End-review

Cabo Delgado Rural Electrification Project

MULITICONSULT

Norad Collected Reviews 10/2016

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www.norad.no
ISBN 978-82-8369-280-8
ISSN 1894-518X

REPORT

End-review Cabo Delgado Rural Electrification Project

CLIENT
Norad

SUBJECT
Final report

DATE: 08.07.2016
DOCUMENT CODE: 128404-Y-RIEn-RAP-001

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Rapport

ASSIGNMENT:	**End Review Cabo Delgado Rural Electrification Project**	DOCUMENT CODE:	128404-Y- RIEn-RAP-001
SUBJECT:	Final report	ACCESS:	Open
CLIENT:	**Norad**	ASSIGNMENT MANAGER:	Linn Silje Undem
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EXECUTIVE SUMMARY

Background

In 2007, Norway and Mozambique entered into an agreement with the objective to support the implementation of the Cabo Delgado Rural Electrification Project Lot 1. As the total project cost turned out to be significantly higher than the estimates made during project preparation, four addenda were signed during the course of the Project in order to complete the planned outputs.

Implementation of the Project was structured into the following four contracts:

1. Consultancy Services
2. Contract 1: substations and 11 kV transmission line
3. Contract 2: Statcom in Nampula
4. Contract 3: 33 kV distribution lines and LV installations including transformer packages

The Project was completed in December 2015. In March 2016 Multiconsult was engaged by Norad to undertake an end-review of the Project. The project has ensured extension of distribution of electricity to 15 villages/towns in the Northern Mozambique, and connections for 3745[1] households, clearly contributing to an overall development in the targeted areas.

Project Implementation and progress

Project organisation

The project was set up as an EPCM contract (Engineering, Procurement and Construction Management) with an EPCM Consultant and three EPC contractors. EDM also established an internal Project Implementation Unit (PIU) responsible for follow-up of both the EPCM Consultant and EPC Contractors.

The organization model is considered appropriate for infrastructure projects like Cabo Delgado Lot 1, and similar setups can be found in comparable projects. **The review team is of the clear impression that the setup seems to have worked well during execution.**

The Embassy also procured monitoring consultants to oversee the procurement process. Quality assurance of the detailed technical design, as well as monitoring of the construction works was however not included in the scope of work for the monitoring consultants. Such quality assurance could have helped ensuring that the technical design was appropriate and that the equipment was delivered according to technical requirements set out in the contracts.

Progress

The ambitions of project completion of Contract 1 and 3 within 2.5 years (June 2007 – December 2009) were clearly very optimistic, taking into consideration the steps and deliverables required in such a project. The review team notes **that the main delays occurred during the pre-construction phase**, and that the construction phase was implemented more or less according to schedule. In the review team´s opinion, **1.5-2 years should be allowed for the pre-construction phase in donor funded infrastructure projects**. The anticipated three-year implementation period for Contract 2 was more realistic, and at least two of the three major reasons for delays were caused by force majeure incidents.

[1] As per December 2015

REV.	DATE	SUBJECT	PREPARED BY	CONTROLLED BY	APPROVED BY
02	8 July 2016	Final report v2	Endre Ottosen and Linn Silje Undem	Linn Silje Undem	Linn Silje Undem
01	29 June 2016	Final report	Endre Ottosen, Jose M.Q. Nicolau and Linn Silje Undem	Ryan Glenn Anderson	Linn Silje Undem
00	20 May 2016	Draft report	Endre Ottosen, Jose M.Q. Nicolau and Linn Silje Undem	Ryan Glenn Anderson	Linn Silje Undem

Procurement and audit
The procurement processes seem to have adhered to the Procurement Guidelines set forth in the Agreement. Some discrepancies were however identified during the first tender evaluation which lead to re-awarding of Contract 1 and updated tenders on Contract 3.
It is the impression of the review team that **the audits to a high degree have been performed in keeping with the contractual requirements and obligations set forth in the Agreement**. The Audits have also been conducted in accordance with statements of International Auditing Standards.

Effectiveness
The format and quality of **the logical framework as included in the Agreement and Addenda does not facilitate systematic follow-up and monitoring of the Project.** The reporting requirements on outputs are seemingly not communicated to or understood properly by EDM as there are several mismatches between the format on foreseen and actual outputs in the final report to the Royal Norwegian Embassy (RNE).

It is the review team's opinion that **the immediate objectives of the project to a large extent have been achieved**, despite delays and budget overruns. The outputs have also more or less been completed/achieved in keeping with the intentions in the Agreement and Addenda.
It should be noted that the output number of connections as established the Agreement is seemingly referring to the total number of targeted connections in Lot 1 and Lot 2, not only Lot 1 which was financed by the grant from RNE. It is the review team´s clear impression that **the introduction of a target of 6310 family connections in the agreement was in fact an error**. This error has been discussed and formally corrected, and the assessment of results achievement should reflect this.

Efficiency
Budget and reasons for overrun
The original budget for the Norwegian support to the Project was 200 MNOK, which was increased to 349 MNOK through Addenda I, II, III and IV, i.e. additional grants amounting to 75% of the original budget. It should be noted that **all contracts have been executed on or below contract value,** allowing use of savings from some of the contracts for additional scope of work. This means that the actual budget overrun is 88.6 MNOK or a 44% increase compared to the original budget.
The review team notes that although the considerable price increase can be partly explained by poor budgeting, **a primary reason for the price escalation was likely the steep increase in market prices** for both transmission (27%) and distribution (31%) from 2004/2005 to 2008. Further, the difficult logistics in Cabo Delgado compared to other provinces in Mozambique seem to be responsible for approximately 10% of the price increase. The sturdy towers and foundations design for the 110 kV transmission line, seems to have had a budgetary implication in the order of 11%. Finally, the use of fixed price contracts led Bidders to secure themselves pricewise, in view of future uncertainties. According to the EPCM Consultant, fixed price schemes would normally result in a price premium of at least 15% to create a security buffer.

Cost efficiency
The unit cost for the 110 kV transmission line is consistent with both EDMs standard cost data as well as Norconsult estimate for Lot 1. The unit cost for the 33 kV distribution line is a bit lower than EDMs expected values and in keeping with or lower than regional benchmarks for similar lines. The **cost for the low voltage installations including the transformer packages are seemingly the main reason why the price of Contract 3 came in higher than expected.**

Cost per connection
The review team notes that the **number of connections has been under-reported by EDM**. The number has neither been corrected for actual energised connections nor been adjusted in order to include additional customers connected after commissioning in 2011.

The average cost per connection to date is on the high side when comparing with other rural electrification projects including EDMs own benchmark. This is mainly caused by the current low number of connections and the relatively high contract price compared to what was budgeted for. The constant effort of connecting new customers will continue to bring down the cost per connection. By assuming a continuously 10% growth rate in terms of new connections over the next 10-year period, the cost per connection for Project is expected to be in keeping with EDMs benchmark in 2020.

Load and consumption

The average annual consumption per household/family in Cabo Delgado was 1017 kWh providing an average consumption of 85 kWh per month. This is close to double of what was estimated in the feasibility study (42 kWh). Since the data for Cabo Delgado also include areas with a high population density, one can assume that the actual consumption data for areas electrified under Lot 1 are lower than the aggregated average.

Technical Aspects

Auasse substation and Nampula Statcom

In the review team´s experience, commissioning of **Auasse substation has clearly facilitated new connections and a more stable supply of electricity** through voltage control as well as increased transmission to the northern part of Cabo Delgado.

The Statcom in Nampula has also had a clear positive impact in the Provinces of both Nampula and Cabo Delgado enabling EDM to increase the transfer capacity from Alto Molocue to Nampula to 135 MW, i.e. an increase of 17 MW, without unacceptable voltage fluctuations.

Dimensioning and use of raw materials

Both EDM staff and the Contractor´s Consultant states that the technical design of the 110 kV transmission line was too conservative, particularly in terms of foundations where American standards were followed resulting in a foundation mass around twice the amount of other similar installations. The review team recognises that the climatic conditions in Cabo Delgado might have influenced the conservative design approach taken by the EPCM Consultant.

Regional power exchange

Lot 3 of the Cabo Delgado Rural Electrification Project was originally meant to include establishment of infrastructure allowing export to Tanzania, but was not implemented. The review team notes that Norplan in their appraisal of the Project from 2005 identified **export to Tanzania as key to ensure the Project's financial viability**. However, this was not a decisive factor for the approval of the Project.

Operation and Maintenance

EDM seems to have **adopted both preventive and corrective maintenance of their assets**. Maintenance plans based on maintenance requirements as well as inspections of equipment are prepared yearly for the both the transmission and distribution system and weekly for the distribution network and guide the overall maintenance. **In general, the financial situation of EDM is challenging due to sustaining tariffs below a cost-reflective level. This makes it challenging to budget sufficient funds for maintenance.** In November 2015, the GoM allowed a tariff increase of almost 30%. However, a sharp fall of the Metical against the USD largely offset the potential increased income from the higher tariffs. Further tariff increases are expected to occur in 2016, hopefully contributing to improve the financial situation of EDM, and thus improving the prospects of allowing sufficient funds for the maintenance component.

Cross-cutting issues, Relevance and Impact

Regional electrification has been a high priority for the Government of Mozambique (GoM), striving to achieve electrification of all the country's district headquarters by 2014. All Cabo Delgado district headquarters was reached in 2015, contributing to achieve this target. The total amount of GoM/EDMs contribution is some 44 MNOK equivalent to a national co-financing level of 11%, when in-kind contribution through tax exemption is included. By deducting the amount related to tax exemption, the national co-financing level equals 1.6%.

Anti-corruption measures have to some extent been addressed in the planning phase. In the project implementation phase, however, anti-corruption has to a little extent been addressed systematically. EDM and its employees do not adhere to any general anti-corruption guidelines or Code of Conduct (CoC). The review team have however no reason to suspect any wrong doing.

It is the review team's clear impression that the electrification project has had substantial positive impact on the areas affected. This was confirmed by all interviewees in the villages visited by the review team. According to the Agreement, a separate socio-economic impact assessment shall be carried out 3-5 years after project completion. The review team has proposed topics to be addressed in this assessment.

Recommendations

The following recommendations should be considered for future infrastructure projects of similar character:

Management

1. The Project should be designed according to a result based management system which facilitates systematic follow-up and monitoring of the Project followed by a corresponding reporting and monitoring system. Examples of such systems were presented in the MTR. Given that EDM has been under-reporting the results achieved by the Project, it seems like the reporting requirements are not properly understood by EDM. The Embassy should thus consider to provide technical assistance/capacity building to EDM on design and implementation of result based management systems.
2. The final report from EDM to the RNE should be updated with the number of energised connections as per December 2015 and relevant values for foreseen output targets. A short explanation on the deviation in the targeted number of families set forth in the Agreement versus the number of families intended for Lot 1 only as well as the difference between service drops[2] and actual energised connections should also be included.

Role and support of Donor

3. When it comes to rural electrification, it must be accepted and respected that the grid will be there for decades and the long-term economic benefits will only increase, whereas the average cost per connection will fall. Thus, in measuring the costs and benefits of projects like these, one should take a minimum of a 5-year, and ideally 10-year, view when it comes to connections and beneficiaries. This is also the case even for minor grid extensions and is the nature of this type of project.
4. Ideally, donor assistance could be provided in a cost sharing model, especially when the "risk" of politically driven projects with longer LV or MV extensions are involved. In Tanzania, such a cost sharing and Result Based Financing (RBF) mechanism (with support provided per connection made) is being implemented. This ensures cost sharing and shifts the risk of cost per connection from the donor to the implementing agency.

Project planning and budgeting

5. Especially in the case of EPC procurement in rural/isolated areas, whereby planning, budgeting and procurement is stretched out over a longer time-frame, accurate early budget estimates will be challenging if not impossible. Budgets should be seen as tentative until tendering is complete, and even then sufficient contingencies should be set aside to cover the challenges of civil and electrical works in challenging and remote terrain.
6. During review of budgets, the following critical questions should be asked; i) How have the challenges of this specific area been accounted for in the budget (e.g. terrain, lack of infrastructure)? ii) Does the budget properly reflect the contracting form and the risk that must be assumed by the contractor? iii) Does the contingency properly reflect the risks of carrying out this type of project in the specific areas?
7. An Agreement structure which reflects the high level of uncertainty in the early budget estimates should be considered. Especially on rural electrifications projects, a contingency of at least 15% should be included until the bids have been received. The contingency should serve as a back-up to cater for either unforeseen circumstances or in case the prices come in higher than expected. Utilisation of the contingency should be subject to an approval from the Embassy.
8. Ensure that realistic time schedules are developed also taking into account time consuming processes of contracting an EPCM Consultant, preparing the design reports, procuring the equipment including the donor's no-objection.
9. Anti-corruption should be addressed systematically as part of the risk assessment along with technical, financial and environmental risks.

Implementation

10. The monitoring consultant contract should be considered expanded to cover also quality assurance of technical design documents and Request for Proposal, as well as monitoring of project implementation and construction on site. Although expanding the scope of work for the monitoring consultant will increase the

[2] A service drop is an overhead electrical line running from a LV pole to the customer's building or other premises allowing them to be connected to the grid.

initial budgets, one might end up saving costs in the implementation phase. However, the potential benefits must be weighed against the additional costs in each case.

11. Training of EDMs local technicians, especially on installation of Top Pole Boxes and energy meters, should be included in the scope of work for the distribution network Contractor.

Sustainability

12. As demonstrated in the Impact Assessment of Rural Electrification in Mozambique from 2013, lifeline consumers are a financial burden to EDM. As connection of large consumers and introduction of productive use of electricity will help bring the customer base up the tariff ladder and thus improve the financial viability of the Project, EDM should consider to develop a plan for an increased connection rate of such customers if such does not exist.
13. As the connection fee of 3500 MZN is a high one-time investment for many private households, measures to overcome this should be considered implemented by EDM.

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Acronyms and abbreviations

BoQ	Bill of Quantity
CoC	Code of Conduct
DCC	Digital Command Control
EDM	Electricidade de Moçambique
EIA	Environmental Impact Assessment
FS	Feasibility Study
GoN	Government of Norway
GoM	Government of Mozambique
ICB	International Competitive Bidding
ITB	Instruction to Bidder
MTR	Mid-Term Review
Norad	Norwegian Agency for Development Cooperation
Project	The Cabo Delgado Rural Electrification Project
RBF	Result Based Financing
RFP	Request for proposal
RNE	Royal Norwegian Embassy
Sabbour	The Consultant responsible for preparation of the feasibility study
ToR	Terms of Reference

1 Introduction

In 2007, Norway and Mozambique entered into an agreement with the objective to support the implementation of the Cabo Delgado Rural Electrification Project Lot 1. As the total project costs turned out to be significantly higher than the estimates made during project preparation, three addenda to the Agreement were signed in order to complete the planned outputs:

Agreement:	*Cabo Delgado Rural Electrification Project (200 MNOK)*	*12.2.2007*
Addendum I:	*Cover costs exceeding original estimates (+30 MNOK)*	*10.12.2010*
Addendum II:	*Construction of Auasse Substation (+27 MNOK)*	*6.10.2011*
Addendum III:	*Installation of SVC[3] plant in Nampula (+85 MNOK)*	*6.10.2011*

In addition, a formal approval was given in 2011 to reallocate unused funds from the existing Agreement in order to construct the 33 kV line from Metoro to Metuge. Further, an additional grant of 7 MNOK was provided through addendum IV in 2014 for covering of Bank Charges. This addendum did not take the form of a formal contract between the Royal Norwegian Embassy (RNE) and EDM. It is not clear whether the amount related to Bank Charges was reflected in the original budget. The Project, including all addenda, was completed in December 2015.

In accordance with requirements in the agreement between Norway and Mozambique, a mid-term review (MTR) was conducted in 2012.

In March 2016 Multiconsult was engaged by Norad to undertake an end-review of the Project. The review team consisted of Linn Silje Undem (Team Leader) and Jose Miguel Quintas Nicolau, and in addition Endre Ottosen was seconded from Norad. The views and opinions expressed in this report are those of the review team and do not necessarily reflect the position of one specific stakeholder.

1.1 Report purpose and scope

The purpose of this end-review, as provided in the Terms of Reference (ToR), is to *"(..) examine the efficiency and effectiveness of the project, as well as to assess technical aspects"*.

While this end-review covers the full Project period (2007-2015), particular attention is given to activities conducted and lessons learned since the 2012 mid-term review. The report aims to establish the degree to which the Project has reached its immediate objectives and outputs. A separate socio-economic impact study will assess development objectives (outcomes) and development goals (impacts), thus this is not addressed in this end-review.

