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Report No: ICR00004301

IMPLEMENTATION COMPLETION AND RESULTS REPORT

IDA 4681-MZ

ON A

CREDIT

IN THE AMOUNT OF SDR 49.7 MILLION

(US\$ 80.0 MILLION EQUIVALENT)

TO THE

REPUBLIC OF MOZAMBIQUE

FOR A

MZ-ENERGY DEVELOPMENT AND ACCESS PROJECT (APL-2) ( P108444 )

December 15, 2017

Energy & Extractives Global Practice  
Africa Region

## CURRENCY EQUIVALENTS

(Exchange Rate Effective November 7, 2017)

Currency Unit = New Mozambique Metical

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MZN 60.7 = US\$1

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US\$1.40 = SDR 1

## FISCAL YEAR

July 1 - June 30

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## ABBREVIATIONS AND ACRONYMS

ALER	Associação Lusófona de Energias Renováveis
APL	Adaptable Program Loan
BTC	Belgium Technical Cooperation
CNELEC	National Electricity Commission
CPF	Country Partnership Framework
CREE	Commission for External Economic Relations
CUT	Conta Unica de Tesouro/Single Treasury Account
DA	Designated Account
DO	Development Objective
EDAP	Energy Development and Access Project
EdM	Electricidade de Mocambique
ENPV	Economic Net Present Value
EOCK	Economic Opportunity Cost of Capital
ERAP	Energy Reform and Access Program
ESMF	Environmental and Social Management Framework
EU	European Union
FUNAE	Fundo De Energia/Energy Fund
GoM	Government of Mozambique
GWC	Global Warming Commitment
GWP	Global Warming Potential
HCB	Hidroelectrica de Cahora Bassa
IBMS	Integrated Business Management System
ICR	Implementation Completion Report
ICT	Information and Communication Technologies
IDA	International Development Association
IEG	Independent Evaluation Group
IP	Implementation Progress
IPCC	Intergovernmental Panel on Climate Change
IPF	Investment Project Financing
IPP	Independent Power Producer
ISR	Implementation Status Report
kWh	Kilowatt hours
LLCR	Loan Life Cover Ratio
MDG	Millennium Development Goal
MIREME	Ministry of Mineral Resources and Energy
MIS	Management Information System
MV	Medium Voltage
MW	Megawatt
MZN	Mozambican Metical (Mozambican currency)
NEDAP	National Energy Development and Access Program
NES	National Electrification Strategy
NGO	Non-Governmental Organization
O&M	Operations and Maintenance
OPCSPQ	Operations Policy and Quality

PAD	Project Appraisal Document
PAP	Project Affected People
PDO	Project Development Objective
PERIP	Power Efficiency and Reliability Improvement Project
PIU	Project Implementation Unit
PV	Photo-Voltaic
RAP	Resettlement Action Plan
RESIP	National Rural Electrification Strategy and Investment Program
RETs	Renewable Energy Resources and Technologies
RoE	Return on Equity
RPF	Resettlement Policy Framework
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCD	Systemic County Diagnostic
SE4All	Sustainable Energy for All
SME	Small and Medium Enterprises
SWAp	Sector Wide Approach
SWHS	Solar Water Heating Systems
TTL	Task Team Leader
WB	World Bank
WHO	World Health Organization

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**DATA SHEET**

**BASIC INFORMATION**

**Product Information**

Project ID	Project Name
P108444	MZ-ENERGY DEVELOPMENT AND ACCESS PROJECT (APL-2) ( P108444 )
Country	Financing Instrument
Mozambique	Adaptable Program Loan
Original EA Category	Revised EA Category
Partial Assessment (B)	Partial Assessment (B)

**Organizations**

Borrower	Implementing Agency
Ministry of Energy	Electricidade de Mozambique (EdM), Funco Nacional de Energia (FUNAE)



**Project Development Objective (PDO)**

Original PDO

The overall Project Development Objective is to accelerate access to electricity and modern energy services in peri-urban and rural areas in a sustainable and commercially viable manner. Within that overall PDO the project will seek to support the Borrower to:

- (a) Increase grid-based access to and improve reliability of the supply of affordable electricity services in peri-rural areas ;
- (b) Increase off-grid access to electricity and modern energy services in unserved rural areas through conventional and renewable energy resources and technologies (RETs);
- (c) Leverage the mobilization of multi-lateral and bilateral donor financing for improving grid-based access to modern energy services through the reinforcement of the existing primary electricity network and the extension of the grid to un-served areas;
- (d) Improve the overall performance of the main sector institutions and their capacity to expand electrification and to mobilize new private sector and donor investment financing through the provision of institutional strengthening and capacity development support; and,
- (e) Elaborate a National Rural Electrification Strategy and Investment Program .

PDO as stated in the legal agreement

PDO stated in the Legal Agreement is the same as the PAD which states:

The overall Project Development Objective was to increase access to electricity and modern energy services in peri-urban and rural areas in a sustainable and affordable manner

**FINANCING**

	Original Amount (US\$)	Revised Amount (US\$)	Actual Disbursed (US\$)
<b>World Bank Financing</b>			
IDA-46810	80,000,000	80,000,000	71,671,496
<b>Total</b>	<b>80,000,000</b>	<b>80,000,000</b>	<b>71,671,496</b>
<b>Non-World Bank Financing</b>			
Borrower	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total Project Cost</b>	<b>80,000,000</b>	<b>80,000,000</b>	<b>71,671,496</b>





**KEY DATES**

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
04-Feb-2010	14-Mar-2011	15-Mar-2014	30-Jun-2015	15-Jun-2017

**RESTRUCTURING AND/OR ADDITIONAL FINANCING**

Date(s)	Amount Disbursed (US\$M)	Key Revisions
20-Feb-2015	32.17	Change in Results Framework Change in Components and Cost Change in Loan Closing Date(s) Reallocation between Disbursement Categories Change in Disbursements Arrangements Change in Legal Covenants Change in Financial Management Change in Implementation Schedule
14-Jun-2016	56.55	Reallocation between Disbursement Categories
16-Dec-2016	66.78	Change in Loan Closing Date(s)

**KEY RATINGS**

Outcome	Bank Performance	M&E Quality
Moderately Satisfactory	Moderately Satisfactory	Substantial

**RATINGS OF PROJECT PERFORMANCE IN ISRs**

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US\$M)
01	29-Jun-2010	Satisfactory	Satisfactory	0
02	28-Mar-2011	Satisfactory	Satisfactory	0
03	10-Jan-2012	Satisfactory	Moderately Satisfactory	.82
04	11-Dec-2012	Satisfactory	Moderately Satisfactory	1.94
05	10-Jul-2013	Moderately Unsatisfactory	Moderately Unsatisfactory	9.84



06	18-Jan-2014	Moderately Unsatisfactory	Moderately Unsatisfactory	14.49
07	06-Jul-2014	Moderately Unsatisfactory	Moderately Satisfactory	17.44
08	15-Dec-2014	Moderately Unsatisfactory	Moderately Satisfactory	20.08
09	30-Jun-2015	Moderately Satisfactory	Moderately Satisfactory	27.64
10	28-Dec-2015	Moderately Satisfactory	Moderately Satisfactory	29.69
11	07-Jun-2016	Moderately Satisfactory	Moderately Satisfactory	38.66
12	28-Dec-2016	Moderately Satisfactory	Moderately Satisfactory	46.06
13	24-Jun-2017	Satisfactory	Satisfactory	49.67

## SECTORS AND THEMES

### Sectors

Major Sector/Sector (%)

**Energy and Extractives 100**

Renewable Energy Biomass	5
Renewable Energy Geothermal	5
Public Administration - Energy and Extractives	30
Energy Transmission and Distribution	50
Renewable Energy Solar	5
Renewable Energy Wind	5

### Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3) (%)

**Private Sector Development 13**

Jobs	3
Job Creation	3
Public Private Partnerships	10



<b>Public Sector Management</b>	<b>29</b>
Public Administration	29
Administrative and Civil Service Reform	16
Transparency, Accountability and Good Governance	13
<b>Urban and Rural Development</b>	<b>57</b>
Urban Development	3
Urban Infrastructure and Service Delivery	3
Rural Development	54
Rural Infrastructure and service delivery	54
<b>Environment and Natural Resource Management</b>	<b>10</b>
Climate change	10
Mitigation	10

#### **ADM STAFF**

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## I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

