %	5 %	1.5 %
On-lending grace period	5 years	5 years	5 years
Loan period after grace	25 years	20 years	25 years
Capital Expenditure (CAPEX)	NOK 57 million	NOK 56 million	NOK 147 million
Operational Expenditure (OPEX)	3 % of CAPEX p.a.	3 % of CAPEX p.a.	3 % of CAPEX p.a.
Number of connections	Real as reported by EdM till 2012 (see Table 12), then increased by 14.3% per year as extrapolated for Northern Region from data in EdM Annual Statistical Report 2011 (electricity access per region) for five years. For the remainder of the economic life, 5 % annual increase is assumed.	Real as reported by EdM till 2012 (Table 12), then increased by 14.3% per year as extrapolated for Northern Region from data in EdM Annual Statistical Report 2011 (electricity access per region) for five years. For the remainder of the economic life, 5 % annual increase is assumed.	Real as reported by EdM till 2012 (see Table 12), then increased by 14.3% per year as extrapolated for Northern Region from data in EdM Annual Statistical Report 2011 (electricity access per region) for five years. For the remainder of the economic life, 5 % annual increase is assumed.
Consumption per connection	Constant over the period.	Constant over the period.	Constant over the period.
Tariffs	Actual tariffs from commissioning till 2013. Real 17 % average increase in 2014 as requested by EdM, then an average 7 % real increase p.a. for the remaining period.	Actual tariffs from commissioning till 2013. Real 17 % average increase in 2014 as requested by EdM, then an average 7 % real increase p.a. for the remaining period.	Actual tariffs from commissioning till 2013. Real 17 % average increase in 2014 as requested by EdM, then an average 7 % real increase p.a. for the remaining period.
Generation costs	Equal to the costs presented in EdM´s Strategic Plan.	Equal to the costs presented in EdM´s Strategic Plan.	Equal to the costs presented in EdM´s Strategic Plan.
Tax	Project impact is calculated before tax.	Project impact is calculated before tax.	Project impact is calculated before tax.

Table 17: Key assumptions underlying the financial analysis

Based on the above assumptions and parameters, a project finance analysis has been conducted of all the three projects.

Real cash flows and Net Present Values of the three Projects are presented in Figure 6, Figure 7 and Figure 8. Applying the above assumptions, the Projects will have **a combined negative impact on the pre-tax financial situation of EdM in the magnitude of USD110 million dollars (NPV)** over their economic lives. Because only the generation-, and Operation and Maintenance cost of the Distributions systems are included, this estimate is seen as conservative. It should also be noted that the assumed tariff development is regarded by the Team as optimistic taking into account the historical tariff development of EdM.

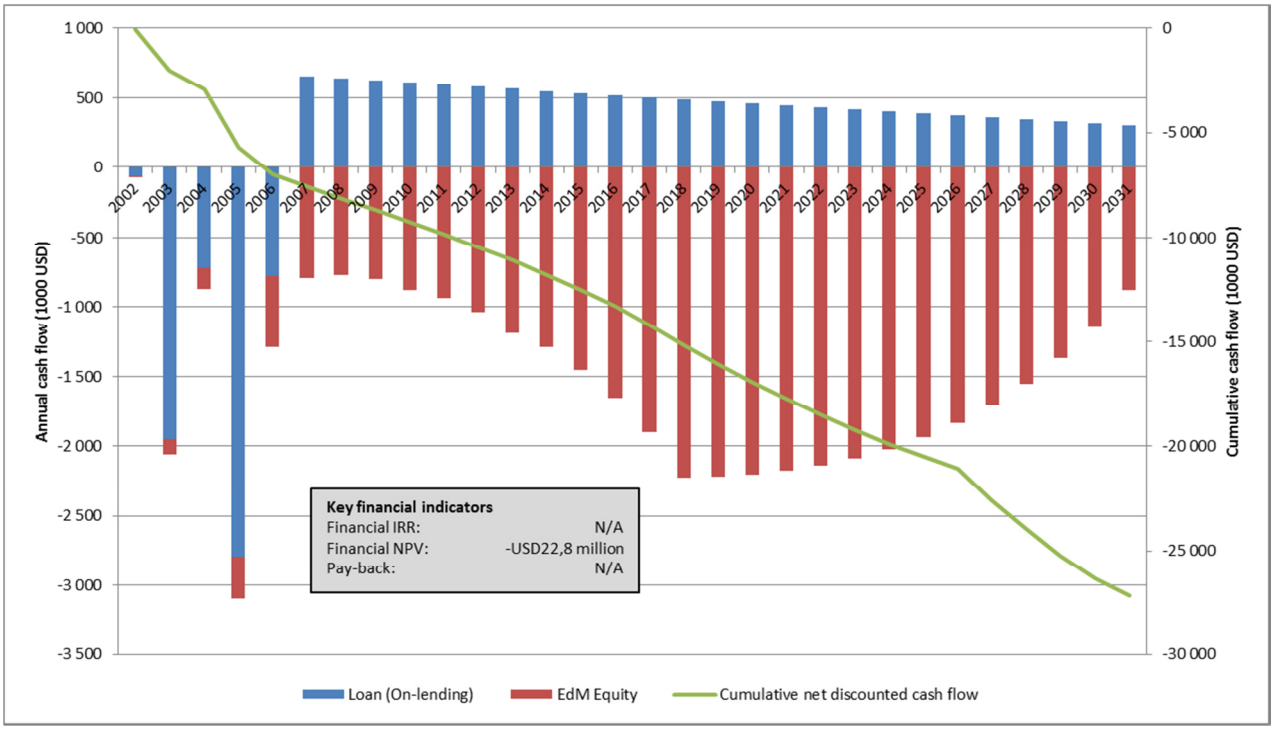

Figure 6: Cash-flow and NPV of the Namacurra Project in real 2002 USD. Norplan

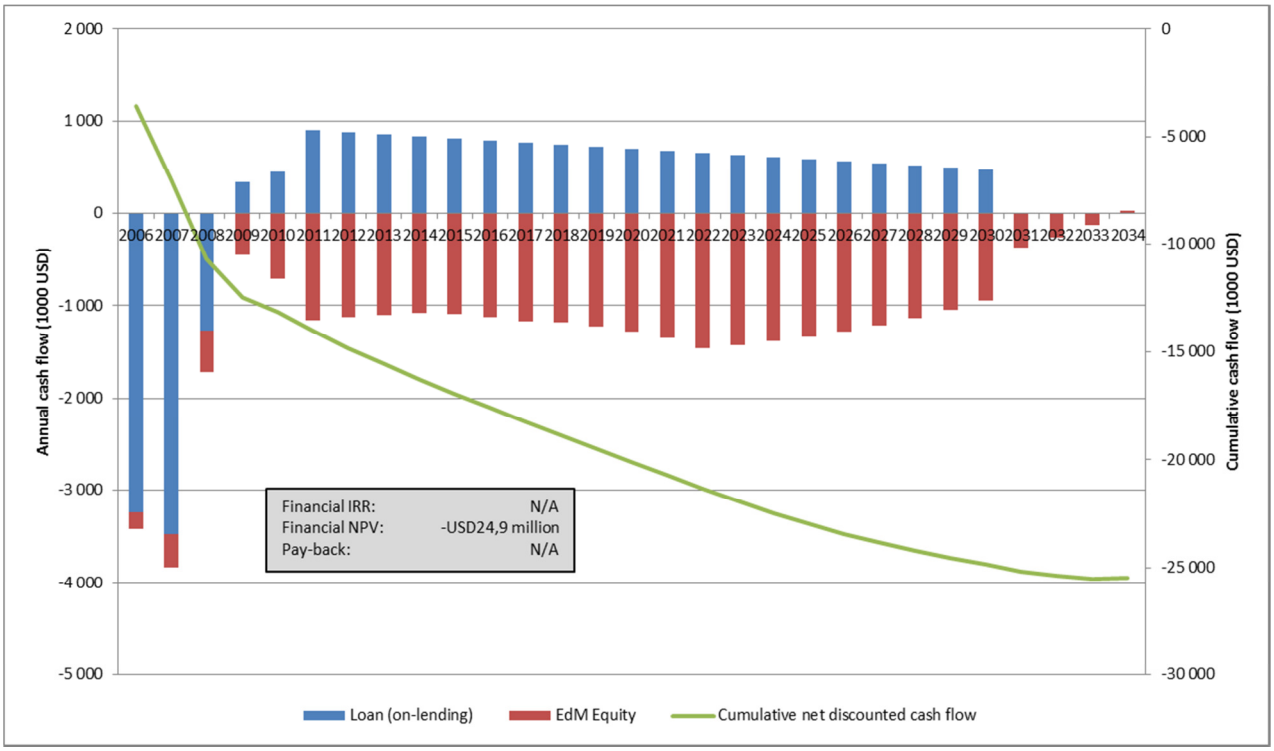

Figure 7: Cash-flow and NPV of the Pebane Extension in real 2006 USD. Norplan

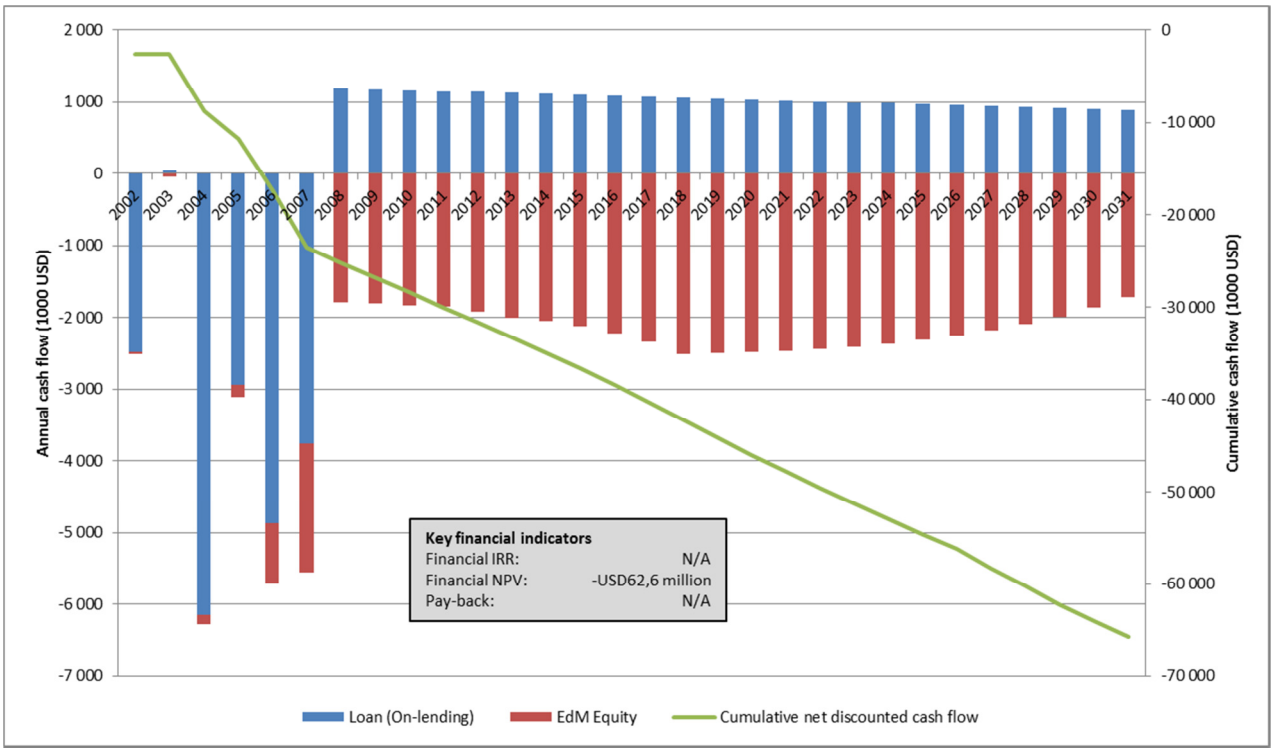

Figure 8: Cash-flow and NPV of the distribution network of the Gurué - Cuamba - Lichinga Extension in real 2002 USD. Norplan

In addition to the low tariff levels, the poor economic performance is also driven by relatively small shares of low voltage productive uses loads, as can be seen in Figure 5 on page 32. The domestic and social tariffs are the ones that are the furthest away from cost-reflectiveness.

It is clear from the above analysis that because the tariffs of EdM are far from cost-reflective, **the Projects have been a burden on the financial performance of EdM**. Indeed every new connection to the Projects will increase this loss.

4.2.2 Tariff sensitivity analysis

Due to the considerable uncertainty surrounding the future tariff development in Mozambique, two key sensitivity analyses were conducted to test the resilience of the above findings. The results are presented in Table 18.

	Namacurra	**Pebane extension**	**Gururé – Cuamba - Lichinga**
Required annual tariff increases from 2015 to reach NPV=0.	14 %	18 %	18 %
No nominal tariff change till 2016. Then 7 % annual increase. NPV in USD	-30 336 491	-28 827 442	-77 917 233

Table 18: Tariff development sensitivity analysis

4.3 Impact on organization

4.3.1 Operation and maintenance of assets

During the field trip, the Team asked local EDM Staff about the additional personnel that had been hired to operate and maintain the various distribution projects as well as additional offices, buildings and vehicles. Annex K summarises the findings, which include about 50 new staff, a dozen vehicles and 16 offices. Average salaries for the additional staff are in the range of MZN8,000-15,000 per month. Most offices are of the container type and would typically cost in the order of USD5,000 each, and a vehicle about USD60,000. Thus it is expected that EdM would have had to procure vehicles and offices for around USD800,000 and that it has an additional payroll cost of about MZN6,900,000 (USD232,000) per year as a consequence of the Projects.

However, with the large number of new connections most local staff seems to focus on installation. In general, the following observations were made:

- There appear to be a shortage of experienced staff in electrical distribution maintenance.
- Staff referred to lack of vehicles and relatively simple maintenance tools and equipment. This shortage may however be temporary as discussed below.
- There is a lack of current up-to-date drawings of the electrical distribution networks.
- Operations and maintenance manuals appeared to be tucked away in substations and not often referred to.

- There appeared to be an ad-hoc attitude to what equipment the management desired to have cleaned, inspected, maintained, serviced and tested, as well the specific order that each piece of electrical equipment was to be recalled from service for inspections, maintenance or testing[19].
- Electrical equipment was reported by some customers to have been damaged or destroyed due to lightning strikes or surge events. The preventative maintenance program should incorporate the inspections, assessments, or testing of existing lightning abatement systems or surge protection systems.
- It also seems that additional measures need to be considered to combat lightning strikes (see section 4.4).

There did not appear to be a comprehensive preventive maintenance and testing program in place and followed anywhere. Such a program would typically detail:

- Basic maintenance and testing of all the electrical distribution equipment.
- Policy development, incorporating detailed policies, procedures and maintenance activities for the electrical distribution system.
- Regular and systematic evaluations and analyses of the distribution infrastructure to aid managers in identifying risks and provide guidance on how such risks would potentially impact their operations.
- Regulatory compliance to assist the management to effectively document and meet the reporting requirements of applicable regulatory authorities.

Regarding the lack of simple maintenance tools and equipment, EdM has had a somewhat difficult process through which there is now a centralized procurement system in place. The Team learnt that **the first deliveries under the new system had just been made and that preparations and plans for next year's need were well under way**. Evidently it has taken a couple of years to implement this new system and EdM is now expecting that routine maintenance tools and spares will be more readily available.

4.3.2 Reputation

The focus group discussions raised the following complaints about EdM:

- No training in the use of electricity provided by EdM
- Time from request to connection varied from 30 to 90 days and appeared to depend upon availability of technicians
- High cost of the connection fee
- Some people did not understand why connection costs could differed between different consumers
- Electricity access in few barrios (residential area) of electrified villages.

Considering that EdM is installing over 100,000 new connections a year and thus also one of the best performing utilities in Africa, these remarks are relatively mild. In addition, both the connection costs and the tariffs are low in comparison with neighboring countries.

4.4 Project impact on system stability

Ever since the 220 kV line was installed to the Northern areas of Mozambique, the low loads there coupled with the long line lengths caused voltages at the end of the line to rise due to the "Ferranti

[19] *Recommendations as to the specific cleaning, inspections, maintenance, servicing, and testing on specific electrical equipment or components can be obtained from the original operations and maintenance manuals from the original equipment manufacturer*

effect". The low level of short-circuit in the northern network generated enormous instability in the system and the outage of one line created huge voltage fluctuations and over voltages in the network. A Static Var Compensator (SVC), an electrical device for providing fast-acting reactive power compensation on high-voltage electricity transmission networks, was installed in the Alto – Molocue substation and a variable reactor was installed in the Nampula 220 kV substation. The last installation has been out of order since the middle of 2009.

The Gurué-Cuamba-Lichinga line was relatively lightly loaded when it was connected to the EDM grid as can be seen from Table 19.

Line	MD 2007. MW	MD 2008. MW	MD 2009. MW	MD 2010. MW	Max. capacity MW	Utilization %
Gurue-Cuamba	4.89	5.2	7.6	7.8	56	13.9%
Cuamba-Lichinga	3.28	3.8	5.1	5.5	56	9.8%

Table 19: Growth of maximum demand (MD) in the Gurué-Cuamba-Lichinga transmission line. EdM

Thus the main impact the line had on EdM's grid was to add to its inherent instability. Although a reactor was installed in Lichinga under the Project, at times EdM was forced to disconnect the line to Lichinga to decrease the voltage. Usually after a few minutes the voltage would be reduced and the line could be reconnected.

In 2010, the EdM system experienced 1,512 activations of the relay protection systems against 1,031 in 2009. This is an increase of 37 %. EdM's Technical Quality Report for the Transmission Network (2010) states that this increase is due to faults in the medium voltage lines and 110 kV lines (38 %) during the rainy season. The costs of these problems are a lack of lightning protection earth wire and in some cases insulators of poor quality. Annex L deals with some design features in the Project contributing to this.

From 2010 the load has grown in the North, and EdM has been facing lower voltages. With additional capacitor banks in Alto Molocue and Nampula the situation has stabilized.

4.5 Conclusions

The Projects have been successful in attracting a large number of connections, in fact far larger than anticipated during the design. Because EdM´s tariffs are not cost reflective, this success has come at an estimated cost of about USD110 million (NPV in 2002-dollar) to the financial performance of EdM. This demonstrates that **it is of the outmost importance to raise the electricity tariffs in Mozambique**. Increased low voltage productive loads would also have improved the financial performance of the Projects due to their higher tariffs.

EdM is able to maintain the assets in an ad hoc manner, but **needs to put a comprehensive preventive operation and maintenance program in place, and then follow it**. Quality of supply in the form of frequent outages due to lightning strikes is impaired by the lack of earth wires on the 110 kV transmission line and the design of the distribution lines in the coastal areas.

There are a number of challenges related to further electrification and access expansion. These include:

- The high costs of supplying rural households, as these areas have a low population density and mainly poor households, with limited demand for electricity (often less than 30 kWh per month).
- Many a rural households cannot afford to pay the high cost of providing electricity to their villages, in particular, to pay for cost reflective connection fees.
- Rural systems have higher technical network losses and operating costs.

- The provision of rural electricity services is in many cases not financially viable and, therefore, EdM has a strong incentive to avoid distribution grid extension in rural areas.
- Eventually it becomes cheaper to use off-grid sources of supply to reach distant communities. This could be mini-grids served by mini-hydro plants or diesel units, and solar-home systems (SHS). However, off-grid electrification also faces the high cost and low-demand challenges of grid extension in rural areas.

Measures that donors could take to mitigate some of these challenges are:

- As Mozambique is targeting a large numbers of low-income households in its electricity access programs, there is a need to ensure that electricity access investments are economically viable, i.e., that benefits (represented mainly by willingness to pay) exceed costs; and that electricity services are financially and operationally viable.
- The regulatory framework needs to accept the concept of full cost recovery of efficient operation of the electricity supply (competitive, appropriate standards, etc) as well as the limited ability of low-income consumers to pay.

5 IMPACT ON BUSINESS

5.1 Introduction

This chapter studies the impacts of the Namacurra, Namacurra – Pebane extension and Gurué – Cuamba - Lichinga electrification projects on existing business and creation of new enterprises (productive uses). Enhanced profitability of new and existing business´, and creation of new businesses are the foremost direct impact of successful productive use of electricity. There are, generally speaking four ways through which electrification can improve the performance of business; i) refrigeration; ii) communication; iii) appliances and machines, and iv) lighting.

While it is well known that promotion of productive use of electricity may enhance development outcomes, recent empirical data suggest that the wanted effects seldom materialize (GIZ, 2013)[20]. The key reason for this lack of results is the absence of supporting programs such as training and micro-finance facilities to stimulate productive uses. Thus, systematic productive use planning is a detailed and comprehensive process, more reminiscent of cross-sectorial rural development than electrification planning (Norplan, 2013)[21].

A key challenge in the analysis of the impact of electrification on business creation and revival is to separate the effects of electrification from other factors that influence the general business environment. To this end a number of data sources has been analysed, including i) aggregate economic data from the Mozambique National Institute of Statistics (INE), ii) data from a survey of 86 randomly selected small and medium sized enterprises in the project areas, iii) 12 focus group discussions, iv) data from the 2005 baseline reports from CMI v) interviews with local leaders, vi) interviews with donor organizations, vii)

[20] *GIZ (2013): Productive Use of Energy - PRODUCE. Measuring impacts of Electrification on Small and Micro-Enterprises in Sub-Saharan Africa. Available at www.produce.org.*
[21] *Norplan (2013): Rural electrification brief number 2 to Norad, on productive uses (draft)*

interviews with EdM personnel and not least viii) interviews with a large number of end users of electricity.

5.2 Presentation of the provinces

As can be seen from Table 20, the formal gross domestic product (GDP) of Niassa and Zambezia reached just above half the national average in 2011. While the underrepresentation of economic activity is likely to be larger in rural provinces than for example in Maputo, it is clear that there is relatively little formal economic activity in the two regions.

With only 12.5 people per km^2, Niassa is the least densely populated province in Mozambique.

	Niassa	Zambezia	National average
Population (est. 2013)	1.5 million	4.6 million	24.7 million
Density (pop/km^2)	12,5	44,1	31,3
GDP per capita in 2011 (USD)	282	285	544

Table 20: Key population and economic data on Niassa and Zambezia provinces compared with national average. INE

5.3 General business development (external factor analysis)

This section presents the overall business development in the Project areas since commissioning of the Projects. The purpose is to identify and describe other factors than access to electricity that has impacted the general business environment. National data has been used where district or local level data are not available.

5.3.1 Development of the national business environment

Through tight spending and monetary policies, the Government of Mozambique (GoM) has succeeded in in bringing inflation levels down from the rampant levels seen following the civil war (annual inflation was 70 % in 1994). Still, increased food prices following prolonged periods of droughts and floods, such as those seen in 2010, can pull inflation into the double digits for single years.

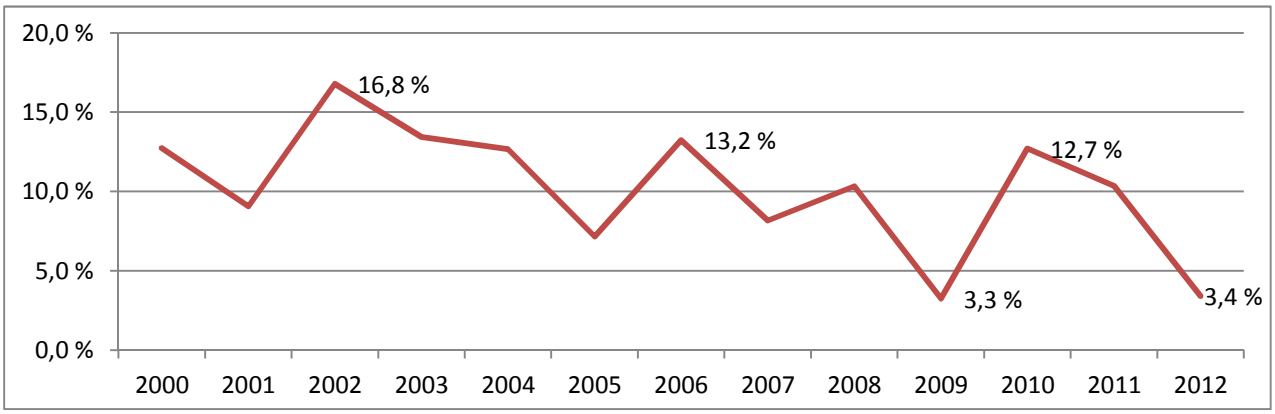

Figure 9: Historical annual inflation rates for Mozambique. World Bank

Mozambique has continued its economic reform program, including privatization of parastatals since 2006. Still, government involvement in the economy remains extensive. A number of trade barriers, not least towards other members of the Southern Africa Development Community (SADEC) have been lowered, and the trade-weighted average tariff rate is now 4.8 %[22].

Despite dramatic falls in global aluminium prices (aluminium accounted for over half of the country´s manufacturing output in 2007[23]) as a consequence of the financial crisis, the country achieved an average 7 % annual growth rate between 2010 and 2012, with investments in agricultural production increasing as a reaction to increased prices on the world market.

A government attempt to increase revenue through price increases on water, fuel and electricity among other goods in 2010, were followed by nationwide riots. In response the government lowered taxes, and reduced the price of electricity to certain groups of consumers, among other measures.

Mozambique is ranked 146 out of 185 economies on the World Bank and International Finance Corporation (IFC) Doing Business ranking for 2013. The key results for the 2013 ranking are found in Figure 10.

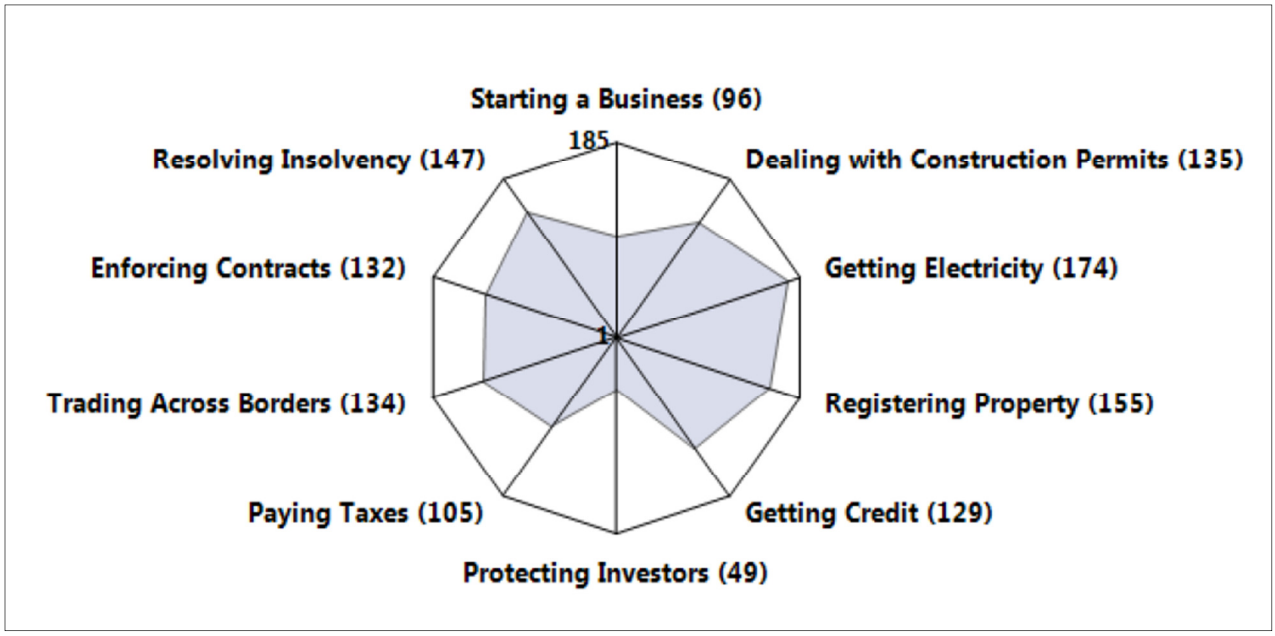

Figure 10: Mozambique´s results in the global Doing Business index. IFC/World Bank

While the Doing Business index only ranks Mozambique for the years 2012 and 2013, the underlying data are largely unchanged back to 2004. This indicates that the environment for formal business in Mozambique has remained largely unchanged from commissioning of the Projects up till today. Lack of access to credit is a key restraint on business development in Mozambique, and according to the think-tank Heritage Foundation less than 5 % of the Mozambican population has access to credit.

[22] *Heritage Foundation (2013): Index of Economic Freedom – Mozambique facts. Available at: http://www.heritage.org/index/-country/mozambique*

[23] *Organization for economic Cooperation and Development (OECD) (2008): Mozambique country study, acailable at (OECD)http://www.oecd.org/countries/mozambique/38562933.pdf*

5.3.2 Development of the business environment in Niassa

Niassa has traditionally had little domestic or foreign investment, except for some tourism and industry based on agricultural output. Even so, the province has experienced 7.6 % annual GDP growth the last 12 years.

With raising food and biofuel prices on the world market, foreign agribusinesses players such as the Brazilian and Portuguese owned AgroMoz are looking to start major plantations in the region. The favourable climate has also attracted foreign investors to forestation projects and the wood processing industry in Niassa.

The Korean telecom giant MoviTel came to Niassa as late as 2012, but has already extended its cell phone coverage to nearly the entire province. Previously there was only coverage around the major cities. During the field visit the Team observed road upgrades near Lurió, and the road between Metangula (Lago district) and Lichinga underwent major improvements around the same time as the Project was commissioned. This greatly increased the market assess of the fish industry in the area. Reduced travel time to the airport in Lichinga has also been positive for the tourism industry in Lago.

The Swedish International Development Cooperation Agency (SIDA) has a long-running partnership with the GoM aimed at reducing poverty and improving the livelihoods of the rural poor in Niassa. The support has included a program of electrification of the Mecanhelas, Maua and Marrupa areas, and an upgrade of the road between Litunde and Marrupa[24].

No major completed or on-going infrastructure projects are listed in the 2012 annual reports of the electrified districts[25]. Interviews with local leaders in the communities, where focus groups discussions and survey interviews were conducted, indicated that a number of minor infrastructure improvements have been carried out since electrification. As indicated in Figure 11, these seem to be fairly equally spread between Project and control areas.

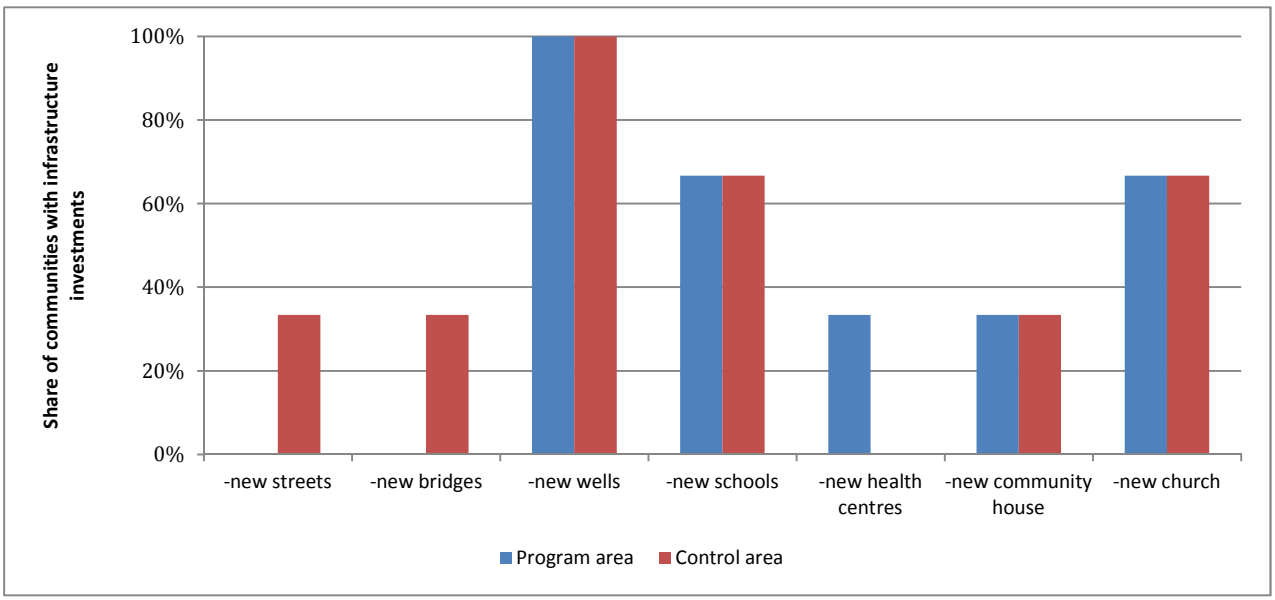

Figure 11: Share of surveyed communities in Niassa where minor infrastructure improvements have been commissioned since the Projects were completed. Norplan survey data

[24] *Personal communication from Counsellor Anders Kritz of the Royal Swedish Embassy in Maputo.*
[25] *These annual reports are standardized statistical summaries prepared for each District in Mozambique.*

5.3.3 Development of the business environment in Zambezia

While still lower than the national average, economic activity in Zambezia traditionally has been higher than in Niassa. Particularly the area around Gurué in the north of the province has had considerable investments due to its favourable conditions for tea production and proximity to Nampula – the capital of Northern Mozambique.

While the existence of agroindustry in Zambezia is not new, its growth, particularly around Lioma and Gurué has been considerable since the Projects were commissioned. The arrival of major multilateral enterprises such as Hoya and AgroMoz has increased agricultural output and formal employment, but it has also raised tensions related to land rights and accusations of land grab[26].

The mobile phone coverage has increased dramatically during 2012 in Zambezia too, as a result of the market entry of MoviTel. A major road improvement project is underway between Gurué and Lioma and from Gurue on to Alto Molcue. There is no central overview of on-going donor programs in Mozambique, but among the key donor programs in the area is the Japan International Cooperation Agency´s (Jica) support to the agricultural sector.

No major completed or on-going infrastructure projects are listed in the 2012 annual reports of the electrified districts. Interviews with local leaders in the communities where focus groups discussions and survey interviews were conducted indicate that a number of minor infrastructure improvements have been commissioned since electrification, but, as indicated in Figure 12 these seem to be fairly equally spread between the project and control villages.

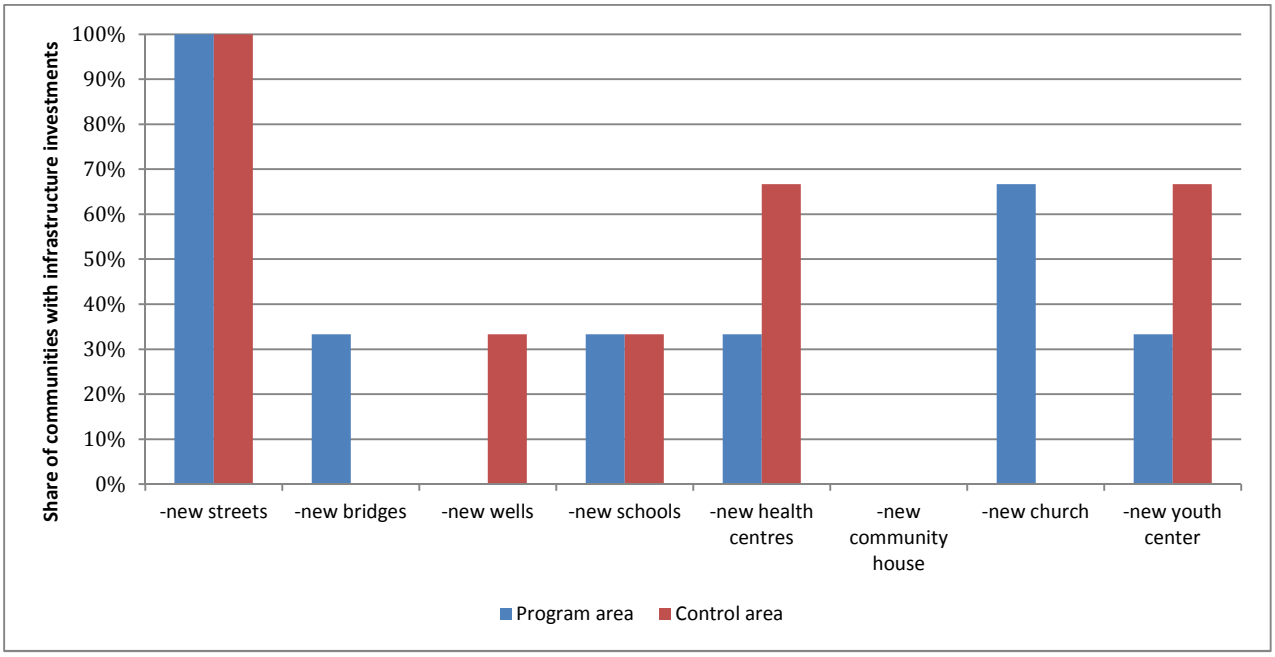

Figure 12: Share of surveyed communities in Zambezia where minor infrastructure improvements have been commissioned since the Projects were completed. Norplan survey data

[26] *Simon Norfolk (2012):* Confrontation between peasant produces and investors in Northern Zambézia, Mozambique. *Paper available at http://www.landandpoverty.com/agenda/pdfs/paper/norfolk_hanlon_mozambique.pdf*

5.4 Review of facilitating programs and other enabling activities

A number of recent reports by the World Bank[27] and other have indicated that electrification in itself is a necessary, but not a sufficient precondition for increased value creation through productive uses of electricity. Enabling programs, such as access to credit for connection fees or other investments, training in the use of electricity and simultaneous assistance to productive sectors can be the key to triggering productive uses. This section therefore explores up on him and him were the facilitating programs and activities that have been put in place to stimulate productive use of electricity from the Projects.