The ToR defines the following main aspects to be addressed in the end-review:

- Cost-efficiency
- Budget overrun and addenda to agreement
- Project organization
- Technical aspects
- Input to impact assessment

The full ToR is included as Annex B

[3] The installation in Nampula is in fact a static synchronous compensator (Statcom) and not a static VAR compensator (SVC)

1.2 Methodology

This review has been conducted partly as a desk study, and partly through a field visit to Maputo and the Cabo Delgado Region, Mozambique. It is based on the OECD Development Assistance Committee´s (DAC) definitions of efficiency, effectiveness, relevance and sustainability of development assistance. The following aspects of the Project have been examined:

- Progress on activities and outputs (chapter 3)
- The extent to which the Project has achieved its objectives (effectiveness) (chapter 4)
- Whether Project implementation has been cost-efficient as compared to alternatives (chapter 5)
- The technical appropriateness of the installed equipment (chapter 6)
- An initial assessment of the Projects impact on livelihood and development (chapter 7)

Finally, chapter 9 presents key conclusions and recommendations for possible future projects.

During and after the visit to Mozambique, the review team conducted a number of interviews with key Project stakeholders. Preliminary findings were presented and discussed with RNE representatives in a wrap-up meeting before leaving Mozambique. A list of people met can be found in Annex A.

Picture 1. Information board from the construction phase.

2 Project Presentation

2.1 Project background

Within its national Energy policy the Government of Mozambique (GoM) set a target of electrifying all district capitals by 2014. Electrification of the province of Cabo Delgado was identified as one of the projects with highest priority in Mozambique's Master plan for extension of the National grid. Being committed and consonant to this policy, EDM prepared an electrification project to extend the national grid to the northern areas of the Cabo Delgado Province (Norplan, 2012).

The Project was structured in the following three lots:

- **LOT 1:** 110 kV line from Metoro to Macomia, electrification in the districts of Quissanga, Macomia and Meluco. Connection of District Headquarters Mahate, Bilibiza, Mucojo, Chai and Muaguide with surrounding areas. Electrification of Matemo, Quirimbas and Ibo Islands were initially included in the scope of the project as an option, but was cancelled due to budget constraints.
- **LOT 2:** 110 kV line from Macomia to Mocimboa da Praia and electrification of the Palma area
- **LOT 3:** 110 kV line continuing to Tanzania

Lot 1 has been financed by Norway, whilst Islamic Development Bank (IDB), the Arab Bank for Economic Development in Africa (BADEA) and the European Union financed Lot 2. Lot 3 was not implemented.

2.2 Project scope and contracts

The scope (as-built) for the Cabo Delgado Rural Electrification Project Lot 1 includes the following items:

- 120 km 110 kV transmission line from Metoro substation to Macomia substation
- 110/33 kV, 16 MVA substation in Macomia
- 110/33 kV, 16 MVA substation in Auasse
- Statcom (75/-75 MVAr) in Nampula
- 275.5 km 33 kV distribution lines
- 48 pcs 33/0.4 kV distribution transformers
- 100 km 0.4 kV reticulation
- Street lighting
- Service connections

Implementation of the Project was structured into four main contracts:

- ENC 18/2006: Consultancy Services (Hifab/Euromoc/Sogreah)
- ENC 18/2006/1: Construction of substations and 110 kV transmission line (Jacobsen Elektro AS)
- ENC 18/2006/2: Statcom (Rongxin Power Electronic Co Ltd - RXPE)
- ENC 18/2006/3: Construction of distribution networks and low voltage installations (Eltel Networks TE AB)

A map of the Project can be found in Figure 1.

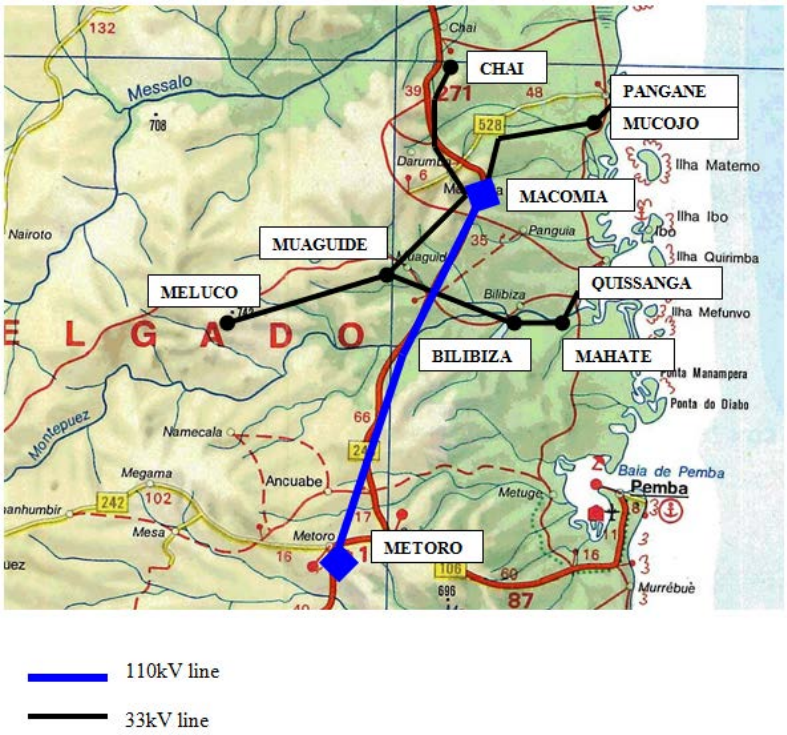

Figure 1. Map of the Cabo Delgado rural electrification project, Lot 1 (EDM)

3 Project implementation and progress

3.1 Project organization

The project was set up as an EPCM contract (Engineering, Procurement and Construction Management). EDM hired an EPCM Consultant (also known as Owners Engineer), which in turn assigned three EPC contractors (Engineering, Procurement and Construction) as described in chapter 2.2.

The EPCM Consultant was a consortium of Hifab, Sogreah and Euromoc. The three partners' main areas of responsibility according to the organization chart found in Figure 2 are:

- Hifab: Project manager and technical responsibility for substations, SCADA, telecom and site supervision.
- Sogreah: Responsible for transmission line and site supervision.
- Euromoc: Regional coordinator and responsible for distribution networks, environment, civil and site supervision.

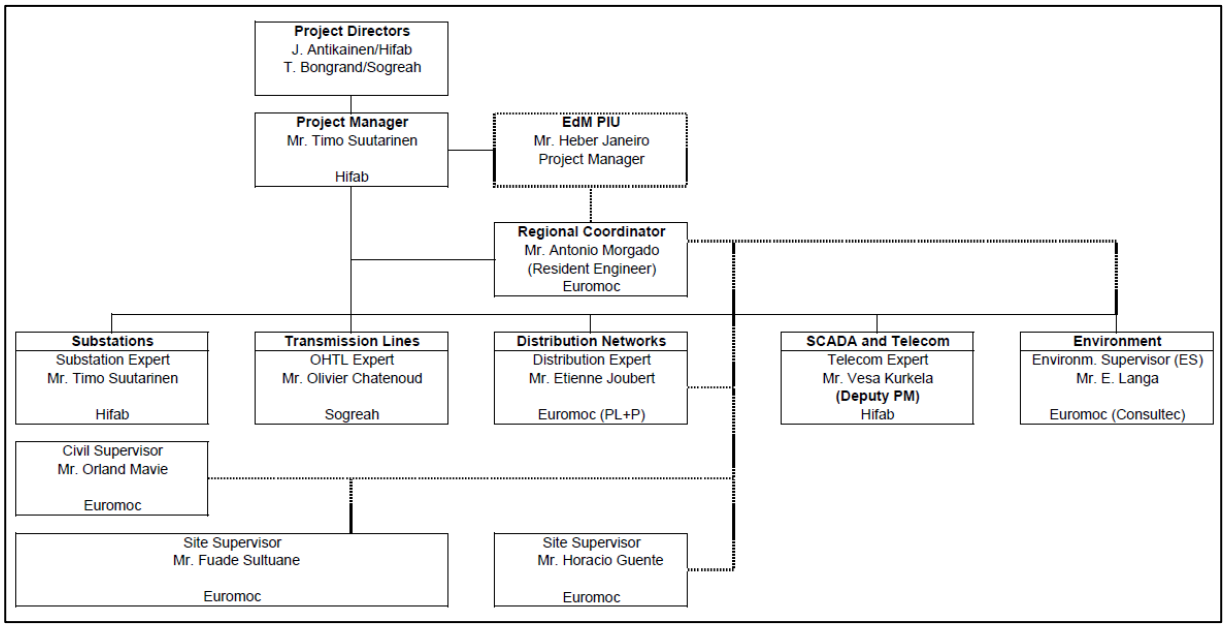

Figure 2. Project organization of the EPCM Consultant (Norplan, 2012).

EDM also established an internal Project Implementation Unit (PIU) responsible for follow-up of both the EPCM Consultant and EPC Contractors. Organisation and responsibilities of the PIU is presented in Figure 3.

The organization model is considered appropriate for such infrastructure projects, and similar setups can be found in comparable projects. **The review team is of the clear impression that the setup seems to have worked well during execution**. Roles and responsibilities of EDM, the Consultant and the Contractors seem to be well defined and adhered to. Jointly progress meetings, on weekly and quarterly basis, were held and both formal as well as informal communications lines have in general ensured that key information are shared between all involved parties. The review team notes that although Hifab was the formal project manager, Euromoc as the regional coordinator played a key role during the project implementation phase and was in practice the project manager on site ensuring proper management and supervision of the contractors. In the review team's experience, EDM was present and sufficiently involved as owner during the design, planning and construction phase.

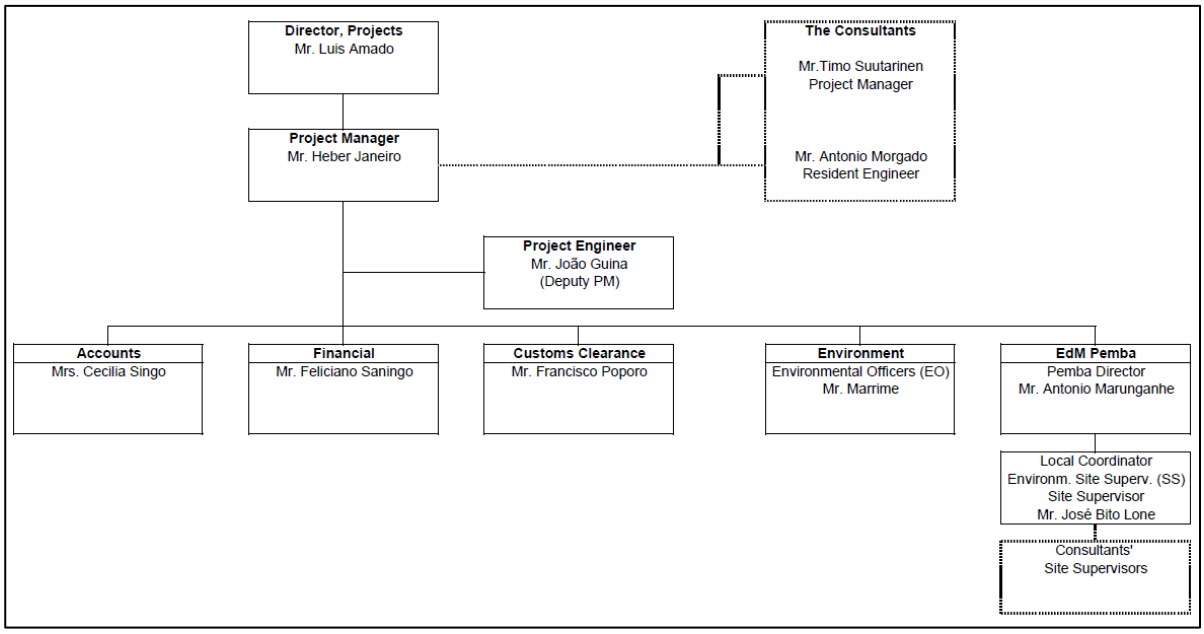

Figure 3. Organization of EDMs Project Implementation Unit (PIU) (Hifab, Euromoc and Sogreah, 2011)

The RNE also procured monitoring consultants to oversee the procurement process. KPMG was hired as monitoring consultant for Contracts 1 and 3 on substations/transmission line and on distribution lines respectively, while Richard Rawson was hired as monitoring consultant for Contract 2 on the Statcom when this was re-tendered. KPMGs assignment was limited to monitoring of the procurement process as well as financial and legal aspects, to ensure a fair and open bidding and selection process in line with the procurement procedures. Mr. Rawson's assignment entailed also monitoring of the implementation of contract works. The procurement of EPCM Consultant contract was not part of the mandate of the Monitoring consultant.

The review team notes that some discrepancies were identified during the first tender evaluation which lead to re-awarding of Contract 1 and updated tenders on Contract 3. The invitation to submit updated tenders for Contract 3 seems to have been an open and transparent process, to which the RNE gave no-objection. However, KPMGs Bid Process Progress Report for Contract 1 informs that the bid evaluation for Contract 1 suggested that "Bidders should be allowed to withdraw (…) contractual deviations in contract negotiations". This would have opened up for passing on a bid which did "not present substantial responsiveness to the commercial and technical specification requested". The RNE gave its objection, which resulted in rejection of the top-ranked Bidder, and awarding of the contract to the next Bidder on the list. The review team have reason to believe that the information leading to the RNE objection was first communicated informally, and that this would not necessarily have been picked up by the monitoring consultant without the efforts of other sources. It is the view of the review team that the role of the Monitoring Consultants will only be filled satisfactory if managed hands on, with the right profiles and sufficient presence.

The review team further notes that the Feasibility Study was subject to a third party assessment. Quality assurance of the detailed technical design, as well as monitoring of the construction works was however not included in the scope of work for the monitoring consultants. To ensure that the technical design is appropriate and that the equipment is delivered according to technical requirements set out in the contracts, the RNE should consider to also include quality assurance of technical design documents and Request for Proposal, as well as monitoring of project implementation and construction on site. Such setup will also enable the RNE to stay informed on a day to day or week to week basis, and thus allow for adjustments and/or corrective measure to be made during implementation.

It can be argued that the EPCM Consultant will ensure adequate quality of both technical design and proper follow-up of the construction works. However, the EPCM Consultant will in many cases first and foremost answer to the project implementer, and in donor funded projects the interest of the donor and the project implementer (beneficiary) will not necessarily always be the same. Thus, in some projects it may be appropriate for the donor to have a consultant protect its interests during project implementation. However, the costs connected with this must always be weighed against the potential benefits.

3.2 Progress

The agreement between the parties does not contain any detailed progress plan or milestones. The assessment is therefore based on information provided in various progress and annual reports as well as findings from the MTR.

An overall summary of progress of the main components is presented in Table 1, and elaborated on in the following.

Table 1. Overall summary of Project progress.

	Planned	Actual	Delay	Main reasons for delay
Pre-construction phase	Q2 2008	Q3 2009	13.5 months	Preparation of Technical Documents due to complexity of the SVC plant in Nampula; Extension of bid submission deadline; Delays in bid evaluation process including no-objection; Sharp price increase of raw materials.
Construction phase (contract 1)	Q1 2011	Q1 2011	3 weeks	N/A
Auasse substation (addenda to contract 1)		Q4 2012		The works have seemingly been completed without delays.
Construction phase (contract 3)	Q1 2011	Q2 2011	1 month	N/A. Majority of facilities were energised and in service by the time of completion.
33 kV Metoro-Metuge (addenda to contract 3)	Q1 2015	Q2 2015	3 months	Delays in access to some of the areas; Extreme weather conditions during the rainy period prevented road access and also caused delays in transport of materials due to shipping cancelations
Construction phase (contract 2)	Q2 2014	Q4 2015	1.5 years	Change of layout; Damage of transformer at port of origin in Malaysia; Severe flooding in Zambézia Province with bridge being destroyed.

<u>Contract 1 and 3: transmission lines, substations and distribution lines</u>

The pre-construction phase was originally scheduled to take 10 months, and the construction phase was scheduled to 18 months. The pre-construction phase was delayed by some 13.5 months, with EPC contracts signed in May (Contract 1) and July (Contract 3, after updated tenders) 2009. The Completion certificates for Contracts 1 and 3 were issued in March and April 2011 respectively (though with a list of outstanding issues for Contract 3, finally completed February 2012). The construction was completed with a few weeks delays compared to contracts, but 1.5 years after the anticipated time of completion in the agreement between the parties[4].

[4] For further details regarding Contracts 1 and 3 we refer to the MTR.

The change order related to Auasse substation became effective in August 2011, and the construction works were completed in October 2012.

The change order related to the 33 kV line Metoro-Metuge became effective in May 2014, and the construction works were completed in April 2015. This line was included as an addendum in order to transfer load from Pemba substation to Metoro substation due to the fact that the power transformer at Pemba substation was overloaded. This new line from Metoro to Metuge is connected to the existing line from Metuge to Pemba establishing a ring between two substations which increases the security and reliability of the distribution system. The review team notes that small villages along the line are foreseen connected through the on-going World Bank funded EDAP program.