### A. CONTEXT AT APPRAISAL (2009)

#### Country and Sector Context

1. Mozambique, located in the Southern coast of Africa, reported a population of 21 million with an annual per capita income of US\$330. Since the devastating civil war that ended in the early 1990s, Mozambique's economy had recovered and had completed a program of "first generation" reforms. Since 1992, incomes had risen considerably and improved infrastructure was approaching pre-war levels. The poverty headcount had fallen from 69 percent in 1997 to 54 percent in 2003. On average the economy had grown by 8 percent annually between 1996 and 2006. The Government of Mozambique's (GoM) approach to stabilization and reforms was working as well as to its efforts in concessional finance, healthy agricultural catch-up growth, fast expansion in tourism, construction and certain manufacturing sub-sectors. The GoM also had considerable success in attracting mega-projects in aluminum smelting, natural gas and titanium mining.
2. Electrification rates in Mozambique were significantly low. Only 10.5 percent of households had access to electricity with over half living in Maputo and surrounding areas. Only 2 percent of households in rural areas had access to electricity. All provincial capitals and municipalities were supplied with electricity with most of them connected to the main national electrical grid. The Government's objective was to reach an electrification rate of 15 percent by 2019, and 20 percent by 2020.
3. Mozambique had considerable energy resources with the capacity to satisfy most of its domestic energy needs which included hydropower, natural gas, coal, biomass, solar and wind. Hydropower potential (Cahora Bassa, Mphanda Nkuwa, etc.) alone was estimated at 12,500 MW of which only 2,200 MW was developed. At the household level, the principal energy source for the majority of Mozambicans was biomass, particularly wood fuel. In rural areas, biomass accounted for nearly all the energy consumed. Charcoal production was widespread in small urban settlements, district capitals, and around larger towns and cities. The commercial production of charcoal was beginning to pose serious tangible negative environmental impacts. Until viable alternative household fuels became available in the marketplace with affordable prices, there was an urgent need to promote improved charcoal production methods and practices, and to sustainably manage forest exploitation for charcoal making.
4. Institutional arrangements in the energy sector in Mozambique consisted of four main entities. *The Ministry of Energy* (ME) was responsible for national energy planning and policy formulation and for overseeing the operation and development of the energy sectors. *Electricidade de Moçambique* (EdM) was a vertically-integrated, government-owned electric utility with an installed capacity of 140MW hydropower and 109MW in thermal power stations. EdM bought most of its power supply from Hidroelectrica de Cahora Bassa (HCB) plant on the Zambezi river. The GoM owns 82 percent of HCB which operates as an Independent Power Producer (IPP). The bulk of the electricity generated at HCB was exported to South Africa. EdM sold any excess electricity on the Southern Africa Short Term Energy Market. The Mozambique transmission grid was then connected with South Africa, Zimbabwe and Swaziland. *The Fundo de Energia* (FUNAE) was established in 1997 as a public institution to promote rural electrification and rural access to modern energy services. *The Conselho Nacional de Electricidade* (CNELEC) was established as an independent advisory regulatory body



for the electricity sector in early 2008 with support from IDA’s “Energy Reform and Access Program” (ERAP APL1; P069183).

### **APL Series**

5. IDA’s financing of the Energy Development and Access Project (EDAP Adaptable Program Loan [APL] 2) constituted the second phase of IDA’s “Energy Reform and Access Program APL Project” (ERAP, active 2003-2011, assessed in ICR2382 report). The objective of the ERAP APL series was to increase access to modern energy in peri-urban and rural areas and was based on a sector strategy to unbundle EdM into Generation, Transmission, and Distribution companies, and to concession the distribution company to a private concessionaire. The original project components were: (i) Power Sector Reform; (ii) Grid-based peri-urban electrification; (iii) Independent grid rural electrification; (iv) Renewable energy and cross-sectoral linkages; and, (v) Institutional Development and Capacity Building.

6. Mozambique’s energy sector policy underwent significant changes since the first phase of the program was prepared in 2002-2003, which had implications in preparing EDAP APL2. A new Ministry of Energy was established in 2005 which later became the Ministry of Mineral Resources and Energy (MIREME) in 2015. After review of its strategy in light of developments in power sectors of neighboring countries, the Ministry presented a new approach to power sector reform under which the Government opted not to seek private participation in EdM in the near term. Instead, the strategy focused on achieving improved performance of EdM through a Performance Contract for EdM, increased technical and financing support for EdM, and operationalizing CNELEC to monitor EDM’s performance. The Government also identified a priority role for the private sector in new generation and transmission “mega-projects” to be developed through public-private partnerships.

7. To better align with the Government’s new strategy for the energy sector, ERAP APL1, the first phase of the APL series, was restructured in 2007. Its power sector reform component supported the establishment and initial operations of CNELEC. The grid-based peri-urban component included grid intensification and activities aimed at demonstrating methods for reducing losses and improving customer service. Its independent grid rural electrification component was reduced because of a lack of private sector interest in taking up available concessions and was eventually cancelled. ERAP APL1’s renewable energy component supported the electrification of 300 schools and clinics in rural areas and also included pilots to use solar Photovoltaic (PV) systems for community level services in rural villages.

8. The power sector reform agenda launched by ERAP APL1 was in effect expanded far beyond its original scope (See paragraph 6 above). At appraisal of EDAP APL2, several generation “mega-projects” were in preparation, totaling more than US\$15 billion in private sector investments. In line with the above, the name of the overall APL series was changed from “Energy Reform and Access Program APL series” to “Energy Development and Access Program” which better aligned with the government’s National Energy Development and Access Program (NEDAP) and better reflected IDA’s assistance strategy for the sector. EDAP APL2 was prepared to build directly off the trajectory of the first phase of the APL series.

### **Theory of Change (Results Chain)**

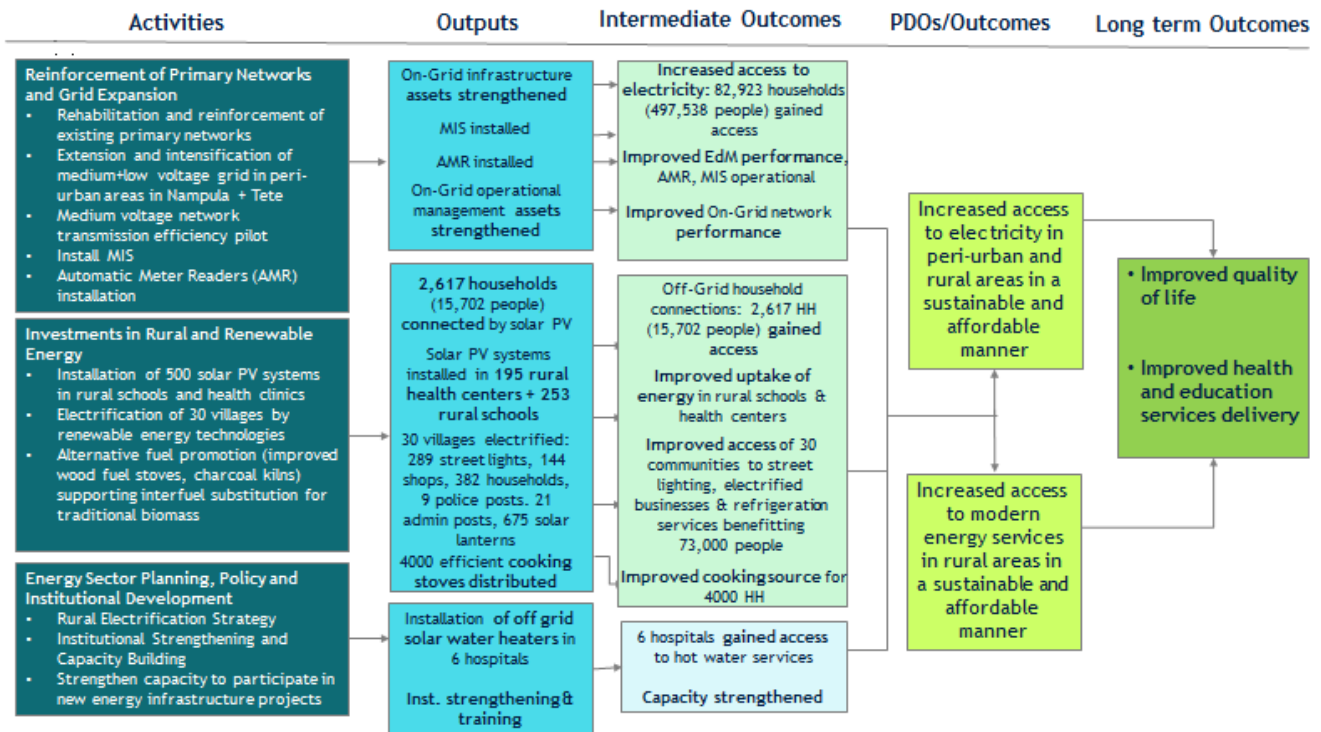
#### **Access to electricity and modern energy services**

9. The project was built on unambiguous evidence from sectoral literature that access to electricity and modern energy services are prerequisites for improved livelihoods, particularly in under-served and un-served communities. This



is consistent with the prevailing view among development organizations, arguing that “Energy is crucial to community services, which in turn are fundamental to improving the lives of poor people and the achievement of the Millennium Development Goals, in particular goal 2 (achieve universal primary education), goal 3 (promote gender equality and empower women), goal 4 (reduce child mortality), and goal 5 (improve maternal health) (UNDP, 2011).”<sup>1</sup>

10. To assess EDAP’s theory of change, this Implementation Completion Report (ICR) looks at the evidence illustrating some of the pathways by which electricity and modern energy investments enable improved health and education services delivery, and demonstrate that access to electricity can enhance the range and quality of health and education services provided to underserved communities and contribute to progress toward social development goals and MDGs. A results chain chart is provided to summarize these pathways.



11. A recent World Bank literature review<sup>2</sup> of the relationship between Energy, Economic Growth, and Poverty Reduction, identified studies that provide reliable evidence on the links between energy use and economic outcomes. The literature review identifies several studies that estimate the benefits of electrification on households or small businesses, and show the effects of electrification on income, total household expenditures, employment or dimensions of education (time spent at home studying, school enrollment rate).

<sup>1</sup> Poor People’s Energy Outlook 2013, Practical Action.