5.4.1 Government and EdM initiatives

There are general funds available for loans to groups or individuals whose projects are deemed eligible by the local Consultative Council through the Governments District Development Funds (FDD). These MTZ 9 million (2012) per district per year are general funds, which means that loans can also be granted to investments that trigger productive uses of electricity.

A review of the annual reports of the six districts where interviews and focus groups have been conducted reveal that FDD loans are mostly provided for agricultural and commercial activities, but some industrial activities are also supported. The availability of FDD loans did not come up in any of the focus group discussions in Niassa, but were mentioned in one focus group in Zambezia. This would indicate that the funds are not very well known in the area.

EdM indicated that they previously offered people to pay the connection fee in instalments, but they later abandoned this polity due to the high rate of defaults.

5.4.2 Initiatives and programs by other organizations and institutions

Niassa

According to the INE business registry, only one international non-governmental organization (NGO) is active in Niassa. Three micro-finance schemes are supported by SIDA through their Malonda Programme[28]. There is no central registry of organizations providing micro-finance in Mozambique, but interviews conducted by the Team indicate that few if any micro-finance enterprises or organizations are active in the project areas.

Zambezia

According to the INE business registry, two international NGO are active in Zambezia, but this may well be an underrepresentation. Interviews with local leaders and the focus group interviews confirm that few NGOs are active in the project areas. One focus group in Nicuadala district reported that a mobile bank named Banco Oportunidade provides credit.

5.4.3 Training in the use of electricity

The focus group members reported that no training or instructions in the use of electricity were provided by EdM. They were only told that the bills had to be paid at the EdM office. This impression is confirmed by interviews made by the Team during the field visit, and also by EdM.

No training by NGOs or other organizations in the use of electricity, productive or otherwise, have been reported in the focus group discussions, or interviews conducted by the Team.

[27] *World Bank Independent Evaluation Group (2008). The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits.*
[28] *For more information, please see: http://www.swedenabroad.com/SelectImageX/202329/Appendix232ToRMalondaFoundation.pdf*

5.4.4 Overall impression of facilitating programs

No specific supporting programs or activities have been put in place to facilitate the introduction of electricity, or induce productive uses in the project areas. There is **little access to credit through micro-finance or other schemes for entrepreneurs**. The exception is the government´s FDD funds, which seem to be little known in the project areas.

5.5 Impact on regional growth

This section investigates whether the projects have had an impact on the overall economic growth of the provinces of Niassa and Zambezia. This is done analysing economic data from 1997 up to 2012 available from the INE.

While several locations in Zambezia, including the economic powerhouse of Gurué were connected to the national grid prior to the project in 2006, this was not the case for Niassa. One would therefore expect the regional impact of the projects to be stronger in Niassa.

Figure 13 presents annual growth in GDP per capita for Niassa and Zambezia in the period between 1997 and 2012, as well as the national number. Over time it would seem that the two regions follow the national average.

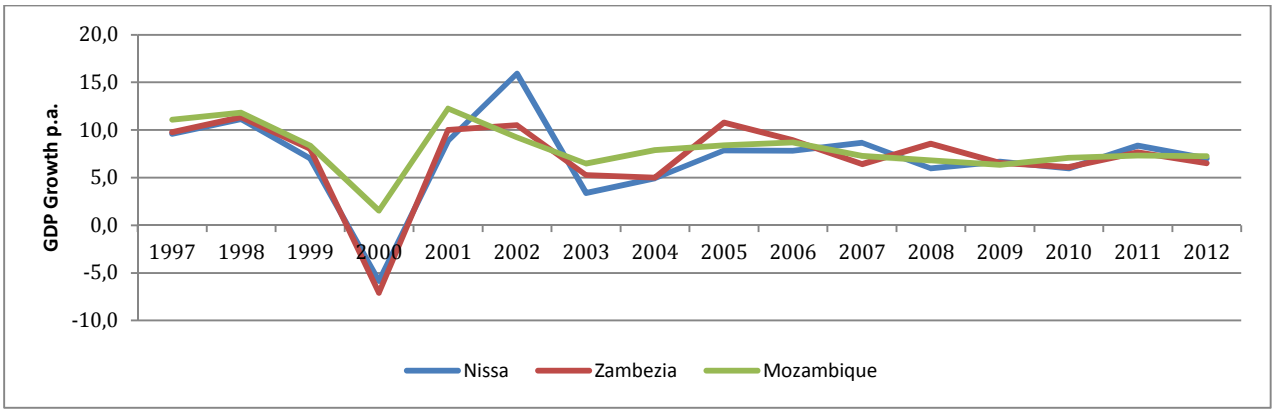

Figure 13: Annual GDP Growth rates for Mozambique and the regions of Zambezia and Niassa from 1997 to 2012. INE

To further investigate whether a shift may have occurred, the average growth rates for the periods before and after commissioning of the Projects are presented in Table 21. The Projects are commissioned at slightly different times, and 2006 is therefore chosen as the breaking point.

	2001-2006	2007-2012
Niassa	8,1%	7,1%
Zambezia	8,4%	7,0%
Mozambique	8,8%	7,0%

Table 21: Average annual GDP growth for Niassa and Zambezia regions and Mozambique in the six year periods before and after the approximate commissioning of the Projects. INE

While it is important to underline that a number of factors influence the GDP growth numbers of a geographical area, it is worth noting from Table 21 that while the growth rate of Niassa was 0.7 percentage points lower than the national average in the six years period prior to the commissioning of the Gurué – Cuamba – Lichinga project, it was 0.1 percentage points above the national average in the six years following it.

The Consultant has not found any other infrastructure development or changes to the macroeconomic conditions particular to Niassa that could explain the above result, and therefore see it as probable that the Gurué – Cuamba – Lichinga transmission project has indeed had a positive impact on the economic development of Niassa province. Though economic growth numbers are not available on district level, it would be expected that the major cities of Cuamba and Lichinga are the major drivers of this development.

Given the limited size of the Namacurra project and its Pebane extension, and the fact that Zambezia province was connected to the national grid prior to the projects, it is not surprising that no impact can be found on the economic growth of the region.

5.6 Impact on business creation

A number of data sources will be used to analyses the Projects´ impact on business creation. The 2005 baseline studies by CMI presents the number of entities and employees in the 2003 INE Establishment Cencus (CEMPRE) for the districts that are part of the projects (labelled the "with" group), and a selection of control districts (the "without" group) that were not set for connection to the national grid over the next years. The "without" districts were selected by CMI due to their relative similarity to the districts that form part of the projects. The Consultant has obtained comparable data for 2011 from INE and will compare the development of the "with" and "without" group.

In addition, data from the business survey, focus group discussions and interviews made by the Team during the field trip are analysed. It should be noted that some village have been connected after commissioning of the Project. This has been taken into account when interpreting the results, but given that these are relatively small, a relatively few it is not deemed to have a significant impact on the data presented.

5.6.1 Number of new businesses created

A key question in assessing the impact of electrification on value creation is whether more businesses are established as a consequence of the Projects.

INE district level data for the number of formal businesses in each district presented in the CMI baseline study is only comparable to current data for Niassa, because all districts in Zambezia have been electrified after the Project. Table 22 therefore only presents the number of formal businesses the "with" and "without" districts of Niassa province from the 2003 INE business census, and comparable numbers from 2011.

The CMI baseline indicated that exclusion of Lichinga Cidade from the analysis may be appropriate, as it is expected that the dynamics of the business environment of a major city will differ much from that in rural parts. The Consultant shares this view, and the district is thus taken out.

Table 22 shows while the number of private sector enterprises in the INE CEMPRE data has increased in all the selected districts in Niassa, the increase has been largest in the "without" group. While no absolute conclusion should be drawn given that data is only available of the Gurué – Cuamba – Lichinga project and the uncertainties of INE data quality, there are at least clear indications that formal business development in the electrified areas of Niassa has not been stronger than in the non-electrified.

		Public administration			Private sector			Civil Society			Total		
		2003	***2011***	***Change***	***2003***	***2011***	***Change***	***2003***	***2011***	***Change***	***2003***	***2011***	***Change***
"With" group	Lago	30	42	40 %	46	57	24 %	3	15	400 %	79	114	44 %
	Lichinga distrito	25	38	52 %	20	28	40 %	5	12	140 %	50	78	56 %
	Sanga	35	56	60 %	22	36	64 %	6	27	350 %	63	119	89 %
	Total	**90**	**136**	**51 %**	**88**	**121**	**38 %**	**14**	**54**	**286 %**	**192**	**311**	**62 %**
"Without" group	N´gauma	18	21	17 %	7	12	71 %	3	6	100 %	28	39	39 %
	Muembe	16	26	63 %	14	29	107 %	7	14	100 %	37	69	86 %
	Majune	38	42	11 %	8	13	63 %	2	6	200 %	48	61	27 %
	Mavago	18	18	0 %	8	10	25 %	1	1	0 %	27	29	7 %
	Total	**90**	**107**	**19 %**	**37**	**64**	**73 %**	**13**	**27**	**108 %**	**140**	**198**	**41 %**

Table 22: Number of formal businesses in the "with" and "without" group in 2003 and 2011. INE CEMPRE/FUE database

Further along this line, data from the business survey has been analysed to establish whether more businesses have been created in the Project areas than the control areas since the Projects were commissioned. If access to electricity indeed did increase business creation one would expect that a larger share of the surveyed businesses in the project area were created after commissioning of the projects than what is the case in the control group. The results are presented Figure 14.

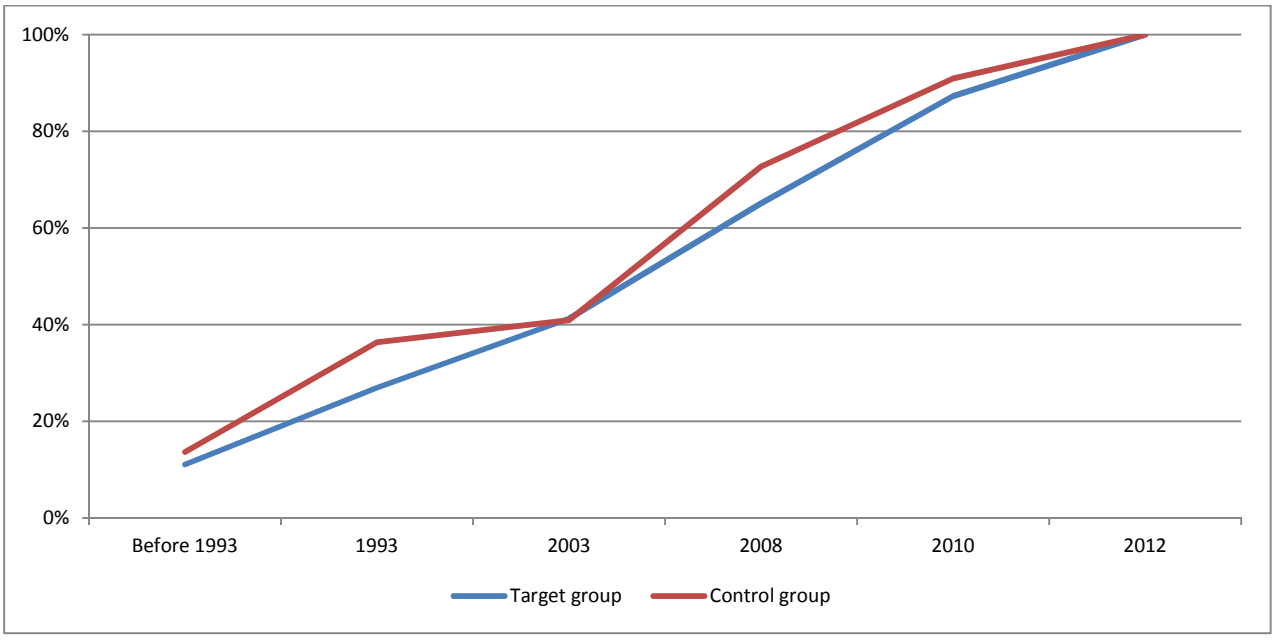

Figure 14: Share of surveyed businesses by year of establishment. Norplan survey data

The data presented in Figure 14 should be treated with a certain amount of care, given the relatively the limited size of the control group. Still, it is interesting to note that contrary to the above hypothesis, the relative share of business creation after commissioning of the projects is actually larger in the control

group than the electrified areas. There is thus no quantitative data in the INE aggregate data or the business survey to suggest that electrification has led to more business creation in the electrified areas.

Due to a lack of quantitative data for businesses in the baseline study it is not possible to conduct an actual comparison of the number of businesses before and after, but comparing the descriptive sections of the baseline study with observations made during the field trip underpin the findings presented above.

There are clear indications that the projects have not led to increased business creation. As will be discussed in the subsequent chapter, a few major industrial enterprises that likely would not have been established without electrification form an exception to this conclusion.

5.6.2 Types of business created

Even though access to electricity opens a number of new business opportunities, it is often found that the overwhelming number of connected rural businesses use electricity for lighting only[29]. A key question for analysis is thus whether there are signs of more energy-intensive industries being established in the areas that have been electrified by Projects.

In what the CMI Baseline study labels "with" and "without" groups of Niassa province, a total of 110 formal businesses are registered. Figure 15 compare the share of energy intensive industries in non-electrified districts to the share for electrified areas. In fact there seems to be relatively more energy intensive enterprises in the non-electrified areas than in the areas electrified by the Projects. It is unfortunately not possible to obtain comparable data from the 1997 CEMPRE survey for a comparison over time.

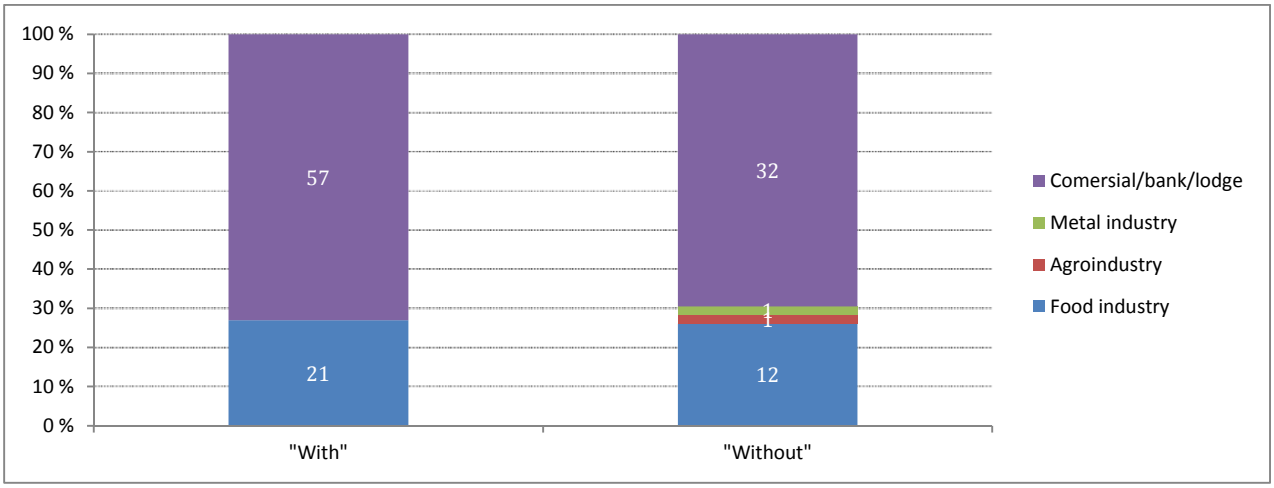

Figure 15: Percentage of industries using electricity in production, and others enterprises (commercial/bank/lodge) in the "with" and "without" group. INE FUE/CEMPRE database

To further investigate which types of industries have been established, the pooled survey data for businesses established after commissioning of the three Projects are presented in Figure 16.

[29] GIZ (2013a). *Productive Use of Energy - PRODUCE. Measuring impacts of Electrification on Small and Micro-Enterprises in Sub-Saharan Africa.*

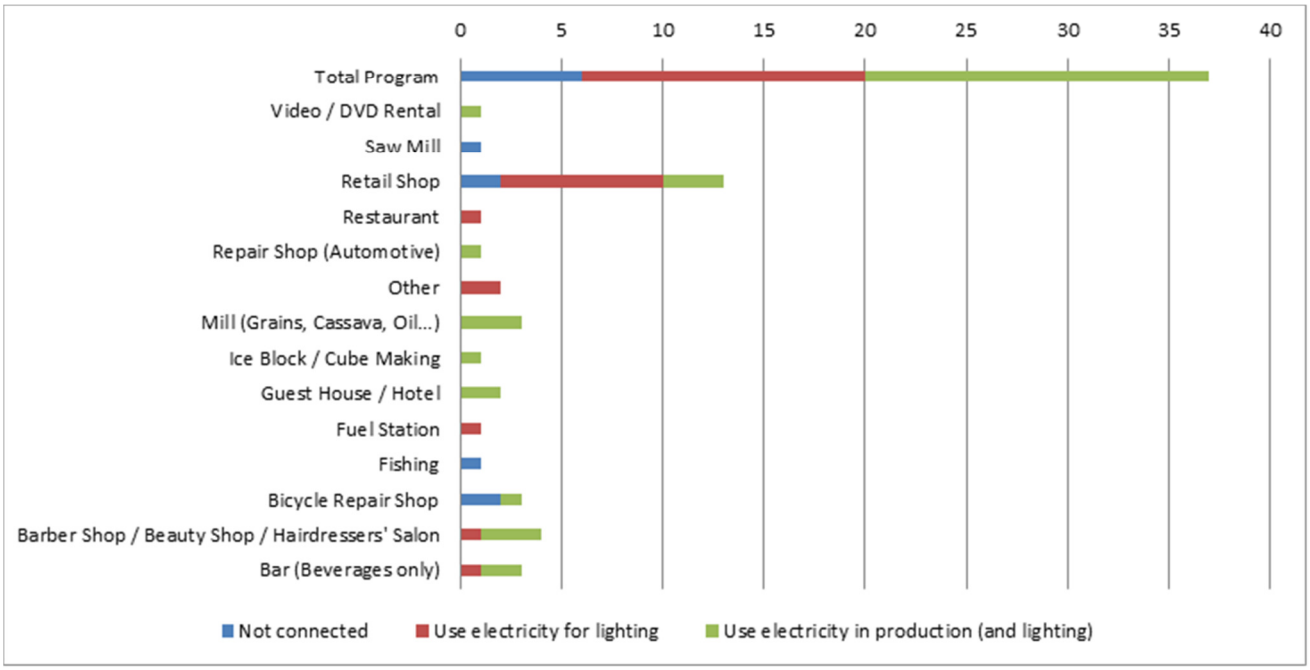

Figure 16: Number of surveyed businesses in the Project areas created since the Projects were commissioned, by type and use of electricity. Norplan survey data

It is interesting to note that **the majority of businesses interviewed have connected, and a relatively high number of businesses use electricity for other purposes than lighting.** A recent GIZ-study conducted in Benin, Ghana and Uganda, found that while service firms tend to get connected to the grid, take-up rates in the manufacturing sector of rural areas were low.

While the above data largely were supported by observations made during the field visit, a few larger enterprise that had been established after electrification and were visited by the Team. These include:

- An African Century Agriculture owned maize and soy silo in Lioma with an 1800 ton per season capacity, employing around 30 people.
- The ICM Fábrica *de descasque* arroz *in Namacurra,* employing 32 people with a capacity to process 150 tons of rice in season.
- A saw-mill in Mocubela employing nine people.
- A cotton spinnery in Lichinga employing over 100 people.

This is not a complete list of larger industries that have been created since the Projects, but it indicates that a number of such enterprises exist. A number of major enterprises also existed prior to the project, including a cotton spinnery with over 100 employees in Mutuáli.

Based on interviews made it is the understanding of the Team that at least three of the four major enterprises listed above would not have been established if energy had to be obtained through use of a generator. In these cases the raw material would likely have been exported out of the region. A concrete example of this dynamic can be found in Box 1.

5.6.3 Businesses created by women

The survey team made specific efforts to identify female business owners, and 19 % of the surveyed business owners were women. About half of these businesses were established prior to the Projects. The businesses owned by women are smaller than those owned by men, with an average 2.1 employees for the businesses owned by women against 3 for businesses owned by men. It should be noted that the sample of female business owners are rather small, and so these findings should be interpreted with a great deal of caution.

Businesses owned by women also have lower average sales, with MTZ10,000/month in average for businesses owned by women, against MTZ55,000 for businesses owned by men. On the other hand it is interesting to note that a larger chair of women owned businesses have connected than what is the case for the whole population of businesses.

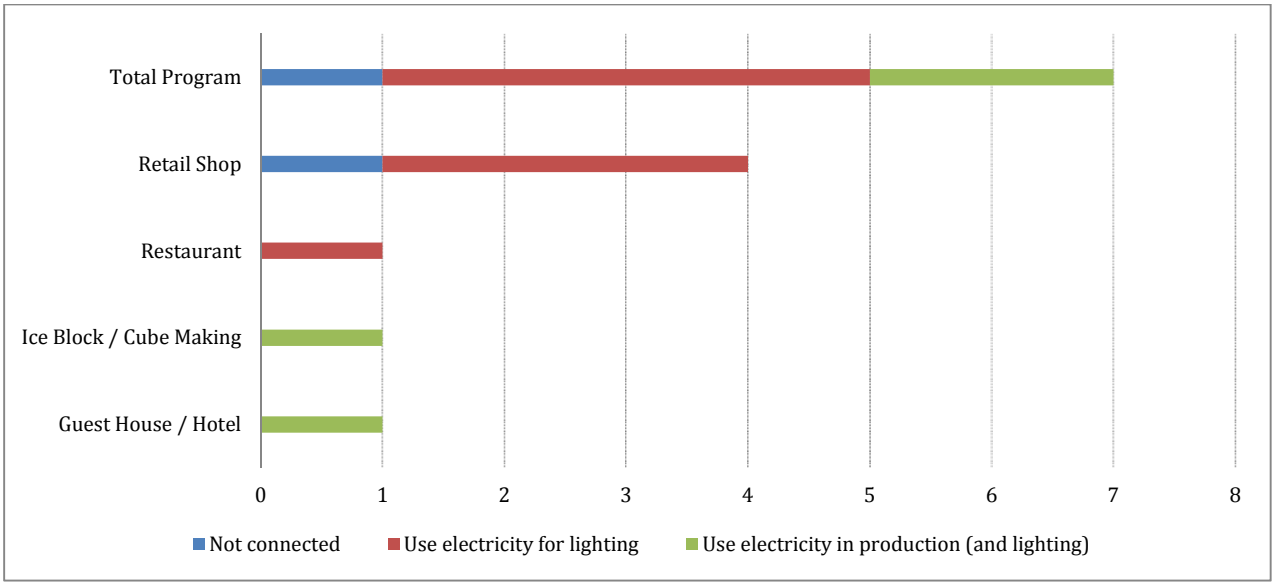

Figure 17: Number of women owned surveyed businesses in the Project areas created since the Projects were commissioned, by type and use of electricity. Norplan survey data

Box 1: One in a million – powering a female entrepreneur in Mocubela

Mrs. Balbina Fimiosse Massingue (43) (to the right) is the only female industry owner in the sleepy Maganja da Costa town of Mucabela, on the road between Olinga and Pebane. She started off selling nuts at the local market decades ago, and now employs over 25 full time workers at her timber concession and newly established saw-mill.

Like most other entrepreneurs in the area, she has had no access to credit. Using only her own savings she has worked her way up, first buying timber concessions from the government, selling timber to the local saw-mills. She has now expanded down the value chain, investing around MTZ 850,000 (over USD 28,000) in two industrial size saws. She has also expanded her fleet of timber trucks to four.

Mrs. Massingue connected her house and saw mill to the grid only 20 days before the Team visited, and so did not yet know how large her electricity bill would be. With raw-material (timber) costs of MTZ1,600/m3, and a sales price for plank in Maputo between MTZ9, 000/ m3 and 15,000/m3 she is, however sure that brining the goods directly to the market in Maputo, rather than selling unprocessed timber locally makes good business sense.

Mrs. Massingue is clear that while she may still have had her timber concessions, she would not have started her saw-mill without access to grid electricity. Running a generator would simply have been too cumbersome and expensive.

Still, the most important take-away from this example is how extraordinary it is for an entrepreneur, and a female at that, to succeed in building a sustainable business with working capital worth over USD86,000 (see table) from scratch with no access to credit, or other assistance.

With reference to the subsequent chapter it is also worth pondering what kind of employment Mrs. Massingue and other entrepreneurial men and women could have created based on access to electricity had they had access to credit.

A considerable life saving	MTZ	USD
Two industrial saws:	850,000	28,333
Four timber trucks:	750,000	25,000
Timber concession (for 2 months prod.)	1,000,000	33,333
Total	**2,600,000**	**86,667**

5.6.4 Employment creation

The number of enterprises established is only part of the story. Their size, that is, how many people they employ is also a key parameter when determining the impact of electricity on the business and economic development of an area.

As discussed, the INE district level data presented in the CMI baseline study is only comparable to current data for Niassa, because all districts in Zambezia have been electrified after the project. Table 23 therefore presents formal employment data for the "with" and "without" districts Niassa province from the 2003 INE business census, and comparable numbers from 2011.

Once again, Lichinga Cidade is excluded from the analysis as it is expected that the dynamics of the job market of a major city will differ much from that in rural parts.

		Public administration			Private sector			Civil Society			Total			Formal employment	
		2003	***2011***	***Change***	***2003***	***2011***	***Change***	***2003***	***2011***	***Change***	***2003***	***2011***	***Change***	***2003***	***2011***
"With" group	Lago	244	244	0 %	101	192	90 %	12	12	0 %	357	448	25 %	0,6%	0,5%
	Lichinga districto	429	472	10 %	120	65	-46 %	53	10	-81 %	602	547	-9 %	0,9%	0,5%
	Sanga	435	435	0 %	49	34	-31 %	21	21	0 %	505	490	-3 %	1,1%	0,8%
	Total	**1108**	**1151**	**4 %**	**270**	**291**	**8 %**	**86**	**43**	**-50 %**	**1464**	**1485**	**1 %**	**0,9%**	**0,5 %**
"Without" group	N´gauma	139	139	0 %	17	20	18 %	3	3	0 %	159	162	2 %	0,5%	0,2%
	Muembe	150	435	190 %	37	61	65 %	26	10	-62 %	213	506	138 %	1,1%	1,5%
	Majune	313	313	0 %	23	20	-13 %	4	4	0 %	340	337	-1 %	1,6%	1,0%
	Mavago	172	172	0 %	17	31	82 %	0	0	0 %	189	203	7 %	1,5%	0,8%
	Total	**774**	**1059**	**37 %**	**94**	**132**	**40 %**	**33**	**17**	**-48 %**	**901**	**1208**	**34 %**	**1,0%**	**0,7 %**

Table 23: Formal employment numbers before the project and in 2011, in the "with" and "without" groups in Niassa. INE CEMPRE/FUE database

With an 40 % increase in private sector jobs in the "without" group, against an 8 % increase in the "with" group, there is clearly no indication that electrification of the Niassa districts of Lago, Lichinga and Sanga have led to increased formal employment in the private sector. The considerable increase in Lago district can likely be explained by the establishment of a Mr. Chicken food industry that the Team did not have the opportunity to visit during the field trip.

The reduction in the number of people employed in the civil society is, according to the district administrator in Cuamba among other, due to the fact that a number of major NGOs have pulled out of the area in the past years. As expected, the number of public administration employees remains largely unchanged, except a major increase in Muembe.

The INE data does not, unfortunately, allow for differentiation between enterprises established before and after the Projects. For this analysis we utilize the business survey data. The surveyed businesses were asked how many people they employ, and the answer is given in Figure 18. The mean number of employees is just under 3 for each group, and there are no outliers in the dataset that would distort this finding. There is thus **no indication that companies using electricity employ more people than others**.

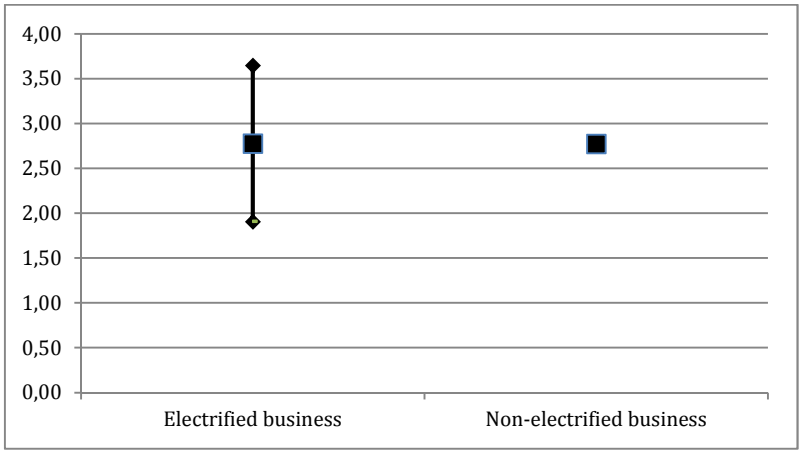

Figure 18: Mean number of employees in electrified and non-electrified industries, with 90 % confidence interval. Norplan survey data

In addition to the small- and medium sized enterprises covered by the survey, some major industries existed prior to electrification, and a number have also been created after the Projects were commissioned. These are too few to allow for a credible analysis on whether electrification has had an impact on the number of people they employ.

5.6.5 Barriers to business creation and productive uses of electricity

Getting access to electricity is the single indicator in the Doing Business index where Mozambique gets ranked lowest. The following key barriers were identified in focus group discussions:

i) Ability to pay the connection fee
ii) Lack of access to financing
iii) Only electricity access in the main village, and little possibility to connect in the barrios where people live

It should be noted that while the connection fee is seen as a key obstacle, a few informants interviewed by the Team also reported that house wiring, and long reaction time from EdM´s side to reports of problems were a challenge. Further, though it was not directly reported, the Team assumes that lack of training in the use of electricity constitutes a barrier.

There seems to be a fair amount of confusion related to the cost of connection. While connections were given a one third of the cost during the project period, when the Entrepreneur was mobilized, no discount is given today. The cost of connection will also differ with the distance to the grid. This seems not to have been communicated properly to the population. Thus some people are left with the impression that the connection pricing is not fair.

One focus group also reported that “though we have money for the connection, we can´t afford the bribe”. It has not been possible for the Consultant to confirm to what degree corruption in EdM is preventing new connections.

5.6.6 Gender specific barriers

Mozambique remains the poorest and least developed country in the Southern African region in gender development terms. It is ranked 150 out of 157 countries in the UN’s Gender Development Index (GDI). In the northern part of Mozambique, men have historically dominated based on tradition and religion. Women hardly work outside subsistence agriculture and are practically absent from the informal

economy. Asset ownership is normally registered in the husband's name, requiring their consent for women to obtain credit with collateral.

The women only focus-groups list access to credit as a key restraint on women entrepreneurs, particularly because many women lack the documents (personal ID) required to apply for loans from the government FDD. This indicates that even though a substantial share of the surveyed women-owned enterprises use electricity, large gender-specific barriers remain.

5.7 Impact on existing business

Electrification creates a number of new opportunities for existing businesses to increase their revenues through increased sales or higher prices for better quality products or reduction of energy costs. As would be expected, the businesses that existed prior to the projects outperform their peers in the control areas. Explanations presented for this in the focus groups include:

- Increased sales due to better quality products, such as cold drinks.
- Longer opening hours in stores due to lighting.
- Increased range of products for existing enterprises, such as stores now offering cell phone charging.
- Reduced costs of energy for existing businesses through replacement of costly diesel generators.

Before turning to the quantitative analysis, the penetration of electricity in businesses that existed prior to the projects should be investigated. Figure 19 presents the sampled businesses in the electrified areas that existed prior to the project. Around 85 % of them use electricity and the majority use electricity in their production. In terms of use of electricity this groups has much the same properties as the businesses established after electrification in the same areas (see Figure 16).

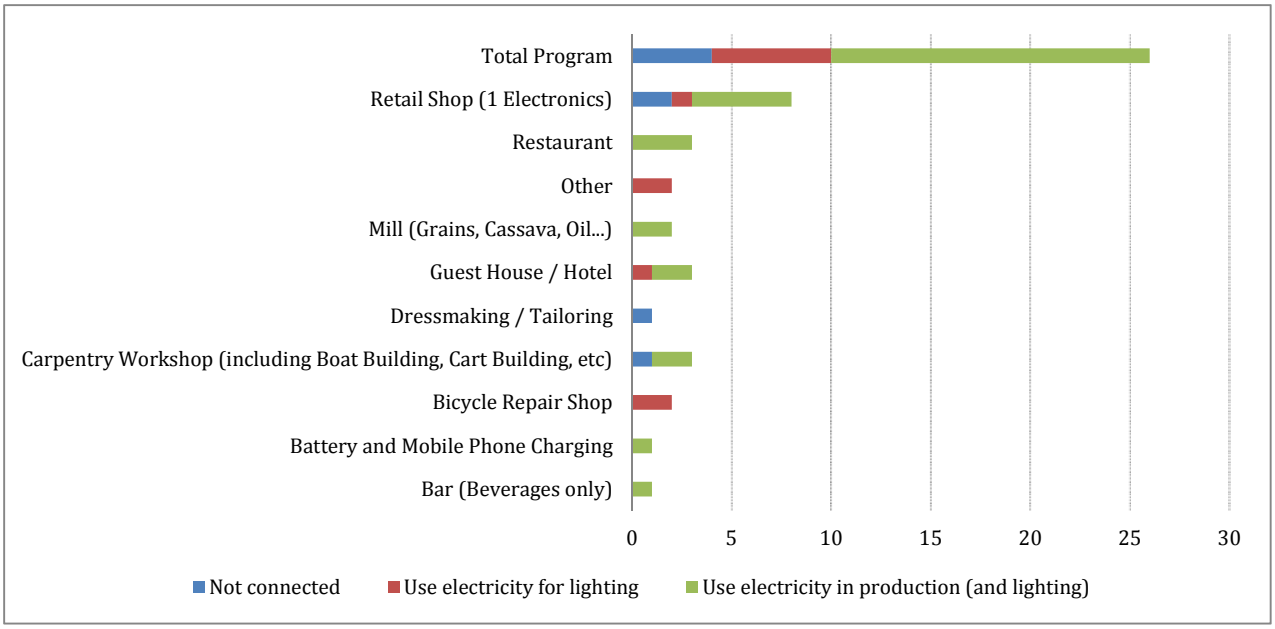

Figure 19: Number of surveyed businesses in the Project areas that existed prior to commissioning of the Projects, by type and use of electricity. Norplan survey data

Particularly the reduced cost of energy due to replacement of diesel generators was important for a number of businesses that were interviewed. As exemplified in Box 3, the savings on fuel costs for village mills and similar enterprises can be considerable.