Contract 2: Statcom

The Statcom was included as an output in the original Agreement, and the contract was put on tender along with Contract 1 and 3. Due to budget constraints, the Statcom was removed from scope of work as this was considered to be the least urgent component. In 2011, four years after the original Agreement, the RNE and EDM agreed on Addendum II to the Agreement, securing funding for the Statcom. No implementation plan was included in the addendum, but the anticipated time of completion was June 2014.

There were several delays during implementation of contract 2, and the Statcom was commissioned in December 2015, 1.5 years after schedule. As the review team has understood the course of events, there were three important reasons for the delays. Firstly, there was a change in the design layout and a relocation of the plant in Nampula in order to accommodate for a future 220 kV transmission line, which caused 7 months delay. Secondly, the transformer suffered shock damages during transportation at port of origin in Malaysia. Following some investigations, this was assessed not to be significant enough for the equipment to be returned to the producer in China, and it was decided that repairs could be done on site. Thirdly, northern Mozambique experienced some extreme storms in the beginning of 2015, causing a large flood in Zambézia which damaged a bridge passing from south to north[5]. The storms also cut off the power for 3-4 weeks, making it impossible to continue with the construction works. The review team has not been able to identify exactly how much of the delays that was caused by the shock damage to the main transformer, and the storms respectively, as these occurred in parallel, but according to RXPE the total delay of the 2 force majeure incidents were some 6 months. There is reason to believe that customs also caused some minor delays.

The ambitions of project completion of the first two contracts within 2.5 years (June 2007 – December 2009) were clearly very optimistic, taking into consideration the steps and deliverables required in such a project. Tendering of an EPCM Consultant, development and approval of design report, shortlisting of prequalified bidders, tendering of contracts including the donors no-objection and import of equipment are all time consuming processes. It is noted by the review team **that the main delays occurred during the pre-construction phase**, and that the construction phase was implemented more or less according to schedule. In the review team´s opinion, 1.5-2 years should be allowed for the pre-construction phase in donor funded infrastructure projects. The anticipated three-year implementation period for the Statcom was more realistic, and at least two of the three major reasons for delays were caused by force majeure incidents.

3.3 Procurement and audit

3.3.1 Procurement

The Agreement's article VIII sets the terms for procurement of goods and services. According to EDM, the procurement process for consultancy services adhered to the SIDA Procurement Guidelines, as per

[5] Correspondence between Richard Rawson and the Embassy, July 10 2014- March 24 2015

agreement. The review team has not been able to confirm this. There is however no reason to believe otherwise. Tendering of Contracts 1-3 for construction of transmission lines, substations, distribution lines and SVC followed World Bank Guidelines for Procurement under IBRD Loans and IDA Credits. This is confirmed by KPMG, who monitored the first procurement process. Out of these, only Contract 1 and 3 was signed, while Contract 2 was cancelled and re-tendered in 2011 (see chapter 3.2).

The Bid Evaluation Reports submitted to the RNE for no objection was evaluated by KPMG. The review team notes that KPMG highlighted that the proposed contract award to ETDE SA for contract 1 might not be consistent with two of the clauses of the Instruction to Bidder (ITB) and that that the Bid Evaluation Report might not be consistent with the Request for Proposal (RFP). As a consequence, the Bid Evaluation Report was revised by the EPCM Consultant and EDM and Jacobsen Elektro AS was finally awarded the contract.

The second procurement process for contract 2 was monitored by Mr. Rawson who confirms that World Bank Guidelines were followed also in that case. Shortlists and tender documents were submitted to the Embassy for approval, and contracts for no objection, as per Agreement.

3.3.2 Audit

As per the Agreement´s article IX, EDMs financial reports have been subject to annual audits, due within second quarter of each year. A final audit is to be done after completion of the projects final financial report, however this end-review will be completed before this audit can be presented.

It is the review team´s impression that **the audits to a high degree have been performed in keeping with the contractual requirements and obligations set forth in the Agreement.** The Audits have also been conducted in accordance with statements of International Auditing Standards.

The assessment undertaken regarding Project audits is based on the audit report from 2014 which was made available to the review team, and does not include an in-depth assessment of all audit reports submitted to the Embassy. The content of the 2014 audit report seems to largely comply with the obligations set forth in the Agreement. Some of the items listed under article IX point 3 in the Agreement are however not specifically addressed in the audit report, e.g. the item related to illegal and corrupt practices. It is not clear whether this means that the topic has not been assessed by the Auditor or if it was due to the fact that no deviations were identified.

The review team notes that the audit from 2014 reports that the Project advanced some amounts in order to pay some expenses on behalf of other projects[6] without a formal approval by the Embassy.

The review team has not been able to identify whether the audit reports were submitted to the Embassy within the agreed deadlines.

[6] Cabo Delgado Lot 2 and Rural Electrification of Balama and Namuno districts

4 Effectiveness

"Effectiveness is a measure of the extent to which an aid activity attains its objectives"
- DAC Criteria for Evaluating Development Assistance

The logical framework design of the Project as described in Annex I to the Agreement defines development goal, development objectives (outcomes), immediate objectives and a set of outputs. The annexes to Addenda I-IV follows the same structure. The development goal and the development objectives remains unchanged in the Addenda, while new immediate objectives and outputs are introduced. Some of the Agreement objectives and outputs are also repeated in the Addenda.

The format and quality of **the logical framework as included in the Agreement and Addenda does not facilitate systematic follow-up and monitoring of the Project.** This was highlighted in the MTR, which clearly states that the Project lacks a proper result based management system and a corresponding reporting and monitoring system with indicators and targets. Given that contract 1 and 3 were more or less completed when the MTR was conducted, development of such system was clearly not relevant for these contracts. This should however been considered for implementation of contract 2, and the reason for why this was not pursued is not clear to the review team.

The reporting requirements on outputs are seemingly not communicated to or understood properly by EDM as there are several mismatches between the format on foreseen and actual outputs in the final report to the RNE.

4.1 Achievement of immediate objectives

It is the review team's opinion that **the immediate objectives of the project to a large extent have been achieved**, despite delays and budget overruns (see chapter 5.2). The immediate objectives, of which the most important is to connect Cabo Delgado to the national grid from Metoro to Chai[7], is fully achieved. Regarding rehabilitation of electricity networks, there are some examples of existing distribution network components from the old diesel generator sets in the region being rehabilitated and reused where this was feasible, however most of the infrastructure is new. The objective related to improve and stabilize the power supply in northern Cabo Delgado is achieved through construction of Auasse substation, which enables EDM to supply 110 kV through the transmission line from Macomia to Auasse (line C 38) implemented under Lot II. Before the substation was commissioned, the line was operated at 33 kV. This bottleneck reduced the quality of supply in the northern Cabo Delgado region. Finally, the objective to increase the transmission capacity of the 220 kV line through Nampula by 25 MW, by installing a Static VAR Compensator (SVC), has been partly achieved. In practice, the SVC plant increased the capacity by 17 MW (see chapter 6.1). A qualitative assessment of achievements towards the immediate objectives is presented in Table 2.

Table 2. The review team´s assessment of achievements towards the immediate objectives

IMMEDIATE OBJECTIVES	CONTRACT	STATUS
Connect Cabo Delgado to the national electricity grid from Metoro to Chai, in order to improve access to electric power supplied through the national grid;	Agreement Addendum I	**Achieved.** Electricity provided to nine villages/district centers in Cabo Delgado.
Rehabilitate and improve electricity networks, thereby expand and improve supply quality, where the networks are old, run down and at the end of their technical life span;	Agreement	**Achieved**. Infrastructure from networks supplied by old diesel generator sets rehabilitated where possible.

[7] As per Agreement although Lot 1 only included the connection from Metoro to Macomia (line C 37 with a transfer capacity of 70 MVA, or 56 MW).

Construct the substation in Auasse, in order to improve access to stable, reliable electric power supplied through the national grid	Addendum II	**Achieved.** Auasse substation is constructed, enabling 110 kV transmission from Macomia.
Ensure ability to meet expected high demand growth through increase in the transfer limit of about 25 MW in the 220 kV grid to Nampula in the Central –North Transmission Grid	Addendum III	**Partly achieved**. The SVC plant has in practice increased transfer capacity with 17 MW.
Unload the transformer at Pemba	Not Specified[8]	**Achieved.**

4.2 Achievement of Project outputs

As the nature of the outputs vary greatly, it is difficult to make an overall assessment of the achievements. Some of the outputs are reports, studies etc., some of which clearly can be ticked of once completed (such as EIA), while others involve more than one study, but are not further specified (such as detailed survey and design). According to the MTR, all the required studies and reports have been produced and delivered.

A number of outputs are tangible products such as lines, substations and the SVC plant. They are easily measureable as they are either built or not. All but one of these outputs are completed, the exception being the 110 kV line from Chai to Palma as specified in the Agreement. However, this output is not referred to in later reports or in Addenda I. Since the section from Chai to Palma clearly belongs under Lot 2, the review team assumes that this stems from an error in the Agreement, which in fact has been corrected to *"110 kV line from Metoro to Macomia"* in Addenda I. Other outputs again where not defined in the agreement, but have been introduced in the later reports, including the final report. This includes the substations in Metoro and Macomia as well as the 33 kV line from Metoro to Metuge, which all have been completed.

The output on training, tools, equipment and spare parts is also somewhat vaguely described in the final progress report, as it does not quantify/specify the deliverables further. It is the review team's impression that **all necessary equipment, tools and spare parts have been provided according to contracts**. Training has been delivered both as on the job training, and through courses. Some examples of training provided to EDM staff are listed in the following:

- Training in OHTL engineering and design;
- Training in World Bank Conditions of Contract
- Training in Project Management
- Operation and Maintenance training
- Training on electromechanical equipment
- Operator training on DCC system

The remaining outputs are related to new connections/consumers. The agreement states that 6 310 families, 18 schools, 11 health units and an unspecified number of private enterprises shall be connected to the grid and supplied with electricity. The review team notes that 8 schools have been connected, only partly reaching the output target. 15 health units have been connected, an overachievement compared to the target. The reported number of private enterprises connected to the grid is 45. The review team has not been able to verify these figures as EDMs statistics are not structured to provide this level of detailed information. There is however no reason to question the reported numbers.

It should be noted that the output number of connections as established the Agreement is seemingly referring to the total number of targeted connections in Lot 1 and Lot 2, not only Lot 1 financed by the grant from RNE. It is the review team´s clear impression that **the introduction of a target of 6310 family**

[8] Deriving from the additional work related to 33 kV Metoro-Metuge which did not take for as a formal Agreement. The objective is Included in final report from EDM.

connections in the agreement was in fact an error. This error has been discussed and formally corrected, and the assessment of results achievement should reflect this (see chapter 5.4.1). Formally, the effectiveness of the project must be measured against the outputs as defined in the agreement, but it seems clear to the review team that **the achieved number of connections has now exceeded what was actually intended for Lot 1.** A qualitative assessment of achievements towards the outputs is presented in Table 3.

Table 3. The review team´s assessment of achievements towards the outputs.

OUTPUTS	CONTRACT	STATUS
Detailed survey and design prepared	Agreement	**Completed.** Detailed survey was conducted by the EPCM Consultant. The detailed design were prepared by the EPC contractors respectively
Environment Impact Assessment Study carried out	Agreement	**Completed**. Scoping report, complete EIA and EMP was prepared by Sabbour.
Construction and supervision performed	Agreement	**Completed**. Construction was performed by the EPC contractors, and the supervision by the EPCM Consultant
110 kV line from Chai to Palma constructed	Agreement	This line was part of Lot 2 and not financed by Norway
6310 families supplied with electricity	Agreement[9]	**Achieved**. Seemingly an error in the Agreement which was formally corrected in minutes from the annual meeting in 2012. The intended targeted number of families (3456) was achieved in 2015 (3745 families connected per December 2015)
18 schools connected to the grid	Agreement	**Partly achieved.** 8 schools connected per December 2015.
11 health units connected to the grid	Agreement	**Achieved.** 15 health units connected to the grid per December 2015
Private enterprises supplied with electricity	Agreement	**Achieved**. 45 private businesses is reported connected to the grid, hereunder maize mills, carpenter shops and various kinds of vendors.
Training, tools, equipment and spare parts for the projects delivered	Agreement	**Completed.** On the job training as well as training courses
A socio-economic baseline study carried out	Agreement	**Completed.** Carried out by Scanteam and EconPolicy Research in 2010
110 kV line from Metoro to Macomia constructed	Addendum I	**Completed** March 2011
110/33 kV substation in Auasse constructed	Addendum II	**Completed** October 2012. The installation facilitates more stable supply and new connections through increased transmission to northern Cabo Delgado. These connections are not counted or attributed to Norwegian support in this report
The city of Mocímboa da Praia and other areas of northern Cabo Delgado province permanently supplied with stable and reliable electricity, including domestic users, schools, health posts and private enterprises connected to the grid	Addendum II	**Completed** October 2012. Construction of the substation in Auasse enables 110 kV transmission to northern Cabo Delgado, which facilitates stable and reliable electricity supply to the customers
An SVC (Static VAR Compensator) (+75/-75 MVAR) in Nampula installed and operational	Addendum III	**Completed**. Commissioned in December 2015, 1.5 years behind the original schedule
33 kV line from Metoro to Metuge constructed	Addendum IV	**Completed** May 2015
110/33 kV Substation Metoro extended	Not specified	**Completed** March 2011
110/33 kV Substation Macomia constructed	Not specified	**Completed** March 2011

[9] Later corrected in minutes from annual meeting in 2012.

5 Project Efficiency

"Efficiency measures the outputs -- qualitative and quantitative -- in relation to the inputs"
- DAC Criteria for Evaluating Development Assistance

5.1 Budget and expenditures

As the final financial report is yet to be finalised, the end-review is based on the financial statement presented in the semi-annual report from December 2015, updated financial numbers from May 2016 as well as information provided to the review team during field mission.

The original budget for the Norwegian support to the Project was 200 MNOK, which was increased to 349 MNOK through Addenda I, II, III and IV, i.e. additional grants amounting to 75% of the original budget. The first increase of 30 MNOK was due to increased total cost after tendering. When the Auasse substation later was included in the project, the additional cost was estimated to 36 MNOK. This cost was partly covered by the utilization of a positive balance from the execution of the construction contracts (9 MNOK), and the assigned Addendum II of 27 MNOK. To cover the cost of the SVC plant in Nampula, an additional grant of 85 MNOK was included in Addendum III. Lastly, an additional grant of 7 MNOK was provided through addendum IV in 2014 for covering of Bank Charges. The budget and accounting overview can be found in Table 4.

The split of funding between the respective contracts is also shown in Figure 4. For Contract 1 the 110 kV transmission line and substations constitute 44% and 56% respectively. For Contract 3 the corresponding numbers for the 33 kV distribution system and the LV installations including transformer packages are 60% and 40%. It should be noted that all **contracts have been executed on or below contract value** allowing use of savings from some of the contracts for additional scope of work. This should be taken into account when assessing the actual budget overrun. By deducting costs related to outputs that were not included in the original scope of work (Auasse substation including accompanying consultancy services[10], the 33 kV lines in Pemba and the 33 kV line Metoro-Metuge), the actual budget overrun is 88.6 MNOK or a 44% increase compared to the original budget. As the SVC plant was reduced compared to the original scope and the electrification of the islands of Matemo, Ibo and Quirimbas were removed from scope of work, the actual budget overrun is somewhat higher than 44%. The review team has not been able to quantify the accompanying cost implications.

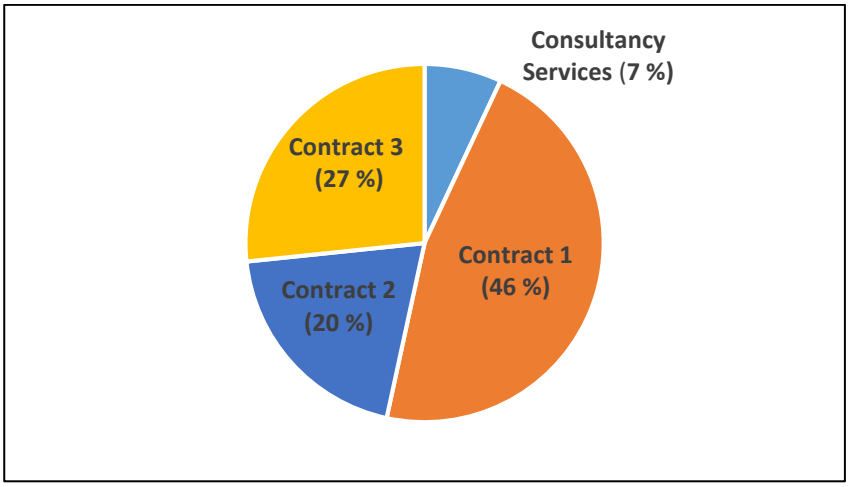

Figure 4. Share of actual contract value including change orders by contract.