<sup>2</sup> Bacon, R., and M. Kojima, *Energy, Economic Growth, and Poverty Reduction: A Literature Review*, The World Bank Group, 2016. <http://documents.worldbank.org/curated/en/312441468197382126/Main-report>



### Project Development Objectives (PDOs)

12. The overall Project Development Objective was to increase access to electricity and modern energy services in peri-urban and rural areas in a sustainable and affordable manner (Financing Agreement, June 23, 2010, page 5).<sup>3</sup>

### Key Expected Outcomes and Outcome Indicators

13. Key expected Outcome Indicators were:

- (i) Number of people provided with access to electricity under the Project by household connections (Power, Core 1);
- (ii) Number of people provided with access to electricity under the Project by household connections (Renewable Energy, Core 1);
- (iii) Number of community connections under the Project (Renewable Energy, Core 2), including (A) number of health clinics electrified; and (B) number of schools electrified;
- (iv) Increased satisfaction reported in customer satisfaction survey.

### Components

14. EDAP APL2 components were the continuation and scaling up of the support program launched through ERAP APL1 and were divided into three main parts:

**(a) Reinforcement of the Primary Networks and Grid Extension Component (US\$ 50.0 million).** This component financed:

- (i) Engineering services for the design, procurement and supervision of EDM investment program;
- (ii) A medium voltage (MV) network transmission efficiency pilot project (Bairro 25 de Junho);
- (iii) Rehabilitation and reinforcement of the existing primary networks that have been overloaded as a result of grid extension and new connections implemented over the previous 5 years;
- (iv) Extension and intensification of the medium and low voltage grid in peri-urban areas in Nampula and Tete provinces; and
- (v) Implementation of an Integrated Business Management System (IBMS).

**(b) Investments on Rural and Renewable Energy Component (US\$ 18.0 million).** This component sought to increase and accelerate decentralized access to modern energy services by supporting the implementation and/or scaling up of:

- (i) Decentralized micro and small investments in renewable energy production and distribution systems, solar PV and thermal, biomass energy and other Renewable Energy Technologies (RET) in rural and some peri-urban areas, including installation of 500 solar PV systems in rural schools and health clinics, and the electrification of 30 villages by RET;

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<sup>3</sup> Note: The system generated PDO in the ICR Datasheet differs from the PDO statement in the Financing Agreement and the PAD. The ICR team was advised that this system generated definition in the datasheet could not be edited. Hence the discrepancy between the PDO quoted above and the one in the ICR Datasheet.





- (ii) Promotion and dissemination of improved wood fuel stoves for use in the household and small and medium enterprise (SME) sectors, introduction of improved charcoal kilns, and support to interfuel substitution for traditional biomass in households and institutions such as schools, clinics, etc.;
- (iii) Demonstration projects to accelerate the sustainable market penetration of clean RETs in agriculture, household, SME and for rural mobility including deployment of multifunctional platforms in rural villages; and
- (iv) Capacity development and institutional strengthening of FUNAE, the implementing agency of this component.

**(c) Energy Sector Planning, Policy and Institutional Development Component (US\$ 10.2 million).** This component financed:

- (i) Elaboration of a national “Rural Electrification Strategy and Investment Program (RESIP”);
- (ii) Technical Assistance and Consulting Services to strengthen the Government’s capacity to promote and participate in the development of new energy infrastructure projects, especially power independent power producers (IPPs) and other mega-projects;
- (iii) Institutional strengthening and capacity building of the Ministry of Energy to improve its performance and governance and to support the design and subsequent establishment of a flexible Sector Wide Approach (SWAp) for the energy sector; and
- (iv) Institutional strengthening support to CNELEC for it to effectively discharge its advisory/regulatory function.

**B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)**

**Revised PDOs**

15. **The PDO** remained unchanged throughout project implementation.

**Revised PDO Indicators and Targets**

16. At the first project restructuring approved in February 2015, the results framework, including some outcome indicators and targets, were revised. The revisions were designed to make the results framework consistent with the proposed change in activities envisaged in the restructuring, and ensuring that end target dates conformed to the proposed extension of the closing date.

17. Outcome targets related to people who were provided with access to electricity were adjusted to measure number of people connected rather than households connected. This change was in line with the WB Core Sector indicators for Energy. This did not constitute a material change in the target but was instead a change in the way the indicator was measured.



A table summarizing the revision of indicators is shown below.

Indicator	Change in Indicator	Comment
Direct Project Beneficiaries	New indicator added	Core indicator tracked by the WB
People provided with access to electricity by household connections	Revised	Baseline and target adjusted to measure number of people rather than households connected. End target date adjusted to be aligned with new closing date. The baseline was adjusted from 42,500 connections to 255,000 people connected. The target was adjusted from 67,500 connections to 405,000 people.
Community electricity connections constructed – Other RE Off Grid	Revised	End target date adjusted to be aligned with new closing date
Improved engagement of customers for measuring satisfaction	Revised	End target date adjusted to be aligned with new closing date
Number of people provided access to electricity under the project by household connections – Rural	Deleted	Indicator subsumed under revised indicator above

### Revised Components

18. At the time of the first restructuring in February 2015, disbursements stood at 43 percent of the credit with delays observed in Components 1 and 3. Regarding Component 1, most procurement was complete and implementation activities relating primarily to improvement of EdM’s information management tools and physical activities reinforcing the primary network and grid extension had started. However, signature of contracts for major works had suffered delays. There was limited progress under Component 3 - a few technical assistance contracts had been completed but others had not begun.

19. Government priorities and needs in the energy sector had evolved. Mozambique was experiencing a crisis in the energy sector due to significant growth in energy demand. Combined with a lack of commensurate physical investments to the grid network, the capacity of the government to provide infrastructure services had weakened. In addition, some activities required more financing than originally envisioned (e.g., solar PV installation activities under Component 2 implemented by FUNAE) while others required less (e.g., contracts for reinforcement of the primary network implemented by EdM). There were currency fluctuations which included a strong appreciation of the US dollar against the SDR, reducing the project amount in US dollars by US\$ 8.7 million which amounted to 11 percent of the total project amount. These factors led the government to review priorities and make adjustments where possible to project components.

20. **Addition of activities to Components 1 and 3:** Activities that were added were consistent with the PDO and included:

- Component 1: Priority and Urgent investments in EdM’s network. A new activity was added under this component for provision of support to reinforce the existing Mocuba and Pemba Substations, including the provision of four new 110/33kV. 40 MVA power transformers and respective switchgear.
- Component 3: GoM requested US\$ 0.9 million of existing Project funds for provision of support for the installation of solar water heaters in selected hospitals.



21. **Cancellation of activities in Components 2 and 3:** To achieve cost savings to undertake additional activities listed above, GoM elected to cancel the following activities:

- Component 2: Support for improved charcoal kilns, support to inter-fuel substitution for traditional biomass in households and institutions such as schools and clinics. Support to undertake demonstration projects to accelerate market penetration of clean renewable energy technologies which included the deployment of multifunctional platforms in rural villages.
- Component 3: Support for the elaboration and dissemination of the Rural Electrification Strategy and Investment Program, and support for preparation and broad consultation for a flexible sector wide approach for the energy sector. The Rural Electrification Strategy and Investment Program was subsequently undertaken and completed. Funded by SE4All, a National Electrification Strategy which included rural electrification, was elaborated and presented to stakeholders in October 2017.

22. GoM considered these activities as having lower priority given activities implemented to that date, the availability of funds and more pressing needs. The financing table below shows the original versus restructured component costs taking into account activities that were added and cancelled by the restructuring.

Components	Original Cost, US\$ million	Cost after 1st restructuring, US\$ million	Action during 1 <sup>st</sup> restructuring	Cost after 2 <sup>nd</sup> restructuring, US\$ million	Action during 2 <sup>nd</sup> restructuring
1. Rehabilitation and Reinforcement of the Primary Network & Grid Extension	50.00	49.30	Revised	49.30	No change
2. Investments in Rural and Renewable Energy	18.00	18.00	Revised	17.30	Revised
3. Energy Sector Planning, Policy & Institutional Development	10.20	4.00	Revised	4.70	Revised
Unallocated	1.80	0.0	Allocated	0.0	No change
Exchange rate fluctuations	--	8.70	Losses	8.70	No change
<b>Total:</b>	<b>80.00</b>	<b>80.00</b>		<b>80.00</b>	

Note: There were no changes to costs during the third and final restructuring which extended the closing date by 6 months.

### Other Changes

23. Change in legal covenant: The legal covenant pertaining to full cost recovery tariffs was amended to establish a new due date of December 31, 2015.

24. Change in disbursement arrangements affecting flow of funds: Disbursement arrangements for the project were amended to establish a Designated Account (DA) for EdM. The DA would allow the agency to handle payments for component 1, for which it was the responsible implementation entity.



### Rationale for Changes and Their Implication on the Original Theory of Change

25. **Changes to the project mentioned above were necessary for the following reasons:**

- (i) Deficits in project account due to fluctuations in exchange rate. Exchange rate fluctuations between the US dollar and the SDR as well as the US dollar and the MZN substantially affected project accounts. By 2015, a strong appreciation of the US dollar against the SDR reduced the project amount by US \$8.7 million equivalent. This reduction translated to approximately 11 percent of the total project amount. It became necessary to restructure the project to cancel portions of the project. In addition, Mozambique had to respond to the significant growth in demand coupled with a lack of proportionate investment in the grid. It was therefore necessary to prioritize and add priority activities to meet demand on an emergency basis.
- (ii) Use of country systems. Following a review<sup>4</sup> of Mozambique's country systems for financial management, the Bank and the government agreed to use the government's Public Financial Management (PFM) system, including the single treasury account (or CUT) for all donor funded projects. All projects in the pipeline, including EDAP, were moved to CUT. The Bank's strategy aimed to strengthen national institutions, seeking to utilize them as an effective, long-term solution to governance and corruption challenges and to mitigating fiduciary risk for all public money. However, in practice this translated to long delays in procurement. Delays were not project specific to EDAP, but were observed across the Mozambique portfolio.
- (iii) Flow of funds arrangements. As mentioned above, EDAP's use of the government's PFM system had led to delays in disbursements. EDAP had multiple implementation agencies. FUNAE and MIREME, agencies responsible for implementing components 2 and 3 respectively, could use ring-fenced windows, or designated accounts, within CUT to process payments. The pace of disbursements was relatively quicker for agencies that had designated accounts. Funds did not disburse quickly for EdM which did not have a designated account and was responsible for implementing 62 percent of the project amount. After discussion, the government agreed to allow EdM to operate its own designated account with the objective of speeding up disbursements.