Figure 20 compares monthly revenue per employee of the electrified old businesses in the Project area (existed prior to the Projects) to the old businesses in the control area. This is the most appropriate comparison, because:

- businesses that have existed for a long time would be expected – on average – to perform better than those recently founded;
- the best businesses in an area are those most likely to electrify, making it inappropriate to compare electrified enterprises to those not connected in the same area.

The finding that **old enterprises using electricity are more efficient (have higher revenue per employee) than their peers in the control area** that has not had the option of connecting is significant at the 90 % confidence interval. This is contrary to conclusions in a recent GIZ-study conducted in Benin, Ghana and Uganda, which did not find electrified businesses to perform better than their non-electrified peers.

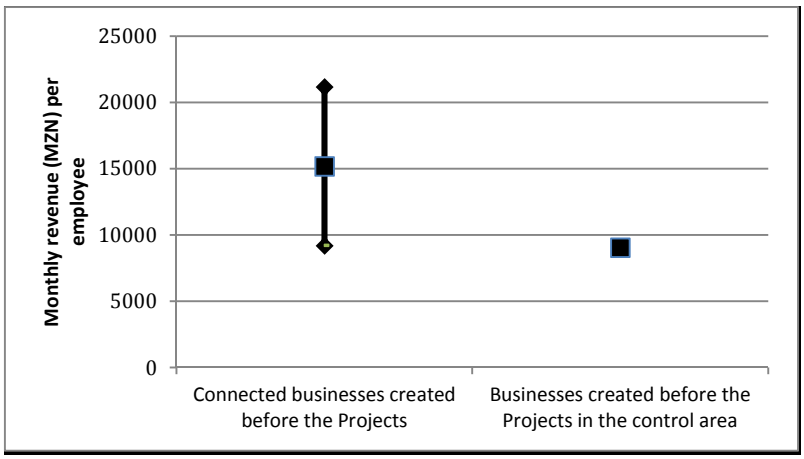

Figure 20: Monthly revenue per employee of businesses using electricity established before the Projects and businesses created before the Projects in the control area, 90% confidence interval. Norplan survey data

Based on the above, the focus group discussions, interviews with end users and local leaders there are clear indications that **electrification has had a positive impact on revenue and efficiency of connected small and medium-sized enterprises.** Ability to produce new products, and increased working hours are found to be the most important causes. In fact, 82% of the households interviewed in the survey reports that working hours have increased as a result of the Projects.

Thus, as further discussed in Chapter 6, the project has increased real value creation and so reduced absolute poverty. There are also some indications that the upward mobility is increased and the inequalities decreased as a consequence of people moving from sustenance farming to paid employment. Based on the focus groups and business survey there are no indications that electricity has replaced charcoal or firewood in businesses.

Major industries

While the survey largely cover small and medium sized industries, the Team has found the same effects in major enterprises like the cotton spinnery in Mutuáli, where the fuel costs have been reduced considerably due to the replacement of a diesel generator with grid electricity. While it is difficult to assess to what degree grid connection has been the direct cause of investments and upgrades in existing major industries, increased profitability would certainly strengthen the sustainability of the industries.

Box 2: Reduced cost of energy for the Lurió village mill

Mr. Henriqes Paulo (to the right) operates a typical villages rice mill in the small town of Lurió in Cuamba district of Niassa. As one of the around 20 connections in town, he is open for business 7 days a week. Milling around 100 kilos per day, he and employs one full time staff in addition to him-self.

The mill was in operation for many years prior the Project, but he was never in doubt that he would get rid of the diesel generator – and connect to the grid once he got the chance. His generator used around 600 liters of diesel a month. At current prices this is equivalent to fuel costs of around MTZ24.000/month, against MTZ10,000/month electricity bills now, a 54 percent reduction. To the best of Mr. Paulo´s knowledge this is a normal reduction for mills that get access to electricity.

He insists that the price of milling grain has come down over the past years, but is not sure whether this is mainly due to the electricity access, or increased competition after a second mill started four years back.

However it is divided; it is clear that there is a considerable gain from electrification.

Monthly energy savings	MTZ	USD
Monthly fuel cost before the project (600l/month)	24,000	800
Monthly electricity cost today	10,000	333
Estimated saving	**56 %**	

5.8 Indirect effects

This section investigates whether electrification has had positive indirect effects on businesses that have chosen not to connect to the grid. Though it is not possible to them in a credible way, a number of such effects have been identified:

- *Enhanced security.* Over 80 % of the respondents in the household survey report that security has increased as a consequence of electrification. Street lights and a general tendency towards more people moving around at night will have a positive impact on sales of both electrified and non-electrified service providers.
- *Increase purchasing power.* The household survey indicates that the value creation, and through it the purchasing power of the local community have increased. This will benefit connected and non-connected businesses alike.

It is thus clear that the Projects have had **positive indirect effects on value creation**. During the field visit, the Team found several examples of increased competition for, and thus higher prices of agricultural produce as a consequence of new food processing industry that has been established after the Projects. An example of this can be found in Box 3. Given that major industries existed in the area even before electricity, and the fact that most of these are not energy intensive it is hard to assess whether they would have been established in absence of electricity.

Finally, the Team has found no indications of new educational initiatives or training being created as a consequence of the Projects, and no negative impacts of electrification have been identified.

6 IMPACT ON POVERTY REDUCTION AND EQUALITY

A key objective of the Project is that of contributing to the reduction of poverty and a general positive effect on livelihoods. Thus, this chapter looks to assess the degree to which the benefits of electrification have directly impacted the poor at the household and community level. Applying the analysis of the data from the survey, the focus group discussions and observations in the field, this section summarizes the analyses and conclusions of the Team.

In order to carry out the analysis, the Team has applied a poverty index to the household survey data which combines income and housing conditions. The resulting categorization of groups is illustrated in Figure 21.

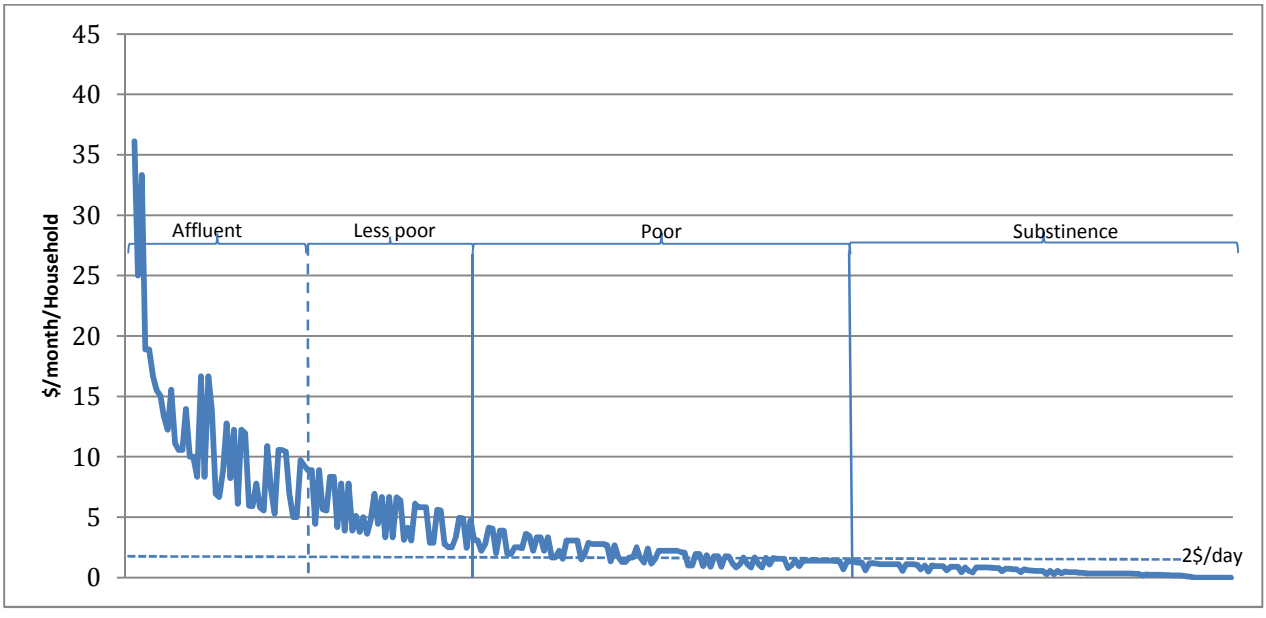

Figure 21: Distribution of income in the survey sample arranged by wealth-index. Norplan survey data

6.1 Poverty reduction on household level

This section investigates the direct impact of electrification on the household level. The first question is whether electrification has impacted expenditure and living conditions of connected household, and the second whether electrification has reduced poverty and impacted wealth distribution.

6.1.1 Impact on absolute household income

Figure 20 on page 59 indicates that businesses in electrified areas are more productive, and thus generate more income for the owners and employees. This is evidence that **electrification has a positive impact on absolute household income.**

6.1.2 Targeting of poor and vulnerable households

A key question is the degree to which the Projects successfully have targeted poorer/vulnerable groups in the community and improved their standard of living. International experience indicates that unless specific action is taken (payback plans, training), the poor will be confronted by barriers to connection and a large portion of early connections will be the better-off group.

Figure 22 presents the connection rates in different wealth groups in the electrified areas. While there is evidence that more wealthy households are disproportionately benefiting from the intervention, it is striking that **a high percentage of the households in the poor and sustenance group have connected.**

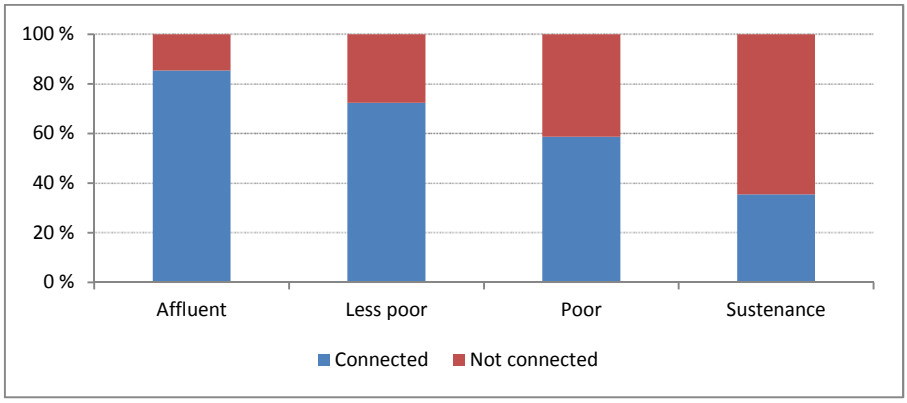

Figure 22: Connection rates in different wealth groups in electrified areas. Norplan survey data

This finding is somewhat surprising, given that frustration was expressed in the focus groups regarding the cost of energy and the cost of connection as a barrier particularly for poorer households. Clearly, the relatively low connection fees and a relatively low social tariff with no set monthly component have provided sufficient incentive to connect.

Regarding the gender aspect of the Program, it is worth noting from that households headed by women are overrepresented in the sustenance and poor group. Though not surprising, this finding indicates that **women are less likely to benefit from electrification than men.**

6.1.3 Impact on energy expenditure and quality

Figure 23 demonstrates that the poor use a considerably higher share of their income on their energy needs than the better-off groups in the community. The Sustenance group uses as much as 35 % of their monthly income on energy. Reduction of energy costs will thus benefit the poor population disproportionately. That the potential economic benefits to poor households from electrification are significant is also confirmed by interviews with local leaders during the field trip, and through the focus group discussion.

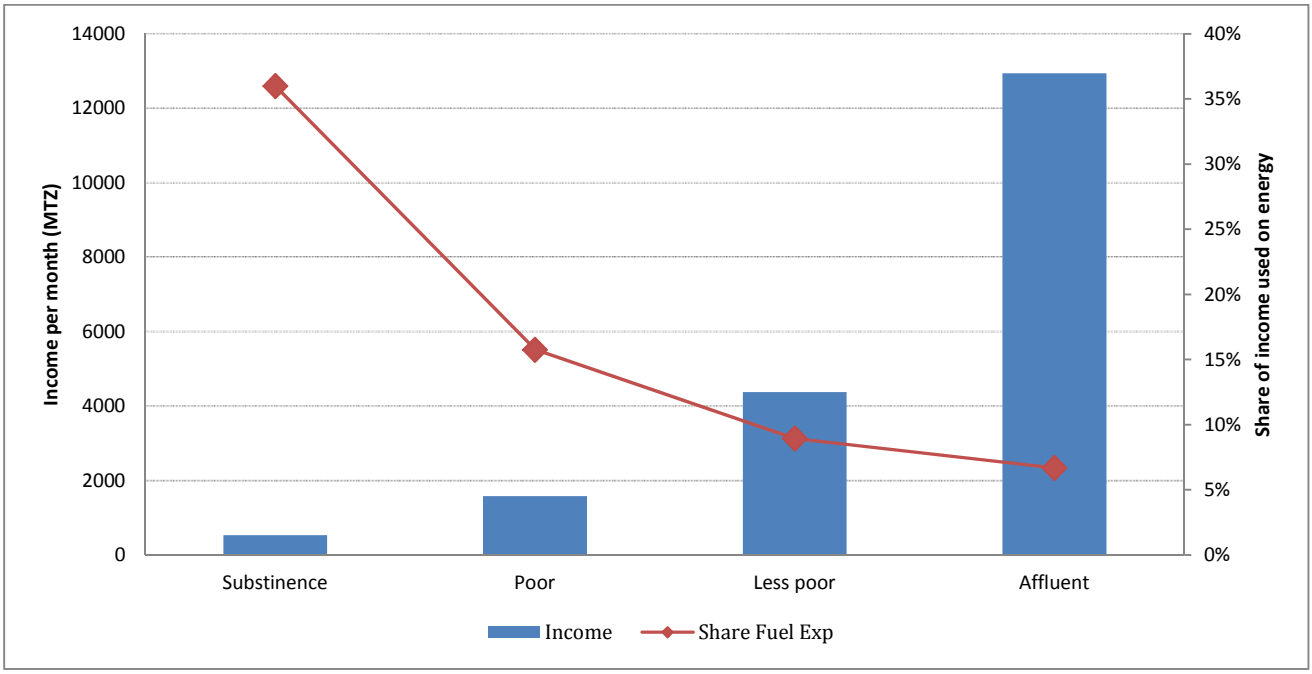

Figure 23: Income and energy expenditure of the survey respondents. Norplan survey data

As illustrated in Figure 24, there is clear evidence in the survey data that electricity displaces low-quality lighting sources such as kerosene and candles. Further, the data reveals that electrified households still use a considerable share of their income on lighting, even after electrification. This is despite much lower unit prices (per kWh) (see chapter 7). This implies that **electrification both reduces unit costs and provides higher quality services to the beneficiaries**. It should be noted that, based on the analysis presented in Figure 28 on page 72 that the consumer surplus from electrification far outweighs the cost to EdM, even when taking into account that the tariffs are not cost-reflective.

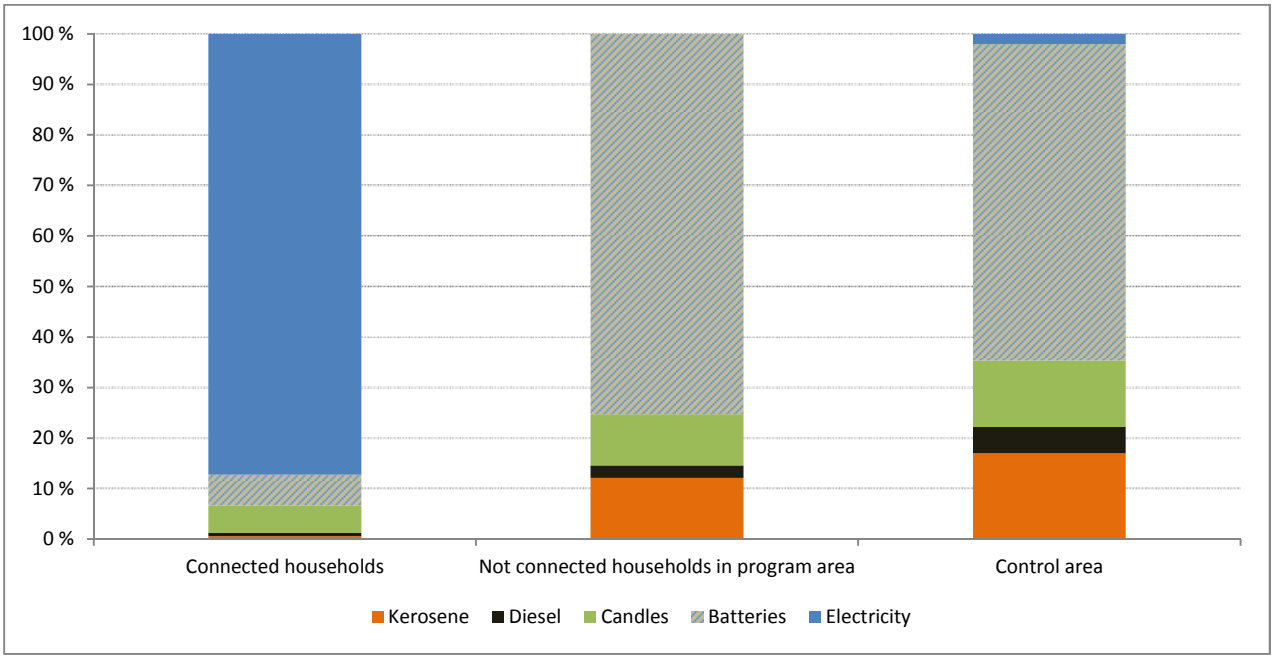

Figure 24: Percentage of non-cooking expenditure on various energy sources. Norplan survey data

However, as seen from Figure 25, there is no evidence in the survey data that electrification has led to the displacement of wood or charcoal consumption for cooking purposes, nor that it reduces time spent by men or women in collecting wood or charcoal. In fact, 100 % of the surveyed electrified households reported either buying wood/charcoal or gathering wood. The focus group discussion and survey confirm that very few households own appliances for cooking with electricity.

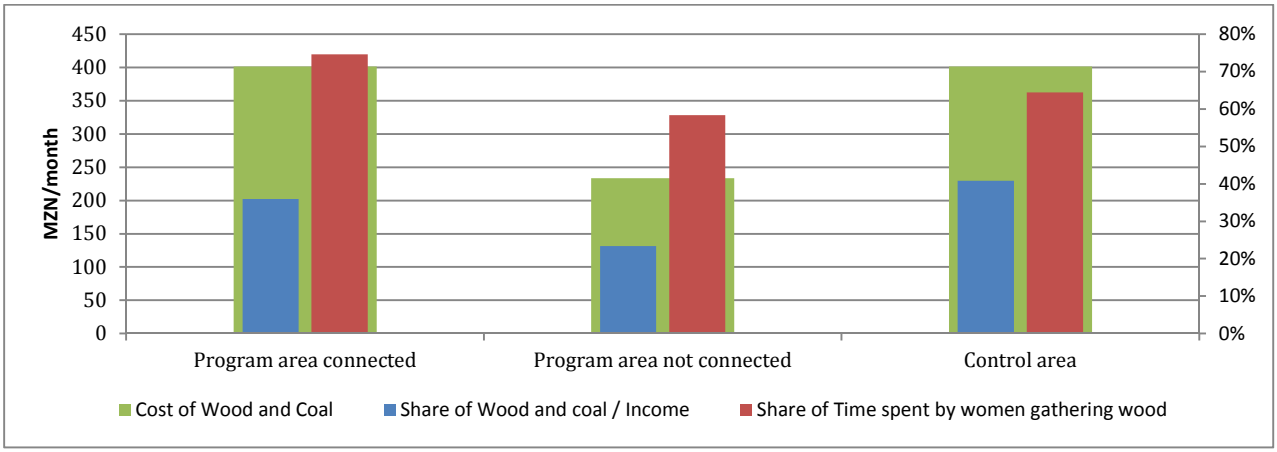

Figure 25: Cost and time spent collecting wood and coal for cooking in connected and non-connected households. Norplan survey data

Thus, the primary direct benefits to households come from;

i) **Improvement of price and quality of lighting.** The provision of electricity provides end-users with significantly better quality lighting (expressed in lumens) at a significantly lower unit price than kerosene or other alternatives. There are clear indications that this is valued highly in program area, as;
   a. the program has been successful in connecting a large number of consumers despite a connection fee of about USD117;
   b. connection leads to a significant displacement of other fuels for lighting and electrified consumers maintain high expenditures of lighting;
   c. the number of lifeline (social) costumers declines over time indicating that people want more energy;
   d. many respondents and focus group discussions confirm improvements from reduced fumes from kerosene.

The CBA of chapter 7 provides quantitative estimates for these benefits.

ii) **Possibility of using appliances.** It is evident from the focus group discussions that the local population puts a high value on the fact that electrification has allowed for the purchase and application of electrical appliances. Figure 26 presents the penetration rates of different appliances in households that have been electrified by the Projects. Specifically, the ability to maintain cold beverages, fans and media were listed among the key benefits in the focus group discussions. One group pointed out the clear benefit of the community was being more up to date due to access to media.

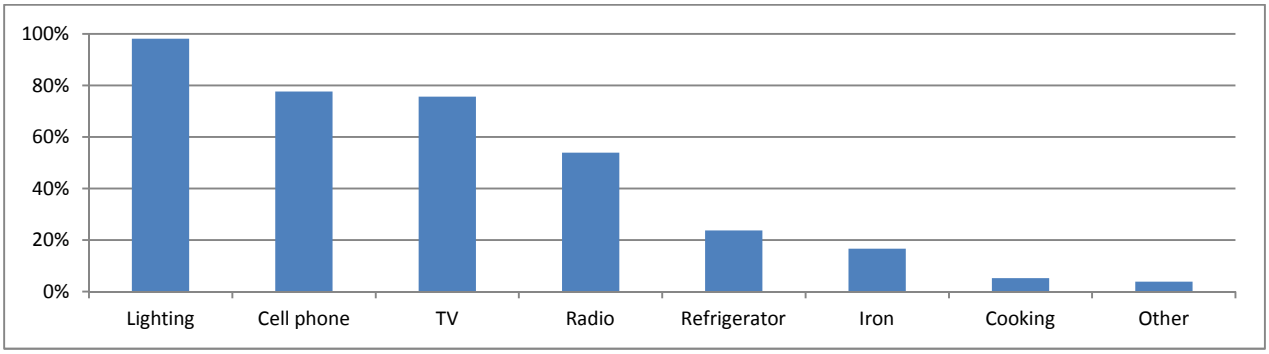

Figure 26: Penetration rates of different appliances in connected households. Norplan survey data

6.1.4 Impact on wealth distribution

As concluded based on Figure 20 (page 59), businesses in the electrified areas are more profitable than their peers in the control areas. How this super profit divided, however, remains an open question.

The lack of comparable data from the baseline study excludes an analysis over time. One should therefore be careful to draw conclusions on this extremely complex issue, but it is interesting to note that **populations in the Program areas are more evenly distributed on wealth groups than what is the case in the Control areas**. Given the higher business profitability mentioned initially it seems reasonable that electrification may have a positive impact on equality and upward economic mobility.

6.2 Impact on the community and living conditions

The indirect benefits of the electrification of a community can be significant. The following has been observed in the program area;

- **Security and social activity.** The program has enabled the lighting of streets and public areas. **80 % of the respondents state that electrification has increased security**, and the focus groups discussions also indicated that these benefits are among the most highly valued by the population. They site reduced thefts, improved feelings of security and increased social activity. While all electrified villages have got some street lights, the illuminated area differs depending on the size of the village/town.
- **Education**. Due to the lumping of social services and commercial connections in EdM statistics it is not possible to establish, based on available information how many schools have been electrified as a result of the program. 9 of the 19 surveyed schools had access to electricity, and among these 5 have a TV and 5 have computers with internet access. Most of these are secondary schools. According to the focus group discussions, night classes have been initiated, something particularly valued by women. Further, a number of teachers and principals have been able to utilize PCs, improving planning. The focus group discussions also indicate a high degree of optimism and expectation regarding further PC use and specifically internet access.
- **Health**. Again, it is not possible to establish the exact number of hospitals and dispensaries connected, but observations made by the Team during the field trip indicate that most clinics in electrified areas now have access to electricity. This is confirmed by the survey, where **10 of the 11 surveyed clinics were connected.** Of these 7 reported that they could not have operated without electricity, while the remaining three said it was “very important”, citing uses such as; night-time surgeries; night-time maternity services and vaccine storage. See Box 4 for an example of how electricity is used in a local clinic.

The above benefits provide high valued services to all members of the community and to the degree it contributes to lifting the quality of life in a rural community should be seen as improving the national

urban-rural equality situation. However, as indicated in the following chapter, these benefits are difficult to quantify.

Box 4: Allowing for night time labor

Vaccine specialist Lúcio Eduardo Joaquin and nurse Rosa Manuel Alexandre at the Impaca health center highlight the ability to provide medical services at night as the most important improvement following electrification.

Even though 8223 people live in its hinterland, the village of Impaca has little infrastructure except a clinic and a primary school. The village only has 6 connections according to one informant. Of these two are commercial (bank and shop).

The medical clinic employs a manager, one nurse, a person in charge of giving vaccines and a caretaker. It has been connected since 2010, and use electricity for lighting and cooling of vaccines. Because vaccines previously were stored in a fridge run on gas, the main difference is the ability to perform child labor and other urgent procedures during night.

The outside lamp is left to burn all day, because the wiring will incinerate if turned on and off. The district pays the electricity bill, and it is not part of the hospitals budget as such.

Though the employees are clear that access to grid electricity has improved the situation of the hospital, they also indicated that EdM can take as much as 48 hours in reacting to a reported problem.

6.3 Conclusion

The primary benefits to households of electrification are higher quality electrical non-cooking services at a lower price.

The Projects have been relatively successful in achieving high access numbers, a result of low connection fees, free ready boards and low tariffs. Despite the lack of programs to help poor households tackle the initial capital barriers associated with the connection fee or purchase of appliances, a relatively high number of households in the poor and sustenance group have connected. Still, the largest benefits (both in numbers of households and total economic benefits) are still accrued to the wealthier groups.

On a community level installation of street lights as part of the Projects has increased security, and connection of a considerable number of schools, clinics and hospitals has also increased the value of these services to the public.

7 COST BENEFIT ANALYSIS

In this chapter, the quantitative life-cycle economic costs and benefits of this public intervention are estimated and compared in order to establish the degree to which the intervention has provided a positive net economic impact. That is, has the public cost of the intervention provided a reasonable rate of return to society, taking into account estimates of the true economic value for end users?

The analysis treats the various stakeholders that are directly impacted by the program separately – households, SMEs, social/public institutions, large industries and EdM – and provides estimates as to the benefits that have and will continue to accumulate to these stakeholders over the life span of the assets. These benefits are compared with the life-cycle costs.

In order to estimate the benefits to end users, the results of the survey data, the fieldwork and aggregate data from EdM regarding sales in the Project area have been relied upon. The Team has carried out an analysis of each group and applied conversion factors and a few assumptions in order to arrive at estimated economic benefits of going from non-electrified to electrified, as described throughout this chapter.

7.1 Household benefits

Households that switch from traditional energy sources to electricity benefit from electricity due to i) reduced price per unit of energy, ii) improved quality and quantity of the energy service and iii) additional services enabled by electricity (e.g. TV). Together, these benefits imply an increased consumer surplus that should all be included in the benefits to this class of users (Annex N provides a more detailed description of this approach). The consumer-surplus method has been endorsed by the World Bank's Independent Evaluation Group (IEG) and is described in detail in its "Welfare Impact of Rural Electrification, 2008". As noted by Meier et al (2010), "despite the uncertainties, the consumer surplus method is generally accepted as a more realistic way of measuring the benefits and the approach has been widely adopted." However, NORPLANs (2012) previous work on this topic revealed that relatively few estimates pertaining to consumer surplus have been developed and/or published for Southern Africa. This study thus offers some input to this gap in the literature.

In order to provide such an estimate, which is specific to the program area, the Team has applied the actual household data from the survey and estimated a representative household demand curve for

electricity (more precisely, lumens), as illustrated by Figure 27. This analysis has involved the application of a range of relevant conversion factors to arrive at lumens, as an indicator of both quantity and quality of services from electricity and traditional energy sources, respectively. These and other assumptions relevant to estimating the demand curve are summarized in Table 24.

	Equivalent W	Lumens	klm-hr per kwh
Energy Saver (3,3W LED)	2	150	43
Incandescent < 50W	40	430	10,75
Incandescent > 50W	60	730	12,17
Fluorescent tube	10	600	60
Solar lamp	6,14	240	39,09
Lantern*[30]	8	450	56
Hurricane lantern	Kerosene, hurricane	32	0,16
Wick lamp	Kerosene, wick	11,4	0,1
Candle	Paraffin candle	11,8	0,2

Table 24: Conversion factors applied to consumer surplus analysis. EFI (2011); O'Sullivan and Barnes (2006).

In accordance with World Bank best practice, and in an effort to avoid over-estimating the benefits, a log-linear (constant elasticity) demand curve has been estimated. As indicated in the figure, the demand curve returns rather robust results with an $R^2 = 0.86$.

To arrive at an estimate for the net benefits of electrification for a representative household, the median household in each of the non-electrified and electrified categories, respectively, were selected and compared. The results – the total direct benefits to a representative household of electrification – are represented in Figure 27 given the assumptions on lighting output per kWh in including change in energy expenditures [(D+E) – (B+D)] and increased consumer surplus (B+C). The net benefit per household is then divided by the kWh consumed for lighting to arrive at an estimated average benefit per kWh consumed.

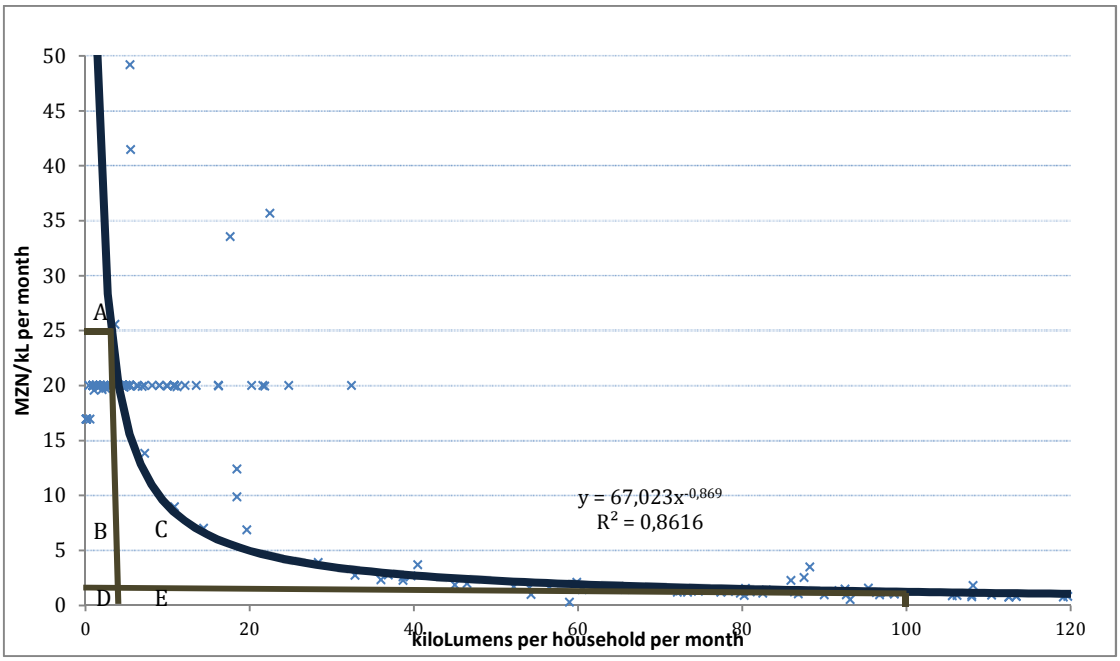

Figure 27: Demand curve as estimated by statistical analysis of household data. Norplan

[30] Lanterns have a lumen output equivalent to a 8W LED

The key output from this analysis, that is carried forward into the final aggregate CBA analysis is the estimated benefit of $0.70/kWh consumed/supplied. This is lower than the $1-1.5 reported by NORPLAN (2012). Still, it is in line with the expectation that the economic benefits in rural Southern Africa may be lower than those in Asia or Latin America[31]. Nonetheless, the high benefits are rather striking when compared with the low tariffs charged by EdM and correspond with the high value placed on the few kWh consumed by rural households. Even with low incomes, the relative value placed on lighting and some basic appliances is high.

The average electricity consumption per household (extrapolated from EdM´s data) is estimated at a mere 20 kWh/month. This would imply an average net benefit of some USD14 per month and would imply a payback for the USD117 connection fee of a mere 9 months. It is worth noting that especially the focus groups stressed the high cost of connection as a key barrier to electrification. Indeed, while the payback is very short, USD117 is a considerable amount of money for a one-time payment by a rural household. In terms of enabling connections and aligning incentives, this analysis would point towards the logic of either i) reducing connection fees and increasing energy tariffs, or ii) providing payment plans for connection (e.g. 12 months).

7.2 Small commercial, social/public services and industrial

This section examines the benefits accrued to SMEs, public services and industrial enterprises.

7.2.1 Commercial

There are (at least) four ways of estimating the benefits to SMEs from electrification; i) the increased profit as a result of electrification, ii) assume displacement of electrification by means of decentralized diesel production (alternative solution), iii) net change of expenditures on energy before and after electrification, or iv) apply the results of the consumer surplus analysis. Regarding (i), as indicated in previous analysis in this report, the team has not found sufficient evidence to indicate/estimate any profit increase directly due to electrification. Regarding (ii), the underlying assumption is that the business would supply itself with diesel power if not electrified. However, the lack of evidence that businesses have been created in response to electrification in the program areas does not support the application of this approach. Approach (iii) would likely lead to an overly-conservative estimate of the benefits, completely neglecting improved lighting quality and/or use of electrical appliances for businesses. Thus, we apply approach (iv) in estimating the benefits to small commercial. Applying the same level of benefit per kWh as that realized by households is viewed as reasonable as it reflects a) a mix of businesses, some of which simply replace existing energy expenditures, some of which offer new services as a result of electrification, and some of which would have considered diesel as an alternative, and b) the fact that small commercial and domestic lives in rural areas tend to be intertwined, thus implying some over-lap of benefits.

7.2.2 Institutions (public and social)

The direct and indirect benefits realized by social/public services can be many and substantial, providing improved education, health and security to a community. A reasonable proxy for these benefits that is often applied is the cost of the alternative solution of small diesel production. However, EdM provides sales/consumption data for commercial and social institutions lumped together, thus not allowing us to provide an estimate of the per kWh benefits different than that from SME's. Thus, by applying the same benefit as that of households, the estimated benefits are likely conservative because consumption per beneficiary in a class room is larger than in a home, although the benefits of USD0.70/kWh are not significantly different than the net benefit compared with diesel generation (about USD0.93/kWh).

[31] *World Bank's Independent Evaluation Group (IEG) (2008): "Welfare Impact of Rural Electrification"*

7.2.3 Industrial

Industrial users of power typically have electricity as a key input to production. Generally, such users will place a high value on the electricity and would typically resort to small diesel generation if grid electricity were not available. Thus, the net benefit per kWh to such end users is estimated as the difference in the cost per kWh between EdM and diesel provided electricity (LCOE).

7.2.4 Aggregate Results

In this section, the above results are combined with EdM data and project cost data to arrive at a complete picture of the costs and benefits of the project over the economic life-span. Table 25 summarizes the key specific assumptions used in the analysis.