[10] Assuming 50 % of Addendum No. 2 to contract ENC 18/2006

Table 4. Actual expenditures versus contract value including share of financing by GoN and GoM respectively.

Contract	Item	Contract value	Actual value	Savings	GoN Funding		GoM/EDM Funding
					Original	Addenda	
ENC 18/2006	Pre-construction Phase	9 131 061	9 131 061		200''	30''	
	Addendum No. 1 (re-tendering of contract 3)	304 722	304 722		200''	30''	
	Construction Phase	6 416 972	6 416 972		200''	30''	
	Addendum No. 2 (Auasse and Nampula)	6 000 000	6 000 000				
	Addendum No. 3 (Change orders to Contract 2 and 3)	2 052 717	2 052 717				
	Total	23 905 472	23 905 472	0			
ENC 18/2006/1	Original Contract	123 999 784	123 675 670	324 114	200''	30''	
	Utilization of contingency (Auasse substation)	6 000 000	5 999 059	941	200''	30''	
	Change Order CO-H-001 (Auasse substation)	29 955 542	29 482 143	473 399		30''+27''	
	Total	159 955 326	159 156 872	798 454			
ENC 18/2006/2	Original Contract	63 337 905	63 337 905			85''	
	Change Order CO-H-008 (remote monitoring system etc.)	6 000 000	5 059 094	940 906		85''	
	Change Order CO-H-009 (change of substation layout etc.)						3 420 150
	Total	69 337 905	68 396 999	940 906			
ENC 18/2006/3	Contract Value	82 773 908	76 468 815	6 305 093	200''	30''	
	Change Order CO-H-002 (33 kV lines in Pemba area)	2 790 600	2 790 150	450	200''	30''	
	Change Order CO-H-003 (33 kV lines Metoro-Metuge)	12 082 748	12 082 748		200''	30''+85''	
	Change Order CO-H-004 (insulators)						316 904
	Total	97 647 256	91 341 713	6 305 543			
Total Contract Cost		350 845 959	342 801 056	8 044 903		342 000 000	4 538 110
Other cost items	Bank charges		7 000 000			7 000 000	
	Compensation (155 291 USD)		1 242 328				1 242 328
	Tax exemption on imported equipment (4.8 MUSD)		38 400 000				38 400 000
	Total Project Cost		**393 180 438**			**349 000 000**	**44 180 438**

The total cost for the project, including Auasse substation, the SVC plant in Nampula, additional 33 kV lines in Pemba and Metoro-Metuge, and Bank Charges is approximately 349.8 MNOK, i.e. some 0.8 MNOK above GoN funding including all addenda. The remaining 0.8 MNOK will be financed by EDM. In addition, EDM contributed with financing of two change orders as well as compensation for loss of land and fruit trees. The GoM has also provided in-kind contribution through tax exemption on imported equipment as well as person-hours for EDM and GoM staff. The review team has not been able to quantify the level of in-kind contribution related to person-hours, but the remaining contribution constitutes according to EDM approximately 44 MNOK when in-kind contribution through tax exemption is included. The review team has not been able to confirm these figures. Further, the review team notes that the financial summary presented by EDM in May 2016 shows a total Norwegian funding of 348.3 MNOK whilst disbursement details from Norad shows a total of 349 MNOK. The review team has not been able to identify the reason for the deviation.

5.2 Analysis behind the budget and reasons for overrun

The original budget derived from estimates presented in the Feasibility Study (FS) from 2005, and was based on the FS Consultant´s (Sabbour) own assessment of market prices as well as data collected during preparation of the FS. The budget in the FS was based on high level unit costs for the transmission and distribution lines, substation and electrification of towns. The budget did however not include detailed estimates of all the cost items. This makes it difficult to assess whether the high level cost estimates were realistic, but the review team is left with an impression that the quality of the budget was poor. The review team notes that Norplan[11] conducted an appraisal of the FS in 2005, and concluded that the cost estimates seemed to match the cost level achievable under International Competitive Bidding (ICB). The budget was revised and updated by the EPCM Consultant when preparing the respective design reports based on input from EDM as well as their own assessment.

In 2008 Norconsult and Vattenfall was engaged by the RNE to analyse the considerable price increase in the bids compared to the original estimates (Norconsult and Vattenfall Power Consultant, 2008). The report clearly states that **the cost estimates presented in the Feasibility Study were too optimistic** not taking into account the difficult logistics in Cabo Delgado compared to other provinces in Mozambique among other factors. The cost estimates in the design report were more realistic, but still a bit on the low side compared to the reference estimates made by Norconsult and Vattenfall. The price estimates from the FS, design report Norconsult/Vattenfall assessment and bids compared to actual contract value are presented in Table 5. As the prices for the distribution line are based on steel, concrete and wooden poles respectively, they are not directly comparable but give an indication of the price level.

Table 5. Price comparison for the transmission/substation and distribution contracts.

Item	FS (2005)	Norconsult reference (2005)	Design report (2008)	Norconsult reference (2008)	Bid (2008)	Actual Contract Value	Increase compared to budget (FS)
110 kV transmission line (USD/km)	48 000	60 000	77 500	89 000	104 000	96 374	101%
110/33 kV substations (MUSD)	2.7	4.4	-	5.5	10.5	9.0	233%

[11] Norplan has been the international brand name of Multiconsult for 40 years. Effective September 2015, all activities has been conducted under the name Multiconsult.

33 kV distribution line excl. LV installations (USD/km)	26 000[12]	-	25 300[13]	27 000[14]	35 000[8]	28 596[9]	9%
Electrification of towns (MUSD)	1.8	-	2.2	-	6.9	4.9	63%

Although the prices for the contracts came in considerably higher than expected, it should be noted that prices between the bidders showed small differences with a variation of 3.7% for contract 1 and 7% for contract 3.

The first SVC tender resulted in only one bidder, and the price was seemingly higher than what could be expected in a market with several bidders. In the second Statcom tender, two suppliers submitted a bid and the prices were within the budget of 85 MNOK.

The review team notes that although the considerable price increase can be partly explained by poor budgeting, a primary reason for the price escalation was likely the steep increase in market prices in the period from 2004/2005 till 2008. This has been documented in several publications, and summarised by Norconsult and Vattenfall in 2008. As can been seen in Figure 5, an increase of 27% and 31% was registered globally for transmission and distribution (construction and equipment) respectively in the period from 2005 to mid-2008.

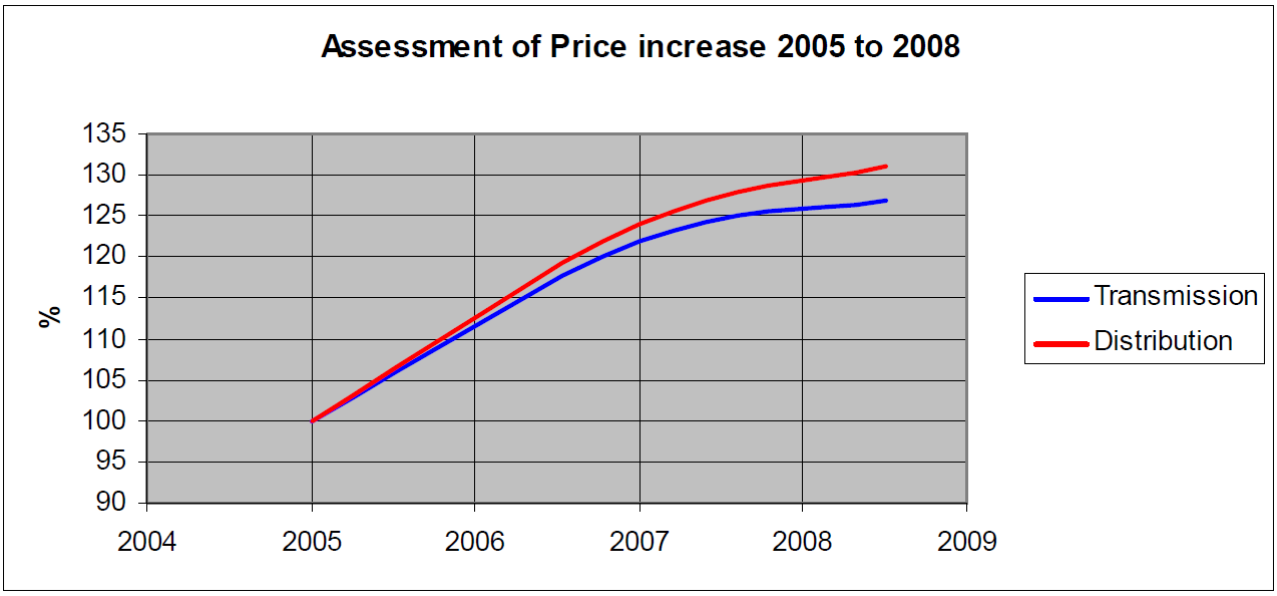

Figure 5. Global price increase for transmission and distribution from 2005 to mid-2008 (Norconsult and Vattenfall Power Consultant, 2008).

Further, the difficult logistics in Cabo Delgado compared to other provinces in Mozambique is seemingly responsible for an additional 10% of the price increase. The sturdy towers and foundations design for the 110 kV transmission line, seems to have had a budgetary implication in the order of 11% (see chapter 5.2). Finally, the use of fixed price contracts led Bidders to secure themselves pricewise, in view of future

[12] Steel poles
[13] Concrete poles
[14] Wooden poles

uncertainties. According to the EPCM Consultant, fixed price schemes would normally result in a price premium of at least 15% to create a security buffer.

The implications of the apparent cost over-runs can be summarized as; i) early stage budgeting is often optimistic and often neglects various (auxiliary) cost elements, ii) one must closely consider local geological and spatial/infrastructure conditions and build in appropriate cost-premiums, iii) recognize that cost risks passed onto the contractor (to make public expenses more predictable) (e.g. EPCs and/or fixed price conditions) will generally come at a cost to the procuring entity, and iv) ultimately, some price risk will result from global economic conditions, particularly regarding metal prices.

5.3 Cost efficiency

5.3.1 Cost

The following elements are the main cost drivers related to implementation of transmission and distribution lines:

- Technical solution (voltage level, tower design, conductor type)
- Local conditions (soil condition, climatic conditions, terrain, level of remoteness)
- Contracting model (lump sum versus budget with invoice based on actual hours spent and EPC versus management contract controlled by the owner)

The unit cost per km for 110 kV and 33 kV lines constructed under Lot 1 compared to relevant benchmarks are shown in Figure 6. Costs related to the EPCM Consultant are not included in the numbers. As the total cost of a project is influenced by all the above parameters, one should be cautious when comparing the unit cost per km for Cabo Delgado Lot 1 directly with other benchmarks. It is the opinion of the review team that comparison with EDMs own benchmarks is the most appropriate standard of reference. Including benchmarks from other relevant countries will nonetheless give a regional reference of the cost level.

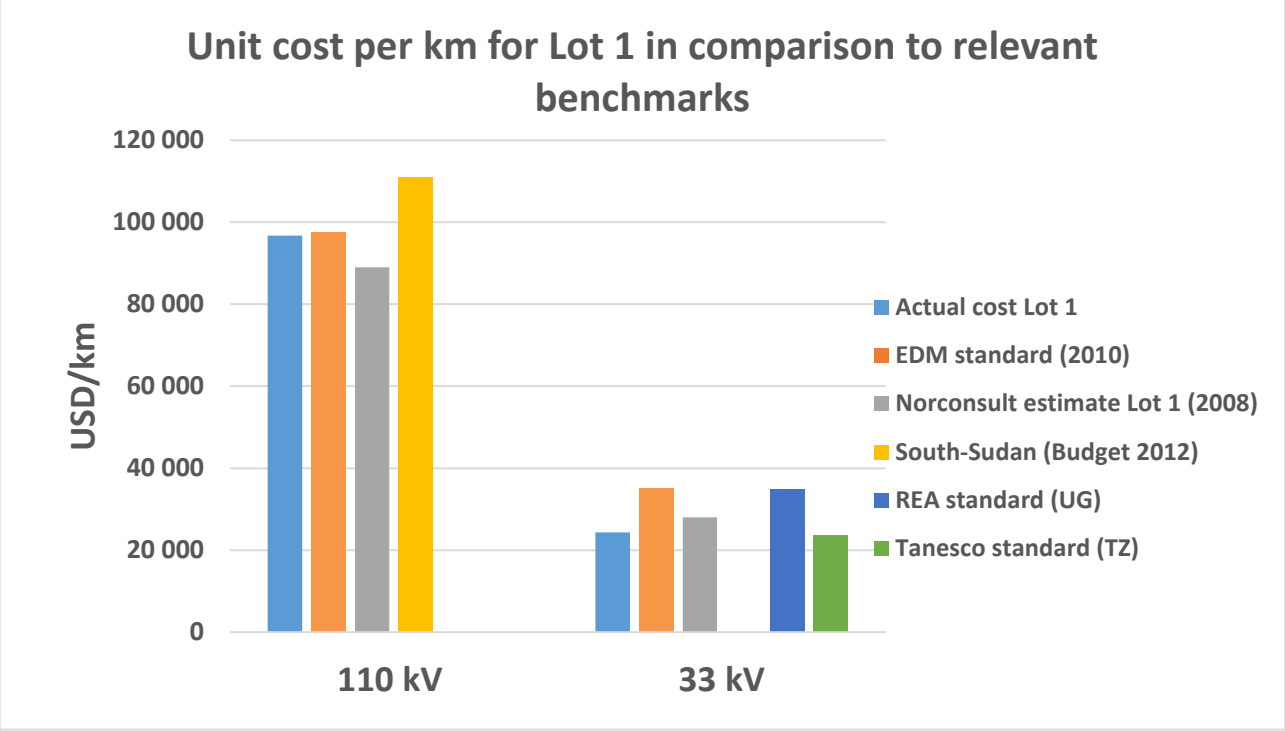

Figure 6. Unit cost per km of Lot 1 transmission and distribution lines compared to relevant benchmarks.

As can be seen from the above figure, **the unit cost for the 110 kV transmission line is consistent with both EDMs standard cost data as well as Norconsult estimate for Lot 1.** The unit cost for the 33 kV distribution line is a bit lower than EDMs expected values and in keeping with or lower than regional benchmarks for similar lines. As indicated in Table 5, the **cost for the low voltage installations including the transformer packages are seemingly the main reason for why the price of Contract 3 came in higher than expected.**

5.3.2 Number of connections

In addition to the tariff level, the number of connections including their consumption is the main driver of the Project´s revenues.

The review team notes that the number of connections as reported by EDM, as well as presented in the MTR, refers to service connections delivered by the contractor and not the actual energised connections. Further, EDM has in its annual/semi-annual reports to the Embassy reported on the number of service drop connections as delivered by the Contractor in 2011 only. The number has neither been corrected for actual energised connections nor been adjusted in order to include additional customers connected after commissioning in 2011. The actual number of energised connections per town/village as presented to the review team during the field mission is shown in Figure 7. According to the data presented by EDM, **the number of energised connections have increased steadily by 400-500 new customers per year since 2011 and reached the intended target for Lot 1 in 2015.**

According to the Director of EDM Pemba, they continuously receive updated targets for new connections in Cabo Delgado. The expected target for 2016 and 2017 are 5500 and 6000 new connections respectively including use of both EDM-Pemba resources for immediate connections and new extensions financed by EDM headquarter in Maputo. This effort to expand new connections will also be partially funded by World Bank EDAP programme.