26. **Implication on the original theory of change.** Changes during project implementation did not have an impact on the theory of change. Project development objectives remained unchanged. The scope of some components was changed to reflect fiscal realities. The changes impacted implementation progress and timing, but did not affect expected outcomes.

## II. OUTCOME

### A. RELEVANCE OF PDOs

#### Assessment of Relevance of PDOs and Rating

Rating: HIGH

27. At the time of project completion, the PDO remained relevant. The development objectives of the project at appraisal were (and continue to remain) highly relevant to the development needs of Mozambique. These objectives are directly in line with the current needs and priorities of the Mozambique Government's poverty reduction agenda (e.g., The Poverty Reduction Action Plan (PARP) 2011-2014), and with the United Nations and the World Bank's priorities of promoting economic growth and increased prosperity in developing countries. Access to electricity services remains low.

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<sup>4</sup> Seligmann, Renaud, *Mozambique: Country Systems review for project Financial Management, Analysis and Recommendations for action*, June 2008.



The rate of energy access at project appraisal in 2009 was low at 10.5 percent. The access rate is currently 26 percent, an increase nearly 15 percent points. As of October 2016, “only 25.2 percent of the population had access to the grid, and less than 2 percent of all rural households were able to use electricity, often relying on more expensive kerosene or wood.”<sup>5</sup> A recent independent evaluation of the World Bank’s electricity access support operations states that: “Lack of access to electricity is a major constraint to economic growth and increased welfare in developing countries. This has been reemphasized by the United Nations and the World Bank Group as co-chairs of the global Sustainable Energy for All (SE4All) initiative, which was launched in 2011, with the goal of achieving universal access to energy within the next 15 years, along with improving energy efficiency and increasing the use of renewable energy. Providing access to electricity is also integral to the Bank Group’s corporate goals of increasing shared prosperity and ending extreme poverty by 2030.”<sup>6</sup>

28. The latest Mozambique Country Partnership Framework (CPF) FY2017-FY2021 aims “to support Mozambique in achieving its objective of creating more inclusive growth through employment promotion and improving productivity and competitiveness in a sustainable manner.”<sup>7</sup> Mozambique intends to develop a more diversified and productive economy to reduce poverty and promote inclusion. The CPF is designed to support this objective, one pillar of which includes expanding access to power.<sup>8</sup> The CPF describes the access expansion objective as follows:

“IDA financing will focus primarily on improving electricity service through grid rehabilitation and reinforcement as well as strengthening of the financial and operational functioning of the utility (through the Power Efficiency and Reliability Improvement Project [PERIP]) along with public sector investment in the transmission system (the Regional Transmission Development Project). These projects will build on the recently completed Transmission Upgrade Project and the Energy Development and Access Program (EDAP). IDA is currently supporting the development of a national electrification strategy, which will provide the foundations for expanded electricity access. Based on lessons learned from electrification programs in Mozambique and international best practices, new approaches such as off-grid electrification (mini grids, individual home systems, and lighting) will be incorporated into a new Energy Access Project to optimize resources and increase access to electricity services on- and off-grid.”<sup>9</sup>

**The relevance of the PDO is therefore rated as HIGH.**

## **B. ACHIEVEMENT OF PDOs (EFFICACY)**

### **Assessment of Achievement of Each Objective/Outcome**

29. As mentioned above, EDAP’s PDO was to increase access to electricity and modern energy services in peri-urban and rural areas in a sustainable and affordable manner. The project achieved its stated objectives.

**Overall PDO Rating: SUBSTANTIAL**

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<sup>5</sup> Mozambique CPF FY17-FY21

<sup>6</sup> Independent Evaluation Group. 2015. *World Bank Group Support to Electricity Access, FY2000-2014: An Independent Evaluation*. World Bank, Washington, DC.

<sup>7</sup> Mozambique Country Partnership Framework FY17-FY21, March 2017

<sup>8</sup> Mozambique Country Partnership Framework FY17-FY21, March 2017

<sup>9</sup> See CPF, FY17-FY21



30. In the rural project target areas, the electrification of 195 health centers has helped improve the quality of services, night care, access to vaccines (in 189 health centers where refrigeration of perishable drugs was made available) and the possibility of patient care after dark. The electrification of 253 schools has facilitated evening classes and increased access to literacy programs at night for some rural residents who would not have had this opportunity otherwise. The installation of community solar PV Systems in 30 rural villages (which included the electrification of local schools and health centers, 144 shops [including refrigerators], 9 police and 21 administrative posts, 744 residences, as well as installation of 289 street lights and distribution of over 675 solar lanterns, among others) has made a qualitative difference in the local living conditions, the business environment, and the overall wellbeing of the community residents.<sup>10</sup>

31. Recognizing that "Lack of access to electricity is a major constraint to economic growth and increased welfare in developing countries"<sup>11</sup>, and to assess the extent to which the project's objectives of providing "increased access to electricity and modern energy services in peri-urban and rural areas in a sustainable and affordable manner" were achieved, it is important to quantify the project's contributions to increased access in Mozambique in the context of the broader on-going electrification efforts.

32. To this end, the ICR will first establish the magnitude of the on-grid and off-grid access programs in Mozambique, and then will assess the scope of the EDAP's contributions and achievement of its objectives in each area. The sustainability and affordability of the on-grid and off-grid connections and access to modern energy services (including provision of access to 6 solar water heaters for hospitals and distribution of 4000 efficient cook-stoves) are discussed next, followed by the broader aspects of improved sector management and governance, which in turn will help strengthen the success of the access agenda.

33. The PAD did not address how affordability and sustainability were to be measured. For evaluation purposes, affordability has been determined by discussion of a 'willingness to pay' assessment, and a less stringent framework developed by the SE4All initiative which defines subsistence level for grid electricity as 30 kWh per month, and considers electricity as affordable if the cost of this electricity is less than 5 percent of the household monthly income.<sup>12</sup> To assess sustainability, this ICR defines sustainability from the point of view of the connectivity providers, i.e., EdM and FUNAE being able to operate and maintain the infrastructure and provision of services.

**Post-Restructuring<sup>13</sup> PDO Outcome Indicator Summary**

PDO Indicator	Baseline	Actual	End Target	Delivery Ratio*	Comment
People provided with new or improved electricity service (Number, Corporate)	255,000	513,240	405,000	172.2 percent	Outcome achieved
People provided with access to electricity by Household	255,000	497,538	405,000	161.7 percent	Outcome achieved

<sup>10</sup> Output data is based on contract completion reports as verified by FUNAE. The qualitative results are based on beneficiary feedback in an earlier impact assessment.

<sup>12</sup> See: *Making Power Affordable for Africa and Viable for Its Utilities*. Kojima, M, and Trimble, C; ESMAP, 2016.

<sup>13</sup> There were no material changes resulting from the restructuring at the PDO level



connections – Grid (Number, Custom Breakdown)	(42,500 HHs at 6 per HH)	(82,923 HHs at 6 per HH)	(67,500 HHs at 6 per HH)		
Community electricity connections constructed – other RE: Off-grid (Number, Custom)	300	823	800	104.6 percent	Outcome achieved
Number of health centers electrified (Number, Custom Supplement)	150	345	400	78.0 percent	Outcome partially achieved Hurricane & Vandalism
Number of schools electrified (Number, Custom Supplement)	150	403	400	101.2 percent	Outcome achieved Hurricane & Vandalism
Improved engagement of customers for measuring satisfaction (Text, Custom)	Assessment of Customer Satisfaction survey by Dec 31, 2009	Not Conducted	Assessment of Customer Satisfaction survey closure of EDAP		Outcome was not achieved at project closure.  Draft Survey was prepared by CNELEC, but the survey was not conducted due to budget constraints. Post project closure, and the dissolution of CNELEC, EdM has launched an online survey for customer satisfaction which has begun receiving feedback <sup>14</sup> .
Direct project beneficiaries (Number, Custom)	255,000	530,052 = (42,500 HHs Baseline + 40,423 HHs + 744 Res + 675 Lanterns + 4000 Stoves) x 6 ( <i>excluding community access, school,</i>	495,730	114.3 percent	Outcome achieved.  Based on HH connections only. The actual number of beneficiaries could be much higher if the beneficiaries of community

<sup>14</sup> <http://questionarios.co.mz/>



		<i>health center, and Hospital solar water heater beneficiaries)</i>			installations could be accurately quantified.
Female beneficiaries (Percentage, Custom Supplement)	50	50	50	100 percent	Outcome achieved. Based on National Statistics

\* Note: The “Delivery Ratio” percentages are calculated by the ICR team using the following formula: Delivery Ratio Percentage = [(Actual value – Baseline Value)/(Target Value – Baseline Value)] x 100.