Real prices/values	**Constant 2002 USD**
Average inflation (2002-2012)	Benefits are adjusted beck to 2002 values using a yearly 2.5% inflation rate
Cost per connection	Constant: 117 USD
Annual growth in connections after 2012	14% the first 5 years, and 5% from 2018
Economic Life	25 Years
Discount rate for public funds	10%
Avoided CO2 emissions (from replacing Kerosene)	2,48 tCO_2/MWh (EIA, 2012)
Price of European Carbon Futures	7,7 €/tCO_2 (EEX, 2013)

Table 25: Specific assumptions applied to CBA analysis, beyond those to estimate benefits/kWh. Norplan

Having estimated the kWh benefits for each of the users, EdM´s data concerning actual sales from 2006-2012 have been used to aggregate benefits for the individual user groups. Beyond 2012, growth in numbers of connections is assumed to increases by 14.3 per cent per year the first five years and then by 5 % for the remainder of the economic life. Actual, initial CAPEX numbers are used, as well as a per connection cost of USD117, which is assumed to have been covered by end users. An economic life-span, i.e. planning horizon, of 25 years has been applied. All costs and benefit levels are set constant at 2002 USD price levels.

The result of the analysis indicates that benefits of the intervention should outweigh the costs, producing an internal economic rate of return of some 19 %, well above the assumed 10% alternative cost on public funding. Figure 28 demonstrates the profile of benefits and costs of the intervention during the first 10 years following initial capital outlays (2008). Two important observations can be noted;

i) All benefits to end-users are net of prices paid to EdM. Thus, in the analysis the revenue accumulating to EdM are counted as benefits, while the costs of connections and operation and maintenance are deducted. The cost-reflectiveness of tariffs does thus not influence this analysis. As can be seen, the benefits to EdM in the form of revenue are marginal relative to net end-user benefits. Further, it is noteworthy that EdM revenues remain below the costs of connection and operation and maintenance of the assets. This is consistent with the analysis regarding the financial impact on EdM and demonstrates how the project is economically but not financially viable to EdM given the current tariff levels.

ii) Despite making only about 0.2 per cent of total connections, industrial users make up about 20 per cent of the benefits. This is in line with the findings of NORPLAN´s study regarding productive uses, which concluded that one of the primary determinants of whether a rural electrification project will prove economical is the pre-existence of conditions for industrial uses.

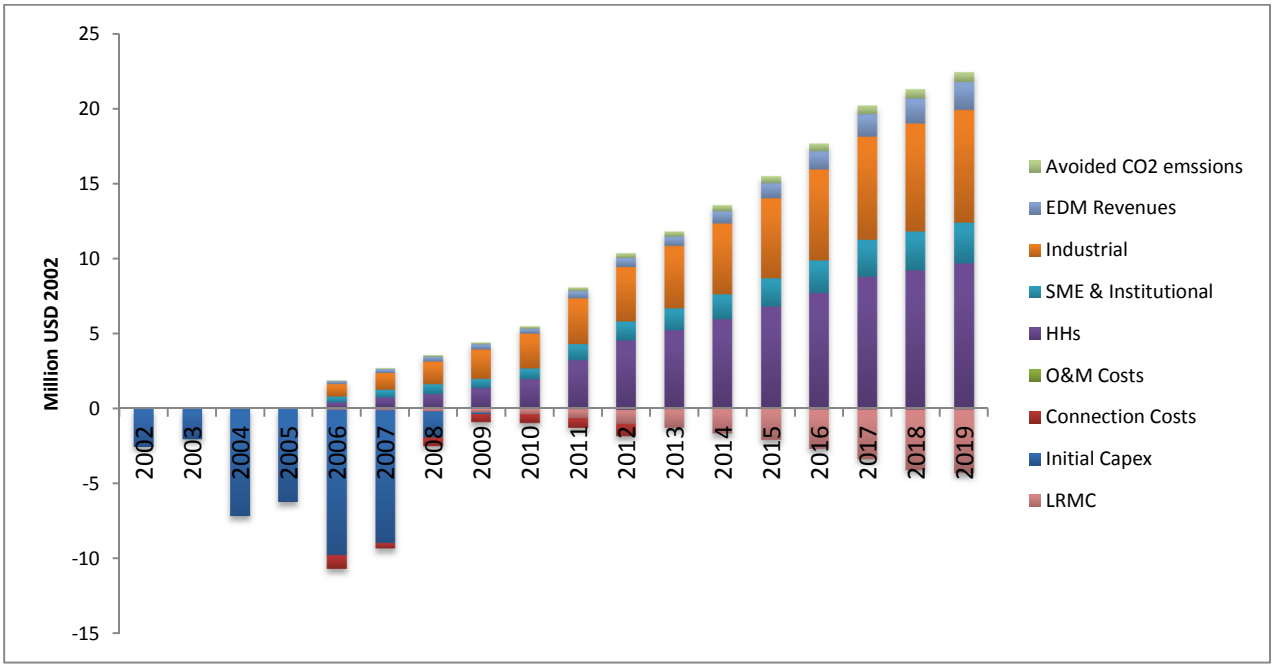

Figure 28: Illustration of the economic costs and benefits of the project in the base case. Distribution of costs and benefits of first 10 years after CAPEX (IRR = 19%). Norplan

7.3 Sensitivity analysis

The results of the CBA are partly driven by analysis of data from the Project and the region, and partly by assumptions regarding the future development. This section analyses the robustness/sensitivities of the CBA results in light of alternative scenarios.

The sensitivity analysis show little variations in the IRR as a consequence of changes in the assumptions as seen in the table below:

Scenario	**IRR**
Base case (see assumptions in table 25)	19%
CAPEX reduction of 20 %	22%
Increased Price of CO_2 to 50$/t$CO_2$	20%
Stop in new connections in 2012	14%

Table 26: Summary of sensitivity analysis. Norplan

7.4 Conclusion

The result of the analysis indicates that benefits of the intervention outweigh the costs, producing an internal economic rate of return of some 19 %, well above the assumed 10% alternative cost on public funding. The sensitivity analyses indicate that this result is highly robust to changes of the underlying assumptions.

The Projects are thus highly viable from an economic perspective, and there should be sufficient willingness to pay to allow for tariffs at cost-reflective levels.

8 OVERALL PROJECT EVALUATION AND RECOMMENDATIONS

This chapter presents the pre-investment goals, objectives and outputs of each Project and provides an analysis of this report´s findings based on the five standard DAC/OECD evaluation criteria. Based on lessons learnt from the Projects, recommendations on potential improvement for future electrification projects are drawn.

8.1 Project Objectives

	Namacurra Project	**Namacurra Electrification Project - Extension to Pebane**	**Gurué-Cuamba-Lichinga Transmission Line Project**
Goal	New distribution grid contributing to increased economic activity and enhanced living conditions.	Contributing to improved economic development and enhanced living conditions.	New transmission line contributing to increased economic activity and enhanced living conditions.

	Namacurra Project	Namacurra Electrification Project - Extension to Pebane	Gurué-Cuamba-Lichinga Transmission Line Project
Objectives	Namacurra, Maganja and Inhassunge areas connected to the grid and supplied with stable power from Cahora Bassa.	General: Nante, Pebane and a stone quarry connected to the grid and supplied with stable power from Cabora Bassa and the electricity network in Mocuba rehabilitated. Specific: • Improved access to grid for areas presently not connected to the grid; • Improved reliability, quantity and quality of supply to areas presently supplied by diesel generator; • Improved quality of life in local communities through reliable power supply to public services; • Enhanced economic development through provision of power to businesses simplifying their establishment and/or extension; • Rehabilitated and improved electricity networks, thereby expanded and improved supply quality, particularly in Mocuba town.	The Niassa Province connected to the national grid and supplied with stable power from Cahora Bassa.
Output	• Tender Documents • Construction supervision • 1000 domestic, 1 medium, 10 small industrial and commercial consumers connected to the grid • Training, project cars, tools and spare parts	• Detailed survey and design • Construction and supervision • Schools, hospitals and businesses/saw mills has stable electricity, 1000 connections in Pebane, 50 connections in Nante, 33kV supply to stone quarry (deleted), Mocuba network rehabilitated, including 2000 new service connections; • Training, tools, equipment and spare parts	• Supervision of construction, • 110 kV line Gurué to Lichinga • Main sub-stations installed • Generating set in Lichinga • 33 kV distribution grids • Connections: Gurué area 1,800 Cuamba area 1,000 Lichinga area 3,300

Table 27: Projects goals, objectives and outputs for the three projects as per the bilateral agreements between the governments of Norway and Mozambique

8.2 Effectiveness

Effectiveness measures to what extent objectives have been achieved and major factors influencing the achievement or non-achievement of the objectives.

Project	Connections	Target	Achieved (2012)
Namacurra	Domestic	1000	5543
	Small industry	10	546
	Medium Industry	1	9
Pebane Extension	Total	3,500	7,040
Gurué	Total	1,800	3,767
Cuamba	Total	1,000	10,614
Cuamba Extension	Total	2,100	10,283

Table 28: Project achievements compared to targets. Norplan

As seen in Table 28, **the Projects have been highly effective in terms of achieving new connections, far surpassing the goals set** for all three projects and similar projects in the region. Despite lack of support programs to assist poor households tackle initial capital barriers associated with the connection fee or

purchase of appliances, EdM have been successful in connecting a relatively high number of households in the poor and sustenance group. This is not least due to tariffs and connection fees that are low compared to other countries in the region. Given that increased access rates continues to be a political goal, and because EdM have proved effective in implementing this policy so far, it is expected that the number of connection will continue to increase even with an expected substantial tariff increases.

As seen in chapter 5, businesses that existed prior to the projects are to a large extent successful in increasing their productivity through productive uses of electricity. The Projects have to a lesser degree been successful in creating new business. Major factors preventing establishment of new business are lack of access to credit for initial investments, and lack of knowledge. A number of international studies have concluded that access electricity is a necessary, but not a sufficient precondition for the development of new industries and productive uses. Best practice execution includes support programs to provide access to finance and training to local entrepreneurs. **No support programs have been implemented as part of these Projects, and the potential for productive use of electricity in the project areas is therefore underutilized**.

8.3 Impact

With a positive Economic IRR of 19 % (the investment would be economically viable for costs of capital up to 19 %); **the Projects have clearly had a large positive impact on different stakeholders**. Main impacts and long-term results from the electrification Projects have been discussed in detail throughout this Report. Main findings from the impact considerations and cost-benefit analysis are;

- A high number of households have been connected, with improved living conditions through reduced energy expenditure and increased energy quality as a result;
- The competitiveness of local industries have been improved through access to reliable electricity at reduced cost;
- Improved social services through electrification of schools, medical clinics, etc.;
- Improved feeling of community security through provision of street lighting in public areas.

In economic terms these advantages far outweigh the negative impact the Projects have had on the financial viability of EdM due to the below cost-reflective tariff, as seen in Figure 28 on page 72. This does not imply that the lack of impact on business creation, and the negative impacts on the financial standing of EdM are not serious issues that should be addressed in order to improve the outcomes of this and future electrification efforts.

8.4 Relevance

Relevance is concerned with measuring the extent to which the Projects are suited to the priorities and policies of the target group, recipient and donor. It is therefore appropriate to discuss the Projects separately in light of the priorities and policies of each stakeholder.

The Government of Norway: The projects have a clear pro-poor profile both in selection of area, and connections made. This is in line with both the overall Norwegian development priorities as well as the development objectives of Mozambique. The Projects have leveraged the long period of sustained economic growth that Mozambique has undergone to increase local value creation.

The Government of Mozambique: Increased electricity access in line with the policies and objectives of the GoM, as expressed in its Action Plan for the Reduction of Absolute Poverty (PARPA), now PARPA II.

The Projects have contributed towards the government´s goal of increasing the connection rate of rural areas to the national grid to electricity to 15% by 2020.

Business community: Access to electricity has enabled local industries to leverage on the general economic growth Mozambique has seen over the last years, to increase the local share of the value chain and increase its export to other regions of Mozambique. As discussed at length in chapter 5, this effect could have been substantially larger if supporting programs had been in place

Households: Given the large share of a household´s expenditure that energy makes up, access to affordable and high quality electricity/ energy is highly relevant for rural households. In addition to the financial advantages, the projects positive impact on health and educational services is also of high relevance.

8.5 Sustainability

Sustainability refers to an assessment of the degree to which the benefits of the Projects are likely to continue after donor funding has been withdrawn.

As can be seen from Table 29 **the sales for all categories except for social grew substantially over the first six years of operations**, with domestic and low voltage large consumers as the most rapid growing categories. The reason for the decline in social connections is, according to EdM that most households, once they have tried electricity, want the option of using more than the 100 kWh limit on social connections. The Consultant has not been able to establish credible explanations of the differences in consumption development patterns for the three Projects.

	Namacurra	Pebane extension	Gurué – Cuamba - Lichinga
Social	-21 %	-88 %	79 %
Domestic	579 %	667 %	201 %
General	65 %	295 %	111 %
Large consumers (BT)	413 %	616 %	7 %
Large consumers (MT)	230 %	72 %	135 %
Total	285 %	465 %	79 %

Table 29: Percentage increase of sales first six years of operations per category

While the study has demonstrated that EdM is able to maintain the assets in an ad hoc manner, it is also clear that a comprehensive preventive operation and maintenance program is required to secure the long-term technical sustainability of the Projects. As seen above, the transmission lines are very lightly loaded, so load growth is not a threat to the sustainability.

If the current low tariff levels in Mozambique are sustained, it is likely that EdM will be unable to maintain the assets and make required reinvestments. This is a substantial threat to the long-term sustainability of the projects. Thus, the sustainability of this and future projects would likely benefit from, among others; i) applying lower cost alternatives; ii) considering isolated grids and/or household lighting products; iii) increasing end user tariffs or iv) ensuring the connection of relatively high-load industrial users as a base load. Combining (i)-(iv) in rural areas could effectively help close the cost-revenue gap.

On the other hand, low tariff levels have been a key driver in creating the substantial number of new connections. Measures such as payment of connection costs in instalments, as well as consumer- or micro-finance for electrical utilities/machines, should be considered to increase and sustain this positive effect.

8.6 Efficiency

Efficiency measures whether project activities have been cost-efficient and implemented in the most efficient way compared to alternatives. The term efficiency is relating to what degree donor assistance uses the least costly resources possible in order to achieve the desired result.

The Projects are all standard EdM grid extension projects. EdM's standard rural distribution configuration is a three phase 33kV 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.

EdM issued turnkey solicitations for the Projects. The Team is of the view that **the design and supervision has been professionally carried out** and that the contracts, specifications and supervision were fit for purpose.

It is very difficult to compare costs per connection between projects, as all projects have certain differences and as the number of connections increase with time. Table 30 below, lists the cost per connection for a sample of projects in and outside the Region and as well the World Bank Energy Sector Strategy benchmark.

It is noted that the Gurué – Cuamba - Lichinga Line, which contains a high number of urban connections, benefits from economies of scale and has an even lower connection cost than the World Bank benchmark. On the other hand, **the cost per connection for the Namacurra project and its extension to Pebane is substantially higher than the World Bank benchmark value, although compare favourably with the regional projects**. This performance is partly a result of the fact that the Project areas are not densely populated and the inclusion of a number of very small villages.

	Project	Project Cost, USD	No of Connections	Cost (USD)/connection
Mozambique	Namacurra Project	8,400,601	6,098 (2013)	1,378
	Namacurra Extn to Pebane Project	8,051,879	7,040 (2013)	1,144
	Lichinga Line Project	20,760,689	24,665 (2013)	842
	ERAP/World Bank		17,685 (2009)	950
Zambia	Two Grid Extension Projects in Kaoma and Mumbwa/EU	11,383,339	6,800 (2014)	1,674
	Tanzania			
	Ukerewe Island/Sweden	4,580,013	About 975 (2011)	4,697
	Simanjiro (Phase 1)/Sweden	4,122,011	About 875 (2011)	4,710
	Makambako Project/ Sweden	7,328,020	About 7,000	1,047
Sri Lanka	Conflict Affected Areas Rehabilitation Project (CAARP)/AsDB			687 (Jaffna) 532 (Kilinochi) 5,837 (Vavuniya 675 (Trincomalee)
	Global			
	World Bank Group Energy Sector Strategy			950
	Off- grid			
	Tanzania, Mawenge 300 kW hydro power grid, Ludewa, started 2010	4,452,150	735 (now, 2013) 1,400 in 6 months	6,057 (735 connections) 3,180 (1,400 connections)

Table 30: Cost per connection of the projects measured against some other projects. Norplan

EdM is using typical European standards that were adapted for high density, high demand centres in continental Europe. These are poorly adapted to rural areas of Mozambique and often results in over-sized networks carrying unnecessary high costs for connecting rural loads.

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. 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.

Although there are many low-cost methods that are worthy of consideration; there are four low-cost methods, with significant cost-reducing impact:

- Appropriate design engineering
- Developing an institutional cost-cutting culture

- Applying Single wire earth return (SWER)**.** Because this technique involves the stringing of only one wire, the construction techniques are simple and cheap, long spans can be achieved and maintenance costs are low.
- Applying shield wire systems where the shield (earth) wires on top of the transmission lines are used as power conductors and shield wires. Such installation costs about 15% of a conventional power line.

Thus, **the Projects could have been implemented at lower costs if low cost technologies had been employed.**

8.7 Lessons learnt and recommendation

This section presents the distilled lessons learned from the impact assessment, and provides recommendations for future rural electrification interventions.

Cost-effectiveness and choice of technical solutions

Although the Project has been successful in increasing access to electricity, there are many challenges related to further electrification and access expansion. These include the high costs of supplying rural households, as these areas have a low population density and mainly poor households, with limited demand for electricity (often less than 30 kWh per month). Rural systems also have higher technical network losses and operating costs. For future interventions **EdM and the donors should consider a low-cost approach to get maximum connections per a given investment by choosing the lowest cost solution**, especially for the upfront investment. Eventually it becomes cheaper to use off-grid sources of supply to reach distant communities. This issue is covered in detail in a recent policy brief on rural electrification prepared by Norplan for Norad.

Economic viability

As Mozambique is targeting large numbers of low-income households in its electricity access programs, it is vital to ensure that electricity access investments are economically viable, i.e., that benefit (represented by willingness to pay) exceed costs; and that electricity services are financially and operationally viable. Thus pre-conditions include a regulatory framework which accepts full cost recovery of efficient operation as well as the limited ability of low-income consumers to pay. Efficient operation includes appropriate design standards and competitive procurements.

From an economic perspective the CBA demonstrates that the Projects are highly viable, and there is thus ample room to increase the tariffs to a cost-reflective level. However, as long as this is not done, the Projects will remain unsustainable from the financial perspective. In this situation new connections put additional financial burden on EdM. **GoN should only support further rural energy service support where the promoter (e.g. EdM) is pursuing/testing specific designs/solutions/business models which are expected to contribute to an improvement of the cost-revenue gap that now heavily characterizes rural electrification in Mozambique.**

Productive uses and business creation

It is well known that inclusion of productive loads can improve the economics of an electrification project substantially, but these Projects fall into a long line of electrification projects that have underutilized this potential. Two important barriers to the productive use of electricity have been identified: (i) the lack of technical knowledge and skills of potential users and (ii) the financial means to acquire relevant equipment.

For future support to rural electrification, it is recommended that supporting lines of credit and training is provided to existing and potential entrepreneurs in the areas, either directly or in parallel to the electrification component. Consider providing a line of credit for rural electrification investments to commercial banks on near-commercial terms. Consider encouraging microfinance institutions (MFIs) to finance interior equipment, advances on consumption, micro and small business activities and financial management capacity building.

It is further recommended that the GoN map the potential for productive uses in candidate areas for electrification, and uses this as a central criterion in the basis for commitment of funds. A demand-driven approach, focusing on the low hanging fruits first (i.e. industrial/commercial anchor loads) is recommended to ensure the long-term effectiveness, impact and sustainability of electrification programs. In addition, parallel support programs should be implemented to harvest and optimize the impact from electrification on business creation. **Norway should not go into electrification project where no plans for productive use stimulation are in place.**

Result management and monitoring

In line with this it should be noted that the Norwegian result management and monitoring systems of the Projects have lacked a focus on productive uses. The CMI baseline study is focused on the social baseline, while there is comparatively little quantitative information on business creation. This shortcoming should be corrected in future management and monitoring systems.

APPENDIX A: ASSESSMENT OF ELECTRICITY CONSUMPTION AND DEMAND PER PROJECT

EdM's Commercial Department provided average electricity consumption figures in kWh/month and average invoiced amounts in MZN for January-June 2013 for consumers broken down into consumer categories for each of EdMs service areas, Sul, Centro and Norte. These statistics were further broken down into 4-5 centres for each area. In the North, figures are available for Nampula, Nacala, Lichinga and Pemba. The figures presented for Lichinga are utilized in this study.

The statistics from EDM's Commercial Department only present energy sales because this is the form in which metering information data can be collected. Clearly it is also important to estimate demand in order to assess the power requirement and the effect on the distribution system.

The Evaluation Team has chosen to estimate the power demand using the following formula, where the relationship between energy consumption and demand is given by the following equation:

$$kW = N*(1- 0.4N + 0.4(N^2 + 40)^{1/2})* (0.005925)*C^{0.885}$$

Where:

kW = Projected Demand in kW

N = Number of consumers

C = Monthly average specific consumption, kWh/consumer/month

This equation was developed originally from data collected on US rural electric consumers, but it has been tested in many countries and predicts demand with acceptable accuracy. It is based on the assumption that power is available throughout most of the day and consumers are free to consume power whenever they wish. As a consequence, it should be used with care if load shedding during peak hours is a regular occurrence or service availability is extremely limited.

	Number of new customers	**Tariff type**	**Power Demand kW**	**Average Consumption /month kWh**	**Total Energy Consumption /month kWh**	**Average Invoicing/ Client MZM**	**Total Invoiced /month MZM**
HHs	5,291	Domestic	1,228	63	333,333	200	1,058,200
HHs	252	Social	45	45	11,340	44	2,662
Schools, Clinics, Commer-cial	543	General	460	268	145,524	909	511,767
Industry	3	LPU LV	48	2,569	7,707	8.735	192,170
Industry	0	MV	0		0		797,500
Industry	0	HV	0		0		0
Total	**6,098**		**2,337**		**658,689**		**1,850,0811**

Table A.1 Consumption Assessment today for the Namacurra Project

The total annual source requirement for the Namacurra project today, excluding losses, is 7.9 GWh. With a total consumption in the Northern Area of 334 GWh, the project represents a consumption of 2.4 %. The project demand is 2.3 MW.

	Number of new customers	Tariff type	Power Demand kW	Average Consumption/month kWh	Total Energy Consumption /month kWh	Average Imvoicing /Client MZM	Total Invoiced /month MZM
HHs	5,569	Domestic	1,293	63	350,847	200	1,113,800
HHs	885	Social	154	45	39,825	44	38,940
Schools, Clinics, Commercial	571	General	483	268	153,028	909	519,039
Industry	12	LPU LV	120	2,569	30,828	8.735	105
Industry	3	MV	268	17,865	53,595	31,990	95,970
Industry	0	HV	0	0	0	0	0
Total	**7,040**		**2,318**		**628,123**		**1,767,854**

Table A.2 Consumption Assessment today for the Namacurra Project Extension to Pebane

The total annual source requirement for the Namacurra Extension – Pebane Project today, excluding losses, is 7.5 GWh. With a total consumption in the Northern Area of 334 GWh, the project represents a consumption of 2.2 %. The project demand is 2.3 MW.

	Number of new customers	Tariff type	Power Demand kW	Average Consumption/month kWh	Total Energy Consumption /month kWh	Average Imvoicing /Client MZM	Total Invoiced /month MZM
HHs	21,374	Domestic	4,956	63	1,346,562	200	4,274,800
HHs	179	Social	32	45	8,055	44	7,876
Schools, Clinics, Commercial	3041	General	2,545	268	814,988	909	2,764,269
Industry	69	LPU LV	475	2,569	177,261	8.735	603
Industry	1	MV	109	17,865	17,865	31,990	31,990
Industry	0	HV	0	0	0	0	0
Total	**24,664**		**8,117**		**2,364,731**		**7,079,538**

Table A.3 Consumption Assessment today for the Gurue-Cuamba-Lichinga Line Distribution Projects

The total annual source requirement for the the Gurue-Cuamba-Lichinga Line Distribution Projects today, excluding losses, is 28.4 GWh. With a total consumption in the Northern Area of 334 GWh, the project represents a consumption of 8.5 %. The project demand is 8.1 MW.

APPENDIX B: Customer connection calculations

Namacurra Project – Pebane Extension

According to EdM Statistics the customer connections in the Namacurra Extension – Pebane project areas (Maganja da Costa. Mucubela and Pebane) have been :

Tariff\Year	2006	2007	2008	209	2010	2011	2012	Total
Social	144	0	52	0	0	0	0	196
Domestic	91	390	831	380	416	617	485	3210
General	8	85	136	14	25	59	22	349
LPU LV	1	0	3	0	2	0	0	6
MV	0	1	1	0	0	0	0	2
HV	0	0	0	0	0	0	0	0
TOTAL	244	476	1023	394	443	676	507	3763

Table B.1: Annual connection numbers for the Namacurra Extension – Pebane project areas except Mocuba and Nantes

Due to lack of updated information the team has estimated the connections in Mocuba and Nantes, based on the connections made during the project in these areas as reported in the Final Report and the growth of national access to electricity presented in EdM's Statistical Summary 2012 for the Northern Region.

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Access rate Northern Region, %	5	6	7	9	10	12	14	
Increase/yr	1.25	1.20	1.17	1.29	1.11	1.20	1.17	
Mocuba	1128	226	226	451	226	451	451	3159
Nantes	40	8	8	16	8	16	16	112

Table B.2: The Consultant´s estimates of annual connection numbers for Mocuba and Nantes

In addition, the customer category distribution for Mocuba and Nantes has been assumed to be similiar to Manja da Costa. Thus the revised total customer connections in the Namacurra Extension – Pebane project areas are:

Tariff\Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Social	833	0	52	0	0	0	0	885
Domestic	527	578	1031	837	650	1036	910	5569
General	46	130	175	24	25	107	64	571
LPU LV	6	0	4	0	2	0	0	12
MV	0	2	1	0	0	0	0	3
HV	0	0	0	0	0	0	0	0
TOTAL	1412	710	1263	861	677	1143	974	7040

Table B.3: Revised total customer connection in the Namacurra Extension – Pebane project

The Gurue-Cuamba-Lichinga project -New Connections

According to the Final Report, the project had planned 8,200 new connections, but only about 5,226 were achieved.

	Gurue	Cuamba	Lichinga	Cuamba Extn	Total
Planned service connections	1,800	1,000	3,300	2,100	8,200
Achieved	546[1]	554	3,112	1,600	5,266

Table B.4 Consumers connected during the project period for the Gurué – Cuamba – Lichinga Project

The Team received EdM Statistics for the subsequent years supposedly covering all the project areas.

Lichinga Area

The statistics revealed the following customer connections in the Lichinga Area (Sanga, Metangula, Maniamba):

Tariff\Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	100	18	9	8	28	11	174
Domestic	478	246	184	93	289	306	992	2588
General	65	14	17	41	47	41	39	264
LPU LV	0	0	2	0	1	1	1	5
MV	0	0	0	0	0	0	0	0
HV	0	0	0	0	0	0	0	0
TOTAL	543	360	221	143	345	376	1043	3031

Table B.5: Annual connection numbers for the Lichinga Area (Sanga, Metangula and Maniamba), excluding Lichinga Town

The Team has pointed out that there were also connections made in Lichinga itself. From the Final Report it seems that 3,112-543=2,569 connections were made in Lichinga. The Team is awaiting confirmation from EDM on this. The Team has estimated the new connections, based on 2,569 connections made during the project in Lichinga. The growth of national access to electricity for the Northern Region presented in EdM's Statistical Summary 2012 has been used.

Year	2006	2007	2008	2009	2010	2011	2012	Total
Access rate Northern Region, %	5	6	7	9	10	12	14	
Increase/yr	1.25	1.20	1.17	1.29	1.11	1.20	1.17	
Lichinga	2569	514	524	1046	512	1033	1054	7251

Table B.6: Assumed annual number of new connections per year in Lichinga

The customer category distribution for Lichinga has been assumed to be similar to other areas in Niassa. Thus the revised total customer connections for the distribution areas in the Lichinga project areas become:

Tariff\Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	100	18	9	8	28	16	179
Domestic	2753	732	660	779	701	1197	2019	8839
General	359	42	62	401	147	148	59	1219
LPU LV	0	0	5	0	1	37	3	46
MV	0	0	0	0	0	0	0	0
HV	0	0	0	0	0	0	0	0
TOTAL	3112	874	745	1189	857	1409	2097	10283

Table B.7: Assumed annual number of new connections per year in Lichinga per category

[1] The difference of 1,254 were installed in the World Bank ERAP project

Cuamba Area

The Team received the EdM Statistics for the new connection after the project in the Cuamba Area, but only covering Lurio, Mutuale and Malema.

Tariff\Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	0	0	0	0	0	0	0
Domestic	651	125	1104	395	1384	584	1631	5874
General	127	47	144	79	171	103	189	860
LPU LV	5	0	0	2	0	0	2	9
MV	0	0	0	0	0	0	1	1
HV	0	0	0	0	0	0	0	0
TOTAL	783	172	1248	476	1555	687	1823	6744

Table B.8: Annual connection numbers for the Lichinga Area (Sanga, Metangula and Maniamba), excluding Cuamba Town

The Team has pointed out that there were also connections made in Cuamba itself. From the Final Report it seems that 2154-783=1,371 connections were made in Cuamba. The Team is awaiting confirmation from EDM on this. The Team has estimated the new connections, based on 1,371 connections made during the project in Cuamba. The growth of national access to electricity for the Northern Region presented in EdM's Statistical Summary 2012 has been used.

Year	2006	2007	2008	2009	2010	2011	2012	Total
Access rate Northern Region, %	5	6	7	9	10	12	14	
Increase/yr	1.25	1.20	1.17	1.29	1.11	1.20	1.17	
Cuamba	1371	274	280	558	273	551	562	3870

Table B.9: Assumed annual number of new connections per year in Cuamba

The customer category distribution for Cuamba has been assumed to be similar to other areas in Niassa. Thus the revised total customer connections for the distribution areas in the Cuamba project areas become:

Tariff\Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	0	0	0	0	0	0	0
Domestic	1821	340	1356	881	1631	1072	2140	9241
General	323	106	172	148	197	166	241	1354
LPU LV	10	0	0	5	0	0	3	18
MV	0	0	0	0	0	0	1	1
HV	0	0	0	0	0	0	0	0
TOTAL	2154	446	1528	1034	1828	1238	2385	10614

Table B.10: Assumed annual number of new connections per year in the Cuamba area per category

Gurue Area

The Team did not receive any information about connections made in the Gurue Area (Gurue, Ile, Muqiquela, Socone, Namarroi and Envinha) and is awaiting an updating of this information. The Final Report states that 546 connections were made in the Gurue Area during the project.

The Team has estimated the new connections, based on 546 connections made during the project in Gurue. The growth of national access to electricity for the Northern Region presented in EdM's Statistical Summary 2012 has been used.

Year	2006	2007	2008	2009	2010	2011	2012	Total
Access rate Northern Region, %	5	6	7	9	10	12	14	
Increase/yr	1.25	1.20	1.17	1.29	1.11	1.20	1.17	
Gurue	546	109	111	222	109	220	224	1541

Table B.11: Assumed annual number of new connections per year in Gurue

The customer category distribution for Gurue has been assumed to be similar to other areas in Niassa. Thus the revised total customer connections for the distribution areas in the Gurue project areas become:

Tariff\Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	0	0	0	0	0	0	0
Domestic	466	353	412	496	458	546	562	3293
General	78	98	45	71	48	71	58	468
LPU LV	2	0	0	3	0	0	1	6
MV	0	0	0	0	0	0	0	0
HV	0	0	0	0	0	0	0	0
TOTAL	547	451	457	569	506	617	621	3767

Table B.12: Assumed annual number of new connection in the Gurué area per category

Thus we have for the whole Gurue-Cuamba-Lichinga Line Distribution Projects:

Tariff\Year	2006	2007	2008	2009	2010	2011	2012	Total
Social	0	100	18	9	8	28	16	179
Domestic	5041	1425	2428	2155	2790	2814	4721	21374
General	760	246	279	620	392	385	359	3041
LPU LV	12	0	5	8	1	37	6	69
MV	0	0	0	0	0	0	1	1
HV	0	0	0	0	0	0	0	0
TOTAL	5813	1771	2730	2793	3191	3264	5103	24665

Table B.13: Total annual connections for the Gurue-Cuamba-Lichinga Line Distribution Project Area

APPENDIX C: LIST OF PEOPLE MET

No.	Name	Title	Organization	District	Project
1		Leader	Mussosane Barrio	Nicuadala	Namacurra
2	Augusto Beira	Leader	Nantes community	Maganja da Costa	Pebane extension
3	Manuel Cabral Braimo	District administrator	Cuamba district	Cuamba	Gurué – Cuamba - Lichinga
4	Miquelina Menezes	Chair Person	Fundo de Energia (FUNAE)	Maputo	N/A
5	Mario Batsana	Director	Fundo de Energia (FUNAE)	Maputo	N/A
6	Alda Rocha	Director for International Relations and Cooperation	Instituto Nacional de Estatística	Maputo	N/A
7	Natércia Macuácua.	Coordinator of Projecto de Estatisticas Territoriais	Instituto Nacional de Estatística	Maputo	N/A
8	Monica Magaua.	Leader of the National Accounts Department	Instituto Nacional de Estatística	Maputo	N/A
9	Adriano Matsimbe.	Leader of Departamento de Estatisticas de Serviços e Cadastro	Instituto Nacional de Estatística	Maputo	N/A
10	Rachi Picardo	Governance Project Coordinator	COWI Mozambique	Maputo	N/A
11	Isabel Costa	Consultant	COWI Mozambique	Maputo	N/A
12	Yari Berti	Consultant	COWI Mozambique	Maputo	N/A
13	Xin Jian Zhang	Owner	Xin Jian Zhang Company Ltd.	Nicuadala	Namacurra
14	Luciano Miguel	Responsible Engineer	ICM Fábrica de descasque arroz - Namacurra	Namacurra	Namacurra
15	Armagon de Confiança	Brother of shop owner	Kiosk in the main market of Namacurra	Namacurra	Namacurra
16	António Luis Gonzalo Couselhiro	Technical leader	Rice irrigation scheme in Nantes	Maganja da Costa	Namacurra
No.	Name	Title	Organization	District	Project
17	Mr. Gabriel Agostinho	Owner	Fuel store in the Nantes market	Maganja da Costa	Namacurra
18	Mrs. Balbina Finiosa	Owner	Saw-mill in Mocubela	Maganja da Costa	Namacurra
19	Mr. Chris Smith and Mrs. Lynn Smith	Manager	Pebane Fishing Lodge	Pebane	Pebane extension

No.	Name	Title	Organization	District	Project
20	Rosa Manuel Alexandre	Nurse	Medical clinic in Impaca	Pebane	Pebane extension
21	Sérgio Cardoso Alfândega	Bartender	Bar in Ile	Ile	Gurué - Cuamba – Lichinga
22	Mr. Estevae Dzimba	Site manager	African Century Agriculture siloes in Lioma	Gurué	Gurué - Cuamba – Lichinga
23	Mr. Bento Joachim		SAN Sociedade Algodaoeiro de Mutúali	Gurué	Gurué - Cuamba – Lichinga
24	Henriques Paulo	Owner	Village mill in Lurió	Malema	Gurué - Cuamba – Lichinga
25	João Alexandre	Agronom	Agrobusiness de Moçambique, S.A.	Malema	Gurué - Cuamba – Lichinga
26	Luís Raimundo Ganje	Director	EdM -Comersial directorate	Maputo	N/A
27	Getá Perry	Director	EdM - Financial directorate	Maputo	N/A
28	Abel Chambuca	Project Manager	EdM - Projects and Electrification directorate	Maputo	N/A
No.	Name	Title	Organization	District	Project
29	Esmeralda Calima	Deputy director	EdM Transmission Network directorate	Maputo	N/A
30	Fátima R. Arthur	Director	EdM - Corporate Performance and Startegic Planning	Maputo	N/A
31	Heber Janeiro	Project Manager	EdM - Projects and Electrification directorate	Maputo	N/A
32	João Guina	Deputy Project Manager	EdM - Projects and Electrification directorate	Maputo	N/A
33	Daniel Guambe	Project Manager	EdM - Projects and Electrification directorate	Maputo	N/A
34	João Catine	Director	EdM - Procurement Directorate	Maputo	N/A
35	Manuel Fernando Anselmo	Distribution manager	EdM - Quelimane	Cidade de Quelimane	Namacurra
36	Angelo da S. M. dos	Head of Network Maintenance Department	EdM - Licinga	Cidade de Lichinga	Gurué – Cuamba –

	Reis				Lichinga
No.	**Name**	**Title**	**Organization**	**District**	**Project**
37	Piloto Matola	Area manager,	EdM - Northern transmission area	Cidade de Lichinga	Gurué – Cuamba – Lichinga
38	Davido Anunça Satimane	Head of office	EdM - Maganja da Costa	Maganja da Costa	Pebane extension
39	Benjamm Janeiro Alfredo	Head of office	EdM - Pebane	Pebane	Pebane extension
49	Issa Rashid	Previous head of office	EdM - Ile	Ile	Gurué – Cuamba – Lichinga
No.	Name	Title	Organization	District	Project
41	Albano Jossar	Customer service manager	EdM - Gurué	Gurué	Gurué – Cuamba – Lichinga
42	Antonio Domingos Augusto	Head of office	EdM - Gurué	Gurué	
43	Paulo Witimisse	Head of office	EdM - Cuamba	Cuamba	Gurué – Cuamba – Lichinga
44	Luís Elias Salomão	Director	EdM - Lichinga area	Cidade de Lichinga	Gurué – Cuamba – Lichinga

APPENDIX D: SURVEY QUESTIONAIRES AND INTERVIEW GUIDES

1) Business survey
2) Household survey
3) Institutions survey
4) Questionnaire for local leaders

NORPLAN	QUESTIONÁRIO NÚMERO	
	I. LOCALIZAÇÃO DA EMPRESA	
	CÓDIGO DO PAÍS: MOZ	
	PROVÍNCIA:	
	DISTRITO:	
	ALDEIA/VILA:	

II. IDENTIFICAÇÃO DO INQUIRIDOR DE CAMPO

NOME	ID DO INQUIRIDOR	DATE MÊS / DIA / ANO	ASSINATURA
	#		

III. INSTRUÇÕES IMPORTANTES PARA O INQUIRIDOR

TUDO O QUE ESTIVER ESCRITO EM LETRAS MAIÚSCULAS É INFORMAÇÃO APENAS PARA O INQUIRIDOR E NÃO DEVE SER LIDO AO ENTREVISTADO.