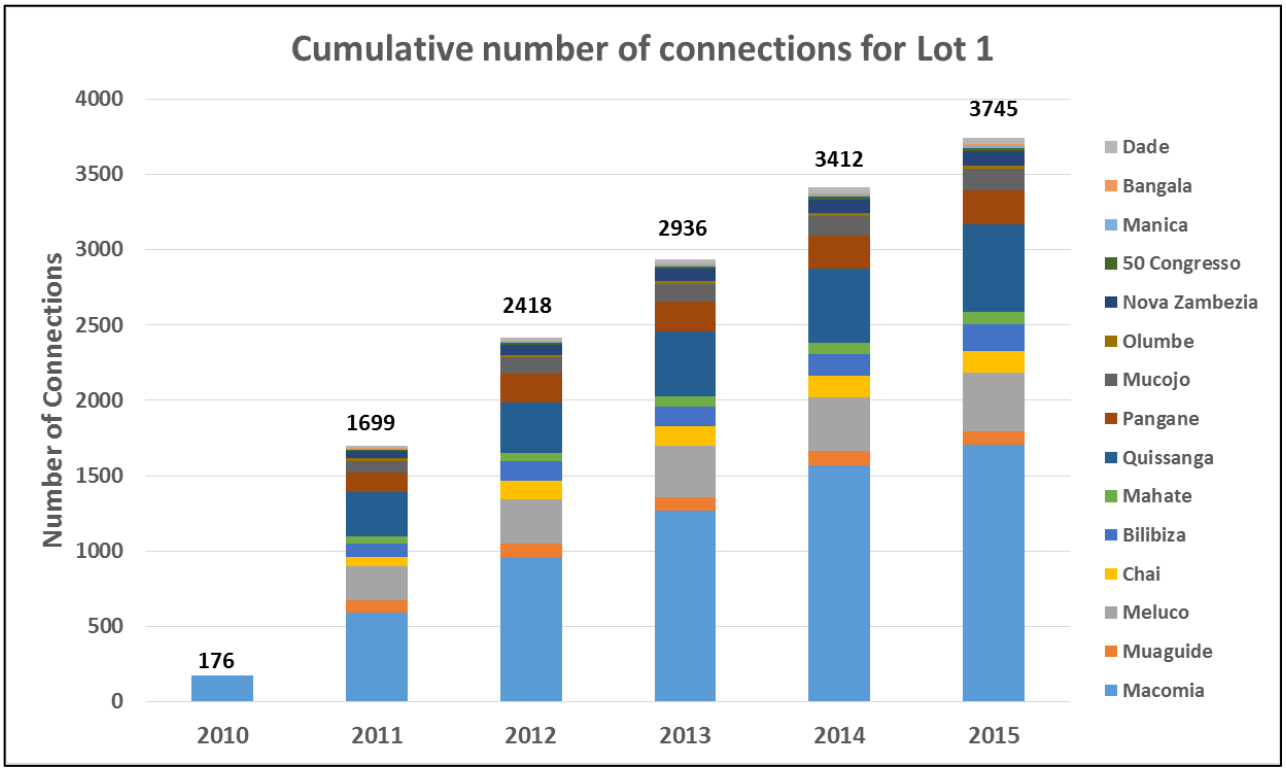

Figure 7. Cumulative number of connections per town/village.

5.3.3 Cost per connection

The current national strategy of providing all district capitals with electricity by connecting them to the national grid highly affects the cost per connection as extension of the transmission system in general is a costly solution for electrification of rural areas in Northern Mozambique. As the **impact of the extension of the national grid to the Province of Cabo Delgado has far reaching implications beyond a mere rural electrification project**, it is in the review team´s opinion not reasonable to consider the costs of extending the 110 kV line from Metoro up to Macomia over 120 km of distance as well as the SVC in Nampula as costs to be attributable to the customers connected under Lot 1. Cost per connection is also influenced by the fact that Mozambique is a large country with low rural population density. Further, the 33 kV lines constructed under Lot 1 will have a combined distribution and sub-transmission function interconnecting areas (i.e. backbone network) with development potential, and will thus enable construction of a significant amount of new low voltage distribution lines from where additional connections will derive in the years to come. The cost of connecting new customers in the targeted towns and villages will thus be lower than the current reference cost.

EDMs rule of thumb for the total electrification cost per connection should amount to between 800 and 1000 USD/connection (Norplan, 2012). These numbers are exclusive of costs related to the medium voltage distribution network (33 kV backbone). For consistency reasons, the comparison cost per connection for Lot 1 is therefore based on costs related to low voltage installations and transformer packages only. By including the low voltage part of the distribution contract including the transformer packages (36.2 MNOK), an additional consultant fee of 7%, a total number of 3745 connections (as per December 2015) and a historical approximate exchange rate of USD/NOK of 6.0 (2010), the connection cost per consumer is 1725 USD. If costs in the high voltage (110 kV) and medium voltage (33 kV) grid is included as well, the connection cost per customer is 6959 USD. This number is exclusive of costs related to substations and the SVC plant in Nampula. By also including the costs related to Metoro and Macomia substation as well as the SVC plant, the cost per connection amounts to 12788 USD. Given the national strategy of supplying new areas with electricity from the grid, extension of the 110 kV transmission system and construction of some 280 km new 33 kV lines were a prerequisite for electrification of the targeted towns and villages under Lot 1.

The cost per connection for Lot 1 compared to relevant benchmarks is shown in Figure 8. It is difficult to compare the connection cost directly with other benchmarks as the nature of the installations and local conditions in different areas and countries vary from case to case. It should nonetheless be noted that the connection cost is seemingly higher in Mozambique than in Tanzania. Having said that, the numbers presented for Tanzania are targets and not actual cost numbers although they are apparently based on average cost estimates from the Rural Electrification Prospectus (2014) and adjusted by Tanesco. To the review team´s knowledge the cost of running an EPC contract has not been taken into account in the cost numbers presented in the Prospectus. It should also be noted that country specific political risk context is somewhat higher in Mozambique than in Tanzania as the latter is considered a more stable country.

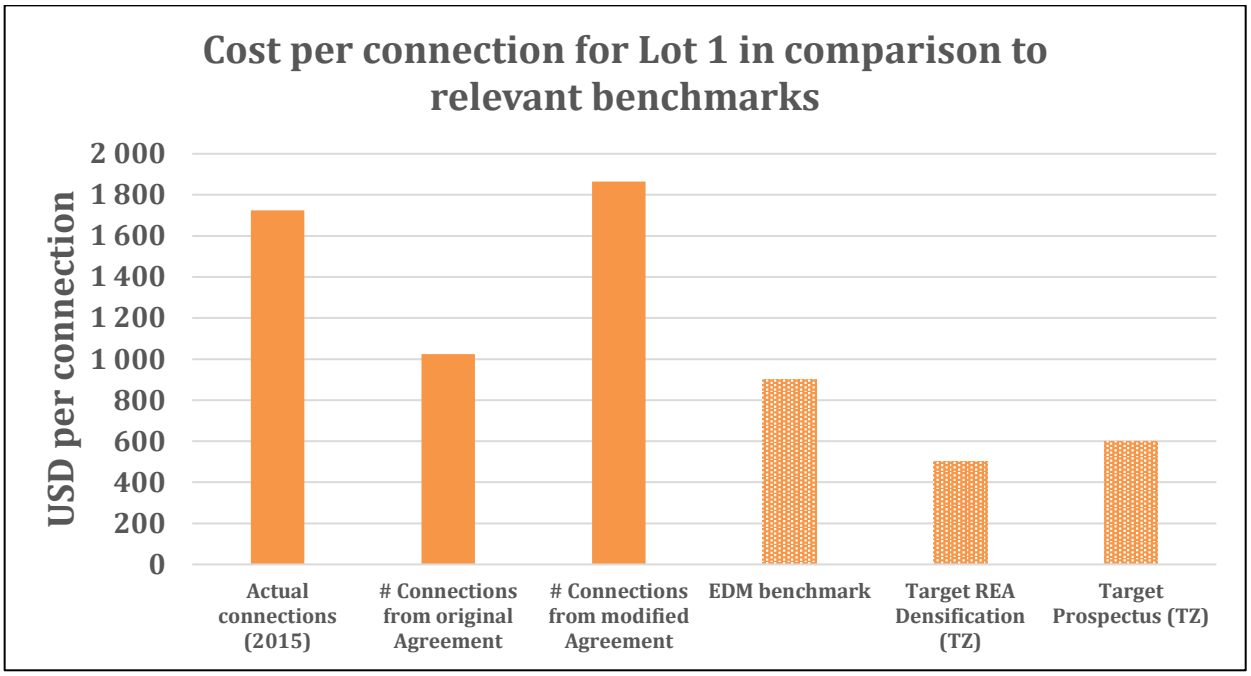

Figure 8. Connection cost per customer as per December 2015 in comparison to relevant benchmarks.

The current cost per connection is high also when comparing with EDMs own benchmark for rural electrification projects. However, it is important to realize that the **cost per connection is also a function of the time-horizon**, as incremental new connections will be done at relatively low cost, continuously bringing down the cost per connection over the life of the MV/LV network. Thus, in benchmarking, one must also consider the time-frame for measurement and the pace of new connections.

Accordingly, based on the continuous effort of connecting new customers in Cabo Delgado, one can expect that the cost per connection will keep on decreasing. That is, the average cumulative growth rate for new connections through the period from 2011 to 2015 was 21.8% per annum. By assuming an average cumulative annual growth rate of 10%[15] over the next 10-year period, the associated cost per connection[16] can be extrapolated. As can be seen in Figure 9, **the cost per connection for the Cabo Delgado Rural Electrification Project Lot 1 over a 10-year planning horizon can be expected to be within EDMs benchmark range[17].**

[15] Based on the growth rate of 9% from 2014 to 2015,
[16] Based on cost of LV installations including transformer packages.
[17] By assuming that the total investment cost equals the cost of the low voltage part of the distribution contract under Lot 1.

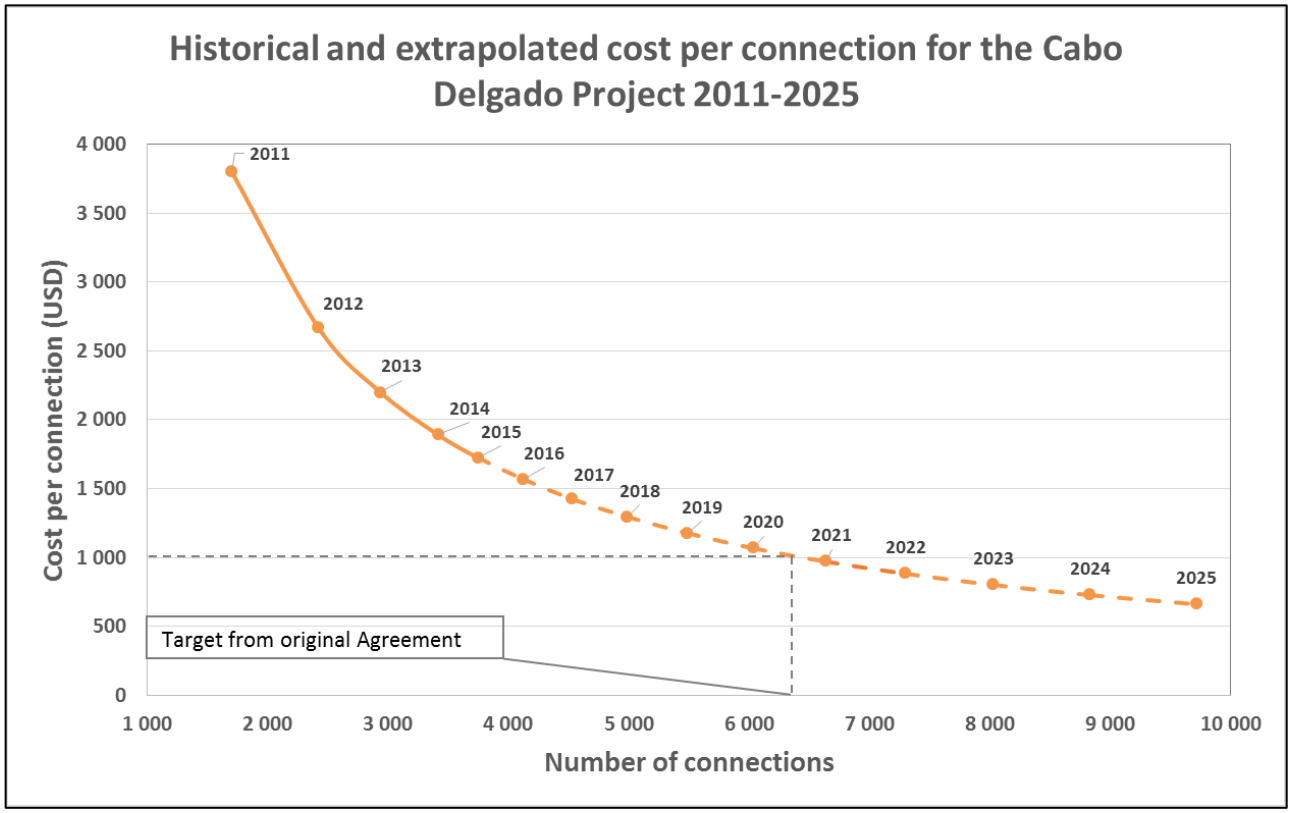

Figure 9. The cost per connection is partly a function of the planning horizon. As demonstrated by the figure, the cost per connection of the installations is falling with every new connection, and can be expected to reach nearly 650 by 2025, well within EDMs benchmark range.

The actual cost of connecting new customers will be lower than the current reference cost per connection as the main parts of the installations are already built. By assuming that for safety reasons each new LV wooden pole can be equipped with one LV distribution box installed with three cable links not exceeding 40 meters, the actual cost can be estimated. The cost of the various items is as follows (excluding cost of ready boards as they are normally outside of EDMs responsibility):

- LV wooden pole in Cabo Delgado: 100 USD (60 USD in Maputo)
- Prepaid meter: 75 USD (exempted of custom duties)
- Insulated cable "Airdrac" (6 mm^2): 1100 USD per km
- Top Pole Box with circuit breaker: 47 USD

Based on the above assumptions, the cost of new connections is 168 USD (33.3[18] + 75 + 44[19] + 15.7[20]). By adding 35% for survey and labour, a cost per connection of 227 USD is arrived at. This is in line with global literature (World Bank, 2012) for connection cost in sub-Saharan countries.

New customers normally pay a fixed connection fee of 3500 MZN which equals some 56-120 USD dependent on the exchange rate applied[21]. The payment will allow them to be connected to the grid including installation of the energy meter. The review team notes that the connection fee is lower than the expected connection cost, but recognizes that there might be local variations which may influence the actual connecting cost. According to EDM there are some cases where the existing grid is located far away from the

[18] Cost of LV wooden pole in Cabo Delgado 100/3 connections = 33,3
[19] Cost of 40 meters of Airdrac insulated cable
[20] Cost of Top Pole Box in Cabo Delgado 47/3 connections = 15,7
[21] June 2010: 1 MZN = 0.029 USD. June 2016: 1 MZN = 0.016 USD

new customer. If the cost of expanding the network is above their budget capacity, EDM will reject the request for connection. However, if the customer can afford the share the costs they might enter into a cost sharing model where EDM normally will cover 60% of the total cost.

5.3.4 Concluding remarks

The end-review shows that **cost per connection for the Project is on the high side compared to relevant benchmarks, applying only those connections made to date**. This is mainly caused by the current low number of connections and the relatively high contract price compared to what was budgeted for. In the review team´s view this is not of major concern as, the **ongoing new connection will likely bring cost per connection in line with EDMs benchmarks within the next five years.**

The review team acknowledge that there is a continuous effort to connect new customers in Cabo Delgado, and notes that EDM performed the following promotional activities during Project preparation and planning:

- If the contract was signed during the construction period, the connection fee was 875 MZN only compared with a normal connection fee of 3500 MZN.
- Sensitisation and information dissemination with regards to benefits from electricity were done during public meetings held by the local authorities.

As many of the household operates on a day-to-day economy, the current roll-out of pre-paid meters will most likely improve the connection rate as well. Further, it became clear to the review team during the visit to Cabo Delgado that the connection fee of 3500 MZN is a high one-time investment for many households. Measures to overcome this, e.g. reduced connection fee and/or down-payment over a longer period, should be considered and implemented by EDM[22].

5.4 Number of connections and consumption

5.4.1 Assumptions behind the original target

Number of families

As mentioned in chapter 4.2, the Agreement identifies a total number of 6310 families to be connected to the grid. As elaborated in the following, the target number of families seems to have been derived from a misunderstanding which was translated into the number as specified in the Agreement.

The FS was originally covering the whole Province of Cabo Delgado. During preparation of the FS, it was decided to split the project into three lots due to the extensive financing requirements. At the same time it was agreed that estimated prices would be prepared for each of the three different lots, but the economic and financial calculation would however be conducted for the project as a whole. When assessing the potential revenues Sabbour made the following assumption (Sabbour, 2005):

> *"It's expected that in the future, 10% of the households will be connected to distribution power supply network right from the beginning and during the following years."*

The whole project was originally covering the following districts: Macomia, Meluco, Quissanga, Muidumbue, Nangade Mueda, Mocímboa da Praia, Palma, Matemo, Quirimbas and Ibo Islands with a total number of inhabitants of 333595. If applying Sabbour´s assumption of 10%, one arrives at 33360 people to be connected to the grid. If one assumes that a Cabo Delgado household/family constitutes an average of 5 people, a total number of 6672 households/families (variation of +5.7% compared to the target of 6310 in the Agreement)

[22] EDM underlines that they do not have the mandate to act as a bank/credit facility, but according to EDMs Pemba director there are ongoing discussion on possible partnerships with a separate facility to manage micro credit schemes.

is arrived at. **Based in the assumptions in the FS, it seems clear to the review team that this was in fact an indicative figure for the number of connections for both Lot 1 and Lot 2, and not just for Lot 1.**

The EPCM Consultant also confirmed that they had received a request from EDM to survey 3456 consumers which in a way demonstrates that EDM was not considering the total output of 6310 consumers to be only for Lot 1, but indeed for the whole project.

The review team notes that the reason for the discrepancy is pointed out both in the MTR as well as in the semi-annual/ annual meetings held in May 2012 and December 2014, and that the minutes from the annual meetings are formally included as part of the Agreement between the parties. Since the number of connections have formally been corrected between the RNE and EDM, the right number should also been included in the reports from EDM to the RNE accompanied by a brief explanation of the background for the error.