### Grid-Based Access

#### Rating: Substantial

34. The EDAP project met or exceeded almost all its targets under the Grid-based access component.<sup>15</sup> The target for the PDO indicator of “People provided with new or improved electricity services” was 150,000 (the difference between the baseline of 255,000 and the target of 405,000). The actual target number achieved was 513,240 beneficiaries, of which 497,538 were grid-based beneficiaries.<sup>16</sup> Therefore, the project provided 242,538 people with new electricity services through grid-based connections (or 161.7 percent of the intended new-beneficiaries target).

35. Using data from EdM’s Annual Statistics Reports for 2010-2016, it can be shown that the number of households with access to grid-based electricity in Mozambique increased nationally by an average of about 108,557 per year between 2010 and 2016.<sup>17</sup> Using this annual national average, the number of new households that gained access to grid-based electricity services during the implementation period of EDAP - from effectiveness date (March 2011) to closing of the project (June 2017) or around 5.25 years – would be about 569,924. Of these, 40,423 households<sup>18</sup> (or about 7.1 percent of nationwide new connections) could be considered as having gained access to electricity services as a result of the EDAP operation.<sup>19</sup>

#### Affordability of Grid-based Electricity Access

36. The affordability of electricity is generally determined based on a ‘willingness to pay’ assessment of intended beneficiaries, and by comparing the cost of electricity against alternative sources of fuel and lighting. EDAP’s grid-based access increase was focused on connecting households in peri-urban areas, where more than 49 percent of the

<sup>15</sup> ISR Seq. No. 13, June 2017. The ISR’s assumption is that the average household size is 6 persons per household.

<sup>16</sup> ISR Seq. No. 13, June 2017.

<sup>17</sup> EdM Annual Statistics Reports 2010, 2011, 2012, 2013, 2014, 2015, and EdM’s update for 2016.

<sup>18</sup> This number is based on ICR calculation as follows:

(Actual number of grid-connected beneficiaries based on 6 persons per household - Baseline number of grid-connected beneficiaries based on 6 persons per household) / number of people per household, or (497,538 – 255,000)/6

<sup>19</sup> In the absence of reliable customer data for project target areas, the ICR has used the national average of 108,557 new connections per year as the reference point. However, since the number of connections per year in the project target areas would have been just a fraction of national connections, the ratio of the number of new connections under EDAP in project target areas (40,423) to the number of new connections in project target areas would be significantly higher than 7.1 percent.





population lives below the poverty line of US \$1.25 per day, and 80 percent of the urban population lives in slums.<sup>20</sup> For majority of these households as well as any others who use less than 125 kWh per month, the Social Tariff is 1.07 MZN/kWh (or less than US \$0.02 per kWh at the time of this ICR preparation in October 2017), and with no grid connection fee.<sup>21</sup> This makes the grid-connection affordable for the low income families who can manage keeping their electricity usage below 125 kWh per month. Under EDAP, EdM's grid-based consumers paid two percent of their household income on electricity consumption or 0.5 percent of annual household expenditure.<sup>22</sup> These are within SE4All's multi-tier framework definition of affordability<sup>23</sup> of less than 5 percent of household income.

### Sustainability of Grid-based Electricity Access

37. Sustainability of these grid-based connections is reasonably assured in three ways: (1) these new customer connections are linked to the existing grid, with appropriate reinforcements and/or upgrades to the grid as needed to ensure that the transmission / distribution network can handle the new connections; (2) The operating cost of new connections in terms of revenue collection is minimized for EdM through the use of pre-paid meters; and (3) Although EdM may incur some revenue losses due to low levels of consumption by these new customers at life-line tariff level, the potential loss of revenue by EdM is negligible compared to the potential gains in expansion of its customer base, reduction of electricity theft, and potential increase in electricity usage by these customers as they move into higher tariff categories once they start using appliances or enter into productive use of electricity, thus moving into higher level tariff categories.

### Off-Grid Access

#### Rating: Substantial

38. Some of EDAP's Off-Grid component activities (community level activities) were designed as a pilot with the objective of implementing demonstration projects to accelerate sustainable market penetration of clean Renewable Energy Technologies (RETs) in agriculture, households, SMEs and rural mobility. Provision of off-grid electricity using modern technologies such as micro and mini-grids, and solar PV systems can be a viable alternative in rural areas which may not be good candidates for electrification through grid-extensions. These alternatives are particularly important for provision of public lighting and electrification of small businesses, rural schools, health clinics and community centers, as well as the dwellings of the corresponding service providers to ensure the improved quality of services provided through these facilities, as well as improving the quality of life for the rural service providers and community residents. In this context, off-grid electrification of a school or health clinic would have a much wider impact on improving the quality of life and services for all members of the community (the PAD estimates this group of beneficiaries at about 350,000<sup>24</sup>).

39. Under EDAP, FUNAE, in close coordination with the Ministries of Education and Health, has installed solar PV systems in 253 rural schools and 195 rural health centers<sup>25</sup> In addition to lighting, 188 of the health centers and 144

<sup>20</sup> UN Millennium Development Goals Indicators on-line Database.

<sup>21</sup> EdM Electricity Tariffs (last verified on Oct 29, 2017 on EdM website at:

[http://www.edm.co.mz/index.php?option=com\\_content&view=article&id=121&Itemid=83&lang=en](http://www.edm.co.mz/index.php?option=com_content&view=article&id=121&Itemid=83&lang=en)).

<sup>22</sup> Households in Mozambique spend an average of 6,924 meticaís per month, equivalent to 1,406 meticaís per person, according to figures from the Household Budget Survey (HBS) for 2014/2015. Source: <https://macauhub.com.mo/2016/01/06/families-in-mozambique-spend-us147-per-month/>, <http://allafrica.com/stories/201512310035.html>

<sup>23</sup> Energy Sector Management Assistance Program 2015. Beyond Connections: Energy Access Redefined. World Bank.

<sup>24</sup> See EDAP PAD Annex 4, *Detailed Project Description*, Paragraphs 33

<sup>25</sup> Note: The above data on the number of electrified schools and health centers is based on FUNAE's ICR report (July 30, 2017).



rural shops have received refrigeration services. The P V systems installed in the houses of teachers and health workers have improved living conditions, thus helping the retention of qualified staff in rural areas.<sup>26</sup>

40. The target for rural school and health center connections was to connect 250 of each. Therefore, the school connection target was over-achieved at 104.6 percent, while the health center connections were achieved at 78 percent of the target, due to unexpected challenges beyond the control of the project (hurricane damage to some buildings and vandalism leading to broken doors and windows, thus making it unsafe for installation of solar PV and other equipment).

41. To quantify the efficacy of the off-grid access component, using rural access data from World Development Indicators (WDI) of the World Bank, it can be shown that between 2010 and 2014, an annual average of about 93,018 rural people nation-wide were provided with access to off-grid electricity through household connections. Over the implementation period of EDAP project (between effectiveness and closing) about 488,345 rural people would have gained access to electricity services.<sup>27</sup> Of these, around 20,200 people (or about 4.1 percent) would have been connected through solar PV installations under the EDAP.<sup>28</sup>

42. This excludes people benefitting from community installations, school and health center solar PV installations, and other public service facility electrifications. (At appraisal, the PAD/FUNAE had estimated the number of beneficiaries of the total of 500 rural schools and health centers to be about 350,000 people, and for the community connections to be about 73,000.<sup>29</sup> These numbers, however, could not be verified by the ICR team).

43. FUNAE had also planned for installing 15 water pumping systems in Cabo Delgado (6 pumping systems), Niassa (5 pumping systems) and Inhambane (4 pumping systems.) However, the water pumping systems were not installed during project implementation. All required materials were delivered to FUNAE for further installations. The systems were not installed during project implementation because required geophysical studies and drilling activities to install the PV water pumping systems with realistic and updated borehole data were not foreseen and therefore not carried out. To address this situation, FUNAE (through Belgium Technical Cooperation – BTC) has undertaken the geophysical studies and drillings activities which will allow it to install the PV water pumping systems.<sup>30</sup> In this regard, FUNAE has launched a public tender to hire a company that will carry out the installations of these PV water pumping systems in Cabo Delgado, Niassa and Inhambane provinces as planned.

44. **Promotion of Biomass energy systems.** The initial design of the project included the production and distribution of 50,000 improved cook stoves, for use in the household and small and medium enterprises (SME) sectors, introduction of 500 improved charcoal kilns, and support to inter-fuel substitution for traditional biomass in household and institutions (schools, clinics). The project also included support for demonstration projects to accelerate the sustainable market penetration of clean renewable energy technologies, including deployment of 70 multifunctional

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<sup>26</sup> FUNAE Beneficiary Survey results

<sup>27</sup> Source: ICR calculations based on WDI data

<sup>28</sup> The number of off-grid beneficiaries is calculated based on data provided in ISR 13. In the absence of reliable customer data for project target areas, the ICR has used the national average of 93,018 new connections per year as the reference point. However, since the number of connections per year in the project target areas would have been just a fraction of national connections, the ratio of the number of rural beneficiaries based on new connections under EDAP in project target areas (20,200) to the number of beneficiaries under new connections in project target areas would be significantly higher than 4.1 percent.

<sup>29</sup> EDAP PAD, Annex 4, Paragraphs 43.

<sup>30</sup> FUNAE EDAP Project Implementation Completion Report, October 30, 2017.



platforms in rural villages. Due to budget constraints described earlier, however, the planned activities and targets were revised and reduced to the following: (i) production and distribution of 4,000 improved cook stoves; (ii) training for local communities/institutions on correct use of improved cook stoves, and local producers of improved cook stoves for the replication of the technology and biomass market development including knowhow transfer to local people.