AS INSTRUÇÕES DIRIGIDAS AO INQUIRIDOR ESTÃO EM LETRAS MAIÚSCULAS, NEGRITO.

- **AS CATEGORIAS DE RESPOSTA QUE NÃO DEVEM SER LIDAS AO ENTREVISTADO ENCONTRAM-SE EM** LETRAS MAIÚSCULAS **NORMAIS. O PRÓPRIO INQUIRIDOR DEVE ATRIBUIR AOS ENTREVISTADOS RESPOSTAS ÀS CATEGORIAS.**

TUDO O QUE ESTIVER ESCRITO EM letras minúsculas **DEVE SER LIDO LITERALMENTE AO ENTREVISTADO**

- **AS PERGUNTAS ESTÃO EM** *letras minúsculas, itálico*
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER INSERIDAS NAS PERGUNTAS (INDICADAS POR ESPAÇO VAZIO "_____" E "PREENCHER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER LIDAS AO ENTREVISTADO DEPOIS DE SE FAZER A PERGUNTA (INDICADO POR "LER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**

  CASO TENHAM QUE SER 'LIDAS' CATEGORIAS DE RESPOSTAS MÚLTIPLAS AO ENTREVISTADO, LER PRIMEIRO TODAS AS CATEGORIAS ANTES DE DEIXAR QUE O ENTREVISTADO ESCOLHA A(S) QUE SE APLICA(M).

OS ESPAÇOS EM BRANCO PRÓXIMO DOS CÓDIGOS NUMÉRICOS DEVEM SER ASSINALADOS COM UM 'X' QUANDO SE APLICA UMA CATEGORIA DE RESPOSTA.

'*São possíveis várias respostas'* **INDICA QUE PODEM SER ESCOLHIDAS VÁRIAS CATEGORIAS DE RESPOSTAS.**

CASO O ENTREVISTADO NÃO ESTEJA DISPOSTO OU NÃO SEJA CAPAZ DE RESPONDER A UMA PERGUNTA OU SE A PERGUNTA NÃO SE APLICAR, COLOCAR

-1 PARA "NÃO SABE"/ "NÃO RESPONDEU"
-2 PARA "NÃO SE APLICA"

NO QUADRO ABAIXO, ENCONTRAM-SE CATEGORIAS DE RESPOSTAS OU CAMPO ATRIBUÍDO.

→ IR PARA A Q(…) ADVERTE QUE AS PERGUNTAS SEGUINTES ATÉ À INDICADA DEVEM SER OMITIDAS.

IV. INTRODUÇÃO

IMPORTANTE! DE PREFERÊNCIA, CONTACTAR O PROPRIETÁRIO DA EMPRESA. SE, DE MOMENTO, NÃO ESTIVER DISPONÍVEL, TENTAR ORGANIZAR ENCONTRO PARA MAIS TARDE.

Bom dia / boa tarde, ***chamo-me*****……(DAR O NOME E APRESENTAR AS CREDENCIAIS)** *e trabalho para a COWI Moçambique que foi contratada pela NORPLAN (uma empresa de consultoria norueguesa). Estamos aqui hoje para realizar um* ***inquérito às pequenas empresas****. Nós estudamos o impacto da linha de transmissão eléctrica recentemente instalada, com objectivo de avaliar os Custos e Benefícios das instalações eléctricas em 100 empresas seleccionadas de forma aleatória.*

O inquérito servirá de avaliação de investimentos anteriores e potenciais que servirão de base para futuros projectos de desenvolvimento a serem financiados pela Agência Norueguesa de Desenvolvimento. Para que estes projectos sejam o mais útil possível para as empresas locais, dependemos fortemente de ***informação exacta, fiel*** *e abrangente. Por isso, é necessário que falemos com a pessoa com melhor conhecimento das actividades da empresa.*

O nosso questionário terá uma duração máxima de ***70 minutos****.*

Está pronto para ***participar?***

SE NÃO QUISER PARTICIPAR, TERMINAR A ENTREVISTA.

SE SIM, *- Óptimo! Então vamos começar o questionário.*

HORA DE INÍCIO: (FORMATO DE 24 HORAS)			:		

A1. INFORMAÇÃO BÁSICA

Q1. *Qual é o nome desta empresa?*	1	

Q2. *Qual é a idade aproximada da empresa?*		
	1	0 ANOS < IDADE ≤ 1 ANO
	2	1 ANO < IDADE ≤ 3 ANOS
	3	3 ANOS < IDADE ≤ 5 ANOS
	4	5 ANOS < IDADE ≤ 10 ANOS
	5	10 ANOS < IDADE ≤ 20 ANOS
	6	IDADE > 20 ANOS

Q3. *Qual é o ramo de negócios da empresa?* **VERIFICAR O MAPA DE CÓDIGOS. CASO SE APLIQUEM VÁRIOS (EX. PROCESSAMENTO E VENDA DE ALIMENTOS), INCLUIR TODOS, SEPARADOS POR VÍRGULAS.**	1	

Q4. *Quantos dias por semana a empresa opera normalmente?*		
	1	

Q5. *A que horas a empesa normalmente inicia as suas operações?* **FORMATO DE 24 HORAS**	1		:		

Q6. *A que horas a empresa normalmente termina as suas operações?* **FORMATO DE 24 HORAS**	1		:		

Q7. *A empresa esteve a operar em <u>todos</u> os últimos 12 meses?*		
	1	SIM → **IR PARA Q10**
	0	NÃO

Q8. *Quantos dos últimos 12 meses a empresa não esteve a operar?*		
1		NÚMERO DE MESES

Q9. *Porque a empesa não este a operar em todos os últimos 12 meses?*		
	1	A empresa abriu há menos de 12 meses
	2	Negócio sazonal
	3	Outro (especificar)

Q10. *Neste momento, quantas pessoas trabalham para esta empresa sem contar consigo? Favor incluir aqui quaisquer membros da sua família que trabalhem para esta empresa.*			
1	Sexo Masculino		
2	Sexo Feminino		

COMENTÁRIOS:

B1. ENERGIA

Q11. *Qual das seguintes fontes de energia é usada por esta empresa? <u>São possíveis várias respostas</u>.* **LER FONTE DE ENERGIA** **SE FOR USADA FONTE DE ENERGIA, FAZER AS PERGUNTAS Q12-Q14 PARA ESTA FONTE DE ENERGIA ANTES DE AVANÇAR PARA A PERGUNTA Q11 REFERENTE À FONTE DE ENERGIA SEGUINTE.**			***Q12.*** *Para qual das seguintes finalidades usa ___? <u>São possíveis várias respostas</u>.* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q11** **EM SEGUIDA, LER A FINALIDADE**								***Q13.*** *Na semana ou mês passado, aproximadamente quanto é que esta empresa gastou em ___?* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q11**			***Q14.*** *Aproximadamente quantos minutos por semana esta empresa gasta na aquisição de ____?* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q11**	
			1	2	3	4	5	6	7		1	2			
		FONTE DE ENERGIA	Iluminação	Cozinha	Rádio	TV	Celular	Equipamento	Máquinas	-1 -2	MZN/SEMANA	MZN/MÊS	-1 -2	MIN PER SEMANA	-1 -2
	1	Lenha (comprada)													
	2	Lenha (apanhada)													
	3	Carvão / briquetes													
	4	Petróleo / querosene													
	5	Pilhas secas													
	6	Baterias de carros ou outras recarregáveis									RECARGA	RECARGA		RECARGA	
	7	Gás (GPL / GNL)													
	8	Diesel (Não usado para viaturas)													
	9	Gasolina (Não usada para viaturas)													
	10	Velas													
	11	Biogás													
	12	Resíduo de culturas (comprado)													
	13	Resíduo de culturas (apanhado)													
	14	Sistema fotovoltaico													
	15	Electricidade da rede													
	16	Outro (especificar)													

Q15. *Esta empresa usa electricidade?*		
	0	Não → **IR PARA Q16**
	1	Sim → **IR PARA Q17**

Q16. *Que importância a <u>electricidade</u> TERIA para o funcionamento desta empresa?* **LER**		
	1	Não importante
	2	Importante
	3	Muito importante

Q17. *Que importância a <u>electricidade</u> TEM para o funcionamento desta empresa?* **LER**		
	1	Não importante
	2	Importante
	3	Muito importante
	4	Não pode operar sem ela

COMENTÁRIOS:

B2. ELECTRICIDADE DA REDE

Q18. *A empresa usa energia eléctrica da rede?*			***Q19.*** *Porque razão esta empresa não está ligada à rede? <u>São possíveis várias respostas</u>.* **LER** **DEPOIS DE CONCLUIR A PERGUNTA → IR PARA Q32**		
	1	Sim, da rede nacional → **IR PARA Q20**		1	Não há rede disponível
	0	Não		2	Existe rede e foi pedida uma ligação, mas ainda não foi estabelecida
				3	A electricidade não é necessária para o funcionamento da empresa
				4	O fornecimento de electricidade através da rede é demasiado irregular
				5	A empresa não consegue pagar a taxa de ligação
				6	A empresa não consegue pagar os consumos

Q20. *Há quantos meses <u>OU</u> anos esta empresa está ligada à rede?*			***Q21.*** *Esta empresa tem a sua própria ligação ou tem acesso à rede através de uma outra ligação?* **LER**			***Q22.*** *Qual foi a taxa de ligação?*			***Q23.*** *Qual foi o custo de instalações como fios, interruptores e tomadas nesta empresa?*		
1	ANOS			1	LIGAÇÃO PRÓPRIA		MZN	-1/-2		MZN	-1/-2
2	MESES			2	VIA OUTRA EMPRESA	1			1		
				3	VIA INSTITUIÇÃO						

Q24. *Qual dos seguintes métodos é usado para pagar a electricidade?* **LER**			***Q25.*** *Qual foi o último pagamento feito pela energia eléctrica da rede?*			***Q26.*** *Que período de consumo foi coberto pelo seu último pagamento (ex. 2 semanas, 1 mês, 3 meses, etc.)?* **APÓS CONCLUIR A PERGUNTA → IR PARA Q28**			***Q27.*** *No mês passado, quanto é que esta empresa gastou na recarga de cartões pré-pagos?*		
	1	Contador de KWh (pós-pago) **PEDIR PARA VER O CONTADOR**		MZN	-1/-2		NÚMERO DE UNIDADES DE TEMPO	UNIDADE DE TEMPO (DIAS, SEMANAS, MESES,…)		MZN	-1/-2
	2	Contador pré-pago (pré-pago)→ **IR PARA Q27**	1			1			1		
	3	Pagamento fixo (taxa fixa)									

Q28. *Quantas vezes por semana se registam cortes <u>imprevistos</u>? "Cortes imprevistos" significa quaisquer interrupções de electricidade não informada com antecedência, ex. através de um plano de redução de carga do seu provedor.*			***Q29.*** *Algum equipamento da empresa foi danificado por oscilações no fornecimento de energia eléctrica?*			***Q30.*** *Que tipo de equipamento foi danificado por oscilações no fornecimento de energia eléctrica? <u>São possíveis 3 menções.</u>*			***Q31.*** *Quanto é que gastou mais ou menos com a reparação ou reaquisição de _____?* **PREENCHER EQUIPAMENTO DANIFICADO INDICADO EM Q30. ADICIONALMENTE OU COMO ALTERNATIVA, PEDIR QUE O ENTREVISTADO QUANTIFIQUE O CUSTO TOTAL DOS DANOS A OUTRO EQUIPAMENTO, CASO EXISTA**		
1	VEZES			1	SIM		EQUIPAMENTO DANIFICADO	-1/-2		MZN	-1/-2
				0	NÃO → **IR PARA Q32**	1			1		
						2			2		
						3			3		
									4	Custo total dos danos a outro equipamento em MZN:	

COMENTÁRIOS:

B3. ENERGIA ELÉCTRICA DE GERADOR PRÓPRIO

Q32. *A empresa usa energia eléctrica de um gerador?*			***Q33.*** *Qual é a potência /capacidade kVA (Quilovoltampere)* ou *kW (Quilowatt) de* cada *gerador usado neste momento por esta empresa?* **PEDIR PARA VER OS GERADORES**				***Q34.*** *Quantos horas por dia usa o _____?* **PREENCHER GERADORES USADOS CONFORME INDICADO EM Q33**		***Q35.*** *Há quantos meses <u>ou</u> anos esta empresa usa energia eléctrica de um <u>gerador</u>?* **USO DE GERADOR EM GERAL – <u>NÃO NECESSARIAMENTE OS QUE ESTÃO EM USO NESSE MOMENTO</u>**		
				kVA	kW	-1 -2	HORAS POR DIA	-1/-2			
1	SIM	1	Primeiro gerador						1	ANOS	
0	NÃO → **IR PARA Q37**	2	Segundo gerador						2	MESES	
		3	Terceiro gerador								
		4	Quarto gerador								

Q36. *No total, quanto é que <u>esta empresa</u> gastou na aquisição e instalação do(s) gerador(es), incluindo adaptações para o seu uso (tomadas, interruptores, cabos, etc.)?* ***PREENCHER GERADORES USADOS CONFORME INDICADO EM Q33***		
	MZN	-1 -2
1		
2		
3		
4		

B4. ELECTRICIDADE DO SISTEMA FOTOVOLTAICO (SISTEMA SOLAR)

Q37. *A empresa usa energia eléctrica de um sistema fotovoltaico?*		***Q38.*** *Qual é a capacidade de pico do sistema fotovoltaico em Wp (Watt de pico)?* **PEDIR PARA VER O PAINEL**			***Q39.*** *Há quantos meses <u>ou</u> anos esta empresa usa energia eléctrica de um sistema fotovoltaico?*			***Q40.*** *No total, quanto é que <u>esta empresa</u> gastou na aquisição e instalação do sistema fotovoltaico, incluindo adaptações para o seu uso (tomadas, interruptores, cabos, etc.)?*		
1	SIM	1	Wp	-1/-2	1	ANOS		1	MZN	-1/-2
0	NÃO → **IR PARA Q41**				2	MESES				

B5. ELECTRICIDADE DA BATERIA DO CARRO OU DE OUTRAS BATERIAS RECARREGÁVEIS (<u>NÃO USADAS NA OPERAÇÃO DO PAINEL SOLAR</u>)

Q41. *A empresa usa energia eléctrica de baterias de carros ou de outras baterias recarregáveis?*			***Q42.*** *Há quantos meses ou anos esta empresa usa energia eléctrica de baterias de carros ou de outras baterias recarregáveis?*			***Q43.*** *Aproximadamente quantos meses **<u>ou</u>** anos dura uma bateria antes de comprar uma nova?*			***Q44.*** *Quantas vezes por semana ou por mês recarrega esta bateria?*		
									1	2	
									VEZES POR SEMANA	VEZES POR MÊS	-1/-2
	1	SIM	1	ANOS		1	ANOS				
	0	NÃO → **IR PARA Q46**	2	MESES		2	MESES				

Q45. *No total, quanto é que <u>esta empresa</u> gastou na aquisição da última bateria?*		
	MZN	-1 -2
1		

B6. ILUMINAÇÃO

		Q46. Quantos dos seguintes dispositivos de iluminação esta empresa usa?			Q47. Qual é o número médio de horas que usa este ____ por dia PREENCHER APENAS O DISPOSITIVO DE ILUMINAÇÃO USADO, CONFORME INDICADO EM Q46.	
		DISPOSITIVO DE ILUMINAÇÃO	**QDE**	-1/-2	**TOTAL DE HORAS USADO POR DIA**	-1/-2
	1	LÂMPADA ECONÓMICA				
	2	LÂMPADA INCANDESCENTE (< 50W)				
	3	LÂMPADA INCANDESCENTE (>= 50W)				
	4	LÂMPADA FLUORESCENTE				
	5	LÂMPADA SOLAR				
	6	LANTERNA				
	7	CANDEEIRO A PETRÓLEO				
	8	LAMPARINA (PETRÓLEO/QUEROSENE)				
	9	LÂMPADA A GÁS				
	10	VELA	POR SEMANA			
	11	Outro (especificar):				

		Q48. *Esta instituição usa electricidade?* ***LER***
	0	Não → **IR PARA Q49**
	1	Sim → **IR PARA Q50**

		Q49. *Como acha que a electricidade iria afectar as operações desta empresa? São possíveis várias respostas.* ***LER***	*1. Horas de trabalho*	*2. Vendas*	*3. Segurança*
	0	Nenhum efeito			
	1	Reduzido			
	2	Aumentado			

		Q50. *Como é que a electricidade afecta as operações desta empresa? São possíveis várias respostas.* **LER**	*1. Horas de trabalho*	*2. Vendas*	*3. Segurança*
	0	Nenhum efeito			
	1	Reduzido			
	2	Aumentado			

COMENTÁRIOS:

C1. COMUNICAÇÃO

EXPLICAR: *A seguir, gostaríamos de saber quais são os meios de comunicação utilizados por esta empresa. Estes incluem meios de comunicação próprios ou alugados por esta Empresa, bem como os meios de comunicação que são usados noutros lugares que não sejam a própria empresa, ou seja, internet café, serviço de telefones, etc.*

Q51. *Aproximadamente quantas vezes por dia <u>ou</u> Semana esta empresa usa os seguintes meios de comunicação para <u>fins comerciais</u>?* ***LER***

INDICAR O NÚMERO DE VEZES POR DIA OU POR SEMANA NO LOCAL APLICÁVEL.

		1	2	3	4	5	6
		Telefone fixo	Fax	Internet	Celular	Rádio Transmissor	Serviço Postal
1	VEZES POR DIA						
2	VEZES POR SEMANA						
	-1 / -2						

Q52. *Qual e quantos destes meios de comunicação a empresa possui ou aluga <u>e usa</u>?*

LER TODOS OS MEIOS DE COMUNICAÇÃO INDICADOS EM Q51 E PREENCHER NO LOCAL APLICÁVEL.

	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2

D1. DOTAÇÃO DE CAPITAL REAL

Q53.
Qual e quantos dos seguintes bens de capital **(EXCLUINDO OS MEIOS DE COMUNICAÇÃO)** *a empresa possui ou aluga <u>e usa</u>?* **LER**

	BEM DE CAPITAL	QUANTIDADE	-1 -2		BEM DE CAPITAL	QUANTIDADE	-1 -2
1	Rádio			11	Edifício(s)		
2	Aparelhagem sonora			12	Barco / Cana		
3	TV (preto e branco)			13	Carro		
4	TV (colorida)			14	Camião / Carrinha		
5	Ventoinha (de tecto, mesa) (eléctrica)			15	Motorizada		
6	Estabilizador			16	Carrinho de mão		
				17	Bicicleta		

Q54.
Quais e quantos bens de capital específicos à actividade a empresa possui ou aluga <u>e usa</u>? **LER**

Ex. Leitor de DVD, Ferro de engomar (especificar se a carvão ou eléctrico), Congelador, Geleira, Moageira (especificar se eléctrica ou manual), Forno (especificar se eléctrico, a carvão ou lenha), Máquina de costura (especificar se eléctrica ou manual), Ferro de soldar, Fogão (especificar se eléctrico, a carvão, querosene ou lenha), Aparelho de vídeo, Aquecedor de água (eléctrico)

BEM DE CAPITAL	QUANTIDADE	-1 -2 -3

COMENTÁRIOS:

E1. FINANÇAS E MERCADOS

Q55. *O dono desta empresa tem uma conta de poupança comercial ou pessoal, corrente ou outra?*		
	1	SIM
	0	NÃO

Q56. *De qual das seguintes fontes esta empresa adquiriu o dinheiro para iniciar a sua actividade? São possíveis várias respostas.* **LER**		
	1	Poupança Pessoal
	2	Familiares ou Amigos
	3	Parceiros de Negócios
	4	Empréstimo de um agiota
	5	Saque a descoberto numa conta bancária
	6	Empréstimo ou saque a descoberto de um banco comercial ou de microfinanças, associação de crédito ou de um doador ou do governo.
	7	Outras fontes. **Especificar:**

Q57. *Quantas empresas produzem ou vendem os mesmos bens e serviços ou semelhantes nesta aldeia?* **LER**		
	1	0
	2	1 a 4
	3	5 ou mais

Q58. *Em média, quantos clientes esta empresa tem cada _____?* **PREENCHER**				
		NÚMERO	-1/-2	
1	Dia			
2	Semana			

AS SEGUINTES PERGUNTAS REFEREM-SE AO VALOR DAS VENDAS (FACTURAÇÃO). EXPLICAR AO ENTREVISTADO QUE ESTE NÃO É O LUCRO, OU SEJA, NÃO É O VALOR DAS VENDAS MENOS AS DESPESAS (OU NÃO SÃO OS RENDIMENTOS DO PROPRIETÁRIO), MAS SIM, APENAS O VALOR DAS VENDAS.

Q59. *Qual é aproximadamente o valor das vendas numa semana má e (ou) num mês mau?*			
		MZN	-1 -2
1	SEMANA MÁ		
2	MÊS MAU		

Q60. *Qual é aproximadamente o valor das vendas numa semana boa e (ou) mês bom?*			
		MZN	-1 -2
1	SEMANA BOA		
2	MÊS BOM		

Q61. *Qual é aproximadamente o valor das vendas na última semana e (ou) último mês?*			
		MZN	-1 -2
1	ÚLTIMA SEMANA		
2	ÚLTIMO MÊS		

Q62. *No último mês, as despesas desta empresa excederam os rendimentos das suas vendas, ou seja, teve prejuízos?*		
	1	SIM
	0	NÃO

COMENTÁRIOS:

F1. DISPOSIÇÃO PARA PAGAR

		Q63. *Quanto estaria disposto a pagar por mês pelo seguinte serviço* **DAR TEMPO PARA DISCUTIR!**													
		1	10 MZN	2	20 MZN	3	50 MZN	4	100 MZN	5	250 MZN	6	Mais, especificar	-1 -2	
1	2 lâmpadas à noite														
2	2 lâmpadas 24/7														
3	2 lâmpadas, rádio e celular à noite														
4	2 lâmpadas, rádio e celular 24/7														
5	2 lâmpadas, rádio, celular e TV à noite														
6	2 lâmpadas, rádio, celular e TV 24/7														
7	2 lâmpadas, rádio, celular, TV e geleira ou outro equipamento à noite														
8	2 lâmpadas, rádio, celular, TV e geleira ou outro equipamento 24/7														
9	5 lâmpadas à noite														
10	5 lâmpadas 24/7														
11	5 lâmpadas, rádio e celular à noite														
12	5 lâmpadas rádio e celular 24/7														
13	5 lâmpadas, rádio, celular e TV à noite														
14	5 lâmpadas, rádio, celular e TV 24/7														
15	5 lâmpadas, rádio, celular, TV e geleira ou outro equipamento à noite														
16	5 lâmpadas, rádio, celular, TV e geleira ou outro equipamento 24/7														

G1. INFORMAÇÃO DO PROPRIETÁRIO

	Q64. *Qual é o seu nome completo?*	***Q65.*** *Quantos anos tem?*		**NÃO FAZER A PRÓXIMA PERGUNTA SE O PROPRIETÁRIO FOR O ENTREVISTADO!** ***Q66.*** *O proprietário é do sexo masculino ou feminino?*		
1		1	ANOS		1	MASCULINO
					0	FEMININO

Q67. *Dos seguintes, qual é o nível de escolarização mais elevado que tem?* **LER**			***Q68.*** *Possui 3, menos ou mais anos de experiência no ramo de negócios da empresa?*			***Q69.*** *Qual foi o rendimento <u>deste</u> negócio no último mês?*			***Q70.*** *Tem outro negócio além deste? Se sim, favor diga qual é o ramo de negócio.* **CONSULTAR O MAPA DOS CÓDIGOS. CASO SE APLIQUEM VÁRIOS (EX. PROCESSAMENTO E VENDA DE ALIMENTOS), INCLUIR TODOS, SEPARADOS POR VÍRGULAS**		
0	Nenhum		1	< 3 ANOS		1	0 < Rendimentos < 1.000		1	SIM, **favor especificar:**
1	Ensino primário		2	≥ 3 ANOS		2	1.000 ≤ Rendimentos < 2.000			
2	Ensino secundário					3	2.000 ≤ Rendimentos < 3.000		0	NÃO
3	Ensino terciário					4	3.000 ≤ Rendimentos < 4.000			
4	Ensino técnico profissional					5	4.000 ≤ Rendimentos < 6.000			
5	Ensino universitário					6	6.000 ≤ Rendimentos < 8.000			
						7	8.000 ≤ Rendimentos < 10.000			
						8	Rendimentos ≥ 10.000			

Q71. *De que material são feitas as paredes da sua casa?* **LER**			***Q72.*** *Quais e quantos dos seguintes bens tem em sua <u>casa</u>? <u>São possíveis várias respostas</u>.* **LER**				***Q73.*** *Quantos filhos <u>menores</u> de <u>quinze</u> anos tem?*	
1	Tijolos / cimento		BEM		Quantidade	-1/-2		NÚMERO DE FILHOS
2	Madeira	1	Bicicleta				1	
3	Barro / lama	2	TV					
4	Caniço / bambu	3	Motorizada					
5	Outro (especificar):	4	Barco					
		5	Geleira					
		6	Carro					

COMENTÁRIOS:

Q74. *No fim da entrevista, gostaria de acrescentar algum aspecto importante ou comentário sobre o questionário ou o inquiridor?*

ENTREVISTA		Completa
		Incompleta

HORA DE CONCLUSÃO: (Formato de 24 horas)			**:**		

AGRADECER O ENTREVISTADO!

OBSERVAÇÕES DO INQUIRIDOR

COMENTÁRIOS GERAIS:

NORPLAN	**QUESTIONÁRIO NÚMERO**
	I. LOCALIZAÇÃO DO AGREGADO FAMILIAR
	CÓDIGO DO PAÍS: MOZ
	PROVÍNCIA: [1] NIASSA [2] ZAMBÉZIA
	DISTRITO:
	ALDEIA/VILA:

II. IDENTIFICAÇÃO DO INQUIRIDOR DE CAMPO

NOME	ID DO INQUIRIDOR	DATA MÊS / DIA /ANO	ASSINATURA
	#		

III. INSTRUÇÕES IMPORTANTES PARA O INQUIRIDOR DE CAMPO

TUDO O QUE ESTIVER ESCRITO EM LETRAS MAIÚSCULAS É INFORMAÇÃO APENAS PARA O INQUIRIDOR E NÃO DEVE SER LIDO AO ENTREVISTADO.

- **AS INSTRUÇÕES DIRIGIDAS AO INQUIRIDOR ESTÃO EM LETRAS MAIÚSCULAS, NEGRITO.**
- **AS CATEGORIAS DE RESPOSTA QUE NÃO DEVEM SER LIDAS AO ENTREVISTADO ENCONTRAM-SE EM** LETRAS MAIÚSCULAS **NORMAIS. O PRÓPRIO INQUIRIDOR DEVE ATRIBUIR AOS ENTREVISTADOS RESPOSTAS ÀS CATEGORIAS.**

TUDO O QUE ESTIVER ESCRITO EM *letras minúsculas* **DEVE SER LIDO LITERALMENTE AO ENTREVISTADO**

- **AS PERGUNTAS ESTÃO EM** *letras minúsculas, itálico*
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER INSERIDAS NAS PERGUNTAS (INDICADAS POR ESPAÇO VAZIO "_____" E "PREENCHER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER LIDAS AO ENTREVISTADO DEPOIS DE SE FAZER A PERGUNTA (INDICADO POR "LER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**

  CASO TENHAM QUE SER 'LIDAS' CATEGORIAS DE RESPOSTAS MÚLTIPLAS AO ENTREVISTADO, LER PRIMEIRO TODAS AS CATEGORIAS ANTES DE DEIXAR QUE O ENTREVISTADO ESCOLHA A(S) QUE SE APLICA(M).

OS ESPAÇOS EM BRANCO PRÓXIMO DOS CÓDIGOS NUMÉRICOS DEVEM SER ASSINALADOS COM UM 'X' QUANDO SE APLICA UMA CATEGORIA DE RESPOSTA.

'*São possíveis várias respostas'* **INDICA QUE PODEM SER ESCOLHIDAS VÁRIAS CATEGORIAS DE RESPOSTAS.**

CASO O ENTREVISTADO NÃO ESTEJA DISPOSTO OU NÃO SEJA CAPAZ DE RESPONDER A UMA PERGUNTA OU SE A PERGUNTA NÃO SE APLICAR, COLOCAR

-1 PARA "NÃO SABE"/ "NÃO RESPONDEU"
-2 PARA "NÃO SE APLICA"

NO QUADRO ABAIXO, ENCONTRAM-SE CATEGORIAS DE RESPOSTAS OU CAMPO ATRIBUÍDO.

→ IR PARA Q(…) ADVERTE QUE AS PERGUNTAS SEGUINTES ATÉ À INDICADA DEVEM SER OMITIDAS.

IV. INTRODUÇÃO

IMPORTANTE! DE PREFERÊNCIA, CONTACTAR UM MEMBRO ADULTO DO AGREGADO FAMILIAR. SE DE MOMENTO NÃO ESTIVER DISPONÍVEL, TENTAR ORGANIZAR ENCONTRO PARA MAIS TARDE.

Bom dia / boa tarde, ***chamo-me****……(***DAR O NOME E APRESENTAR AS CREDENCIAIS)** *e trabalho para a COWI Moçambique que foi contratada pela NORPLAN (uma empresa de consultoria norueguesa). Estamos aqui hoje para realizar um* ***inquérito familiar****. Nós estudamos o impacto da linha de transmissão eléctrica recentemente instalada com objectivo de avaliar os Custos e Benefícios das instalações eléctricas em alguns agregados familiares seleccionados de forma aleatória.*

O inquérito servirá de avaliação de investimentos anteriores e potenciais que servirão de base para futuros projectos de desenvolvimento financiados pela Agência Norueguesa de Desenvolvimento. Para que estes projectos sejam o mais útil possível para os agregados familiares locais, dependemos fortemente de ***informação exacta, fiel*** *e abrangente. Por isso, é necessário que falemos com a pessoa com melhor conhecimento das actividades familiares.*

Toda a informação fornecida por si será tratada ***confidencialmente****.*

O nosso questionário terá uma duração máxima de ***70 minutos****.*

Está pronto para ***participar?***

SE NÃO QUISER PARTICIPAR, TERMINAR A ENTREVISTA.