Consumption per customer

When preparing the FS, an average consumption of 500 kWh per year per household/family was considered as a baseline. This provides an average consumption of 42 kWh per month, meaning that most of the new customers would fall under the social tariff category (up to 100 kWh per month).

Connection cost

The targeted number of connections as identified in the FS and included in BoQ was seemingly not based on any assumptions or analysis of cost per connection

5.4.2 Load and consumption

Load

Actual load in the area (Macomia and Auasse substation) compared to the initial load forecast set forth in the design phase is presented in Table 6. Data from the period from 2013 till 2014 for Auasse substation and from 2011 till 2014 for the energy consumption in Macomia substation have not been made available for the review team. Although the initial predictions were very optimistic in terms of total load, the relative annual growth rate after the Project was commissioned has been more or less in accordance with the initial forecasts.

The sudden load drop in Macomia substation from 2012 till 2013 is due to commissioning of Auasse substation which distributed the overall load in the area between the two substations. It should be noted that as Auasse substation supplies the areas electrified under Lot 2, adding the load from this substation will not give the actual load for the 15 areas electrified under Lot 1.

Table 6. Load Macomia substation compared to initial forecast.

Load	2010	2011	2012	2013	2014	2015
Initial load forecast excl. Ibo, Quirimbas and Matemo [MW]	5.8	6.1	6.3	6.5	6.6	6.8
Actual load Macomia Substation [MW]	0.3	1.7	2.7	1.1	1.4	1.6
Actual load Macomia Substation (GWh)	N/A	N/A	N/A	N/A	N/A	6.5
Actual load Auasse Substation (MW)	N/A	N/A	N/A	N/A	N/A	4.1
Actual load Auasse Substation (GWh)	N/A	N/A	N/A	N/A	N/A	19.7

Consumption

Based on the existing tariff structure of EDM, the customers fall under one of the five following tariff categories:

1. Domestic (social, families);
2. Commercial (commerce, cafeterias, restaurants, small business and industry);
3. Agriculture (mainly irrigation);
4. Great Consumers of Low Voltage (industry that is supplied by LV);
5. Medium and High Voltage consumers.

EDMs annual statistical report contains consumption data for each Service Area including Pemba. Disaggregated data for the areas electrified under Lot 1 is not available, thus the consumption per customer as identified in the FS has been compared with aggregated data for the whole Cabo Delgado. Although the aggregated consumption data does not allow one to assess the direct project impact, they will give a fair indication of the consumption in the electrified areas under Lot 1. In addition, the review team has estimated some indicative consumption numbers based in Ampere data from the outgoing 33 kV feeders at Macomia substation shared by EDM.

In 2014 the household sector in Cabo Delgado represented 46% of total invoiced energy, and industry/commercial customers[23] account for 46% as well. Further, the average annual consumption per household/family in Cabo Delgado was 1017 kWh providing an average consumption of 85 kWh per month. This is close to double of what was estimated in the feasibility study. Since the data for Cabo Delgado also include areas with a high population density, one can assume that the actual consumption data for areas electrified under Lot 1 are lower than the aggregated average. A rural electrification impact study conducted by Norplan in 2013 (Norplan, 2013), identifies an average monthly household consumption for domestic and social customers in rural areas of 63 kWh and 45 kWh respectively. The review team notes that these numbers are more in keeping with the assumption from the Feasibility Study.

A measure of the impact can be assessed by the growth in consumption that Cabo Delgado experienced from 2005 with a total invoiced consumption of 29 MWh per year to 74.7 MWh in 2012. This corresponds to an increase of 258%, which is in line with estimates made by Sabbour that indicated a growth of 250-350% due to suppressed demand being met. The increase from 2012 to 2013 (96 MWh) and from 2013 to 2014 (108.7 MWh) was 13.2% and 7% respectively. The feasibility study forecasted an average annual increase of 7% for the remaining time of the project.

Based on the Ampere data for each outgoing 33 kV feeder at Macomia sub and by applying the following assumptions, an indicative average household consumption can be estimated for the areas electrified under Lot 1:

- Hours of consumption: 4062 (average 2015 numbers as presented in Table 5Table 6)
- Distribution losses: 20%
- Number of household: 3745
- Share of households: 60%

Based on the above assumptions, an average monthly household consumption of 73 kWh is arrived at. By assuming that the share of households equals the average number for the whole Cabo Delgado (46%), the accompanying average monthly consumption is 56 kWh. It should be noted that this also includes the consumption at the island of Ibo which was not financed by Norway.

[23] Includes both the commercial, great consumers of low voltage and the medium and high voltage consumers

To the degree Norad wants to identify the actual consumption for the areas electrified under Lot 1, it should be considered to include this in the socio-economic impact assessment to be conducted 3-5 years after project completion.

6 Technical Aspects

6.1 Auasse substation and Nampula Statcom

Auasse substation

Auasse substation was originally included in Lot 2 of the Cabo Delgado Electrification Project, but due to budget constraints, EDM was forced to look for temporary solutions with installation of mobile substations in Auasse. According to the Decision document from 2011 it was argued that operation of the network with a mobile substation is not a reliable system, since it only has one outgoing feeder. Such solution was considered acceptable for emergency situations but not for continuously operation of the grid, and the supply of electricity in Mocímboa da Praia and other parts of northern Cabo Delgado were low and unreliable.

The review team notes that the 110 kV line from Macomia to Auasse is lightly loaded and spans over a long distance. This causes high voltage levels, especially at the end of the line. The shunt reactor installed in Auasse substation helps bringing down the voltage to acceptable levels.

In the review team´s experience, **commissioning of Auasse substation has clearly facilitated new connections and a more stable supply of electricity through voltage control as well as increased transmission to the northern part of Cabo Delgado.**

Statcom in Nampula

The need for additional voltage control facilities in the Central-North Transmission System in Mozambique has been justified in several studies including the Electrification Master Plan. Following cancellation of the first tender for the 150 MVAr capacitive and 50 MVAr inductive SVC plant due to budget constraints, updated analysis were performed both by Norconsult and the EPCM Consultant. The need for the large SVC plant was initially based on the assumption that the supply in the northern areas would be strengthened by constructing a new line from Phombeya in Malawi to Nampula. As Malawi did not support the interconnection project, this measure was no longer considered realistic on a short to medium term. Hence the rationale for the large SVC plant was no longer in place neither from a technical or economic point of view. Nonetheless, there was still a need for voltage control in the area, and the updated analysis showed that a SVC plant with a capacity range of 75 MVAr capacitive and 25 MVAr inductive could increase the transfer limit of about 25 MW (Norconsult and Vattenfall Power Consultant, 2008).

According to the Transmission Department in EDM, **the Statcom in Nampula has had a clear positive impact in the Provinces of both Nampula and Cabo Delgado**. Before its installation the transmission transfer capacity was limited to 118 MW from the substation in Alto Molócué (Zambézia Province) to the substation in Nampula. The limitation was linked to the need to keep voltage at acceptable levels i.e. 110 kV ± 5% variations, and previously EDM experienced that in some occasion the voltage dropped to 90 kV. The limitation led to load shedding during peak hours and the installation of an emergency diesel powered station (by Aggreko) selling electricity at 15 USD cents per kWh. This power plant has been closed since the Statcom entered into operation in December 2015. The Statcom also **enabled EDM to increase the transfer capacity from Alto Molocue to Nampula to 135 MW, i.e. an increase of 17 MW, without unacceptable voltage fluctuations.** The review team is not in a position to assess the reason for why the actual increase is 8 MW or 32% lower than estimated as this requires a more in-depth analysis. In general, such deviation might be caused by changes in key assumptions, e.g. the system load, or if the estimates were based on some incorrect assumptions.

Commissioning of the SVC plant in Nampula has also has a positive impact on the transmission corridors from Nampula to Moma and Nampula to Nacala.

6.2 Dimensioning and use of raw materials

The technical design for the Project was prepared by the EPCM Consultant based on the feasibility study, EDMs technical standard as well as other national and international standards as found applicable by the Consultant. It is the understanding of the review team that the technical design for the 110 kV transmission line as proposed by the EPCM Consultant deviated from EDMs own standard for such equipment.

Both EDM staff and the Contractor´s Consultant (Jøsok Prosjekt AS) states that the technical design of the 110 kV transmission line was too conservative, particularly in terms of foundations where American standards were followed resulting in a foundation mass around twice the amount of other similar installations. According to Jøsok Prosjekt, the design of the towers was also conservative compared to similar installations. This has not been confirmed by EDM, and the review team has not been able to verify Jøsok´s statement. The final Design Report from December 2007 states that *"…the Contractor shall be free to propose alternative types of foundations, providing these comply with general requirements specified"*. According to Jøsok Prosjekt, several meetings and discussions were held with the EPCM Consultant (Sogreah) to change the design requirements for the 110 kV transmission line, but they did not reach an agreement and based the detailed design on the requirements set forth in the RFP. EDM also looked into the possibility of requesting Sogreah to redesign the 110 kV foundations, but that would have implied delays on project implementation and the Ministry of Energy was eager to see the Project progress through without further delays.

Based on information provided by EDM on a similar transmission line built in Niassa Province, the various components of a 110 kV transmission line represents the following share of the total cost:

- Foundations: 15%
- Conductor and fittings hardware: 45%
- Steel lattice tower: 25%
- Design and OPGW: 15%

By assuming that the foundation mass was doubled, the foundations would represent 26% instead of 15% as per the above information. Based in these assumptions, it might be concluded that the choice of American Standards for foundations did have a budgetary implication in the order of 11% for the 110 kV transmission line.

It should also be noted that Cabo Delgado is in a climate zone under influence of the monsoon system, which brings in heavy rain falls over short periods, leading to the creation of swamp-like areas during the rainy season. The review team has not been able to verify whether the climatic conditions in Cabo Delgado influenced the conservative design approach taken by Sogreah, but recognize that this might be an explanation for the sturdy design adopted.

Regarding use of insulators the review team verified that **the insulators installed are dimensioned for 110 kV and not for 420 kV as suggested in the MTR.**

6.3 Losses

According to EDM, the losses in the distribution network in Cabo Delgado are ca. 20% of which 6% represents technical losses, and 14% non-technical losses. The non-technical losses are mainly related to thefts, meters not working properly, poor meter reading and deficient invoice processing.

The losses in the transmission system in Mozambique are normally in the range of 7-7.5%. Before commissioning of the Statcom in Nampula, the transmission losses in the Cabo Delgado Province were higher than the benchmark. The review team has not been able to quantify this number, but notes that the reason

for construction of the Statcom in Nampula was to control reactive power flow in order to stabilize the system voltage and partly also reduce the system losses.

The Central-Northern System is currently being fed from Cahora Bassa/Songa, and except for a few back-up diesel generators with limited capacity there are no local generation facilities. This affects the transmission cost related to electrification of rural areas in Northern Mozambique. In the review team´s opinion introduction of local generation sources in the Northern Mozambique will reduce the overall transmission losses in this area. Such strategy might also postpone some of the investments in the grid in this part of Mozambique. On the other hand, it should be noted that the fluctuation in power output from intermittent renewable energy resources results in a need for additional energy to balance supply and demand on the grid on an instantaneous basis, as well as ancillary services such as frequency regulation and voltage support which will increase the overall cost of such solution. When determining the most appropriate solution for electrical supply to the Northern part of Mozambique, proper grid analysis including load flow and losses should be conducted. The available energy resources in the area should also be assessed in this regard.

6.4 Regional power exchange

Lot 3 of the Cabo Delgado Rural Electrification Project which originally was meant to include establishment of infrastructure allowing export to Tanzania has been briefly assessed in the feasibility study. **The assessment did however not address the export potential or realism of such plans** as it is limited to a very short description of line length as well as indication of the line´s starting- and endpoint (border of Tanzania). The export line was neither included in the 2004 Electrification Master Plan. This has also been confirmed by EDM which states that no detailed studies of the export potential were undertaken. Based on the above findings, it is the impression of the review team that Lot 3 was included in the feasibility study more as a future possibility than a realistic project to be implemented in near future. This is seemingly also the reason for why Lot 3 was not pursued. The review team notes that Norplan in their appraisal of the Project from 2005 identified export to Tanzania as key to ensure its financial viability. However, this was not a decisive factor for the approval of the Project.

When it comes to possible future export opportunities, the review team notes that a MoU was recently signed between EDM and TANESCO with the goal to study such an interconnection, and that joint technical working groups that will study the possibility of cross border power exchanges are currently being established. According to EDM, the existence of Lot 1 and Lot 2 of the Cabo Delgado Rural Electrification Project has created the conditions for start developing what will possible become Lot 3.

The Northern part of Mozambique, namely Cabo Delgado Province, Niassa Province and Nampula Province are currently being fed by a long radial network coming from Cahora Bassa Hydro Power Station, and the system is therefore without redundancy. Last year´s floods in Zambézia Province caused the disruption of the supply to the Northern region for more than three months, thus there is a need for another injection point of power supply. This could either be the interconnection with Tanzania, a new gas power plant in Mocimboa da Praia (70MW), a new hydro power plant (e.g. 50 MW in Lurio river or 50 MW in Messalo river), a solar power plant in Metoro (30MW), or a combination of various alternatives in line with the Energy Strategy of Mozambique that recommends diversifying the energy matrix by increasing the number of generation sources.

As the power exchange characteristics of Lot 3 would allow supply of small loads in Tanzania as Mozambique is currently doing with Malawi, Zimbabwe and Swaziland, the word interconnection with Tanzania is misleading as it usually is associated with power exchanges of a bigger magnitude. Connection of Cabo Delgado to the national grid by a 110 kV transmission line would open new prospects for a joint collaboration between EDM and TANESCO that could be actively pursued for mutual benefit.

6.5 Earthing grid connection

All steel supports in the new part of Metoro substation are seemingly thoroughly connected to the earth grid through duplicated earthing connections at each foundation. The review team has not been provided sufficient drawings to verify that the integration of the new and old earthing grids have been performed in a correct and safe manner, but notes that the protection equipment is working well and that no faults have been reported by EDM Transmission Department which is operating the Substation.

Further, it can be noted that the substation in general has a very good record and this end-review concurs with the technical assessment in the MTR stating that *"The overall impression of the construction work is that this part of the Phase III, Lot 1 project is performed according to high standards. EDM will be supplied with electrical equipment that should be fully operational for the predefined lifespan with relatively low maintenance cost".*

6.6 Follow-up of findings from MTR

The recommendations and findings listed in the MTR regarding the 110 kV line and 33 kV distribution system, were according to EDM assessed with regards to their feasibility of being implemented. As the Project was already commissioned when the MTR was undertaken, some of the recommendations could not be implemented and while other have been addressed.

6.6.1 Substations and 110 kV transmission line

Status on follow-up of findings from the MTR regarding substations and the 110 kV transmission line are presented in Table 7.

Table 7. Status on follow-up of the findings from the MTR regarding substations and the 110 kV transmission line.

Finding	Status
Transmission line lattice towers for Lot 1 have very sturdy design. Required sturdiness should be analysed and verified prior to project commence in order to focus project efficiency by optimizing the overall material cost.	Please refer to chapter 6.1.
One operator house built at Macomia is vacant. Relevant requirements should have been assessed before implementation in project.	The operator house is no longer vacant as one of the operators have moved in.
Risk assessment concerning fire consequences should be addressed further. The consequences if a major fire occurs in the main building in Macomia or Metoro is very severe for the whole district.	MTR brought up the non-existence of active fire extinguishing system in the main building for any parts of the installations. The review team raised this issue with EDMs Director of Transmission and despite the fact that this is not yet contemplated on EDM standards, new consideration shall be given to this issue, especially viewed in light of several fires over the recent years. The issue of unreliable water supply has been satisfactorily resolved with wells being drilled now allowing reliable water supply in Macomia substation. Air conditioners are now in operation.
Remote service modem for reprogramming, maintenance and monitoring of the SCADA system should be considered.	According to EDM Director of Transmission, there is an ongoing project of installing a mini-SCADA to monitor all parameters from Cahora Bassa to Auasse.

Adequate local storage facilities and a system for registration and storage logging for mandatory spares and surplus parts from the installation should be implemented and maintained.	Storage in Metoro have been satisfactorily resolved. In Macomia this issue needs to be further addressed. While recognizing that there were no signs of components being stolen and also the fact that those components are manufactured to endure sun and rain exposition, better protection would prolong its life. Proper storage systems will also allow for better inventory control, as well as give a better overall impression of the facilities.

6.6.2 Distribution network

Status on follow-up of findings from the MTR regarding the 33 kV distribution network are presented in Table 8. It should also be noted that ELTEL does not agree with findings in the MTR stating that *"due to sturdiness of the foundation, poles may also have a weak spot near the base if subjected to heavy forces, e.g. from wind"*, and claims that they have not experienced this problem.