45. Activities concerning improved charcoal kilns and multifunctional platforms did not proceed due to the budget shortfall. FUNAE hired two non-governmental organizations (NGOs) for the promotion and distribution of biomass energy systems in Manica, Inhambane and Gaza provinces. Under these arrangements, 123 individuals and associations were trained on the production of improved cook stoves in order to establish a local market for these types of cookstoves and to help local entrepreneurs in production and marketing of the stoves. According to FUNAE, “Three associations are currently working on the production and selling of improved cook stoves in Gaza Province (Manjacaze District), Inhambane (Jangamo District) and Manica (Chimoio City at Gondola District). They produce domestic wood and charcoal improved cookstoves as well as institutional wood stoves.”<sup>31</sup> By project closing, about 4,000 improved cookstoves (including 44 ‘institutional cookstoves’) were distributed in the project target areas. This ICR concludes that the intended objective of promotion of improved cookstoves was successful but it will take sustained commitment and development of the industry to create a viable commercial market in cookstoves.

46. The capacity building support for MIREME and FUNAE, combined the establishment and fine-tuning of the mechanisms for rural solar PV installations are expected to help leverage further support by the Government and other partners for off-grid rural electrification, and to attract private sector investments in off-grid rural access initiatives.

**Affordability of off-Grid Electricity Access**

47. Under FUNAE’s off-grid rural electrification program, the beneficiaries are charged a fixed monthly fee for use of the systems. Payments are made in cash payments, bank transfers or e-Sistafe (a government system, for payments between government institutions). The fees charged are presented in the table below. These fees are collected by local village committees set up by FUNAE, comprising community elders and other reputable members who collect the fees and act as FUNAE’s local agents in the community. These committees keep 25 percent of the collected fees for their own operating costs, and deposit 75 percent of the collected fees in FUNAE’s account for covering the system operations and maintenance costs by FUNAE. The current monthly fee-for-service amounts are shown in table below.

System Type	Residential Kit A1	Residential Kit A2	Residential Kit A4	Residential and Public Institutions	Commercial Establishments	Commercial Establishments	Schools	Health Centers Type I	Health Centers Type II
Items Included	1 Lamp, 1 DC Plug	4 Lamps, 1 DC Plug	4 Lamps, 1 AC Plug	5 Lamps, 1 Plug	5 Lamps, 2 Plugs	5 Lamps, 2 Plugs, 1 refrigerator	18 Lamps 1 Plug	10 Lamps, 3 Plugs	6 Lamps, 3 Plugs
Fees per month (MZN) / US\$	100.00 / \$1.61	200.00 / \$3.22	250.00 / \$4.03	400.00 / \$6.45	500.00 / \$8.06	800.00 / \$10.32	800.00 / \$10.32	800.00 / \$10.32	400.00 / \$6.45

The exchange rate used for this table is about 1USD: 62 MZN.

<sup>31</sup> Ibid.



48. These monthly fees-for-service were originally set at higher levels by FUNAE, but after monitoring the percentage of paying customers relative to number of systems installed, FUNAE determined that the usage fees needed to be adjusted downward. After these adjustments, the number of paying customers increased and has remained steady according to FUNAE.<sup>32</sup>

49. Following the multi-tier framework for defining and measuring access to energy under the SE4ALL Initiative<sup>33</sup>, the affordability of the electricity customers of the off grid based residential consumers under EDAP is close to tier 3-5 (less than five percent of household income). An estimate of 5.8 percent of their household expenditure was spent on the electricity consumption based on the residential PV fee of total MZN 4,800 per year with annual consumption of 173 kWh. This is less than the multi-tier framework's definition of households' consumption of 365 kWh per year.<sup>34</sup>

### **Sustainability of off-Grid Electricity Access**

50. The installation of these systems by FUNAE at schools and health centers has been based on a safety/security assessment of the buildings to ensure adequate security and sustainability of the systems against theft or physical damage to equipment. While this requirement has reduced the number of potential health centers that could receive solar PV systems, it has increased the sustainability of the systems against vandalism and theft of equipment.

51. FUNAE remains the legal owner of the installed equipment, and while the capital expenditure on the equipment is provided through various FUNAE funding sources (including the Government's on-granting of EDAP and other funds to FUNAE), the operation and maintenance of these systems remain FUNAE's responsibility, with portions of it covered by the fee-for-service arrangement described earlier (the percent contribution of these fees to FUNAE's overall O&M costs for off-grid installations could not be determined by the ICR team since FUNAE does not keep track of these costs as a separate expenditure line-item).

52. FUNAE has established protocols with relevant entities to train technicians who will be in charge of the O&M of the PV systems that have been installed. These arrangements are reasonably adequate for ensuring the near term sustainability and proper functioning of these installations. O&M would however be helped with standardization of PV system equipment and help make it more sustainable.

### **Providing Access to Solar Water Heaters in Hospitals**

53. The Ministry of Mineral Resources and Energy (MIREME) ensured that six (6) hospitals in as many provinces were also equipped with solar water heaters. A summary of the hospital locations and their respective in-patient capacity is provided in the table below.<sup>35</sup> As shown in the table, 21 percent of total beds are specifically for addressing the gynecology, obstetrics and maternity needs of women in these hospitals. Availability of heated water for meeting the needs of more than 970 in-patient hospital residents (of which at least over 200 would be in various women's wards) on an on-going basis through the use of solar water heaters would considerably improve the hygiene services for hospitalized patients and health workers in these communities.

<sup>32</sup> Based on information provided by FUNAE to the ICR team.

<sup>33</sup> Energy Sector Management Assistance Program 2015. Beyond Connections: Energy Access Redefined. World Bank.

<sup>34</sup> Households in Mozambique spend an average of 6,924 meticaais per month, equivalent to 1,406 meticaais per person, according to figures from the Household Budget Survey (HBS) for 2014/2015. Source: <https://macauhub.com.mo/2016/01/06/families-in-mozambique-spend-us147-per-month/>, <http://allafrica.com/stories/201512310035.html>

<sup>35</sup> Data compiled by the ICR team from MIREME's "Design and Supervision of Public Sector Solar Water Heater (SWH) Demonstration Project", October 2014.



Hospital Name / Location	Employees	In-patient Beds	Women’s Health	Hot Water Needs (Liter)	Comment
Namaacha Rural Hospital	16	55	-	1,000	Currently rely on a 1 liter kettle
Chimoio Provincial Hospital	741	421	64	13,000	Complementing existing electrical geysers
Lichinga Provincial Hospital	250	56	42	8,000	Complementing existing electrical geysers
Mueda Rural Hospital	152	160	24	5,000	
Ulongue Rural Hospital		109	49	4,000	
Gurue Rural Hospital	150	163	45	6,000	

54. Together, these activities and arrangements contributed to the sustainability of the off-grid electrification. The overall efficacy of the project is therefore rated as **SUBSTANTIAL**.

**C. EFFICIENCY**

**Rating: Substantial**

**Assessment of Efficiency and Rating**

55. The economic and financial analysis at the project completion followed World Bank guidance documents (2001, 2014a, 2014b, 2016, 2017a and 2017b) and Bank Directive: Investment Project Financing<sup>36</sup>. Following the guidance note (2014a), this analysis addressed (i) the project’s development impact, (ii) the public-sector provision or financing as the appropriate vehicle, (iii) the World Bank’s value added, (iv) financial, fiscal and environmental sustainability and (v) the project justification nexus — results, risks, and economic rationale. The analysis examined the causal chain that links project activities and inputs to these objectives in Annex 1. Results Framework and Key Outputs. The risk and sensitivity analysis to those results included those in Section D. Risk to Development Outcome. Major data sources for the analysis comes from invoices, interim financial reports, contracts, World Bank Client Connections website, and other reports in the internal World Bank documents, the client and the Bank team. Following the ICR Guidance (2017b), the analyses at appraisal in PAD and at the project completion were compared.

56. The economic and financial analysis at the project completion covered 91 percent of the total project cost. The remainder was policy or sector-wide related capacity building activities in Component 3, which per ICR guidance, was to be assessed at the efficacy level. At appraisal, economic analysis covered 81 percent of the total project and financial

<sup>36</sup> References are presented in footnotes in Annex 4



analysis covered EdM as a whole entity. The appraisal analysis included Component 1 except institutional development activities and PV activities in Component 2. The PAD used 12 percent discount rate for economic analysis. To be consistent, the analysis at completion was presented in 2009 prices (in local currency compared to US dollar at appraisal) and at a 12 percent discount rate. However, pursuant to the World Bank's guidance (2016), an economic discount rate of six percent was also used for the economic analysis as Economic Opportunity Cost of Capital (EOCK). Also, following the same guidance (2016), an economic discount rate for the long-term project life period available forecast data from 2010-2022 was estimated at 8 percent, which was used for a comparison purpose. Results are summarized in the following paragraphs and further details are presented in Annex 4.

### Economic Analysis

57. The economic analysis showed that the project's activities and inputs would meet the PDO with an Economic Net Present Value (ENPV) of MZN 401 million (US\$15 million), or about 0.1 percent of GDP in 2016, and an EIRR at 34 percent. Table A4-2 compared the results at completion with those at appraisal. The appraisal analysis' total ENPV was more than twice that of the completion analysis, MZN 1 billion. The appraisal analysis did not provide the economic internal rate of return (EIRR) of the entire project but provided an EIRR at 26 percent for Component 1 and 18 percent for Component 2. By contrast, the completion analysis resulted in an EIRR at 25 percent for Component 1, 8 percent for Component 2 and 68 percent for Component 3. The reason for the high return of Component 3 was due to the estimated higher solar energy factor than the energy factor for the traditional electricity water heater. Using the default six percent discount rate as EOCK under the 2016 World Bank guidance, the ENPV would become MZN 982 million, and using the estimated EOCK at 8 percent, the ENPV would become MZN 726 million.