SE SIM, - *Óptimo! Então vamos começar o questionário.*

HORA DE INÍCIO: (FORMATO DE 24 HORAS)			:		

A1. INFORMAÇÃO BÁSICA

	Q1. *Qual é o seu nome completo?*		***Q2.*** *Quantos anos tem?*		**NÃO FAZER A PRÓXIMA PERGUNTA SE O CHEFE DO AGREGADO FAMILIAR FOR O ENTREVISTADO!** ***Q3.*** *O chefe do agregado é do sexo masculino ou feminino?*		
1		1	ANOS		1	MASCULINO	
					2	FEMININO	

	Q4. *Qual é o tipo de cobertura tem a casa?* **LER**			***Q5.*** *Qual é o tipo de chão tem a casa?* **LER**			***Q6.*** *Qual é a fonte de energia eléctrica?* **LER**.***CONFIRME OBSERVANDO***		
	1	Betão		1	Terra / estrume de vaca		1	Ligação à rede da EDM
	2	Telhas ou lusalite		2	Betão / cimento		2	Ligação a um gerador comum
	3	Chapas de zinco		3	Outro (especificar)		3	Gerador próprio
	4	Outro (especificar)					4	Nenhum
							5	Outro (especificar)

	Q7. *Qual é o estatuto do entrevistado?* **LER**			***Q8.*** *Qual é a situação de propriedade da casa / residência?* **LER**			***Q9.*** *Há quanto tempo vive aqui?*	
	1	Chefe do agregado familiar		1	Proprietário		NÚMERO DE ANOS	
	2	Parceiro do chefe do agregado familiar		2	Aluguer	1		
	3	Outro (especificar)						

	Q10. *Dos seguintes, qual é o nível de escolarização mais elevado que tem?* **LER**			***Q11.*** *Qual é a principal fonte de renda do agregado familiar?* **LER** *É POSSÍVEL MAIS DO QUE UMA RESPOSTA*			***Q12.*** *Qual é o número de membros do agregado familiar?* *NÚMERO DE PESSOAS ENTRE*		S. MASCULINO	S. FEMININO
	0	Nenhum		1	Agricultura/pescas		1	Adultos de 18 anos ou mais		
	1	Ensino primário 1º ciclo (1ª-5ª)		2	Trabalho por conta própria		2	Adolescentes de 13-17 anos		
	2	Ensino primário 2º ciclo (6ª-7ª)		3	Emprego assalariado		3	Crianças de 5-12 anos		
	3	Ensino secundário (8ª-12ª)		4	Outro (especificar)		4	Bebés menores de 5 anos		
	4	Ensino técnico profissional								
	5	Ensino universitário								

Q13.
Perfil de gastos (Discutir durante algum tempo). Quais foram os gastos do agregado familiar no último mês referentes a

		MZN	-1/-2
1	Comida e bebida		
2	Vestuário e calçado		
3	Renda de casa		
4	Energia/ combustível (todas as fontes)		
5	Ensino/ propinas escolares		
6	Cuidados de saúde		
7	Transporte		
8	Telecomunicações		
9	Outro (especificar)		

Q14. *Na sua opinião como compara a situação económica geral do AGREGADO FAMILIAR em relação há um ano atrás?* **LER**			***Q15.*** *Na sua opinião como compara a situação económica geral da COMUNIDADE em relação há um ano atrás?* **LER**			***Q16.*** *Como é que este agregado familiar se compara economicamente com os outros nesta COMUNIDADE?* **LER**		
	1	Muito pior		1	Muito pior		1	Muito pior
	2	Um pouco pior		2	Um pouco pior		2	Um pouco pior
	3	Mesma		3	Mesma		3	Mesma
	4	Um pouco melhor agora		4	Um pouco melhor agora		4	Um pouco melhor
	5	Muito melhor agora		5	Muito melhor agora		5	Muito melhor
	6	Não sabe/ Não se aplica		6	Não sabe/ Não se aplica		6	Não sabe/ Não se aplica

COMENTÁRIOS:

B1. USO DE ENERGIA

		Q17. *Qual das seguintes fontes de energia é usada por este agregado familiar? São possíveis várias respostas.* **LER FONTE DE ENERGIA** **SE FOR USADA FONTE DE ENERGIA, FAZER AS PERGUNTAS Q18-Q20 PARA ESTA FONTE DE ENERGIA ANTES DE AVANÇAR PARA A PERGUNTA Q17 REFERENTE À FONTE DE ENERGIA SEGUINTE.**	***Q18.*** *Para qual das seguintes finalidades usa ___? São possíveis várias respostas.* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q17** **EM SEGUIDA LER A FINALIDADE**									***Q19.*** *Na semana OU mês passado, aproximadamente quanto é que este agregado familiar gastou em ___?* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q17**			***Q20.*** *Aproximadamente quantos minutos por dia OU por semana este agregado familiar gasta na aquisição de ____?* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q17**		
		FONTE DE ENERGIA	1 Iluminação	2 Cozinha	3 Rádio	4 TV	5 Telefone celular	6 Ferro de engomar	7 Geleira/congelador	8 Outro	-1 -2	1 MZN/SEMANA	2 MZN/MÊS	-1 -2	MIN POR SEMANA MASCULINO	MIN POR SEMANA FEMININO	-1 -2
	1	Lenha (comprada)															
	2	Lenha (apanhada)															
	3	Carvão / briquetes															
	4	Petróleo / querosene															
	5	Pilhas secas															
	6	Baterias de carros ou outras recarregáveis										RECARGA	RECARGA		RECARGA	RECARGA	
	7	Gás (GPL / GNL)															
	8	Diesel (Não usado para viaturas)															
	9	Gasolina (Não usado para viaturas)															
	10	Velas															
	11	Biogás															
	12	Resíduo de culturas (comprado)															
	13	Resíduo de culturas (apanhado)															
	14	Sistema fotovoltaico															
	15	Electricidade da rede															
	16	Outro (especificar)															

Q21. *Este agregado familiar usa electricidade?* ***LER***		
	0	Não → **IR PARA Q22**
	1	Sim → **IR PARA Q23**

Q22. *Que importância a electricidade TERIA para este agregado familiar?* **LER**		
	1	Não importante
	2	Importante
	3	Muito importante
	4	Não sabe/ Não se aplica

Q23. *Que importância a electricidade TEM para este agregado familiar?* **LER**		
	1	Não importante
	2	Importante
	3	Muito importante
	4	Não sabe/ Não se aplica

COMENTÁRIOS:

B2. ELECTRICIDADE DA REDE

Q24. *O agregado familiar usa energia eléctrica da rede?* **LER**		
	1	Sim, da rede nacional **→ IR PARA Q26**
	2	Sim, de uma mini-rede **→ IR PARA Q26**
	0	NÃO

Q25. *Porque razão este agregado familiar não está ligado à rede? <u>São possíveis várias respostas</u>.* **LER.** ***DEPOIS DE CONCLUIR A PERGUNTA → IR PARA Q38***		
	1	Não há rede disponível
	2	Existe rede e foi pedida uma ligação, mas ainda não foi estabelecida
	3	A electricidade não é necessária
	4	O fornecimento de electricidade através da rede é demasiado irregular
	5	O agregado familiar não consegue pagar a taxa de ligação
	6	O agregado familiar não consegue pagar os consumos

Q26. *Há quantos meses <u>OU</u> anos este agregado está ligado à rede?*		
	1	ANOS
	2	MESES

Q27. *Este agregado familiar tem a sua própria ligação ou tem acesso à rede através de uma outra ligação?* **LER**		
	1	LIGAÇÃO PRÓPRIA
	2	VIA OUTRO AGREGADO FAMILIAR
	3	VIA INSTITUIÇÃO OU EMPRESA

Q28. *Qual foi a taxa de ligação?*			
	MZN	-1/-2	
1			

Q29. *Qual foi o custo de instalações neste agregado familiar como fios, interruptores e tomadas?*		
	MZN	-1/-2
1		

Q30. *Qual dos seguintes métodos é usado para pagar o consumo de energia?* **LER**		
	1	Contador de KWh ((Kilowatt hora) pós-pago) PEDIR PARA VER O CONTADOR
	2	Contador pré-pago (pré-pago) **→ IR PARA Q33**
	3	Pagamento fixo (taxa fixa)

Q31. *Qual foi o último pagamento feito pela energia eléctrica da rede?*		
	MZN	-1/-2
1		

Q32. *Que período de consumo o seu último pagamento cobriu (ex. 2 semanas, 1 mês, 3 meses, etc.)?* **DEPOIS DE CONCLUIR A PERGUNTA → IR PARA Q34**			
	NÚMERO DE UNIDADES DE TEMPO	UNIDADE DE TEMPO (DIAS, SEMANAS ou MESES)	
1			

Q33. *No mês passado, quanto é que este agregado familiar gastou na recarga de cartões pré-pagos?*		
	MZN	-1/-2
1		

Q34. *Quantas vezes por semana se registam cortes <u>imprevistos</u>? "Cortes imprevistos" significa quaisquer interrupções de electricidade não informados com antecedência, ex. através de um plano de redução de carga do seu provedor.*		
1	VEZES	

Q35. *Algum electrodoméstico foi danificado por oscilações no fornecimento de energia eléctrica?*		
	1	SIM
	0	NÃO **→ IR PARA Q38**

Q36. *Que tipo de electrodomésticos foi danificado por oscilações no fornecimento de energia eléctrica? <u>São possíveis 3 menções</u>*		
	EQUIPAMENTO DANIFICADO	-1/-2
1		
2		
3		

Q37. *Quanto é que gastou mais ou menos com a reparação ou reaquisição de _____?* **PREENCHER EQUIPAMENTO DANIFICADO INDICADO EM Q36. ADICIONALMENTE OU COMO ALTERNATIVA, PEDIR QUE O ENTREVISTADO QUANTIFIQUE O CUSTO TOTAL DOS DANOS A OUTRO EQUIPAMENTO OU GERAL**		
	MZN	-1/-2
1		
2		
3		
4	Custo total dos danos a outro equipamento em MZN:	

COMENTÁRIOS:

B3. ENERGIA ELÉCTRICA DE GERADOR PRÓPRIO

Q38. *O agregado familiar usa energia eléctrica de gerador?*			***Q39.*** *Qual é a potência /capacidade kVA (Quilovoltampere) ou kW (Quilowatt) de cada gerador usado neste momento por este agregado familiar?* **PEDIR PARA VER O GERADOR(ES)**				***Q40.*** *Quantos horas por dia usa o _____?* **PREENCHER GERADORES USADOS CONFORME INDICADO EM Q39**				***Q41.*** *Há quantos meses ou anos este agregado familiar usa energia eléctrica de um gerador?* **USO DE GERADOR EM GERAL – NÃO NECESSARIAMENTE OS QUE ESTÃO EM USO NESSE MOMENTO**		
					kVA	kW	-1			HORAS POR DIA	-1			
1	SIM		1	Primeiro Gerador				1	Primeiro gerador			1	ANOS	
0	NÃO → **IR PARA Q43**		2	Segundo Gerador				2	Segundo gerador			2	MESES	

Q42. *No total, quanto é que este agregado familiar gastou na aquisição e instalação do(s) gerador(es), incluindo adaptações para o seu uso (tomadas, interruptores, cabos, etc.)?* ***PREENCHER GERADORES USADOS CONFORME INDICADO EM Q39***		
	MZN	-1/ -2
1		
2		

B4. ELECTRICIDADE DO SISTEMA FOTOVOLTAICO (SISTEMA SOLAR)

Q43. *O agregado familiar usa energia eléctrica de um sistema fotovoltaico?*			***Q44.*** *Qual é a capacidade de pico do sistema fotovoltaico em Wp (Watt de pico)?* **PEDIR PARA VER O PAINEL**			***Q45.*** *Há quantos meses ou anos este agregado familiar usa energia eléctrica de um sistema fotovoltaico?*				***Q46.*** *No total, quanto é que este agregado familiar gastou na aquisição e instalação do sistema fotovoltaico, incluindo adaptações para o seu uso (tomadas, interruptores, cabos, etc.)?*		
1	SIM			Wp	-1/-2	1	ANOS		-1 -2		MZN	-1/-2
0	NÃO → **IR PARA Q47**		1			2	MESES			1		

B5. ELECTRICIDADE DA BATERIA DO CARRO OU DE OUTRAS BATERIAS RECARREGÁVEIS (NÃO USADAS NA OPERAÇÃO DO PAINEL SOLAR)

Q47. *O agregado familiar usa energia eléctrica de baterias de carros ou de outras baterias recarregáveis?*			***Q48.*** *Há quantos meses ou anos este agregado familiar usa energia eléctrica de baterias de carros ou de outras baterias recarregáveis?*				***Q49.*** *Aproximadamente quantos meses ou anos dura uma bateria antes de comprar uma nova?*				***Q50.*** *Quantas vezes por semana ou por mês recarrega esta bateria?*		
											1	2	
											VEZES POR SEMANA	VEZES POR MÊS	-1 -2
1	SIM		1	ANOS		-1 -2	1	ANOS		-1 -2			
0	NÃO → **IR PARA Q52**		2	MESES			2	MESES					

Q51. *No total, quanto é que este agregado familiar gastou na aquisição da última bateria?*		
	MZN	-1 -2
1		

B6. ILUMINAÇÃO

		Q52. *Quantos dos seguintes dispositivos de iluminação este agregado familiar usa?*			***Q53.*** *Qual é o número médio de horas que usa este _____ por dia* **PREENCHER APENAS O DISPOSITIVO DE ILUMINAÇÃO USADO, CONFORME INDICADO EM Q52.**	
	DISPOSITIVO DE ILUMINAÇÃO	**QDE**	-1/-2		**TOTAL DE HORAS USADO POR DIA**	-1/-2
1	LÂMPADA ECONÓMICA					
2	LÂMPADA INCANDESCENTE (< 50W)					
3	LÂMPADA INCANDESCENTE (>= 50W)					
4	LÂMPADA FLUORESCENTE					
5	LÂMPADA SOLAR					
6	LANTERNA					
7	CANDEEIRO A PETRÓLEO					
8	LAMPARINA (PETRÓLEO/QUEROSENE)					
9	LÂMPADA A GÁS					
10	VELA	POR SEMANA				
11	Outro (especificar):					

		Q54. *Este agregado familiar usa electricidade?*
	0	Não → **IR PARA Q55**
	1	Sim → **IR PARA Q56**

		Q55. *Como acha que a electricidade iria afectar a vida diária deste agregado familiar? São possíveis várias respostas.* ***LER***	***1.*** *Horas de estudo/ trabalho*	***2.*** *Rendimentos*	***3.*** *Segurança*
	0	Nenhum efeito			
	1	Reduzido			
	2	Aumentado			

		Q56. *Como é que a electricidade afecta a vida diária deste agregado familiar? São possíveis várias respostas.* **LER**	***1.*** *Horas de estudo / trabalho*	***2.*** *Rendimentos*	***3.*** *Segurança*
	0	Nenhum efeito			
	1	Reduzido			
	2	Aumentado			

COMENTÁRIOS:

C1. FINANÇAS E MERCADOS

A PERGUNTA A SEGUIR DIZ RESPEITO AO RENDIMENTO MENSAL.

	Q57. *Qual é aproximadamente o rendimento do agregado familiar numa semana <u>má e (ou)</u> mês <u>mau</u>?*				***Q58.*** *Qual é aproximadamente o rendimento do agregado familiar numa semana <u>boa e (ou)</u> mês bom?*				***Q59.*** *Qual foi aproximadamente o rendimento do agregado familiar na <u>última</u> semana <u>e (ou)</u> no último mês?*			
		MZN	-1 -2			MZN	-1 -2			MZN	-1 -2
1	MÁ SEMANA			1	BOA SEMANA			1	ÚLTIMA SEMANA		
2	MAU MÊS			2	BOM MÊS			2	ÚLTIMO MÊS		

D1. DISPOSIÇÃO PARA PAGAR

		Q60. *Quanto estaria disposto a pagar por mês pelo seguinte serviço*													
		1	10 MZN	2	20 MZN	3	50 MZN	4	100 MZN	5	250 MZN	6	Mais, especificar	-1 -2
1	2 lâmpadas à noite													
2	2 lâmpadas 24/7													
3	2 lâmpadas, rádio e celular à noite													
4	2 lâmpadas, rádio e celular 24/7													
5	2 lâmpadas, rádio, celular e TV à noite													
6	2 lâmpadas, rádio, celular e TV 24/7													
7	2 lâmpadas, rádio, celular, TV e geleira ou outro equipamento à noite													
8	2 lâmpadas, rádio, celular, TV e geleira ou outro equipamento 24/7													
9	5 lâmpadas à noite													
10	5 lâmpadas 24/7													
11	5 lâmpadas, rádio e celular à noite													
12	5 lâmpadas rádio e celular 24/7													
13	5 lâmpadas, rádio, celular e TV à noite													
14	5 lâmpadas, rádio, celular e TV 24/7													
15	5 lâmpadas, rádio, celular, TV e geleira ou outro equipamento à noite													
16	5 lâmpadas, rádio, celular, TV e geleira ou outro equipamento 24/7													

E1. DOTAÇÃO DE CAPITAL REAL

Q61.
Qual dos seguintes bens de capital é usado por este agregado familiar?
São possíveis várias respostas.

LER

		EQUIPAMENTO	QUANTIDADE	-1 -2
	1	Rádio		
	2	Aparelhagem sonora		
	3	TV (preto e branco)		
	4	TV (colorida)		
	5	Ventoinha (de tecto, mesa) (eléctrica)		
	6	Estabilizador de voltagem		
	7	Ferro de engomar eléctrico		
	8	Ferro de engomar não eléctrico		
	9	Termoacumulador		
	10	Geleira		
	11	Congelador		
	12	Computador		
	13	Máquina de costura		
	14	Edifício (s)		
	15	Barco / Cana		
	16	Carro		
	17	Camião / Carrinha		
	18	Motorizada		
	19	Carrinho de mão		
	20	Bicicleta		
	21	Outro (especificar)		

Q62. NÃO FAZER ESTA PERGUNTA. O INQUIRIDOR DEVE AVALIAR!

Qual é a estimativa da riqueza do agregado familiar? (usar indicadores como casa, TV, motorizada, mobiliário, estado de conservação, apresentação dos filhos, etc.)

	1	Rico
	2	Menos Rico
	3	Menos Pobre
	4	Pobre

COMENTÁRIOS:

Q63. *No fim da entrevista, gostaria de acrescentar algum aspecto importante ou comentário sobre o questionário ou o inquiridor?*

ENTREVISTA		Completa
		Incompleta

HORA DE CONCLUSÃO: (Formato de 24 horas)			:		

AGRADECER O ENTREVISTADO!

OBSERVAÇÕES DO INQUIRIDOR:

COMENTÁRIOS GERAIS:

NORPLAN	**QUESTIONÁRIO NÚMERO**	
	I. LOCALIZAÇÃO DA INSTITUIÇÃO	
	CÓDIGO DO PAÍS: MOZ	
	PROVÍNCIA:	
	DISTRITO:	
	ALDEIA/VILA:	

II. IDENTIFICAÇÃO DO INQUIRIDOR DE CAMPO

NOME	ID DO INQUIRIDOR	DATA MÊS / DIA / ANO	ASSINATURA
	#		

III. INSTRUÇÕES IMPORTANTES PARA O INQUIRIDOR DE CAMPO

TUDO O QUE ESTIVER ESCRITO EM LETRAS MAIÚSCULAS É INFORMAÇÃO APENAS PARA O INQUIRIDOR E NÃO DEVE SER LIDO AO ENTREVISTADO.

- **AS INSTRUÇÕES DIRIGIDAS AO INQUIRIDOR ESTÃO EM LETRAS MAIÚSCULAS, NEGRITO.**
- **AS CATEGORIAS DE RESPOSTA QUE NÃO DEVEM SER LIDAS AO ENTREVISTADO ENCONTRAM-SE EM** LETRAS MAIÚSCULAS **NORMAIS. O PRÓPRIO INQUIRIDOR DEVE ATRIBUIR AOS ENTREVISTADOS RESPOSTAS ÀS CATEGORIAS.**

TUDO O QUE ESTIVER ESCRITO EM letras minúsculas **DEVE SER LIDO LITERALMENTE AO ENTREVISTADO**

- **AS PERGUNTAS ESTÃO EM** *letras minúsculas, itálico*
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER INSERIDAS NAS PERGUNTAS (INDICADAS POR ESPAÇO VAZIO "_____" E "PREENCHER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER LIDAS AO ENTREVISTADO DEPOIS DE SE FAZER A PERGUNTA (INDICADO POR "LER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**

  CASO TENHAM QUE SER 'LIDAS' CATEGORIAS DE RESPOSTAS MÚLTIPLAS AO ENTREVISTADO, LER PRIMEIRO TODAS AS CATEGORIAS ANTES DE DEIXAR QUE O ENTREVISTADO ESCOLHA A(S) QUE SE APLICA(M).

OS ESPAÇOS EM BRANCO PRÓXIMO DOS CÓDIGOS NUMÉRICOS DEVEM SER ASSINALADOS COM UM 'X' QUANDO SE APLICA UMA CATEGORIA DE RESPOSTA.

'*São possíveis várias respostas'* **INDICA QUE PODEM SER ESCOLHIDAS VÁRIAS CATEGORIAS DE RESPOSTAS.**

CASO O ENTREVISTADO NÃO ESTEJA DISPOSTO OU NÃO SEJA CAPAZ DE RESPONDER A UMA PERGUNTA OU SE A PERGUNTA NÃO SE APLICAR, COLOCAR

-1 PARA "NÃO SABE"/ "NÃO RESPONDEU"
-2 PARA "NÃO SE APLICA"

NO QUADRO ABAIXO, ENCONTRAM-SE CATEGORIAS DE RESPOSTAS OU CAMPO ATRIBUÍDO.

→ IR PARA A Q(…) ADVERTE QUE AS PERGUNTAS SEGUINTES ATÉ À INDICADA DEVEM SER OMITIDAS.

IV. INTRODUÇÃO

IMPORTANTE! DE PREFERÊNCIA, CONTACTAR UM DIRIGENTE DA INSTITUIÇÃO. SE DE MOMENTO NÃO ESTIVER DISPONÍVEL, TENTAR ORGANIZAR ENCONTRO PARA MAIS TARDE.

Bom dia / boa tarde, ***chamo-me*** *……* (**DAR O NOME E APRESENTAR AS CREDENCIAIS)** *e trabalho para a COWI Moçambique que foi contratada pela NORPLAN (uma empresa de consultoria norueguesa). Estamos aqui hoje para realizar um* ***inquérito às instituições****. Nós estudamos o impacto da linha de transmissão eléctrica recentemente instalada com objectivo de avaliar os Custos e Benefícios das instalações eléctricas em cerca de 100 instituições seleccionadas de forma aleatória.*

O inquérito servirá de avaliação de investimentos anteriores e potenciais que servirão de base para futuros projectos de desenvolvimento financiados pela Agência Norueguesa de Desenvolvimento. Para que estes projectos sejam o mais útil possível para todos os sectores da comunidade, incluindo as instituições, dependemos fortemente de ***informação exacta, fiel*** *e abrangente. Por isso, é necessário que falemos com a pessoa com melhor conhecimento das actividades da instituição.*

O nosso questionário terá uma duração máxima de ***70 minutos****.*

Está pronto para ***participar****?*

SE NÃO QUISER PARTICIPAR, TERMINAR A ENTREVISTA.

SE SIM, *- Óptimo! Então vamos começar o questionário..*

HORA DE INÍCIO:: (FORMATO DE 24 HORAS)			:		

Q1. *Qual é a função desta instituição?*		1	Escola → **IR PARA Q2**
		0	Centro de saúde → **IR PARA Q17**

A1. INFORMAÇÃO BÁSICA: ESCOLA

Q2. ***Qual é o nome desta escola?***	1	
Q3. ***Que cargo ocupa na escola?***	1	

Q4. *Qual é a idade aproximada da escola?*		
	1	0 ANOS < IDADE ≤ 1 ANO
	2	1 ANO < IDADE ≤ 3 ANOS
	3	3 ANOS < IDADE ≤ 5 ANOS
	4	5 ANOS < IDADE ≤ 10 ANOS
	5	10 ANOS < IDADE ≤ 20 ANOS
	6	IDADE > 20 ANOS

Q5. *Quantos dias por semana são dadas aulas normalmente?*	
1	

Q6. *A que horas começa normalmente o dia na escola?* **FORMATO DE 24 HORAS**	1			:		

Q7. *A que horas termina normalmente o dia na escola?* **FORMATO DE 24 HORAS**	1			:		

Q8. ***Nos últimos 12meses, por quantos meses a escola não esteve aberta??***		***Q9.*** *Neste momento, quantas pessoas trabalham nesta escola <u>sem contar consigo</u>?*		
1	NÚMERO DE MESES	1	MASCULINO	
		2	FEMININO	

Q10. *Que tipo de escola é esta?* **LER**			***Q11.*** *Quantos alunos do sexo masculino e feminino existem nesta escola?*			***Q12.*** *Quantos professores tem?*	***Q13.*** *Quantas salas de aula tem?*	***Q14.*** *Quantos alunos tem?*	***Q15.*** *Quantos alunos internos tem?* ***(ALUNOS INTERNOS, CASO EXISTAM, DEVEM SER CONTADOS NA Q14 E Q15)*** → **DEPOIS DE RESPONDER ÀS PERGUNTAS, IR PARA Q31**
	1	Primária	1	MASCULINO		NÚMERO DE PROFESSORES	NÚMERO DE SALAS DE AULA	NÚMERO DE ALUNOS	NÚMERO DE ALUNOS INTERNOS
	2	Secundária	2	FEMININO					
	3	Técnica/profissional							
	4	Internato							

COMENTÁRIOS:

A2. INFORMAÇÃO BÁSICA: CENTRO DE SAÚDE

Q17. *Qual é o nome deste centro de saúde?*	1	

Q18. *Qual é a idade aproximada do centro de saúde?*		
	1	0 ANOS < IDADE ≤ 1 ANO
	2	1 ANO < IDADE ≤ 3 ANOS
	3	3 ANOS < IDADE ≤ 5 ANOS
	4	5 ANOS < IDADE ≤ 10 ANOS
	5	10 ANOS < IDADE ≤ 20 ANOS
	6	IDADE > 20 ANOS

Q19. *Quantos dias por semana o centro de saúde funciona normalmente?*	
1	

Q20. *A que horas o centro de saúde normalmente começa a funcionar?* **FORMATO DE 24 HORAS**	1		:		
Q21. *A que horas o centro de saúde normalmente termina as suas actividades?* **FORMATO DE 24 HORAS**	1		:		

Q22. *O centro de saúde esteve a funcionar <u>todos</u> os últimos 12 meses?*			***Q23.*** *Durante quantos dos últimos 12 meses o centro de saúde <u>não</u> esteve a funcionar?*		***Q24.*** *Porque razão o centro de saúde não esteve a funcionar durante todos os 12 meses?*			***Q25.*** *Neste momento, quantas pessoas trabalham neste centro de saúde, <u>sem contar consigo</u>?*	
	1	SIM → **IR PARA Q25**	1	NÚMERO DE MESES		1	A instituição abriu há menos de 12 meses	1	
	0	NÃO				2	Outro (especificar)		

Q26. *Existem instalações para o alojamento pessoal?*			***Q27.*** *A unidade sanitária tem doentes internados?*			***Q28.*** *Qual é o número de mulheres atendidas na maternidade por mês?*
	1	SIM (Especificar Número)		1	SIM (Especificar Número)	NÚMERO DE MULHERES
	0	NÃO		2	NÃO	

Q29.
*A sua unidade sanitária presta os seguintes serviços? (***SÃO POSSÍVEIS VÁRIAS RESPOSTAS***)* **LER**

		SERVIÇOS
	1	Atendimento diurno
	2	Atendimento nocturno
	3	Pequena cirurgia
	4	Vacinação
	5	Exames de laboratório
	6	Estomatologia
	7	Partos
	8	Pré- natal
	9	Pós-natal
	10	Outro

Q30.
Número total de pessoas que trabalham na unidade sanitária
LER

	PESSOAL		-1/-2
1	Médicos		
2	Técnico de medicina		
3	Enfermeiro chefe		
4	Enfermeiros		
5	Parteiras		
6	Outros (Especificar)		

COMENTÁRIOS:

B1. ENERGIA

			Q31. *Qual das seguintes fontes de energia é usada por esta instituição? São possíveis várias respostas.* **LER FONTE DE ENERGIA** **SE FOR USADA FONTE DE ENERGIA, FAZER AS PERGUNTAS Q32-Q34 PARA ESTA FONTE DE ENERGIA ANTES DE AVANÇAR PARA A PERGUNTA Q31 REFERENTE À FONTE DE ENERGIA SEGUINTE.**	***Q32.*** *Para qual das seguintes finalidades usa ___? São possíveis várias respostas.* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q31** **EM SEGUIDA LER FINALIDADE**							***Q33.*** *Na semana OU mês passado, aproximadamente quanto é que esta instituição gastou em ___?* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO NA PERGUNTA Q31**			***Q34.*** *Aproximadamente quantos minutos por dia OU por semana esta instituição gasta na aquisição de ____?* **PREENCHER FONTE DE ENERGIA CONFORME INDICADO EM Q31**	
		FONTE DE ENERGIA	1 Iluminação	2 Cozinha	3 Rádio	4 TV	5 Celular	6 Equipamento	-1 -2	1 MZN/SEMANA	2 MZN/MÊS	-1 -2	MIN POR SEMANA	-1 -2
	1	Lenha (comprada)												
	2	Lenha (apanhada)												
	3	Carvão / briquetes												
	4	Petróleo / querosene												
	5	Pilhas secas												
	6	Baterias de carros ou outras recarregáveis								RECARGA	RECARGA		RECARGA	
	7	Gás (LPG / GNL)												
	8	Diesel (Não usado para viaturas)												
	9	Gasolina (Não usado para viaturas)												
	10	Velas												
	11	Biogás												
	12	Vegetação / Capim(comprado)												
	13	Vegetação / Capim (apanhado)												
	14	Sistema fotovoltaico												
	15	Electricidade da rede												
	16	Outro (especificar)												

Q35. *Esta instituição usa electricidade?*		
	0	Não → **IR PARA Q36**
	1	Sim → **IR PARA Q37**

Q36. *Que importância a <u>electricidade</u> TERIA para o funcionamento desta instituição?* **LER**		
	1	Não importante
	2	Importante
	3	Muito importante

Q37. *Que importância a <u>electricidade</u> TEM para o funcionamento desta instituição?* **LER**		
	1	Não importante
	2	Importante
	3	Muito importante
	4	Não pode funcionar sem ela

COMENTÁRIOS:

B2. ELECTRICIDADE DA REDE

Q38. *A instituição usa energia eléctrica da rede??*		***Q39.*** *Porque razão esta instituição não está ligada à rede? <u>São possíveis várias respostas</u>* **LER** **DEPOIS DE CONCLUIR A PERGUNTA → IR PARA Q52**	
1	Sim, da rede nacional → **IR PARA Q40**	1	Não há rede disponível
0	Não → **IR PARA Q39**	2	Existe rede e foi pedida uma ligação, mas ainda não foi estabelecida
		3	A electricidade não é necessária para o funcionamento da instituição
		4	O fornecimento de electricidade através da rede é demasiado irregular
		5	A instituição não consegue pagar a taxa de ligação
		6	A instituição não consegue pagar os consumos

Q40. *Há quantos meses <u>OU</u> anos esta instituição está ligada à rede?*			***Q41.*** *Esta instituição tem a sua própria ligação ou tem acesso à rede através de uma outra ligação?* **LER**			***Q42.*** *Qual foi a taxa de ligação?*			***Q43.*** *Qual foi o custo de instalações nesta instituição como fios, interruptores e tomadas?*		
1	ANOS		1	LIGAÇÃO PRÓPRIA		MZN	-1/-2		MZN	-1/-2
2	MESES		2	VIA OUTRA INSTITUIÇÃO	1			1		
			3	VIA INSTITUIÇÃO						

Q44. *Qual dos seguintes métodos é usado para pagar o consumo de energia?* **LER**			***Q45.*** *Qual foi o valor do último pagamento feito pela energia eléctrica da rede?*			***Q46.*** *A que período de consumo o seu último pagamento se refere (ex. 2 semanas, 1 mês, 3 meses, etc.)?* **DEPOIS DE CONCLUIR A PERGUNTA → IR PARA Q48**			***Q47.*** *No mês passado, quanto é que esta instituição gastou na recarga de cartões pré-pagos?*		
1	Contador de KWh (pós-pago***)*** **PEDIR PARA VER O CONTADOR**		MZN	-1/-2		NÚMERO DE UNIDADES DE TEMPO	UNIDADE DE TEMPO (DIAS, SEMANAS, MESES,…)		MZN	-1/-2
2	Contador pré-pago (pré-pago) → **IR PARA Q47**	1			1			1		
3	Pagamento fixo (taxa fixa)									

Q48. *Quantas vezes por semana se registam cortes <u>imprevistos</u>? "Cortes imprevistos" significa quaisquer interrupções de electricidade não informados com antecedência, ex. através de um plano de redução de carga do seu provedor.*		***Q49.*** *Algum equipamento foi danificado por oscilações no fornecimento de energia eléctrica?*			***Q50.*** *Que tipo de equipamento foi danificado por oscilações no fornecimento de energia eléctrica? <u>São possíveis várias respostas</u>*			***Q51.*** *Quanto é que gastou mais ou menos com a reparação ou reaquisição de _____?* **PREENCHER EQUIPAMENTO DANIFICADO INDICADO EM Q50. ADICIONALMENTE OU COMO ALTERNATIVA, PEDIR QUE O ENTREVISTADO QUANTIFIQUE O CUSTO TOTAL DOS DANOS A OUTRO EQUIPAMENTO, CASO EXISTA**		
1	VEZES	1	SIM		EQUIPAMENTO DANIFICADO	-1/-2		MZN	-1/-2
		0	NÃO → **IR PARA Q52**	1			1		
				2			2		
				3			3		
							4	Custo total dos danos a outro equipamento in MZN:	

COMENTÁRIOS:

B3. ELECTRICIDADE DE GERADOR PRÓPRIO

Q52. *A instituição usa energia eléctrica de um gerador?*			***Q53.*** *Qual é a potência /capacidade kVA (Quilovoltampere) <u>ou</u> kW (Quilowatt) de <u>cada</u> gerador usado neste momento por esta instituição?* **PEDIR PARA VER O(S) GERADOR(ES)**				***Q54.*** *Quantas horas por dia usa o _____?* **PREENCHER GERADOR USADO CONFORME INDICADO EM Q53**		***Q55.*** *Há quantos meses <u>ou</u> anos esta instituição usa energia eléctrica de um <u>gerador</u>?* **USO DE GERADOR EM GERAL – <u>NÃO NECESSARIAMENTE OS QUE ESTÃO EM USO NESSE MOMENTO</u>**		
					kVA	kW	-1/ -2	H POR DIA	-1/-2			
1	SIM		1	Primeiro Gerador						1	ANOS	
0	NÃO → **IR PARA Q57**		2	Segundo Gerador						2	MESES	
			3	Terceiro Gerador								
			4	Quarto Gerador								

Q56. *No total, quanto é que <u>esta instituição</u> gastou na aquisição e instalação do(s) gerador(es), incluindo adaptações para o seu uso (tomadas, interruptores, cabos, etc.)?* ***PREENCHER GERADORES USADOS CONFORME INDICADO EM Q53***		
	MZN	-1/ -2
1		
2		
3		
4		

B4. ELECTRICIDADE DO SISTEMA FOTOVOLTAICO (SISTEMA SOLAR)

Q57. *A instituição usa energia eléctrica de um sistema fotovoltaico?*			***Q58.*** *Qual é a capacidade de pico do sistema fotovoltaico em Wp (Watt pico)?* **PEDIR PARA VER O PAINEL**			***Q59.*** *Há quantos meses <u>ou</u> anos esta instituição usa energia eléctrica de um sistema fotovoltaico?*			***Q60.*** *No total, quanto é que <u>esta instituição</u> gastou na aquisição e instalação do sistema fotovoltaico, incluindo adaptações para o seu uso (tomadas, interruptores, cabos, etc.)?*		
					-1/-2					MZN	-1/-2
1	SIM		1	Wp		1	ANOS		1		
0	NÃO → **IR PARA Q61**					2	MESES				

B5. ELECTRICIDADE DA BATERIA DO CARRO OU DE OUTRAS BATERIAS RECARREGÁVEIS (<u>NÃO USADAS NA OPERAÇÃO DO PAINEL SOLAR</u>)

Q61. *A instituição usa energia eléctrica de baterias de carros ou de outras baterias recarregáveis?*			***Q62.*** *Há quantos meses <u>ou</u> anos esta instituição usa energia eléctrica de baterias de carros ou de outras baterias recarregáveis?*			***Q63.*** *Aproximadamente quantos meses <u>ou</u> anos dura uma bateria antes de comprar uma nova?*			***Q64.*** *Quantas vezes por semana <u>ou</u> por mês recarrega esta bateria?*		
									1	2	
									VEZES POR SEMANA	VEZES POR MÊS	-1/-2
1	SIM		1	ANOS		1	ANOS				
0	NÃO → **IR PARA Q66**		2	MESES		2	MESES				

Q65. *No total, quanto é que esta instituição gastou na aquisição da última bateria?*		
	MZN	-1/ -2
1		

B6. ILUMINAÇÃO

	Q66. *Quantos dos seguintes dispositivos de iluminação esta instituição usa?* **LER**			***Q67.*** *Qual é o número médio de horas que usa este _____ por dia* **PREENCHER APENAS O DISPOSITIVO DE ILUMINAÇÃO USADO, CONFORME INDICADO EM Q66.**	
	DISPOSITIVO DE ILUMINAÇÃO	**QUANTIDADE**	-1/-2	**TOTAL DE HORAS USADO POR DIA**	-1/-2
1	LÂMPADA ECONÓMICA				
2	LÂMPADA INCANDESCENTE (< 50W)				
3	LÂMPADA INCANDESCENTE (>= 50W)				
4	LÂMPADA FLUORESCENTE				
5	LÂMPADA SOLAR				
6	LANTERNA				
7	LANTERNA HURRICANE CANDEEIRO A PETRÓLEO				
8	LAMPARINA (PETRÓLEO/QUEROSENE)				
9	LÂMPADA A GÁS				
10	VELA	POR SEMANA			
11	Outro (especificar):				

	Q68. *Esta instituição usa electricidade?* ***LER***
0	Não → **IR PARA Q69**
1	Sim → **IR PARA Q70**

		Q69. *Como acha que a electricidade poderia afectar as operações desta instituição? São possíveis várias respostas* ***LER***	***1.*** *Horas de trabalho*	***2.*** *Serviço*	***3.*** *Segurança*
	0	Nenhum efeito			
	1	Reduzido			
	2	Aumentado			

		Q70. *Como acha que a electricidade afecta as operações desta instituição? São possíveis várias respostas* **LER**	***1.*** *Horas de trabalho*	***2.*** *Serviço*	***3.*** *Segurança*
	0	Nenhum efeito			
	1	Reduzido			
	2	Aumentado			

COMENTÁRIOS:

C1. COMUNICAÇÃO

EXPLICAR: *A seguir, gostaríamos de saber quais são os meios de comunicação utilizados por esta instituição. Estes incluem meios de comunicação próprios ou alugados por esta instituição, bem como os meios de comunicação que são usados noutros lugares que não sejam a própria instituição, ou seja, internet café, serviço de telefones, etc.*

Q71. *Aproximadamente quantas vezes por dia ou semana esta instituição usa os seguintes meios de comunicação para fins relacionados com os serviços que presta* ***?*** **LER**

INDICAR O NÚMERO DE VEZES POR DIA OU POR SEMANA NO LOCAL APLICÁVEL.