Each of the LV wooden poles constructed under Lot 1 is equipped with a box (each pole can carry one to four boxes) from where only three connections should derive[24]. As observed during field trip EDM is increasing the number of connection drops per box in each pole. This should be avoided for safety reasons.

Table 8. Status on follow-up of the findings from the MTR regarding the 33 kV distribution network.

Finding	Status
Tension of 33 kV overhead lines, verification log of applied force during erection	According to EDM, the tension of the 33 kV overhead lines are in keeping with the technical specifications and identical to other 33 kV lines in Mozambique.
Protective caps on pole top cutting surface to prevent direct water exposure	The review team has not been able to verify whether protective caps have been fitted according to the contract requirements. ELTEL did however claim that all poles were delivered and installed with protective caps. According to ELTEL Final Inspection Report (FIR) from early 2013 (after DLP) no remarks were made on protective caps. The review team has asked the EDM project manager to request Cabo Delgado Staff to climb some poles and verify their existence.
Increased cross arm mechanical strength to inhibit deformation	EDM believes that the current design is working well and is of higher quality than the previous technical solution.
Fulfilment of protection class (IP) requirements in cabinet cable entries	The issue concerning cabinet cable entries have been addressed and are now in accordance with required degree of protection.
Padlocks on ground cabinet in order to prevent unauthorized access to live high energy parts	Padlocks on ground cabinet in order to prevent unauthorized access to live energy parts are in place.
Securing stays, for instance by applying high force pincer clamp-on at ground levels	EDM is aware that the material is valuable for poachers, and is continuously considering various mitigation measures to overcome this problem. A key issues in this regard is to anchor the project well in the population as well as to involve them on the O&M.
Guaranteed steel strip life span expectancy in Cabo Delgado climate	According to Eltel, the same type of steel strip was installed in Nampula in 1999, and they are still there and working well.
Reuse of equipment, risk assessment and acceptance procedure	According to EDM, an assessment of the quality of the equipment was conducted before they were reused.
Securing of high energy main rising cable at domestic interface	Not followed-up. Installation of the electric energy meters was the responsibility of EDM Pemba, and not included in the Project. The review team notes that EDMs own local technicians are seemingly lacking skills related to handling and installation of such equipment.

[24] Advice from the supplier according to Eltel

Fire hazards in housings	EDM acknowledge that although the ready boards are made for outside conditions, they are installed inside due risk of thefts and vandalism. The ready boards should however be well protected and only prepared for a single lamp. Until now there have been no reports of fire.

Picture 2. Storage of surplus parts from the installation works in Macomia substation.

6.7 Operation and maintenance

6.7.1 Distribution network

Operation and maintenance (O&M) of the distribution network in Cabo Delgado is the responsibility of the EDM Pemba office. **Maintenance plans based on maintenance requirements as well as inspections of equipment are prepared yearly and weekly, and guide the overall maintenance of the assets. EDM seems to have adopted both preventive and corrective maintenance.**

EDM ensures sufficient funding of operation and maintenance by cross-subsidizing the costs. Revenues from electricity sales in the various district offices are transferred to the EDM headquarter and allocated according to the approved annual budgets. According to the Director of the EDM Pemba office, 35% of the budget received monthly from EDM Headquarters is to be spent on maintenance according to the maintenance plans. The Director also confirms that the budget received from the head office is sufficient to cover their O&M activities.

Implementation of the Cabo Delgado Rural Electrification Project enabled EDM to replace the diesel generator sets previously operating in Pemba. The city capital of Pemba used to spend some 300 000 USD per month on diesel as well as on high maintenance costs. Other parts of the province e.g. Macomia, previously had a diesel gen-set that operated for a maximum of 5 hours a day (17h to 22h) supplying only a few customers such as the District Administrators Offices, the hospital and the police. Before electrification reached this district the gen-set consumed 200-300 litres of diesel per day, supplying power of poor quality and reliability. According to EDM, savings from closing down the diesel production alone is sufficient to cover for funding of O&M of the new grid.

6.7.2 Substations and 110 kV transmission line

Maintenance of the 110 kV transmission line and substations is co-ordinated by the Directorate of Transmission Systems through its office in Nampula. According to EDM, **annual maintenance plans based on inspections by the regional operator as well as periodic maintenance requirements are prepared and**

adhered to by the regional offices. Maintenance activities normally starts immediately after commissioning with monitoring of erosion and replacement and/or repairs of equipment if deemed necessary. A centralized maintenance system with overview of needs and activities is not in place, hence EDM is fully reliant on their on-site staff. Lack of spare parts or specialized staff to do certain tasks will sometimes result in delays in repairs, but this is not considered to be a major problem.

Theft and vandalism is a challenge in some corridors, e.g. Nampula-Nacala, but EDM has so far not faced this problem in Cabo Delgado.

The amount of funding for O&M activities is identified during the annual budget process, and the final budget is approved by a budget committee. According to EDM, the maintenance budget for the whole transmission system is some 6 MUSD and includes minor rehabilitation works as well. The review team recognises that the sturdiness of parts of the equipment might have a good impact on maintenance costs as well by reducing them to simpler activities.

In general, the financial situation of EDM is challenging due to sustaining tariffs below a cost-reflective level. This makes it challenging to budget sufficient funds for maintenance. In November 2015, the GoM allowed EDM to increase the tariff (average price is 7 cents of USD) from 2.7Mt to 3.5Mt, equivalent to an increase of almost 30%. However, a sharp fall of the Metical against the USD largely offset the potential increased income from the higher tariffs. Further tariff increases are expected to occur in 2016, hopefully contributing to improve the financial situation of EDM, and thus improving the prospects of allowing sufficient funds for the maintenance component.

EDM has also adopted a policy of involving the local population in their O&M activities. Implementation of such approach to maintenance has shown to be less expensive and at the same time more inclusive by bringing additional revenues to the local population who can experience direct benefits from the existence of the infrastructure beyond the direct power supply to their households. This helps ensure local ownership of the grid infrastructure.

Picture 3. Vegetation clearing at Metoro substation.

7 Relevance and Impact

"Relevance is the extent to which the intervention is suited to the priorities and policies of the target group, recipient and donor"

"Impact addresses the positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended"

- DAC Criteria for Evaluating Development Assistance

7.1 National and local ownership

Regional electrification has been a high priority for the Government of Mozambique. Plans for expansion of the national grid to the province of Cabo Delgado were defined in the 2004 Electricity Master Plan (EDM, Mozambique Electricity Master Plan Study, 2004). The importance of extending the national grid to this northern-most region of the country was confirmed for the review team during the meeting with the National Director of Energy in The Ministry of Mineral Resources and Energy (MIREME). Up until the early 2000s, the reach of the national grid was limited to the capital and the regional centres, and the government has been under pressure from the regional administration in the districts to increase access to electricity beyond the major cities, and to replace the existing diesel generator sets in the district capitals. A pilot project was launched in Tete province, with a 5-year plan to electrify all district headquarters in the province. The project was considered a success, and it was decided to replicate this other regions, to increase access to electricity all over the country. Cabo Delgado was selected as one of the follow-up districts, and the target to reach all Cabo Delgado district headquarters was reached in 2015. The project has been of high priority, and EDM has reported to MIREME on the progress on a regular basis.

The Cabo Delgado Rural Electrification Project was structured in three lots, and Norway agreed to finance Lot I. As mentioned in chapter 5.1, the GoM provided in-kind contribution through a tax exemption on imported equipment as well as person-hours for EDMs own staff. In accordance with the Agreement, EDM also covered compensation for loss of land and fruit trees as well as two change orders. The total amount of GoM/EDMs contribution is some 44 MNOK equivalent to a national co-financing level of 11%, when in-kind contribution through tax exemption is included. By deducting the amount related to tax exemption, the national co-financing level equals 1.6%. One can find similar set-up in comparable projects in Uganda, where Norway has also been an active donor. In the Agreement between the MFA and the Government of the republic of Uganda on construction of the 220 kV Nkenda-Hoima transmission line (2012-2017), MFA commits to grant 300 MNOK to finance the project, while Uganda commits to "defray any customs duties, VAT and other taxes, fees and levies on all equipment, materials and supplies financed by the grant and imported into Uganda for the benefit of the project". In that case, the contribution from Uganda is not quantified in the agreement. The same clause can be found in the agreement between MFA and Uganda on construction of three rural distribution gird projects, (Mubende-Kyenjojo, Kabale-Kisoro and Rakai-Lyatantonde-Sembabule). In that case the budget quantifies the MFA contribution to NOK 112 mill/ USD 20 mill, and the contribution from Uganda to USD 4.39 mill (18 %), to cover way leaves compensation, taxes and outreach/awareness raising.

7.2 Initial assessment of impact

The following initial assessment on the Project´s impact on livelihood and development is stemming from relevant observations in the field. No systematic approach or quantification of impacts are included as this will be addressed by a separate socio-economic economic impact assessment to be conducted 3-5 years after project completion.

The review team visited two of the villages directly impacted by the Lot 1 electrification, as well as several other villages and towns in the province. Interviews were conducted with town/village authorities, private costumers, local business-owners, a vocational training centre/teachers school and a local health clinic.

It is the review team's clear impression that the electrification project has had substantial positive impact on the areas affected. All interviewees state that access to electricity 24/7 has improved their daily life. The private costumers mentions possibilities to do homework, social activities and sports in the evenings as well as access to national and global news through internet as some of the positive impacts. Private businesses owners, such as the owner of a local maize mill in Macomia, informed that 24/7 access to electricity has enabled him to serve more customers during the day, and thus increase the revenues. Another Macomia villager opened a "mobile telephone hospital" after being connected to the grid, and with the revenues from the business on mobile telephone repairs and services he is able to support his family.

Picture 4. Maize mill in Macomia

Picture 5. Mobile telephone hospital in Macomia

Picture 6. Health Clinic in Bilibiza previously supplied with solar PV

The electrification of Bilibiza village resulted in replacement of the diesel gen-set at the ADPP Agro Vocational Training Centre and Teachers Education by more affordable and stable supply of electricity from the grid. The director informed that the grid connection has had a great impact on the operation of the school. With 24/7 access to electricity, the school has invested in several water pumps which both supplies tap water and have facilitated expansion of their cultivated land. They have invested in new agricultural machinery, and they are developing a small sports arena, which the student can use for activities also in the evenings. With access to electricity, some of the students have also invested in refrigerators and set up small shops to sell cool beverages to their co-students. Also for the local health clinic in Bilibiza, replacing the old PV-panel with grid-supplied electricity have had positive impact. With 24/7 access to stable electricity they now have stable cooling for vaccines, and equipment such as microscopes and incubators can be used.

The socio economic baseline study was conducted in 2010, and most connections were done between 2011 and 2012. Since then, some 4-500 new connections have been added each year. Because of the delays in installation of the SVC plant, the project was not finally completed until December 2015. The agreement formally states that the impact assessment is to be done 3-5 years after project completion, meaning primo January 2019 at the earliest. However (and even though new connections are added continuously), the review team is of the opinion that since most connections were made in 2011-2012, the socio-economic impact assessment can be conducted already in 2017 or 2018. The assessment should build on findings from the baseline study and include proper statistical techniques for deriving solid findings on impacts of the electrification efforts. To ensure that the assessment is based on solid data, end-user surveys should be conducted and the methodology should be based on international best practice. Data from the end-user surveys should be complemented by focus group discussions and secondary source analysis.

The socio-economic impact assessment could among other address the following main elements:

- Net financial impact on EDM):
  - Actual consumption per customer category
  - Capital, operational and generation cost
- Impact on private business development:
  - Impact on existing business
  - Number and type of new businesses created
  - Barriers to business creation and productive uses of electricity
- Impact on regional growth:
  - Number of schools and pupils connected
  - Number of health clinics connected
  - Impact on other public service institutions
- Impact on poverty reduction and equality:
  - Household income
  - Poor and vulnerable households
  - Energy expenditure and quality
  - Wealth distribution

To the degree Norad wishes to quantify the impacts, a cost-benefit analysis could be considered, using either detailed survey data or appropriate rules of thumb. No matter, efforts should be made to quantify number of beneficiaries and attribute relative costs and benefits to the various stakeholders, as the distribution of these are often key drivers of the eventual sustainability of the intervention. For example, to what degree have benefits come in the form of low cost electricity versus improved revenues from EDM? And, to the degree quantification is at the focus of the study, KPIs such as cost-benefit ratios and NPVs can be estimated.

The review team notes that construction of Auasse substation and the 33 kV line from Metoro to Metuge have facilitated new connections beyond the towns and villages directly financed by Norway. It should therefore be considered to include these areas in the socio-economic impact assessment. Given that baseline data are lacking, the scope of work should be adjusted accordingly.

8 Cross-cutting issues

8.1 Anti-corruption

Anti-corruption is listed as one of four cross-cutting issues in Norwegian Grant Management, and shall be addressed in all projects funded by grants from Norway. It is mandatory to undertake systematic risk assessments both during planning and implementation of projects, and risk of corruption/anti-corruption measures should be addressed in these assessments.

Anti-corruption measures have to some extent been addressed in the planning phase. The Agreements Annex I identifies the risk of corruption as one of 12 risks, and highlights the risk of corruption in the tender phase, and the risk of mismanagement of funds. Further, Annex II to the Agreement lists "Problems or risks" as one of the elements to be addressed in annual/semi-annual progress reports. The Agreements article VIII on Procurement lists requirements which should, if followed, reduce the risk of corruption in procurement of goods and services. The Agreements Article IX lists the requirements for audits, hereunder that audit reports shall include opinions/findings on whether the audit has uncovered any illegal or corrupt practices.

In the project implementation phase, however, anti-corruption has to a little extent been addressed systematically. Up until 2011, the progress reports from EDM did not present any risk assessments or follow-up of risks as identified in the Agreements annex I. Starting from 2012, risk assessment matrixes are included in the semi-annual/annual progress reports following recommendations from the MTR. The risks are categorized as technical, financial and environmental risk, however corruption is not addressed specifically. It should also be noted that EDM and its employees do not adhere to any general anti-corruption guidelines or Code of Conduct (CoC). That said, the review team have no reason to suspect any wrong doing.

While shortcomings in the corruption risk assessments are identified, it should also be noted that the use of monitoring consultants may mitigate risk of corruption in the procurement processes. As described in chapter 3.3.1 on procurement, the monitoring consultants confirm that World Bank/SIDA guidelines were followed during the procurement process. As discussed in chapter 3.3.2, audits have been performed in keeping with the contractual requirements.

For future reference, it is important that corruption risks are addressed systematically and according to contract in the project implementation phase.

8.2 Environment, gender mainstreaming and human rights

Assessment of environment[25], gender mainstreaming and human rights is outside the scope of this end review. A few observations are however included in the following.

Interviews with local village and district heads gave promise to the review team that the process prior to electrification was conducted in an including manner. At least two rounds of public meetings were held prior to the construction, where the population in each village was informed about opportunities, possible negative impacts, the expected price level etc. A needs assessment where inhabitants could express interest to be connected to the grid was also conducted.

Regarding compensation, EDM informs that for each line located in a populated area, there was a systematic mapping of possible impacts on livelihoods, loss of property or cultivated land, cutting of fruit trees etc. At least one village administrative leader confirms that this mapping exercise was conducted in collaboration with representatives from the local communities. No resettlements were requires. **Negative impacts on livelihood were compensated according to a fixed maximum amount for each category of loss.** The rates for compensation are regulated through a general state regulation, but each Province has some flexibility

[25] An EIA was conducted by Sabbour in 2005.

when it comes to applying the compensation level although it cannot exceed the maximum amount as stated by the Government. However, there are at least one report from a villager claiming that compensation for loss of trees had not been paid according to the agreement. According to one source, there was a case in which a village meeting decided that instead of compensating for losses, the available funds should be reallocated for further line construction. This information remains unconfirmed, but on a general note it should be underlined that such practice should not be accepted.

Picture 7. Electrification of private households in Bilibiza.

9 Conclusions and Recommendations

This Project has been highly relevant for Mozambique in terms of expanding the national grid to the northernmost province and by that providing access to electricity to rural areas. Extension of the national grid to the Province of Cabo Delgado is also considered to have far reaching implications beyond a mere rural electrification project as it improves the quality of supply both in the Provinces of Nampula and Cabo Delgado. Further, several of the installations financed by Norway facilitates new connections outside of the targeted area for Lot 1. The Project has also seemingly had a substantial positive impact on livelihood and development in the areas affected.

The Project is over all considered to be well executed and the installations seems to be well kept according to good standard. However, the project plans were too optimistic in terms of both budgeting and scheduling, **partly due to weak underlying analysis**. Although the main reason for the increased costs seems to be related to the steep increase in market prices for distribution and transmission lines, other factors could have been foreseen, such as difficult logistics in the Cabo Delgado region, the cost implications of the sturdy design, and the contracting model (EPC with fixed price conditions). Regarding the progress of the project implementation, the delays caused by re-tendering was difficult to foresee, however the scheduling of the pre-construction phase should have been more conservative.