### Aspects of Design and Implementation Efficiency

58. The following were assessed in aspects of design and implementation efficiency;

- **Actual component costs compared to the estimated component cost at appraisal.** The main reasons for divergences were due to a strong appreciation of the US dollar against the SDR, reducing the project amount in US dollars by US\$ 8.7 million which amounted to 11 percent of the total project amount. Also, the Government priorities were changed. Although some of the sub-components of Component 2 were cancelled, that itself did not have impacts on efficiency. The cookstove sub-component was scaled down, but the overall efficiency was related to outputs (13 percent) and inputs (87 percent) ratios in terms of present value (PV) at EOCK (costs of improved cookstove productions versus costs of consultant, contractors and the project management). On the other hand, the addition of water heater systems in Component was more efficiently executed, 88 percent of the cost (in PV team at EOCK) were used for the equipment and installation of the water heating systems, and supported the solar thermal roadmap.
- **Actual administrative costs compared to expected costs.** The PAD did not include specific allocation of the administrative costs. However, the completion analysis found that Component 1's administration cost was one percent of the total IDA allocation in Component 1 (e.g., vehicle, computer, printer, binding machine, and furniture, bank charge, translator, etc.) and Component 2' administration cost was seven percent of the IDA allocation in Component 2 (e.g., vehicle, tires, car maintenance, cell phone, computer, telephone and internet fees, office supplies, office rent, procurement consultant fee, procurement advertisement cost, custom clearing agent for one of the solar PV contractor, audit agent for solar PV supervising consult firm, (in PV terms at EOCK).



While Component 3 is not subject to efficiency assessment (per ICR Guidance on sector efficiency), occasionally, excessive bank charge was observed. For example, as much as US\$2,227 (in nominal prices) was recorded in the IFR quarter ending September 30, 2014.

- **Cost or time overruns impact on efficiency.** One of the PV systems contracts did not include the tax payment. That resulted in hiring a special clearing agent to pay the tax on behalf of contractor, which was unnecessary expenditure (MZN 168,251 in PV terms at EOCK) and reduced the efficiency of implementation. Time overrun including the procurement delay incurred additional service charge for the Government. The PAD did not include the expected service charge but based on the estimated disbursement table in the PAD, the expected service charge was estimated.<sup>37</sup> It was found that due to the high inflation rate during the project extension period of 2016-2017 (19 percent per year), the actual service charge in PV terms was 27 percent less than that was estimated from the PAD. However, the project closing date extension for two years would indicate negative impacts on efficiency, especially given the limited results achieved on SIGEM, the potential reduction on technical loss and the eventual cancellation of the PV maintenance of the PV contractor who also could not install all the PV systems. Procurement delay and time overrun reduced the NPV due to the discounting impacts and the high inflation rate during the 2016-2017.
- **High TTL turnover on inefficiency.** TTLs were changed four times during the seven-year project period. An Aide Memoire dated October 7 - 11, 2013 noted “Ministry of Energy (ME) emphasized that absence of the Bank’s TTL for the project in the country partly contributed to project delays. ME nonetheless welcomed that new TTL based in Maputo is assigned.” Hence, the TTL location outside the country might have contributed to the inefficiency but the turnover of the TTLs itself did not demonstrate an evidence of the inefficiency.

### Financial Analysis

59. Financial analysis was conducted for EdM and FUNAE but did not cover MIREME (except levelized cost/kWh) because IDA-financing to solar heater system in the hospitals did not generate revenues for MIREME. Component 1 was financed by IDA and on-lent to EdM from the Ministry of Finance without equity. Without equity and with low lending rate at 1.3 percent (IDA on-lending from the Ministry of Finance to EdM) and high inflation rate, the simple calculation of weighted average cost of capital would become negative. For financial analysis of EdM component, a discount rate of 1.3 percent is used as a financial opportunity cost of capital. For FUNAE, as IDA was given as a grant, a return on equity (RoE) of 16 percent based on the cost of capital estimated from Treasury Bill of the Central Bank of Mozambique and an inflation rate. The results showed that EdM and FUNAE had negative financial net present values (FNPV) due to their inability to recover the costs of services. However, FUNAE’s financial internal rate of return (FIRR) was positive as 13 percent. EdM’s Annual Debt Service Coverage Ratio (ADSCR, Net revenue over project debt repayments) and Loan Life Cover Ratio (LLCR, present value [PV] of net revenue over PV of project debt repayments) up to the end of the project life of Component 1 were negative. This indicated the EdM may not be able to repay IDA funding to the Ministry of Finance based on the project revenue alone.

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<sup>37</sup> Estimated based on the PAD’s estimated disbursement table in the data sheet, which had no page number, but before the main text.



On the basis of high rates of EIRR and overall strong aspects of design and implementation efficiency, the overall efficiency of the project is rated as **SUBSTANTIAL**.

**D. JUSTIFICATION OF OVERALL OUTCOME RATING**

**Overall Outcome Rating: Moderately Satisfactory**

60. The PDO of the project was to increase access to electricity and modern energy services in peri-urban and rural areas in a sustainable and affordable manner. The overall outcome rating is assessed as Moderately Satisfactory. The rating is based on the project’s design in addressing a highly relevant objective and achieving that objective with substantial efficacy. One outcome indicator, completion of the customer satisfaction survey was not completed (but was not directly relevant to achieving the objective of electricity access which was achieved), and the indicator to electrify 250 schools was achieved at 78 percent (primarily due to hurricane damage and vandalism). All other outcome indicators surpassed their targets. This ICR assesses that there was substantial benefit to project areas due to the projects efforts to increase electricity access. While a formal beneficiary survey was not conducted, the voices of beneficiaries as heard in this feature story<sup>38</sup> on EDAP’s outcomes published on the Bank’s external website are particularly evocative. Given the above achievements, but taking into account implementation delays, the overall outcome rating is assessed as Moderately Satisfactory<sup>39</sup>.

**Rating Summary Table:**

Sub-Ratings			Outcome Rating
Relevance	Efficacy	Efficiency	
High	Substantial	Substantial	<b>Moderately Satisfactory</b>

**E. OTHER OUTCOMES AND IMPACTS (IF ANY)**

**Gender**

61. **EDAP’s development objectives included benefits to men, women and children. With regards to benefits specifically to women, the following outcomes are expected:**

- i. Improved hygiene in hospital services for women (installation of solar water heaters supporting hospital services covering over 970 concurrent in-patients, including over 200 concurrent in-patients in Women’s Wards on on-going basis).

<sup>38</sup> <http://www.worldbank.org/en/news/feature/2017/03/01/world-bank-supports-rural-electrification-to-decisively-curb-poverty-in-mozambique>

<sup>39</sup> In the last ISR prior to project closing, DO, IP and FM ratings were upgraded. DO and IP ratings in particular were upgraded from “Moderately Satisfactory” to “Satisfactory” as EdM and FUNAE had by then completed their activities successfully. This ICR rates the development objective of the project as “Moderately Satisfactory”. The discrepancy in ratings between the last ISR and this ICR is because the ISR assessed that all activities had satisfactorily concluded at project closing, whereas this ICR assesses the project for the entire project duration and considers many other factors such as efficiency in addition to efficacy.





- II. Increased school attendance of girls as a result of classroom-hour extension, increased safety and security, and possibility of studying at home after dark.
- III. Improved access to health services (over 195 health centers electrified, six hospitals provided with access to solar water heaters, etc.)
- IV. Increased free time for women through distribution of 4,000 efficient cook- stoves that saved fuel costs and/or time (about 40 percent of fuel cost reduction).

### **Institutional Strengthening**

62. EDAP’s institutional strengthening activities were partially successful, in that the project helped strengthen the capacity of each of the four key sector players to some extent for the near-term achievement and long term sustainability of the project outcomes of increased access to grid and off-grid electricity services.

63. MIREME benefited from some staff training, and completion of various studies and consultancies that could assist in promotion of renewable energy IPP development, and provision solar water heaters to public hospitals in rural areas. Examples include: Renewable Energies Incentives Review in Mozambique (April 2013); Off Grid Renewable Energy Systems Tariff Models Review, Mozambique (September 2014); and Design and Supervision of Public Sector Solar Water Heating (SWH) Demonstration Project Field Work Report (October 2014). These efforts in the long run could assist in improving the expansion of options for availability of electricity supply and modern energy services at reasonable cost for a larger segment of Mozambique’s peri-urban and rural population. Hiring of financial management and procurement specialists also strengthened MIREME in more effective management of its projects, including EDAP. However, the capacity of the MIREME in project monitoring and reporting was (and as yet remains) inadequate and in need of strengthening. Under the EDAP, MIREME also benefited from material strengthening (purchase of vehicles and computer equipment).