		1	2	3	4	5	6
		Telefone fixo	Fax	Internet	Celular	Rádio Transmissor	Serviço Postal
1	VEZES POR DIA						
2	VEZES POR SEMANA						
	-1 / -2						

Q72. *Qual e quantos destes meios de comunicação a instituição possui ou aluga e usa?*

LER TODOS OS MEIOS DE COMUNICAÇÃO INDICADOS EM Q55 E PREENCHER NO LOCAL APLICÁVEL.

	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2	QUANTIDADE	-1 -2

D1. DOTAÇÃO DE CAPITAL REAL

Q73.
Qual e quantos dos seguintes bens de capital **(EXCLUINDO OS MEIOS DE COMUNICAÇÃO)** *a instituição possui ou aluga e usa?* **LER**

		BEM DE CAPITAL	QUANTIDADE	-1 -2
	1	Rádio		
	2	Aparelhagem sonora		
	3	TV (preto e branco)		
	4	TV (colorida)		
	5	Ventoinha (de tecto, mesa) (eléctrica)		
	6	Estabilizador		

		BEM DE CAPITAL	QUANTIDADE	-1 -2
	7	Edifício(s)		
	8	Barco / Cana		
	9	Carro		
	10	Camião / Carrinha		
	11	Motorizada		
	12	Carrinho de mão		
	13	Bicicleta		

Q74.
Quais e quantos bens de capital específicos à actividade a instituição possui ou aluga e usa? **LER**
Ex. Leitor de DVD, Ferro de engomar (especificar se a carvão ou eléctrico), Congelador, Geleira, Moageira (especificar se eléctrica ou manual), Forno (especificar se eléctrico, a carvão ou lenha), Máquina de costura (especificar se eléctrica ou manual), Ferro de soldar, Fogão (especificar se eléctrico, a carvão, querosene ou lenha), Aparelho de vídeo, Aquecedor de água (eléctrico)

BEM DE CAPITAL	QUANTIDADE	-1 -2

COMENTÁRIOS:

E1. INFORMAÇÃO DO ENTREVISTADO

	Q75. *Qual é o seu nome completo?*	***Q76.*** *Quantos anos tem?*		**NÃO FAZER A PRÓXIMA PERGUNTA SE O DIRIGENTE DA INSTITUIÇÃO FOR O ENTREVISTADO!** ***Q77.*** *O dirigente é do sexo masculino ou feminino?*		
1			ANOS		1	MASCULINO
		1			0	FEMININO

Q78. *Dos seguintes, qual é o nível de escolarização mais elevado que recebeu?* **LER**			***Q79.*** *Possui menos de 3 ou 3 ou mais anos de experiência no ramo de actividades da instituição?*			***Q80.*** *Qual foi o orçamento desta instituição no último mês?*		
	0	Nenhum		1	< 3 ANOS		MZN	-1/-2
	1	Ensino primário		0	≥ 3 ANOS	1		
	2	Ensino secundário						
	3	Ensino terciário						
	4	Ensino técnico profissional						
	5	Ensino universitário						

COMENTÁRIOS:

Q81. *No fim da entrevista, gostaria de acrescentar algum aspecto importante ou comentário sobre o questionário ou o inquiridor?*

ENTREVISTA		Completa
		Incompleta

HORA DE CONCLUSÃO: (FORMATO DE 24 HORAS) ____ : ____

AGRADECER O ENTREVISTADO!

OBSERVAÇÕES DO INQUIRIDOR

COMENTÁRIOS GERAIS:

NORPLAN	QUESTIONÁRIO NÚMERO	
	I. LOCALIZAÇÃO DA ALDEIA	
	CÓDIGO DO PAÍS: MOZ	
	PROVÍNCIA:	
	DISTRITO:	
	ALDEIA/VILA:	

II. IDENTIFICAÇÃO DO INQUIRIDOR DE CAMPO

NOME	ID DO INQUIRIDOR	DATA MÊS / DIA /ANO	ASSINATURA
	#		

III. INSTRUÇÕES IMPORTANTES PARA O INQUIRIDOR DE CAMPO

TUDO O QUE ESTIVER ESCRITO EM <u>LETRAS MAIÚSCULAS</u> É INFORMAÇÃO APENAS PARA O INQUIRIDOR E NÃO DEVE SER LIDO AO ENTREVISTADO.

- **AS <u>INSTRUÇÕES</u> DIRIGIDAS AO INQUIRIDOR ESTÃO EM <u>LETRAS MAIÚSCULAS, NEGRITO</u>.**
- **AS <u>CATEGORIAS DE RESPOSTA</u> QUE NÃO DEVEM SER LIDAS AO ENTREVISTADO ENCONTRAM-SE EM** <u>LETRAS MAIÚSCULAS</u> **NORMAIS. O PRÓPRIO INQUIRIDOR DEVE ATRIBUIR AOS ENTREVISTADOS RESPOSTAS ÀS CATEGORIAS.**

TUDO O QUE ESTIVER ESCRITO EM letras minúsculas **DEVE SER LIDO <u>LITERALMENTE</u> AO ENTREVISTADO**

- **AS PERGUNTAS ESTÃO EM** *letras minúsculas, itálico*
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER INSERIDAS NAS PERGUNTAS (INDICADAS POR ESPAÇO VAZIO "_____" E "PREENCHER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**
- **AS CATEGORIAS DE RESPOSTAS QUE DEVEM SER LIDAS AO ENTREVISTADO DEPOIS DE SE FAZER A PERGUNTA (INDICADO POR "LER") ESTÃO EM** letras minúsculas **(NÃO ITÁLICO).**

  CASO TENHAM QUE SER 'LIDAS' CATEGORIAS DE RESPOSTAS MÚLTIPLAS AO ENTREVISTADO, LER PRIMEIRO <u>TODAS</u> AS CATEGORIAS <u>ANTES</u> DE DEIXAR QUE O ENTREVISTADO ESCOLHA A(S) QUE SE APLICA(M).

OS ESPAÇOS EM BRANCO PRÓXIMO DOS CÓDIGOS NUMÉRICOS DEVEM SER ASSINALADOS COM UM 'X' QUANDO SE APLICA UMA CATEGORIA DE RESPOSTA.

'*<u>São possíveis várias respostas'</u>* **INDICA QUE PODEM SER ESCOLHIDAS VÁRIAS CATEGORIAS DE RESPOSTAS.**

CASO O ENTREVISTADO NÃO ESTEJA DISPOSTO OU NÃO SEJA CAPAZ DE RESPONDER A UMA PERGUNTA OU SE A PERGUNTA NÃO SE APLICAR, COLOCAR

-1 PARA "NÃO SABE"/ "NÃO RESPONDEU"
-2 PARA "NÃO SE APLICA"

<u>NO QUADRO ABAIXO, ENCONTRAM-SE CATEGORIAS DE RESPOSTAS OU CAMPO ATRIBUÍDO.</u>.

<u>→ IR PARA Q(…)</u> ADVERTE QUE AS PERGUNTAS SEGUINTES ATÉ À INDICADA DEVEM SER OMITIDAS.

IV. INTRODUÇÃO

IMPORTANTE! PROCURAR CONTACTAR UM DOS <u>LÍDERES</u> DA ALDEIA. SE DE MOMENTO NÃO ESTIVER DISPONÍVEL, TENTAR ORGANIZAR ENCONTRO PARA MAIS TARDE.

Bom dia / boa tarde / boa noite, ***chamo-me*****.....(DAR O NOME E APRESENTAR AS CREDENCIAIS)** *e trabalho para a COWI Moçambique que foi contrata pela NORPLAN (uma empresa de consultoria norueguesa. Estamos aqui hoje para realizar um* ***inquérito****. Nós estudamos o impacto da linha de transmissão eléctrica recentemente instalada para avaliar os Custos e Benefícios das instalações de capacidade de transmissão adicional em aldeias seleccionadas de forma aleatória.*

O inquérito servirá de avaliação de investimentos anteriores e potencialmente como base para futuros projectos de desenvolvimento executados pela Agência Norueguesa de Desenvolvimento. Para que estes projectos sejam o mais útil possível para as instituições locais, dependemos fortemente de ***informação exacta, fiel*** *e abrangente. Por isso, é necessário que falemos com a pessoa com a melhor visão das actividades da instituição.*

O nosso questionário terá uma duração máxima de ***30 minutos****.*

Está pronto para ***participar****?*

SE NÃO QUISER PARTICIPAR, TERMINAR A ENTREVISTA.

SE SIM, *- Óptimo! Então vamos começar o questionário.*

HORA DE INÍCIO: (FORMATO DE 24 HORAS)			:		

A1. INFORMAÇÕES SOBRE A ALDEIA

	Q1. *Qual é o seu nome completo?*	***Q2.*** *Quantos anos tem?*		***Q3.*** *O entrevistado é do sexo masculino ou feminino?*		
1			ANOS		1	MASCULINO
		1			0	FEMININO

Q4. *Qual é o estatuto do entrevistado?*			***Q5.*** *Qual é a população da aldeia?*	***Q6.*** *Qual é a situação das estradas?*		
	1	Representante do Governo	NÚMERO DE AGREGADOS FAMILIARES		1	Pavimentadas
	2	Chefe da aldeia			0	Não pavimentadas
	3	Outro (especificar)		***Q7.*** *As estradas são transitáveis durante todo o ano?*		
					1	Sim
					0	Não

Q8. *Existe um governo local / autoridade na aldeia?*			***Q9.*** *Foram implementados projectos de infra-estrutura, ou seja, abastecimento de água, estradas, pontes, etc., nos últimos 8 anos?*			***Q10.*** *Os projectos que foram implementados ainda funcionam?*		
	1	Sim		1	Sim		1	Sim
	0	Não → **IR PARA Q11**		0	Não → **IR PARA Q11**		0	Não

Q11. *Existe na aldeia…?*		
	1	Administração local
	2	Casa da comunidade
	3	Igreja
	4	Esquadra da polícia
	5	Prisão
	6	Acampamento militar

Q12. *Existe abastecimento de água organizado na aldeia?*		
	1	Sim
	0	Não

Q13. *É usada electricidade para bombear a água?*		
	1	Sim
	0	Não

Q14. *Estão presentes ONG na aldeia?*		
	1 NOME	2 ACTIVIDADE
1		
2		
3		
4		
5		
6		

Q15. *Existem instituições de microfinanças na aldeia?*				
	1	Sim		-1/-2
	0	Não		

Q16.
Existem empresários ou empreendedores na aldeia?

	NOME	ACTIVIDADE	CONTACTO (NOME E TELEFONE)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Q17.
Pode apresentar uma lista de alguns dos desenvolvimentos que tiveram lugar nos últimos 5 anos que foram da iniciativa da comunidade? **LER**

	1	Estradas
	2	Pontes
	3	Poços
	4	Escola
	5	Centro de saúde
	6	Casa da comunidade
	7	Igreja / casa paroquial
	8	Centro da juventude
	9	Outro (Especificar)

Q18.
Pode apresentar uma lista de alguns dos novos desenvolvimentos que empresários ou empreendedores trouxeram para a aldeia nos últimos 5 anos (ou seja, abertura de uma loja, compra de uma moageira, venda de um sistema solar? **LER**

	1	Novas lojas
	2	Novas moageiras
	3	Venda de sistemas solares domésticos
	4	Novos restaurantes
	5	Novas oficinas
	6	Outro (Especificar)

Q19.
Como são satisfeitas as necessidades de energia da população em geral?

	1	Lenha
	2	Carvão
	3	Querosene
	4	GNL
	5	Bateria de carro
	6	Pilhas secas
	7	Outro (especificar)

Q20.
Existem sistemas solares na aldeia?

	1	Sim
	0	Não → **IR PARA Q22**

Q21.
Quantos sistemas solares existem na aldeia?

NÚMERO DE SISTEMAS SOLARES	-1 -2

Q22.
Existem geradores na aldeia?

	1	Sim
	0	Não → **IR PARA 24**

Q23.
Quantos geradores existem na aldeia?

NÚMERO DE GERADORES	-1 -2

Q24. *Há actividades de desenvolvimento na aldeia que não tenha sido capaz de realizar devido à falta de energia eléctrica?*		
	1	Moagem
	2	Carpintaria
	3	Oficina de soldagem / metais
	4	Refrigeração / recolha de leite
	5	Processamento de produtos agrícolas / produção de lacticínios
	6	Carregar baterias
	7	Processamento de madeira
	8	Outro (Especificar)

Q25. *No fim da entrevista, gostaria de acrescentar algum aspecto importante ou comentário sobre o questionário ou o inquiridor?*

ENTREVISTA		Completa
		Incompleta

HORA DE CONCLUSÃO: (Formato de 24 horas)			**:**		

AGRADECER O ENTREVISTADO!

OBSERVAÇÕES DO INQUIRIDOR:

COMENTÁRIOS GERAIS:

APPENDIX E: FOCUS GROUP DISCUSSION GUIDE

Focus Group Guide

I. ABOUT FOCUS GROUP DISCUSSIONS IN GENERAL

The purpose of these Focus Group Discussions is to extract additional information on issues that were not addressed in the quantitative structured interviews. The survey team should create discussions based on before-after completion of project comparisons and retrospective questions.

Specifically, we are looking for the following:

i) gathering opinions, beliefs, perceptions, benefits, and impacts of rural electrification;

ii) testing existing assumptions on the impacts of rural electrification;

iii) encouraging discussions on the topics mentioned above, and

iv) providing an opportunity to learn about impacts directly from the rural beneficiaries.

The discussions and findings should be summarised in Focus Group Reports that finally will be compiled and submitted to Norplan.

II. METHODOLOGICAL GUIDELINES

Background

The goal of the Focus Groups is to get an impression of what electrification does and what it does not do. The qualitative investigation should therefore focus on the supply chain inside the community of the produced goods and services. The guiding question is to what extent the value added that remains in the community increases. In other words, it is important to learn about the degree to which the increased access to electricity through extension of the grid enables certain tasks to be carried out *locally*, instead of not being carried at all, or being carried out outside the community.

Furthermore, light should be shed on indirect effects on the side of consumers in the community and other firms potentially suffering from competing for the same customers.

In other words, how is the production process (in a wider, economic sense) affected? Do the firms produce new products? To who are they sold (locally or "exported"? Why were these products not produced before?

Finally, the Focus Groups should also elaborate on how electricity has impacted the local community at large.

Study guidelines

i) Number of groups and selection of participants

2-3 such Focus Groups should be held in each of the two study areas (Namacurra area and Cuamba – Lichinga area). In addition, there should be one women-only focus group in each of the areas, preferably lead by a woman facilitator.

Each focus group should consist of:

- 3-4 non-randomly selected business owners (see note on selection below) AND
- 3-4 representatives for the community (village chief, representative from education and health services).

- The Field Team Leader should pick the participants of the Focus Groups (business owners, representatives from health and education sectors and local leaders). The information obtained from village leaders during structured interviews could be helpful here. Make sure these are the actual OWNERS of businesses or LEADERS of educational/health institutions with full insight into their operation.

  The selection of firms should, as far as possible, somehow represent the following types of **formal <u>and</u> informal** businesses:

  ✓ Winners (those that cannot produce without electricity and that offer new products)

  ✓ Losers (those that do connect to the grid but that only face higher costs without benefiting from electricity)

  ✓ "Ordinary" user (firms that already existed before and that uses electricity to produce more or faster or other better products

  ✓ Unconnected firms

  ✓ Firms owned by women

  Suggestion of firms to be included: Fish cooling facility, wood industry, carpenter, restaurant. Possibly a pharmacy, a barber, and some of the retailers. Also maybe some repair shops.

ii) Organisation

- The Field Team Leader should be responsible for the Focus Group Discussions.
- He/she should introduce him-/herself and the project to local leaders. A document of approval from higher levels of administration, for instance the Ministry of Energy / Direcção Nacional de Electricicdade or EDM, would be suitable for the purpose as this should help to get people's attention and trust.
- The Field Team Leader might introduce her/himself to the entrepreneurs through local leader or village leaders he or she previously has interviewed. This will create trust. Also, try to have the local leader or someone else make an announcement of the event in advance.

iii) Focus Group Discussions (open-ended questions and additional information)

In general, do not stick strictly to these questions but leave open for issues raised during the talk. The questions have to be open ended to give opportunity to follow up unexpected threads. Other indirect effects from the project can be brought up such as competitors who have not benefited from the project.

- What are the main barriers to establishing new businesses that use electricity?
- Are some barriers or opportunities to establishing businesses that use electricity specific to businesses owned by women?
- What assistance is available to encourage business development based on the access to electricity?
- Is micro-finance available in this area?

- Is micro-finance available for financing electricity connection? Connection fee? Installation costs?
- Has electricity replaced fuelwood or charcoal as energy sources in the business activities?
- Has training in the use of electricity been provided? What are the results?
- Did you connect to the grid when you started the enterprise? Why? Why not?
- If you connected when your business had been operating for some time: How did connection to the grid change production patterns (quantity and quality of output, sales, competitive situation, access to external customers, prices, profits)? What was the eventual effect of electrification on the enterprise?
- If you are connected: What was the time from you requested connection to you actually were connected?
- Who buys the products? Intermediate traders? Local people? Exporters? In other words: Where is the product ultimately consumed? In the region? In Mozambique? On international markets?
- Does the connection to electricity change the price and quality of your product?
- Would you connect again if you knew then what you know now about electricity and its effects on the enterprise? Is the investment into a grid connection and wiring/appliances/machines worthwhile for your enterprise?
- Do you think the investment is worthwhile for other enterprises? To whom would you recommend a grid connection?
- Has connecting to the grid let to more success for businesses in the community as a whole?
- Has electricity replaced fuelwood or charcoal in cooking?
- What, in your opinion are the effects of electricity on the community? Has the population in general benefitted from access to electricity? In what ways?
- What is the importance of electricity for schools? What do schools use electricity for?
- What is the importance of electricity for health centres? What do health centres use electricity for?
- Has had electricity any effect for security of the community?
- What is the importance of electricity for women?
- Has it been any development programmes or projects in the area at the same time or after the electrification project was completed? If yes, what projects?
- Has it been any infrastructure improvements? (For instance upgrade of roads, telecommunication services?) If yes, what improvements?

APPENDIX F: FOCUS GROUP WRITE-UPS

Chimbonila, UNDI

Data: 17/072013

Importância da Energia

- Trouxe benefício a 20 distritos.
- É importante porque as pessoas podem fazer muita coisa em casa;
- Trás muita alegria para casa, (Ex: nos rituais, as pessoas podem dançar);
- Pode-se conservar comida e gelar refrescos;
- É importante para a iluminação pública;
- Seria bom para a moagem;
- Poderia estimular a criação de mais fábricas e criar mais empregos;

Desvantagens:

- O preço da energia é mais cara no distrito em relação a cidade;
- Muitas pessoas não tem dinheiro para ter energia (muitos camponeses só produzem de 6 em 6 meses);

Escola

- Há pessoas que querem estudar, mas só podem estudar de noite e a energia poderia ajudar a essas pessoas;
- Permite o funcionamento de máquinas fotocopiadoras e computadores;

Comerciantes

- Os comerciantes que têm gado poderiam matar e congelar para depois vender.

Chivanga

Data: 20/07/2013

Hora: 9:00hrs – 10:00hrs

Importância da Energia

- Importante para a indústria moageira;
- Importante para a iluminação pública;
- Permite assistir aulas de noite;
- Com a energia pode-se fazer festas com músicas tocadas em rádios;
- Os negociantes podem conservar produtos frescos (peixe, carnes e outros);
- Pode-se gelar bebidas (água, refrescos e outros);
- Permite que se abram indústrias de serralharia;
- Pode-se carregar o celular e outros aparelhos electrónicos;
- Importante para pequenas indústrias (serração e costura);
- Importante para bombear água (apesar de haver muita).

Kansina, Distrito de Cuamba

Data: 23/07/2013

Importância da Energia

- Permite que se melhore a indústria moageira (de momento tem que se deslocar ao outro bairro) e carpinteira (evitando que os carpinteiros se desloquem para a cidade só para cortar a tábua);
- Pode-se adquirir congeladores e outros electrodomésticos de conservação alimentar;
- Permite usar máquinas que funcionem a energia;
- Poderiam recarregar os telefones (Agora vão ao bairro ao lado e pagam);
- A população sofre por causa das distâncias que tem que percorrer.
- Seria importante dentro das mesquitas e igrejas porque reza-se a noite;
- Os comerciantes vendem bebidas quentes, não se assiste televisão, vídeos, etc. Tudo isto por falta de Energia.

Malica

Data: 18/07/2013

Participantes

5 Mulheres e 3 Homens

Mulheres

- Com Electricidade evita-se que os produtos apodreçam. Bom para a conservação;
- *Hospital*:
    - Ajuda a esterilizar o material e a conservar as vacinas. Permite que se trabalhe devidamente a noite;
    - Permite usar o aspirador eléctrico para aspirar a secreção dos bebes (maternidade);
- *Escolar*
    - Com a energia poderiam introduzir aulas de informática, e na gestão também poderiam usar o computador.

Homens

- Com a energia, os animais perigosos não entram no bairro. Agradecem a vinda de Energia;
- Graças a Energia tem congeladores (tem produtos frescos e poem conservar outros produtos);
- Pode-se assistir televisão e ouvirem a rádio, estando informados sobre notícias de fora.

O maior negócio pode ser feito de noite.

uio (sem energia)

Data: 20/07/2013

Importância

- A energia é muito importante para os negociantes pois assim podem adquirir produtos frescos (peixe, carnes, etc.) sem receio de que apodreçam;
- A casa fica bonita com Energia (podem ter vídeo, televisão, etc.);
- Poderiam comprar sumo, gelar nos congeladores em plásticos e ir vender na praia aos Pescadores. Também poderiam fazer gero (um sumo de fruta);

- Os pescadores podem conservar o peixe na geleira e ir vender no dia seguinte;
- Para a conservação de alimentos;
- Permitiria que as pessoas estudassem de noite. De momento só há aulas de noite na escola da sede e poucas pessoas é que lá frequenta. (tem medo de ir para a sede de noite).

Cuamba, Teteriane

Data: 25/07/2013

Importância da Energia

- Importante para a iluminação pública,
- Os negociantes podem trabalhar a noite;
- Importante para a produção de gelo e vender;
- Importante para os serviços de saúde, para trabalhos de parto tanto de dia como de noite;
- Iluminação das residências;
- Conservar comidas e bebidas;
- Ver marginais quando de noite;
- Permite estudar de noite.

Licuar Mulheres

Data: 17/072013

8 Mulheres possuem energia;

2 Mulheres não possuem energia;

Vantagem de ter a ligação eléctrica

Criação de novos negócios;

Maior qualidade dos produtos comercializados;

Maior actualização de notícias;

Vantagem de ter a ligação eléctrica para os homens

Criação de novos negócios como barbearias e carpintarias;

Quanto tempo leva para a ligação eléctrica

90 dias;

Constrangimentos na ligação eléctrica

A taxa de ligação é alta para as PME´s;

Onde é colocado o produto comercializado

Dentro do distrito e na sede provincial (Quelimane);

Os produtos são comercializados em distritos de outras províncias;

Apoios disponíveis

Não existem micro finanças;

7 Milhões são para pessoas que trabalham no aparelho do Estado.

Nicoadala (Bairro Lobo)

Data: 18/072013

O bairro não possui energia eléctrica;

Vantagens de ter energia eléctrica?

Pode-se estudar no curso nocturno;

Há conservação de alimentos;

Iluminação pública e doméstica que permite segurança pública;

Pode-se consumir bebidas geladas;

Conservação de alimentos;

Comercialização de produtos frescos;

Aumento de volume de negócios;

Televisão permite actualizar as notícias;

Permite a existência de máquinas de soldar;

Permite a compra de alimento em quantidades e sua conservação;

Criação de moagens na zona;

Permite poupança de recursos financeiros que seriam usados para longas deslocações para moagem de cereais para Nicoadala;

Traz desenvolvimento atraindo investimentos;

Permite maior entretenimento;

Redução de roubos;

Há alguns operadores interessados comerciais interessados na abertura de grandes indústrias de exploração de carvão;

Quais são os constrangimentos da falta de energia?

Os alunos frequentam a 7ª classe no bairro mas depois tem que percorrer 2Km para irem a sede de Nicoadala porque a 8ª classe só tem lá. Porque não há condições de ter o curso nocturno;

As crianças percorrem longas distâncias para irem para fora da zona irem brincar na sede com energia;

Desvantagem porque tem que carregar bateria e telefone no mercado e acabam trocando as baterias, dão baterias falsas;

As mulheres que se dedicam a comercialização de produtos frescos terminam cedo as suas actividades. Mas gostariam de trabalhar até as 20hrs;

Os filhos desistem da escola a partir da 8ª classe porque como estudam a noite e longe, tem medo de escuridão;

Vantagem da existência de energia para as escolas

Redução do analfabetismo com a criação do curso nocturno;

Aumento de cultura geral com a escolarização nocturna;

A Movitel estava interessada em colocar internet na escola;

Vantagem da existência de energia para os Hospitais

O bairro não possui centro de saúde mas ajudaria no pronto-socorro de população enferma;

Alguns apoios disponíveis no bairro

Investimentos de chineses em comparticipar na ligação eléctrica;

«Actualmente os chineses trabalham com lâmpadas de mão, mas interessam em comparticipar na ligação eléctrica»;

Os carpinteiros têm uma Associação para maximizar a produção de artigos de madeira mas com falta energia, não se faz muito, as máquinas são manuais.

Homens Nante

Data: 18/072013

Pessoal com Energia: 6

Pessoal sem Energia: 2

Razões de não ligação de energia eléctrica

Não tem Energia porque o valor da taxa de ligação são 3500 e nos Bairros é de 875;

A electricidade substituiu a lenha

Não. A Electricidade não substituiu a lenha porque há receio de aumento da conta eléctrica;

Vantagem de ligação da energia eléctrica

Há criação de novos negócios: venda bebidas geladas, moageiras, indústrias de serração e recauchutagens;

Aumento das horas de comercialização;

Diminuiu o roubo;

Na saúde era obrigatório levar uma vela ou lanterna para ser atendido no período nocturno;

Há microfinanciamento do Banco Oportunidade;

Tempo de ligação da corrente

Depende da pessoa que vai pedir por vezes há descriminação;

A electricidade é paga na sede distrital de Maganja que dista a 20Kms;

Dificuldades:

Micro financiamento

A energia não substitui o carvão.

Nante Mulheres

Data: 19/072013

Quem possui energia: 2 pessoas

Quem não possui energia: 7

Porque não tem energia?

Não tem energia porque não tem condições para pagar a taxa de ligação;

As que vivem distantes a energia não chega lá;

Vivo na casa do hospital porque mau marido é enfermeiro e tenho energia;

Vantagens de ter energia no posto

Conservação de alimentos nos frigoríficos;

Refrigeração de bebidas;

Iluminação das casas e vias públicas;

Comprou congelador e vende gelinho. Não vende peixe por causa do transporte para ir comprar;

Actividades de rendimento permitem o sustento da família;

Aumenta o rendimento nos agregados familiares;

Quando se paga pela ligação de energia quanto tempo demoram para ligar?

Não demora quando se pede instalação. São rápidos

Negócios que surgiram com a instalação da energia

Venda de gelados;

Venda de Refrescos;

Venda de Peixe;

Vantagem da existência de energia para as escolas

O posto não tem curso nocturno, que é uma desvantagem. Podia-se ligar porque há muita gente interessada em estudar a noite;

Vantagem da existência de energia para os Hospitais

Iluminação e conservação de vacinas;

Vantagem da existência de energia para a segurança

Iluminação pública nocturna;

Vantagem da existência de energia para as mulheres

Iluminação doméstica;

Criação de novos negócios;

Televisão que serve para actualização de notícias;

Entretenimento de crianças;

Carregamento de telemóveis;

Melhora a planificação doméstica pois compram produtos baratos e consegue-se conservar;

Peixe;

Permite o prolongamento do período de trabalho e consequentemente os rendimentos das mulheres;

Para onde são vendidos os produtos que comercializam

Vende-se para gente de outros distritos. (Arroz);

Vende-se para o consumo interno no posto;

Barreira para o consumo/instalação de energia eléctrica

A elevada taxa de ligação;

Falta de energia bairros;

Falta de microfinanciamento para ligação da energia;

A taxa de ligação é de 3,500Mts;

Para a compra de material é de 2500 Mts aproximadamente;

A energia não substitui a lenha para cozinha.

Nicoadala Grupo Homens

Data: 20/072013

Participantes com energia: 2, sem energia: 8

Vantagens de ter electricidade:

Pode-se comprar congelador para aumentar actividades de rendimento;

Pode-se usar para compra de aparelhagem e iluminação;

As crianças dormem mais facilmente;

Os centros de saúde ficam melhor apetrechados;

Há maior conservação de alimentos;

A segurança aumentada está melhor garantida pois reduziram o número de bandidos;

Pode-se estudar de noite nas escolas;

Há conservação de medicamentos e no tratamento de doentes.

Vantagem da ligação eléctrica para as mulheres

Nos centros de saúde as mulheres podem dar parto no período nocturno;

Consegue-se organizar melhor as coisas;

Iluminação doméstica;

Os adolescentes podem brincar próximo aos seus locais de casa.

Vantagem da ligação eléctrica para os homens

Desenvolvimento de novos negócios;

Impacto pós-Instalação da ligação eléctric

Venda de produtos frescos (cerveja, carne, peixe);

Conservação de produtos alimentares;

O preço do produto aumenta com a ligação eléctrica?

O preço permanece o mesmo. Apenas há maior aproximação de mais clientes e maior qualidade do produto;

A ligação à energia permite criação de maior emprego: o comerciante e a comunidade em geral têm uma maior actualização das notícias.

Homens Magiga

Data: 23/07/2013

Pessoas com energia: 2

Pessoas sem energia: 8

Razões de falta de ligação eléctrica: Falta de energia no bairro periférico;

Indisponibilidade financeira para pagar a taxa de ligação que custa 3000,00Mts;

Vantagens da ligação à rede eléctrica:

Pode-se usar electrodomésticos domésticos;

Pode-se carregar telefones em casa;

É fácil carregar baterias/geradores;

Pode-se congelar produtos frescos;

Aumenta a renda através da criação de novos negócios;

Vantagens da ligação eléctrica nos centros de saúde

Facilitar de serviços, iluminação nas noites;

Pode-se proceder intervenções cirúrgicas no período nocturno;

Pode-se conservar remédios e vacinas;

Vantagens da ligação eléctrica nas escolas

Pode iluminar no curso nocturno;

Vantagem da ligação eléctrica para a segurança

Reduz o número de ladrões;

Limpeza da vila, evita o fecalismo ao ar livre;

Vantagem da ligação eléctrica para as mulheres

Permite o uso na cozinha;

Iluminação doméstica;

Permite que possam dar partos nos períodos nocturnos;

Onde os produtos são comercializados

Vende-se os produtos nas comunidades, outros distritos e noutras províncias vizinhas;

O peixe seco é comercializado nas províncias de Nampula e Niassa;

Barreira para o uso de electrificação

Falta de financiamento;

Falta de banco no posto;

Falta de micro financiamento;

Como tem sido os preços dos produtos comparativamente aos períodos com/sem energia

Os preços baixam porque o produto perde sabor por ter ficado muito tempo no congelado;

A electricidade não substitui a lenha e o carvão;

As mudanças que ocorreram com a ligação da energia são: em 2007 houve criação de moageiras, instalação de antena parabólica e videoclube no posto;

Há fábrica de processamento de castanha de caju e amendoim;

Mas falta ainda o sistema Pré-pago.

Mulheres Magiga

Data: 22/07/2013

Vantagens de estar ligado à energia

Criação de novos negócios;

Pode-se carregar telefones;

Actualização de notícias;

Maior segurança para beneficiários;

Porém é necessário expandir para os bairros;

Tempo de ligação a energia

90 dias é o tempo de espera;

Vantagens escolas

Pode-se ter aulas no curso nocturno para reduzir a superlotação das salas de aulas no período diurno;

Centros de saúde

Pode-se ter partos partos nocturnos;

Permite a realização de material cirúrgico para operações;

Vantagens mulheres

A iluminação nocturna permite o aumento de horas para actividades de rendimento;

Onde o produto é comercializado

População de outras comunidades;

Barreiras no consumo de energia

Falta de expansão nos bairros;

Apoios disponíveis

Dinheiro do Fundo de Desenvolvimento Local;

Falta de documentação da população;

Diferença de preços entre o período

Não há diferença de preços. O que mudou é a qualidade dos produtos;

A taxa de ligação é de 1000 Mts. Por cada metro o custo do fio é de 30mts/ fio;

A energia não substituiu o carvão porque os custos são muito altos.

APPENDIX G: DESCRIPTION OF VISITED COMMUNITIES

The Namacurra project

1. **Nicuadala (Nicuadala district, Zambezia)**

No major industries in the area. There are some saw-mills and grain mills. With his 6 employees, Xin Jian Zhang Company Ltd. is the largest industry in the area. The bairros where interviews were conducted only have about 15 connections out of 70 houses, and mainly thatched roofs. No new employment was reported in the bairro as consequence of the project.

2. **Namacurra, (Namacurra district, Zambezia)**

Namacurra has around 20 000 inhabitants, and is the center of an agricultural district. 7 bairros have access to power, and there are plans to connect two more. Many of the shops and stalls in the market have access to electricity. The buildings in the center are mainly concrete, and the street lighting is quite extensive. The Namacurra is a relatively poor area, with comparatively less industry than for example Gurué.

3. **Zalala (Nicoadala district, Zambezia)**

There is considerable coconut production in the area. Most of it is owned by the local population, but the *Madal* Company also has plantations. The Zalala beach lodge is the only major consumer in Zalala, but there is also a shrimp-farming business. Others than that there is very little activity. BioTech Limitada have plans for construction of a Coco Pellets Biomass Factory in Maquival. The intent is to use biomass effected by the Coconut Lethal Yellowing Disease (CLYD)to produce renewable energy in the form of pellets. The plans would require a 7 km t-off, and an energy need of 3 MW has been indicated. It has not been possible to establish the current status of these plans.

The Pebane extension

4. **Nantes (Maganja da Costa, Zambezia)**

Nantes is a poor community, with little economic activity other than agriculture, a mill and some shops. There is a rice cleaning industry outside town. Only the center of town in electrified (about 54 connections), but several bairros are asking for connection.

There was a generator in place prior to electrification (in 2009), providing electricity for the clinic and a few shops. In addition to better access and lower cost of energy, electrification has reduced the distance grain had to be transported to the mill by 4 kilometers.

The clinic and secondary school is connected to the grid. Not the primary school. There is street light in the main street, and the market. Maybe 5 percent of the shops/stalls in the market have access to electricity.

The project also connected a major irrigation scheme (over 714 hectares) that previously ran a generator. Businesses are mainly owned by men (one lodge owned by a woman), but the irrigation scheme mainly benefits women.

5. **Olinga (Maganja da Costa, Zambezia)**

Olinga is the district headquarter of Maganja da Costa, a relatively poor farming district with very little industry except for a grain mill employing two people (consumption of about MTZ6,000/month). There is also a district hospital, (using about MTZ15,000/month). Olinga used to have a generator, supplying about 150 connections prior to the project. Economically the town is said to be somewhat better off now than five years ago.