Despite the slow start, the Project progressed well once commenced and construction works related to contract 1 and 3 were completed with only minor delays. The immediate objectives and outputs have more or less been met, the exemption being the increase in transfer capacity enabled by installation of the Statcom in Nampula which in practice increased the capacity by 17 MW and not 25 MW as originally planned. EDMs reporting of results to the RNE still have shortcomings, especially when it comes to presentation of actual outputs compared to what was originally foreseen.

The average cost per connection to date is on the high side when comparing with other rural electrification projects including EDMs own benchmark, but is expected to be in line with the benchmark within another five years. The constant effort of connecting new customers will continue to bring down the cost per connection. By assuming a continuously 10% growth rate in terms of new connections over the next 10-year period, the cost per connection for Project is expected to be in keeping with EDMs benchmark in 2020.

As this is an end-review, most of the corrective measures recommended in the following is not relevant to implement for this Project. They should however be considered for future infrastructure projects of similar character:

Management

1. The Project should be designed according to a result based management system which facilitates systematic follow-up and monitoring of the Project followed by a corresponding reporting and monitoring system. Examples of such systems were presented in the MTR. Given that EDM has been under-reporting the results achieved by the Project, it seems like the reporting requirements are not properly understood by EDM. The Embassy should thus consider to provide technical assistance/capacity building to EDM on design and implementation of result based management systems.
2. The final report from EDM to the RNE should be updated with the number of energised connections as per December 2015 and relevant values for foreseen output targets. A short explanation on the deviation in the targeted number of families set forth in the Agreement versus the number of families

intended for Lot 1 only as well as the difference between service drops[26] and actual energised connections should also be included.

Role and support of Donor

3. When it comes to rural electrification, it must be accepted and respected that the grid will be there for decades and the long-term economic benefits will only increase, whereas the average cost per connection will fall. Thus, in measuring the costs and benefits of projects like these, one should take a minimum of a 5-year, and ideally 10-year, view when it comes to connections and beneficiaries. This is also the case even for minor grid extensions and is the nature of this type of project.
4. Ideally, donor assistance could be provided in a cost sharing model, especially when the "risk" of politically driven projects with longer LV or MV extensions are involved. In Tanzania, such a cost sharing and Result Based Financing (RBF) mechanism (with support provided per connection made) is being implemented. This ensures cost sharing and shifts the risk of cost per connection from the donor to the implementing agency.

Project planning and budgeting

5. Especially in the case of EPC procurement in rural/isolated areas, whereby planning, budgeting and procurement is stretched out over a longer time-frame, accurate early budget estimates will be challenging if not impossible. Budgets should be seen as tentative until tendering is complete, and even then sufficient contingencies should be set aside to cover the challenges of civil and electrical works in challenging and remote terrain.
6. During review of budgets, the following critical questions should be asked; i) How have the challenges of this specific area been accounted for in the budget (e.g. terrain, lack of infrastructure)? ii) Does the budget properly reflect the contracting form and the risk that must be assumed by the contractor? iii) Does the contingency properly reflect the risks of carrying out this type of project in the specific areas?
7. An Agreement structure which reflects the high level of uncertainty in the early budget estimates should be considered. Especially on rural electrifications projects, a contingency of at least 15% should be included until the bids have been received. The contingency should serve as a back-up to cater for either unforeseen circumstances or in case the prices come in higher than expected. Utilisation of the contingency should be subject to an approval from the Embassy.
8. Ensure that realistic time schedules are developed also taking into account time consuming processes of contracting an EPCM Consultant, preparing the design reports, procuring the equipment including the donor's no-objection.
9. Anti-corruption should be addressed systematically as part of the risk assessment along with technical, financial and environmental risks.

Implementation

10. The monitoring consultant contract should be considered expanded to cover also quality assurance of technical design documents and Request for Proposal, as well as monitoring of project implementation and construction on site. Although expanding the scope of work for the monitoring consultant will increase the initial budgets, one might end up saving costs in the implementation phase. However, the potential benefits must be weighed against the additional costs in each case.

[26] A service drop is an overhead electrical line running from a LV pole to the customer's building or other premises allowing them to be connected to the grid.

11. Training of EDMs local technicians, especially on installation of Top Pole Boxes and energy meters, should be included in the scope of work for the distribution network Contractor.

Sustainability

12. As demonstrated in the Impact Assessment of Rural Electrification in Mozambique from 2013, lifeline consumers are a financial burden to EDM. As connection of large consumers and introduction of productive use of electricity will help bring the customer base up the tariff ladder and thus improve the financial viability of the Project, EDM should consider to develop a plan for an increased connection rate of such customers.
13. As the connection fee of 3500 MZN is a high one-time investment for many private households, measures to overcome this should be considered implemented by EDM.

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Annex A: List of people met

	Name	Organization	Title
1	Mrs. Camilla Helgø Fossberg	Royal Norwegian Embassy	Counsellor
2	Mr. Heber Janeiro	EDM	Project Manager
3	Mr. Abraao Rafael	EDM	Deputy Director
4	Mr. Ernesto Fernandes	EDM	Consultor
5	Mr. Antonio Morgado	Euromoc	Director
6	Mr. Jan Erik Johnsson	Hifab	Project Manager
7	Mr. Helder Gimo	EDM Pemba	Director
8	Mr. Jose Lone	EDM Pemba	Local Project Coordinator
9	Mrs. Joaquina Nordine Abdalberto	Macomia Town Authority	Chief Administrator
10	Mr. Damiao Chavlota	Bilibiza Town Authority	Chief Administrator
11	Mr. João Guina	EDM	Deputy Project Manager
12	Mr. Feiliciano Massingue	EDM Transmission Department	Director
13	Mr. Robert Berg	Eltel Networks TE AB	General Project Manager
14	Mr. Victor Hasson	Eltel Networks TE AB	Import/Export Manager
15	Mr. Pascoal Bacela	MIREME	National Director of Energy
16	Mr. Andrew Smith (telco)	Rongxin Power Engineering (RXPE)	Contracts Manager
17	Mr. Stein Sundbye (telco)	Jacobsen Elektro	Project Manager
18	Mr. Richard Rawson (telco)	Independent Consultant	N/A
19	Mr. Thor Oftedal	Royal Norwegian Embassy	Counsellor (former)
20	Mrs. Mari Sofie Furu	Royal Norwegian Embassy	Counsellor (former)

Annex B: Terms of Reference

Terms of reference
End Review
of
Cabo Delgado Rural Electrification Project, Mozambique
(MOZ-3035 – MOZ-04/286; MOZ 10/0037; MOZ-10/0060; MOZ-11/0021)

Background

Norway has provided support to the energy sector in Mozambique since the 1970s, financing several transmission/distribution line projects over the years. In 2006, the Norwegian Embassy in Maputo received an official request for support to the implementation of the Cabo Delgado Rural electrification project. The request was based on the Government of Mozambique's Master Plan for extension of the national grid (see attached list of reference documents), in which the electrification of the northern province of Cabo Delgado was identified as one of the projects with high priority. According to a baseline study conducted in 2010, 90 % of the population in the region were below the poverty line, and less than 2 % had access to power supply.
The Master Plan structures the project in three lots. Norway was requested to finance Lot I, and BADEA – the Arab Bank for Economic Development in Africa was requested to finance Lot II. The first agreement between Norway and Mozambique regarding electrification of Cabo Delgado was signed in 12 February 2007, with the objective to connect Cabo Delgado to the national grid from Metoro to Chai (Lot I). The total costs for the project turned out to be significantly higher than the estimates made during preparation of the project. Three addenda to the contract was signed between 2010 and 2011, in order to complete the planned outputs.

Agreement	Cabo Delgado Rural Electrification Project	12.2.2007	NOK 200 million
Addendum I	Cover costs exceeding original estimates	10.12.2010	NOK 30 million
Addendum II	Construction of Awasse Substation	6.10.2011	NOK 27 million
Addendum III	Installation of SVC[27] plant in Nampula	6.10.2011	NOK 85 million
Total			NOK 342 million

The project including all addenda was finalized 17 December 2015. The Agreement's Article X, states that the following reviews and evaluations shall be made:

- Socio-economic base line study: Commissioned in 2009, completed in 2010.
- Mid-term review: Commissioned and completed in 2012
- End-review: To be carried out within six months after project completion
- Socio-economic impact study: To be carried out 3-5 years after project completion

Purpose of the End Review

The purpose of the review is to examine the efficiency and effectiveness of the project, as well as to assess technical aspects. The review shall follow-up on and provide added value compared to the mid-term review (MTR) from 2012, and tease out lessons learned. The review shall focus on the immediate objectives and outputs. The separate socio-economic impact study will assess development objectives (outcomes) and development goals (impacts), thus this will not be addressed in the end review.
The review will address the following main questions:

- **Cost-efficiency:** Assess the cost efficiency of the implemented measures, both on an overall, project level, and specifically for the technical installations.
- **Budget overrun and addenda to agreement:** Assess the underlying analysis on which the agreement and original project plan were based, examine the quality of the budget, and suggest measures for improving budgetary planning.
- **Project organization:** Assess the appropriateness of the project organization, also compared to other, similar projects.

[27] Static Var Compensator

- **Technical aspects:** Examine the technical appropriateness of the installed equipment, e.g. dimensioning, choice of raw material, and assess to which extent this has been implemented according to plan and budget (cf. first bullet point).
- **Input to impact assessment:** Suggest topics to be addressed in the impact assessment, and assess implications of carrying out this immediately after project completion.

Scope of work

The End review shall be carried out by reviewing project documentation and through a field trip to Mozambique where interviews with relevant stakeholders will be conducted.
The review shall include the following assessments:

Effectiveness

1. Assess the effectiveness of the project, i.e. to what extent has the outputs and the immediate objectives as defined in the agreement and the addenda been achieved.

Efficiency and progress

2. Assess to which extent the project organization and the division of roles and responsibilities has been appropriate for efficient project execution, hereunder also the performance and presence of the subcontracting consultants, in comparison with other relevant projects funded by Norway in Sub-Saharan Africa.
3. Assess the progress of the project, and examine to which extent milestones have been met and deliverables completed in due time, mainly with focus on the outputs in addendum III on installation of the SVC plant in Nampula.
4. Examine to which extent the contractual requirements and obligations connected to procurement and audits are met, c.f. Agreements article VIII and IX
5. Assess to which extent the project has been implemented in a cost-efficient manner, considering the outputs/results against the input factors (funds and human resources), also considering the addenda to contract
6. Compare the cost efficiency of this project to other, relevant projects. Hereunder assess also the unit costs per km of 110 kV and 33 kV lines, in comparison to relevant benchmarks (including EDMs own experiences).
7. Assess the connection costs per customer, taking into account costs also in the high voltage grid (110 kV, 33 kV, and SVC) and electrical losses.
8. Assess the quality of the analysis behind the budget, and examine reasons for the considerable budget overrun. Suggest measures that could have improved the quality of the budget.
9. Examine why the number of new connections have seemingly not increased noteworthy since 2011, and point to suggestions for how the numbers could have been increased. Hereunder also assess to which extent the low maximum load as identified in the MTR has increased since 2011.
10. Assess to what extent the later measures as set forth in addenda I-III, such as the Awasse substation and the Nampula SVC plant have had positive effects in terms of increased/improved access to energy, and to what extent the project as whole has had impact beyond the areas directly connected to the distribution grid financed by this grant.

Technical aspects

11. Examine the analysis and decisions behind the choice of dimensioning and use of raw material for lines and mast foundations, namely for the 110 kV Metoro-Macomia line, and the use of 420 kV isolators (c.f MTR), and assess what budgetary implications this have had.
12. Examine the assumptions/analysis on which the number of connections where based, such as connection costs and consumption per customer. Compare these assumptions with actual data.
13. Assess the share of consumption divided on household sector and industry/commercial customers.
14. One of the arguments for construction of the 110 kV line was potential for regional power exchange through transmission to Tanzania (cf. MTR). Assess the realism of these plans, the quality of the underlying analysis for this potential, and the reasons for why this was not pursued.
15. Confirm that the earthing grid integration between new and old part at the Metoro sub-station is satisfactory, cf. information provided to the review team post MTR.

16. Assess to which extent the recommendations and conclusion listed in MTR regarding the 110 kV line and the 33 kV line have been followed up.
17. Examine whether operation and maintenance plans have been developed, and if so to which extent these are well prepared for follow up, cf. concerns expressed in MTR of lack of funding for O&M.

Other issues

18. Sustainability and relevance: Assess the local ownership of the project, and to which extent the project is implemented according to the priorities of the Government of Mozambique. Hereunder also assess the degree of national co-financing, compared to relevant examples from other bilateral and multilateral donors.
19. Cross-cutting issues: Assess how anti-corruption been addressed, in terms of risk identification and mitigation measures.

Impact

A socio-economic base line study was completed in 2010. A socio-economic impact assessment is to be carried out 3-5 years after project completion.

20. Give an initial assessment of the projects impact on livelihood and development in the grid-connected areas. Based on these assessments and other findings in this end review, suggest topics to be addressed in the socio-economic impact assessment.
21. Most connections where completed already in 2011, while construction of Awasse substation and the Nambula SVC plant came in place later. Assess implications of carrying out the socio-economic impact assessment immediately after project completion (instead of after 3-5 years).

Review Team and Qualifications

The End Review will be undertaken by a Review Team consisting of the following members:

- Team leader and technical expert (international)
- Team member: Technical expert (local/regional)
- Team member seconded from Norad

A Consultant will be hired by Norad in coordination with the Royal Norwegian Embassy in Maputo. The Consultant will provide (-) the international Team leader and (-) the local/regional Technical expert (from Mozambique or South Africa), as well as any backstopping office support the Consultant may find necessary to complement the review team.
Required qualifications: Team leader

- Ability to professionally lead the review team
- Experience from similar reviews in developing countries
- Strong analytical and communication skills
- Advanced report writing skills
- Technical expertise within electrical transmission and distribution
  This requirement may also be met through support from backstopping office support
- Knowledge of the Portuguese language is an advantage, but not a requirement

Required qualifications: Technical expert

- Technical expertise within electrical transmission and distribution
- Experience from similar reviews of projects funded by international donors in the region
- Proficient in the Portuguese and English language
- Good report writing skills
-

A team member will be seconded from Norad to participate in the undertaking of the End review, hereunder participate during the field visit and co-author the report together with the Consultant.

Implementation and work modality

The assignment will include research of relevant background material and documentation (cf. Annex I), interviews with relevant stakeholders (cf. Annex II), a field visit to Mozambique (Maputo and Cabo Delgado), as well as report development. The majority of the workload including the field trip will take place in April 2016, however the Consultant should be available to initiate the work in March.

Division of work, referring to 3) Scope of work: The Consultant will be responsible for all tasks 1-21, and the sole responsible for no. 5-17. The team member seconded from Norad will contribute to tasks no. 1-4 and 18-21. Norad's team member will be at the team leaders full disposal during the field trip plus one week upon return to Oslo. This may also include presence at the Consultants premises if deemed necessary. The team shall work as one unit, and all assessments shall be addressed in one, unified review report. The Consultant will have the editorial responsibility for the review report.
The Consultant will be responsible for the following deliverables:

- Mission preparation note and proposed ToC, to be delivered before field mission
- Presentation to the Embassy in Maputo at the end of field mission
- Draft report, ca 3 weeks after return from field mission
- Final report, ca 1 week after return of Norad's comments to draft report[28]. The Final report shall address all assessments (1-21) as described under scope of work. The final report shall be no longer than 30 pages, and be delivered in .doc and .pdf format.

Contract value

The Consultant will be reimbursed at a fixed fee of NOK 350.000 excluded travel expenses. The total contract value included travel expenses and other expenditures is 400.000. This includes field visit to Maputo and Cabo Delgado region.

Annex I: List of reference documents
The Review Team shall conduct the review based on assessments of the program documentation, including (but not limited to):

- Application and Appropriation document
- Feasibility study and appraisal of Feasibility study
- Agreement and Addenda I-III
- Mid-term review and Baseline study
- Price Analysis Report
- Progress reports, work plans, financial statements and budgets
- EDM Master plan
- RFPs, Proposals from contractors, Contracts
- Evaluation of Norwegian Power-related Assistance: Annex 4 - Case Studies Mozambique

Annex II: List of relevant stakeholders
Stakeholders to be interviewed include (but is not limited to)

- EDM staff
- Ministry of Energy,
- The Royal Norwegian Embassy in Maputo, present and previous staff
- Representatives of local/regional communities,
- ENERGIA representatives,
- Consultant Service Contractors: Hifab, Sogreah, Euromoc
- Construction contractors: Jacobsen Elektro AS, Eltel Networks, RXPE
- The Embassy's consultant: KPMG
- EDM's consultant: Norconsult

[28] The team member seconded from Norad will *not* be taking part in Norad's review and commenting of the work undertaken by the Review team.