6. **Mocubela (Maganja da Costa district, Zambezia)**

In addition to some commercial connections, the village of Mocubela has two saw-mills as it´s only industry. One of them employs a total of 25 people, and is owned by a female entrepreneur. There are about 140 domestic connections; in addition there is a secondary school and a clinic that is connected to the grid. No NGOs are active in the area, and except for the hospital that is being built, no infrastructure investments have been made over the past years. A 1 kilometer t-off between Mocubela and Ratata supplies a third saw-mill with around 10 employees.

7. **Impaca (Pebane district, Zambezia)**

Even though 8223 people live in the area, the village is small and has little infrastructure except a clinic and a primary school. There are thatched roofed. The town only has 6 connections according to a local interviewee. Of these two are commercial (bank and shop). A key reason given for why more people have not connected is the cost of house wiring. The same informant complained that EdM could easily take 48 hours in responding if one reported a complaint.

8. **Magjiga (Pebane district , Zambezia)**

This little town has about 80 connections, a bank and a mill.

9. **Pebane (Pebane district, Zambezia)**

Pebane is the district-headquarter of Pebane. Like Olinga, it is quite a poor area, but here fishing is the main industry. Pebane has street lights in the center. No NGOs are active in the region. Pebane has two businesses that freeze fish for export out of the region. One of these employs 5 people, while the other was shut down at the time of the team´s visit. Pebane Fishing Lodge is the largest power consumer in the district. There is also a saw-mill on the way towards Mocubela, and a grain mill in town.

Gurué – Cuamba - Lichinga

10. **Ile (Ile district, Zambezia)**

Ile is on the 33 kV distribution network coming out of Gurué. There was no power in Ile prior to the project. Other than 11 grain mills in the greater area, the only business in Ile are commercial. Ile has more extensive street lights system than the towns on the Namacurra project and it´s extension to Pebane.

11. **Gurué (Gurué district, Zambezia)**

With its 130 000 inhabitants, Gurué is the relatively affluent center of a major tea producing region. Its proximity to Nampula, the capital of the North, spurs business and industry in the area. There are around six large tea factories in the area which were in production prior to the project. On the line to Ile there is also a saw-mill employing 10 workers.

12. **Magiaca (Gurué district, Zambezia)**

The little town of Magiaca was not electrified till the year 2011. The only industry using electricity are two grain mills, each with two employees. These were operational prior to electrification, using diesel generators. There are no NGOs or microfinance schemes active in the area. Street lights are installed, but these were not working during the Team´s visit.

13. Lioma (Gurué district, Zambezia)

Lioma is the relatively well off center of a major agricultural area, with soy and maiz as the major produces. The British company African Century Agriculture have recently built two 1800 ton siloes to receive and store mais and soy from the area for export to Nampula. The company also has plans to create a chicken feed production plant in Lioma.

A number of major agribusiness firms, including AgroMoz, Red Agro and Hoyo Hoyo are active in the area, and there are reports of conflicts between these large agribusinesses and small scale farmers. AgroMoz have plans for soy siloes with a total capacity of 9000 tons in Lioma.

14. Mutuáli (Malema district, Nampula)

The town of Mutáli has a major soy plantation owned by the Brazilian/Portuguese/Mozambican agribusiness Agribusiness de Moçambique (AgroMoz). Started only last year, the production is now 9000 tons of soy from 3000 hectares. Next year the yield is expected to double, as another 3000 hectares are cultivated. The company has plans for building soy siloes in Lioma.

The major energy consumer in Mutuáli is major factory for cotton spinnery, employing over 100 people. There are also two mills.

15. Lurió (Malema district, Nampula)

The small village of Lurió got access to power only in 2010. The town has two mills, which both run on grid electricity and employ two people each. No other industry. The number of domestic connections are estimated to around 50. Outside of town, on the way towards Cuamba there is a road construction camp run by the company *Arthur Couto. This is a medium voltage consumer.*

16. Cuamba (Cuamba district, Niassa)

The city of Cuamba has around 95,000 inhabitants. In addition to a small hydropower plant, Cuamba also had a town generator prior to the project. At that time (2005) there were 3,390 consumers in Cuamba.

Currently there are 16 large consumers, including a bakery, a rice cleaning factory and a cotton spinnery with 12 ton per day capacity and over 150 employees. The spinnery is, according to the district leader a result of the project, and has lead to a considerable (up to 100 percent) increase in local cotton prices. A separate line supplies a mineral mine.

EdM make about 100 connections each month in the city of Cuamba, and around 20 in the rest of the project area. While the district leader reports that investments have increased considerably due to the project, they have problems with the transformers of the schools. This resulting in poor quality. Some NGOs are active in schooling and health, but they are reducing in number now.

17. Lichinga (Lichinga district, Niassa)

Lichinga has relatively little economic activity relative to its size of 160,000 inhabitants. What industry there is mainly relates to agriculture. There are siloes for storage of soy, and AgroMoz have plans for cultivation here too. Some major road improvements are planned in the area, and a road construction camp is set up in Lichinga for this work.

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APPENDIX I: ENERGY SECTOR FRAMEWORK presentation

Legal Framework

The Electricity Law (Law n. º 21/97 of 1 October) establishes the general policy of the sector, the organization and management of the electricity supply and the general legal framework for generation, transmission, distribution and sale of electricity.

Other Legal Instruments

In addition to the Electricity Law, there are a number of other important legal instruments regulating the energy sector. The most important are

- Resolution of Council of Ministers 5/98 defining strategic guidelines for sector development
- Decree No. 21/2005 institutionalizing and empowering the Ministry of Energy
- Decree No. 8/2000 relating to granting of concessions
- Decree No. 43/2005 specifying Electricidade de Moçambique (EDM) a public company
- Decree No. 45/2004 relating to environmental impact assessments
- Decree No. 42/2005 establishing electricity standards
- Decree No. 48/2007 relating to licenses for electrical installations

Sector Actors

The energy sector actors can be divided into regulation, facilitation, generation, distribution and commercialization/marketing/retail.

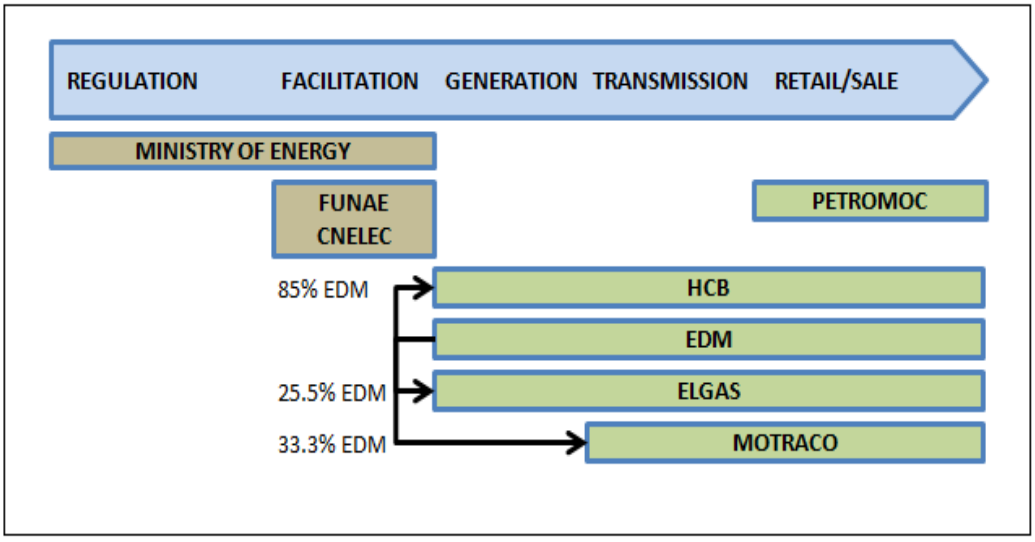


Figure I.1: Energy Sector Actors in Mozambique

The Ministry of Energy (ME)

The ME is responsible for supervision and regulation of the energy sector and directs, plans, promotes and manages the inventory and use of energy resources, and the development and expansion of electricity, natural gas and petroleum products.

The Ministry of Energy has as supervisory function over:

- Fundo Nacional de Energia (FUNAE),
- Conselho Nacional de Electricidade (CNELEC);

- Hidroeléctrica de Cahora Bassa (HCB);
- Electricidade de Moçambique (EDM);
- Petróleos de Moçambique (PETROMOC);
- Elgás;
- Companhia de Transporte de energia eléctrica de Moçambique (MOTRACO).

Fundo Nacional de Energia (FUNAE)

FUNAE ("the National Energy Fund") was established in 1997 and has a mission to promote greater access to energy in a sustainable and rational manner, with special focus on rural areas, to contribute to the economic and social development of the country, and for this purpose:

- Raises and administers funds to support energy production public and private;

- Creates initiatives for alternative forms of energy, aimed at low-cost solutions and the promotion of conservation and rational and sustainable management of energy resources.

Conselho Nacional de Electricidade (CNELEC)

CNELEC ("the Electricity Regulator") was created in 1997 and started operating in 2000. CNELEC has an advisory regulatory function.

Cahora Bassa

The Cahora Bassa, S.A.R.L. (HCB) was established in 1975 to operate the Cahora Bassa hydroelectric power station, one of the largest hydroelectric dams on the African continent. Since 2008, the Mozambican Government holds 85% of the share capital of this company.

Electricidade de Moçambique (EDM)

Electricity of Mozambique, E. E. (EDM) was created in 1977 as a state owned vertically integrated power utility for generation, transmission and distribution of electricity in Mozambique. In 1975 EDM was transformed into a public company.

Petroleos de Mozambique (PETROMOC)

In 1999, PETROMOC was established in 1999 as the national petroleum company.

Elgas

ELGAS is a private company established in 2001, which is involved in the supply of electricity produced from natural gas extracted in Temane in Inhambane province.

Companhia de Transporte de Energia Eléctrica de Moçambique (MOTRACO)

MOTRACO was established in 1998 to import electricity from Eskom and transport it to Mozal. EDM, SEB and ESKOM each hold 33.3% of the share capital.

Relevant Policies, Plans and Donor initiatives

The GoM realises the importance of electrification for economic and social development and energy is one of the priority areas of the country's Action Plan for the Reduction of Absolute Poverty (PARPA), now PARPA II.

The Government's Electricity Master Plan was developed by EdM in 2004. It includes an intensified connection rate of rural areas to the national grid based on a general nationwide goal of increasing access to electricity to 15% by 2020, a goal which has already been exceeded. EDM has established certain criteria for new areas to be electrified. These criteria have been discussed and developed in consultation with stakeholders. The GoN financed electrification projects in the rural areas in the Niassa and the Zambezia Provinces receive their power from the Gurue –Cuamba - Lichinga transmission line. This line was among the highest prioritised in EDM's Electricity Master Plan.

The Government's Energy Strategy (2009-2013) stresses electrification both through the grid and though renewable sources, even hybrid solutions using sustainable biomass resources (wood and biofuels), solar, wind and hydro for rural electrification and social infrastructure.

Although the access rate increased from 12 percent in 2008 to 18 percent in 2011, there are many challenges related to further electrification and access expansion. These include the high costs of supplying rural households as these areas have a low population density and mainly poor households, with limited demand for electricity (often less than 30 kWh per month). Rural systems also have higher technical network losses and operating costs. Many of these households cannot afford to pay the high cost of providing electricity to their villages, in particular, to pay for the connection fee. The provision of rural electricity services is not financially viable and, therefore, EdM has a strong incentive to avoid distribution grid extension in rural areas.

Eventually it becomes cheaper to use off-grid sources of supply to reach distant communities. This could take the form of mini-grids served by mini-hydro plants or diesel units, and solar-home systems (SHS). However, off-grid electrification also faces the high cost and low-demand challenges of grid extension in rural areas.

As Mozambique is targeting large numbers of low-income households in its electricity access programs, challenges include ensuring that electricity access investments are economically viable, i.e., that benefits (represented mainly by willingness to pay) exceed costs; and that electricity services are financially and operationally viable. Thus pre-conditions include a regulatory framework which accepts full cost recovery of efficient operation (competitive, appropriate standards, etc) as well as the limited ability of low-income consumers to pay. The government would need to provide adequate resources, possibly ensuring cross-subsidies complemented by special funds.

Other donors active in the project areas have included:

Swedish International Development Agency (Sida):

- Co-financier in the Gurue-Cuamba-Lichinga Transmission Project (120 MSEK in the beginning and about 6-7 MSEK to the final agreement between EdM and ABB)
- Financing of a 33kV line from Cuamba to Mecanhelas and a 33kV line from Cuamba to Marrupa
- Rehabilitation of road N14 between Litunde and Marrupa and now Marrupa – Ruaça
- Spot improvements on the road between Cuamba and Lichinga
- Long term support to the Province of Niassa

The World Bank:

- Urban distribution network rehabilitation, e.g. in Gurue
- The ERAP project has provided PV installations in a number of schools and clinics in Zambezia and Niassa

EdM reports other important donor assistance from the African Development Bank, Kreditanstalt fur Wideraufbau (KfW) on substations and network rehabilitation; Caisse Francaise de Developpement, the Portuguese and Italian Governments.

APPENDIX J: CURRENT EDM TARIFF

The current EdM tariff categories are shown below:

NO	TARIFF NAME SEGMENT		BASIC CHARGE	MAXIMUM DEMAND	ENERGY CHARGE			
			All month	All months	Tot/Year			
		Max kVA	Mt/m	Mt/kW/m	Mt/kWh 0-100	Mt/kWh 0-300	Mt/kWh 301-500	Mt/kWh >500
1	Social Convent.	1.1			1.07			
2	Social PP	1.1			1.07			
3	Domestic Conv	19.8	83.5			2.5	3.53	4,71
4	Agriculture Conv	19.8	83.5			2.68	3.81	4.24
5	General Conv	19.8	83.5			2.97	4.24	4.64
6					All			
7	Domestic PP	19.8			3.18			
8	Agriculture PP	19.8			3.71			
9	LPU LV	19.8			4.26			
10	LPU MV		249.9	127.74	1.66			
11	LPU MV Agriculture		1,172.99	142.99	1.37			
12	LPU HV		1,172.99	142.99	1.24			
13	EDM Internal		1,172.99	157.49	1.23			
14	Iluminacao Publica							
15	Auto Consumos							

Table J.1: EdM tariff categories

The street lighting consumption is 53 GWh (2012) and constituted 1.2 % of the total energy consumption. EDM's own use of energy for EDM's buildings, offices, etc is 6 GWh (2012), which constitutes 0.1% of the total energy consumption.

APPENDIX K: ADDITIONAL O&M STAFF AND FACILITIES

Estimated additional staff, vehicles and buildings for the projects

During the field trip, the Consultant questioned the local EDM Staff about the additional staff that had been hired to operate and maintain the various distribution projects as well as additional offices, buildings and vehicles required.

The Quelimane EdM office advised on the additional staff hired to operate and maintain the Namacurra project. The assumed number of additional staff hired as a consequence of the Namaccura project extension to Pebane is based on information provided by the EdM offices in Olinga and Pebane. It is difficult to be categorical about the extra staff in Maganja da Costa, considering there was a generator there before. The numbers are thus estimates made by the Consultant.

Although the quality of responses varied, the Team has tried to cross-checked the various information gathered where possible, to obtain a general overview of the staff available for O&M of the distribution projects. In some cases the infrastructure appears to have been part of longer term plans, but the need seems to have become acute with the project.

	Staff	**Vehicles**	**Buildings**
Namacurra Project			
Namacurra	4	1	2
Nicuadala	5	1	Container office
Zalala	2	1 motorbike	Container office
Ihas	2	1 motorbike	Small building
Namaccura Project extension to Pebane			
Maganja da Costa	3	1	Old generator bldg
Pebane	4	1	Office
Gurue Area			
Gurue	11	2	Office
Ile	3	1	Container type
Namarroi	2		Container type
Lioma	2		Container type
Cuamba Area			
Cuamba	24 (8 O&M)	3	Office
Malema	3	1	Container type
Mutuale	1		Container type
Lichinga Area			
Lichinga	60 (10 O&M)		Offices
Metangula	3	1	Container type
TOTAL	**50**	**12 + 2 motorbikes**	**16**

Table K.1: Additional staff hired for the various projects

APPENDIX L: SYSTEM STABILITY ISSUES

1.1 Transmission Earth Wires

There is one area that seems to have been underestimated in the project design and that is the lightning protection.

The Final Report for the Namarcurra Project – Pebane Extension states:

Certain areas of Mozambique are exposed to unusually high frequency of lightning. It should be considered to increase the insulation level on major components located in such areas, and it is recommended that additional lightening protection such as spark gaps and Franklin rods be installed at locations where they improve protection of major components.

The transmission line Gurue-Cuamba-Lichinga has overhead earth wires about 1.5 km out from each substation, but otherwise no earthwires, which causes several interruptions during the rainy season. The EdM transmission Department estimate 2-3 interruptions a day during the rainy season, which might be certain days only, but nevertheless a considerable problem.

The lack of earth wires in the project means that EDM has to use Power Line Carrier technology for data communication over the transmission network. These days most transmission lines carry fiber-optic communications cables to provide connections between major sub-stations and control centers. Usually the earth wire is embedded in an Optical Ground Wire (OPGW). While not being a major limitation, utilities are increasingly using fiber optic cables for their primary system communication needs and the power-line carrier apparatus is relegated as a backup channel or for very simple low-cost installations that do not warrant installing fiber optic lines.

EdM has investigated various possibilities to address the problem (i) retrofitting earth wires and (ii) installing lightning arresters. However, towers without earth wire peaks are structurally different (weaker) than towers with earth wire peaks and are not appropriate for retrofitting.

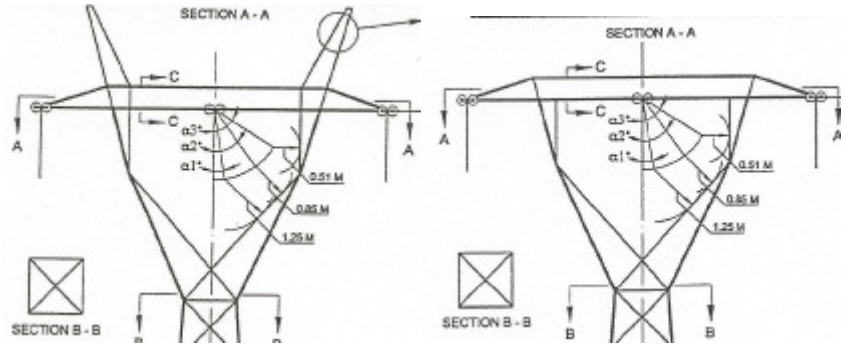


Figure L.1: 110 kV tower with (left) and without (right) earth wire peaks

The alternative with a multitude of lightning arresters is not a feasible solution either. It seems that EdM is in a fix regarding this problem.

It seems that a main reason for not having earthwires was the design criteria established in the beginning of the 80's. Due to economic constrains it was decided to install earthwires from 220 kV and above. The 110 kV lines would only have earthwires in the 5 adjacent spans of the substations. EdM had at that time

a lot of investments to carry out and had to define priorities. In addition, the great value of having fibre optic cable was not known to EdM at that time and thus did not influence the design criteria.[1]

1.2 Wood Poletop Assemblies

There are several reports of lightning strikes on the distribution lines cutting out the lines, e.g. in the coastal areas.

The projects use wooden poles which is the preferred solution for supporting low cost distribution network in Mozambique. However, the projects have used steel cross-arms in spite of its higher cost than wood. By shifting to steel cross-arms the better lighting insulation feature of wood has been given up. While wood has no steady state insulation level, tests have shown consistently that wood adds about 300kV to basic insulation level (BIL, or lightning withstand level) of a pole top for each meter of wood gap. Considering that the BIL of a standard 33kV post insulator is only 170kV, the value of additional wood is apparent. The BIL of a poletop assembly consisting of a post insulator and a 2.4m cross-arm with wood cross-arm braces is almost 500kV. The impact of poletop BIL on lighting flashovers per 100 miles of line is shown in the Figure 12.

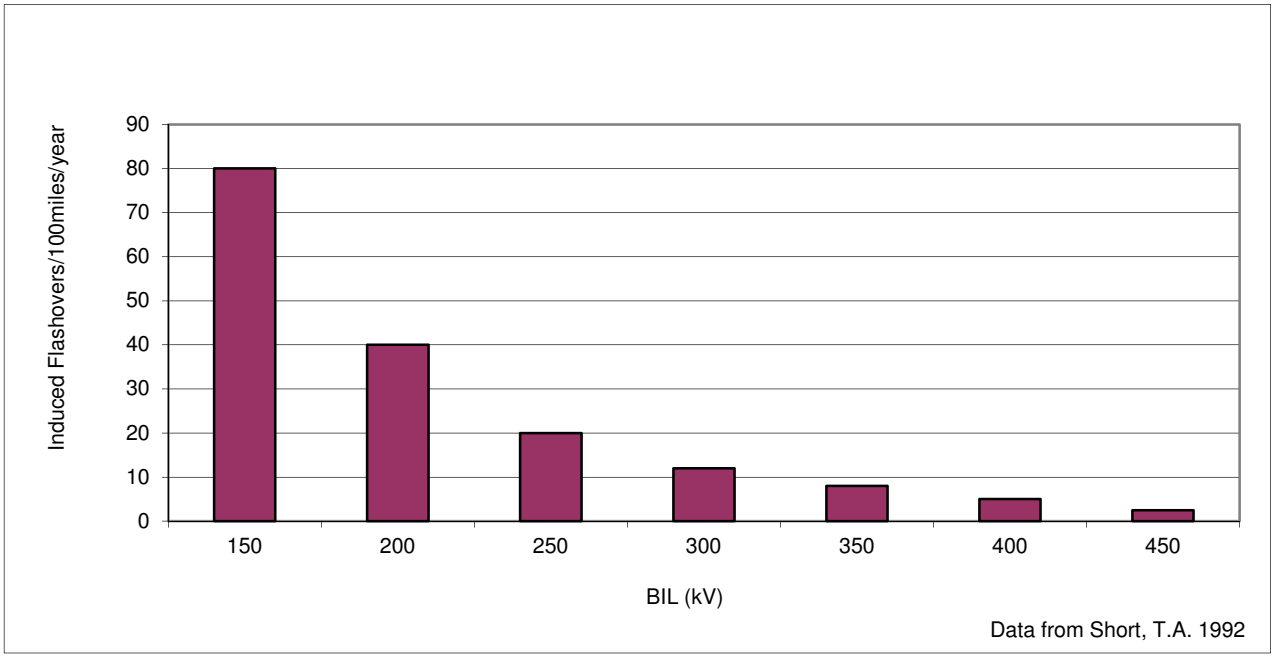


Figure 12: Induced Flashovers for various BILs. NRECA

It is apparent that for a poletop BIL of 500kV, the number of flashovers due to lighting per 160km of line is on the order of one per year.

[1] *Private email dated 7 August, 2013 from Ernesto Fernandes, EDM Executive Board Member until 2005*

APPENDIX M: TERMS OF REFERENCE

Norad

Terms of Reference

Impact Study

Rural Electrification of

Gurué-Cuamba-Lichinga Transmission Line Project

Namacurra Electrification Project and

Namacurra Electrification Project – Extension to Pebane

1 Background

The Embassy in Maputo has for many years supported Mozambique's efforts to increase the level of access to electricity in rural areas. The justification for the strong focus on rural electrification has been the assumption that access to electricity would contribute to increased economic activity and enhanced living conditions – i.e. poverty reduction.

The electrification rate of Mozambique was as low as 5% in 2001. The efforts have produced results, and by 2014 all district capitals are expected to be connected to the national grid. However, the total electrification rate remains low, around 22% (2012). In particular, northern and central regions still linger around 11-12%.

The electrification efforts have been expensive, with high average costs per household connection, and with consistently low levels of electricity use and little income generation for the utility, EDM.

At the same time, the real effects on economic activity in terms of development of small businesses and income generating activities are not obvious.

The Embassy now wishes to conduct a study of three earlier projects, which all had increased economic activity and enhanced living conditions as project goals. The projects were completed between 2005 and 2008, which would allow for the mid- to long-term effects of electrification to start materializing.

The three projects that will be subject to this study are:

1. "Assistance to the Gurué-Cuamba-Lichinga Transmission Line Project" (MOZ 0012)
2. "Namacurra Electrification Project" (MOZ 2016) (distribution)
3. "Namacurra Electrification Project - Extension to Pebane" (MOZ 2016) (distribution)

Basic details about these projects are provided in Annex I.

As a basis for the study, a number of studies provide background data and insight:

- Socio-Economic Baseline Study for the three projects subject to this study
- Evaluation Study of Norwegian Supported Energy Programmes, which covered among other the Alto Mocue-Gurué Transmission project. The Gurué-Cuamba-Lichinga Transmission Line Project is an extension of this early project (1998-2001)[1].
- Key Project Documents, Appraisals, Decision Documents and Final Reports

A list of documents to be provided is shown in Annex II. In addition, the consultant shall seek any use other relevant studies and data to improve the reliability and consistency and to enlighten the issues raised in the scope of work.

2 Purpose and intended use

The study will serve two purposes:

i. Evaluate the impact of the projects on development of business activities and income generation and the financial and operational impacts on the energy utility (EDM).
ii. Review to what extent the projects have achieved the planned results, thus provide insight into the direct effect projects for rural electrification have on the living conditions as well as lessons learned with regard to prioritization and design of rural electrification projects

The findings are expected to provide valuable input for prioritization and design of energy projects, and orientation in the future support to the Mozambican Energy sector.

This insight should be relevant not only for the Embassy in Maputo, but also to Mozambican policy makers and other stakeholders in the Energy sector. It should also contribute to policy planning and strategy development through complementing similar studies from other countries and help build a better understanding of grid-based electrification projects and their risks, impact on living conditions, economic development and poverty reduction, and the soundness of the energy sector operations in developing countries.

3 Scope of work

The evaluation shall be a critical review of the impact of rural electrification.

The impact study shall focus on the following two areas (purpose (i)):

1. *Business creation or revival*
2. *Impact on the power utility*

[1] There exists a baseline study for this project which might provide useful information.

Focus area 1 - Business creation or revival

A key element in bringing people out of poverty is job creation. Business creation or revival of economic activities is hence seen as crucial for development. Paid jobs are also important for providing development opportunities for women and promoting gender equality. The impact study shall investigate the following issues related to the focus area 1:

- To what degree has access to electricity lead to establishment of new businesses? (Businesses where electricity is a key factor input/businesses which would not have been established without access to electricity) What kind of businesses has been established? How many people have been employed in these companies?
- To what degree have local government and the power utility played a role in facilitating business development? If so what is the impact of these activities?
- Other institutions/organisations that have played a significant role in facilitating business development?
- Have there been any barriers to establishment of such business and if so what are they?
- To what degree has access to electricity affected and new business creation (based on the electricity access) other businesses? (Indirect effects)
- To what degree has access lead to regional economic growth (beyond the general economic growth in the region)?
- Can there be observed a link between electrification and poverty reduction? How does this compare with the development in non-electrified areas? The study should also look at wealth distribution as a consequence of increased economic activity
- What measures has been taken to encourage business development based on the access to electricity?
- To what degree have training in use of electricity been provided? If provided, what is the impact of these activities?
- To what degree has incentives and access to framework conditions as micro loans etc. been in place, and how important has this been for the creation of new businesses?
- To what degree are new businesses created by women? Are there any barriers in this context for women to start-up businesses?
- Have there been other donor programmes having synergies with the projects in this study?
- With regards to existing economic activities (tea plantations and manufacturing in Gurué, coconut and rice production in Namacurra), in which manner did the supply of electricity contribute to their a) modernization, b) productivity, c) profitability, d) job creation?
- Did electricity supply support/facilitate new initiatives of education and training programs at the technical and/or professional levels?
- Did the electricity supply replace firewood and charcoal as energy sources in the business activities (existing and new)?
- Other effects on the business climate?

Focus area 2 - Impact on the power utility (Electricidade de Mocambique, EDM)

The financial situation/credit rating of the power utility is important in order to be able to obtain financing and attract private investments (e.g. in power production). Given that extension of transmission lines and distribution grids are giving the power utility more assets to maintain and operate and that rural tariffs not necessarily are reflecting the real costs of the electricity, this might have negative impact on the power utility.

The impact study shall investigate the following issues related to the focus area 2:

- How have the projects affected the economic situation of the power utility?
    - The study should look at increased O&M costs and whether the utility has received additional funding for operating and maintaining the system
    - How many new customers has the power utility attracted and how has the development been over time?
    - Collection rate (compared with similar areas)
    - To which degree are the tariffs reflecting the real cost of electricity (production, operation, maintenance, investments, management etc.) and how have new customers affected the financial balance of the utility?

The study should include an overview of tariff structures and operational cost and how this has developed over time

- To what degree have the assets been properly maintained and operated?
- How have the new assets affected the system stability?
    - Has there been taken any measures to enhance grid stability? How has this been financed?
- Has the power utility hired more people as a consequence of new assets built in the projects? If so, where have these jobs been created?
- To what extent have the projects been part of a larger transmission and distribution plans? If so, to what degree is this plan still valid?
- What additional investments in commercial and administration structures (buildings, telecommunications, shops, IT resources, etc) and personnel have been made to support and operationalize these electrification programs?
- Has there been other donor programmes as follow-ups of these electrification projects?
- How have the projects affected the power utility's reputation?
- Other effects on the power utility?

These two focus areas shall constitute an independent section of the Final Report.

In addition, the Final Report shall include a description of the three electrification projects with respect to their context, content, processes and financial and institutional arrangements.

A more general assessment of the impact of the three projects shall be carried out. The assessment shall be based on the five standard evaluation criteria of OECD/DAC. The principal evaluation questions under the different evaluation criteria are the following:

Effectiveness

- To what extent have the electrification projects met their objectives, focusing on intended outcome and impact?

- What factors, internal and external to the projects, have influenced the fulfilment of objectives (positively or negatively)?

Impact

- Have the projects lead to any improvements in peoples living conditions and or public services and have there been any other positive or negative, intended or unintended effects beyond those reflected in the explicit objectives of the interventions?

Relevance

- To what extent have the interventions conformed to the needs and priorities of target groups and the policies of Mozambique?

- How have the electrification projects interacted with other factors to achieve socioeconomic development and poverty reduction?

Sustainability

What is the share of households connected to the electricity grid and how has the use of electricity changed over time?

- What other effects or impact can be observed, and how have they developed in the time after completion of the projects?

- What have been the observed factors affecting the sustainability of the projects?

- What are main risks to sustainability observed, taking the technical, financial and institutional dimensions into account, and how can they be dealt with?

Efficiency

- What have been the costs of the results achieved to date? (Also to be seen in comparison with cost of results at end of project). And how does this compare with other rural electrification programmes in Africa? (Comparison should also be done with non-grid based projects)

- Are there noticeable differences in efficiency between the projects studied (Gurué-Cuamba-Lichinga Transmission Line project and Namacurra Electification projects) and, if so, what are the reasons for this?

The findings shall be compared with and seen in light of results in similar programmes.

The evaluation questions are to be elaborated further in dialogue with Norad during the inception phase.

Based on the findings, the evaluation team shall present lessons learned and recommendations in respect to the following:

- Key success factors
- Main pitfalls/risks
- Key improvements on rural electrification projects
- Key factors which could have improved the quality and outcomes of the impact study (recommendations with regards to baseline study improvements, data gathering/availability, project design etc.)
-

4 Implementation/Method and Data

Inception

Prior to the start of data collection a short Inception Report shall be presented. This shall be based on the proposed methodology described/assignment solution in the tender. The Inception Report shall include:

- A model for analysis of the electrification projects,

- A further elaboration of evaluation questions and of how evaluation criteria will be applied,

- An overall evaluation design showing how evaluation questions will be answered,

- An account of baseline data identified, relevant studies and similar projects relevant for comparison,

- An account of primary and secondary data sources and of how data will be analysed,

- A discussion on evaluability and attribution, including how the consultants will deal with the contextual complexities and various factors contributing the socioeconomic development and how to isolate the effect of access to electricity from the general economic growth in the country/regions

- A basic analysis of stakeholders, influencing and/or affected by the projects directly or indirectly,

- An account of how stakeholders will participate in the evaluation (who, how, when, why),

- Possible key issues to be further looked into in the evaluation,

- Possible delimitations to be agreed upon with Norad,

- A detailed work programme

A review of background documents for the three projects shall be made (project documents, decision memoranda, baseline studies, environmental impact assessments, monitoring reports, previous reviews, etc.).

The draft Inception Report shall be presented to Norad. The Inception report shall be approved by Norad prior to the initiation of the evaluation exercise. A Final Inception Report shall be submitted within one week of the receipt of comments on the draft form.

Impact Study Implementation

The impact study will be based on study of available documentation and field work - including collection of primary data as basis for the evaluation of impacts.

The work shall be conducted in close consultation with Electricidade de Mocambique (EDM).

The Embassy may participate in the field work, but will not be a member of the team as such.

Norad may participate in the field work and in the review team if found desirable by the consultant and Norad (not to be considered in the tender).

The impact study shall be made in line with the evaluation plan and methodology agreed with Norad as presented in the Inception Report. It is foreseen that it will involve interviews, focus group discussions, and statistical analysis. The use of mixed methods for data collection and analysis will be considered a strength.

5 Reporting and timing

The study shall preferably be finalised by early September.

The field trip shall be carried out as early as feasible and preferably before July.

It is anticipated that the study will require in the order of 10-20 man weeks.

Specific Deliverables and tentative deadlines:

- Draft Inception Report – to be delivered two weeks after project start-up
- Final Inception Report – to be delivered one week after receiving comments from Norad (to include comments from the embassy other relevant stakeholders)
- Field Mission Report – to be delivered one week after field trip, this report can be a presentation
- Draft Report – to be delivered four weeks after Final Inception Report delivered
- Final Report – to be delivered one week after the receipt of comments on the Draft Report

The Final Report shall consist of an executive summary including the main findings and recommendations related to the scope of work.

The report shall address all issues listed in scope of work (or as agreed in the inception phase).

The main component of the report shall address the two focus areas. These focus areas shall constitute an independent section of the Final Report.

The report shall represent a critical and objective evaluation of the three projects.

The report shall be to the point and appendices shall be used if there is need for longer descriptions/explanations and further details.

The report shall be written in English and submitted in electronic form.

6 Consultant team

It is seen as favourable that the proposed team to a large degree consist of consultants based in Mozambique.

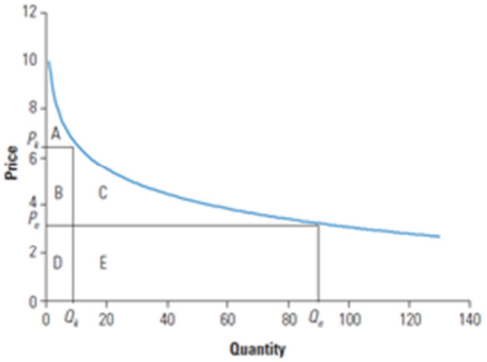
Requirements:

- The team shall speak Portuguese. At least one person has to be fluent in Portuguese
- The team shall consist of at least one person with economic competence

APPENDIX N: EXPLANATION OF THE CONSUMER SURPLUS

Box 5: Explaining the Consumer Surplus Approach

Economic theory states that the total benefit of a given quantity of a good at a given price is equal to the area below the demand curve. In this example, we calculate the benefit of lighting, which is measured in lumens. The blue line shows the demand curve for lumens. Data from an energy survey give two points on the demand curve: price of lumens and the quantity consumed using either kerosene (P_k, Q_k) or electricity (P_e, Q_e). The amount the consumer is willing to pay for a quantity Q is the area under the demand curve from 0 to Q. Hence, the consumer is willing to pay A+B+D for consumption of Q_k, but actually pays just B+D (= P_k Q_k), leaving a consumer surplus of A. Once electricity becomes available, the consumer surplus is A+B+C, so the increase in consumer surplus as a result of electrification is B+C. This consumer surplus has two parts: that arising from the reduction in the price of the Q_k units already being consumed and the consumer surplus associated with the new consumption, Q_e - Q_k.



Note: P_e = price of electricity from the grid; P_k = price of kerosene; Q_e = quantity of electricity used from the grid; Q_k = quantity of kerosene consumed.

Source: IEG, 2008: *The Welfare Impact of Rural Electrification*