64. The project assisted FUNAE in hiring of consultants for procurement, solar PV system, biomass energy including cookstoves, and training of M&E officers. Under EDAP (APL-2), FUNAE carried out staff training activities on good management practices and project monitoring and evaluation techniques. More importantly, the staff training in solar PV systems and related technical areas had a positive impact on improving the technical knowledge and management skills of FUNAE staff, thus enabling FUNAE staff to improve their performance.<sup>40</sup>

65. The institutional strengthening and capacity building of EdM included: (i) conventional capacity development support and training in business process management, planning design and construction of transmission and distribution systems, operation and maintenance of transformers and switchgear, and environmental safeguards, project management, and monitoring and evaluation areas; (ii) institutional development on environmental and social safeguards (strengthening of the Environmental and Social Safeguards Unit); and (iii) establishment of an Integrated Business Management System (SIGEM). With the successful implementation and use of the financial module of SIGEM during the final stages of project implementation, EdM was able to publish its financial audit for the first time without qualification and to identify gaps on procedures, process, approvals and delegation authority, which are necessary for its own governance. Other modules of this business management system are yet to be used effectively by EdM. EDAP’s follow on project, Power Efficiency and Reliability Improvement Project (PERIP), approved by the Bank’s Board in early FY18, includes funding for components that aim to further strengthen the deployment of the MIS.

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<sup>40</sup> As reported by FUNAE during interviews and in FUNAE’s ICR report, October 23-25, 2017



### **Mobilizing Private Sector Financing**

66. There were no direct efforts to mobilize private sector financing for the agreed activities under this project. Following extensive discussions with IDA and a stakeholder workshop in November 2005, the Government had opted to not seek private participation in EdM. The Government's strategy instead focused on achieving improved performance in EdM in the near term. Indirect efforts to mobilize private sector financing were through FUNAE's intention to use the solar PV installation program and the improved cook stove initiative as pilot projects to attract private sector participation in these areas. However, there was no verifiable effectiveness or impact assessment available by the time of this ICR.

### **Poverty Reduction and Shared Prosperity**

67. The project sought opportunities to contribute to poverty reduction and shared prosperity. The Off-Grid component was focused in rural areas where most of the people were financially and socially disadvantaged. Cookstoves activities too were focused in rural areas. Through public consultation and questionnaires in coordination with local governments, people applied for the stoves. Cookstoves were distributed to people under an installment payment arrangement. Most of the cookstove producers who were trained under EDAP (both men and women) were previously people with no cash income. Component 3 in providing improved hygiene in hospitals in different regions through the installation of solar water heaters was a key feature in the campaign to increase shared prosperity.

68. In light of the experience from various developing countries that have rolled out universal access programs, it is expected that the beneficiaries of this project in peri-urban and rural areas are (and will continue to be) better off in their well-being, quality of life, and productivity as a result of gaining access to electricity services under this project.

### **Other Unintended Outcomes and Impacts**

69. As a result of cost savings, and at the suggestion of the Government (MIREME), six hospitals in as many provinces received solar water heaters for improved service delivery to their patients (more than 970 in-patients, of which at least 204 would be women) and staff (over 1,300 staff working different shifts). The impact of these hospital service improvements were discussed in earlier sections of the ICR. EDAP's solar water heater installation contributed to the Solar Thermal Technology Roadmap for the Mozambique, which was developed in 2015.<sup>41</sup>

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<sup>41</sup> The roadmap was prepared by authors from science and technology park (STP), EdM, University Eduardo Mondlane (UEM) and FUNAE) and is implemented by the same institutions. Additional details are in a footnote in Annex 4.



### III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

#### A. KEY FACTORS DURING PREPARATION

70. The project objectives were clearly defined for increasing access to electricity services both on-grid and off-grid. The targets for number of connections were reasonable and could be achieved under the project. Project design was simple and was based on earlier experience gained under ERAP (APL1) as well as lessons from a wide range of similar World Bank operations in grid extension access projects and solar PV system household and community connections. The PDO monitoring indicators for increased access were aligned with the project objective and the targets were appropriate. The key implementing entities - MIREME, EdM, FUNAE, and CNELEC - were appropriately engaged to oversee the sector planning, policy and institutional development; grid based access expansion; off grid rural electrification; and regulatory advisory services, respectively. Critical risks at sectoral, operational and institutional capacity levels were assessed as low to moderate, with the somewhat over-optimistic assumption that all project implementing agencies had reached adequate readiness for implementation. The overall risk of the operation was rated as Moderate.

71. Consistent with the format of an APL program, EDAP APL2 was subject to the completion of two triggers in the restructured ERAP APL1. The first trigger related to the continued operation of independent grid concessions in Northern Inhambane. By the time of EDAP preparation, this trigger was no longer relevant to the APL series as the Northern Inhambane independent grid concession had been cancelled and was no longer a component of EDAP. The second trigger related to EdM's performance contract being in place and at least one performance monitoring cycle including review by CNELEC having been completed. It was not achieved by EDAP APLs' board date in January 2010. The Bank deemed the lack of completion of this trigger not as a lack of ownership of the fundamental sector reform process and policy, but rather as the result of procedural delays in processing of procurement and resulting overlaps with elections activities in the country. The requirement for meeting this trigger was waived by the Board during the approval process and completion of the satisfaction survey was attached to EDAP's results framework with the expectation that the requirement would be met within a few months of the start of project implementation.

72. Although the design of EDAP (APL2) was based on successful activities of the ERAP (APL1), there were oversights in the design of disbursement arrangements and in project cost estimates. These contributed to the slow start of EDAP implementation, requiring subsequent restructurings of the project. These included:

**(i) Impractical Flow-of-Funds Arrangements for EdM.** Following the Paris Declaration on the use of country systems, in June 2008 the Government of Mozambique and the World Bank agreed to channel all country portfolio funds through the Government's Single Treasury Account (CUT). This implied that all project funds had to be disbursed through CUT, following national procedures. Under this arrangement, FUNAE and MIREME's project related invoices were to be paid directly from the CUT (since both entities were part of Government departments), whereas EdM was expected to pay its invoices first, and then get reimbursed later by the MIREME from the Designated Account. This arrangement (which was dictated by the GoM-WB agreement, and at the time was beyond the project team's control) subsequently led to significant delays in EdM's implementation activities. This inefficient arrangement was eventually



remedied through the establishment of a separate Designated Account for EdM during the first project restructuring in July 2015.

**(ii) Under-estimation of project costs:** In determining solar PV package cost estimates, the original project appraisal did not include the costs of systems for staff housing of the schools and clinics which were being electrified under EDAP. Project design also did not take into account the required two-year maintenance program for the rural Solar PV installations. Together, these would add up to about US\$4.75 million, creating a significant budget shortfall. This omission was identified only after effectiveness, and required subsequent design changes and down-scaling or cancellation of some off-grid activities to compensate for the funding gap.

**(iii) Taxes and Duties were not considered:** Taxes and duties applicable to imported solar PV equipment were also not taken into account in project cost estimates at appraisal, raising the estimated budget shortfall to about US\$6.35 million, or 9.1 percent of the total financing.<sup>42</sup> This additional shortfall was addressed through changes in design and reduction in scope of some activities, and reallocation funds among project components.

## B. KEY FACTORS DURING IMPLEMENTATION

73. **The project had a slow start.** The project was approved by the Board on February 4, 2010. It took more than one year before effectiveness conditions were met and the project was declared effective in March 2011. The project had to wait yet another seven months (until October 2011) for the initial deposit to be made into the Designated Account for reasons unrelated to EDAP (APL2) as described below. Therefore, project implementation started with a 20-month delay before any contracts could be signed and implementation activities could be initiated by the three implementing entities.

74. **Non-project related initial deposit delays.** Even after project effectiveness in March 2011, disbursement of the initial deposit was blocked due to failure of the Government and the ERAP (APL-1) implementing agencies to fully repay the outstanding refunds from the ERAP (APL -1) project. The final payment of approximately US\$9,000 was finally paid in October 2011, and disbursements under EDAP were then cleared. This was approximately 20 months after Board approval and seven months after project Effectiveness.<sup>43</sup>

75. **Flow of Funds Arrangements for EdM.** As stated earlier, the EDAP project was to operate one Designated Account in US\$ managed by the MIREME, covering all project payments through the CUT. Under these arrangements, FUNAE and MIREME's activities were to be paid directly from the CUT, whereas EdM was expected to pay its invoices first, and then get reimbursed by MIREME from the Designated Account. However, in practice this arrangement led to significant delays in EdM's implementation activities. It faced various challenges in paying invoices using its own funds, including the time required for internal EdM clearances and approvals, in addition to Government procurement and contract clearance procedures described below. In addition, the MIREME reimbursements to EdM required the review and verification of EdM's invoices, payment records and other supporting documentation before reimbursements could be processed, which further increased payment delays.

<sup>42</sup> Aide Memoire , Supervision Mission of Sept-Oct 2012.

<sup>43</sup> Source: Aide Memoire Sept 14-23, 2011



76. **Procurement Delays.** Two major factors contributed to significant delays in procurement during implementation: (i) lack of advance preparation of procurement packages; and (ii) stringent and time consuming Government clearance requirements for large procurements.

(i) No attempt was made to prepare the major procurement packages in advance of project effectiveness. Therefore, the time consuming preparation, clearance, and processing of large procurement contracts during implementation period (which had started with a 20 month delay as described above) contributed to significant implementation delays and the need for two closing date extensions for a total of just under two years.

(ii) Additional delays were encountered as a result of the requirement for all major contracts to be cleared by the *Tribunal Administrativo* (which, by law, also required translation of all procurement documents into Portuguese) and the Commission for External Economic Relations (CREE).<sup>44</sup> These clearances were required before these contracts could be signed and any payments could be made. Obtaining the necessary approval from CREE for the Consulting Engineering contract, for example, took about five months. In almost all large procurements under EDAP (including EdM's procurement of business management information system at US \$7.1million, or FUNAE's US \$11.5 million contract for Solar PV systems) similar clearance delays were encountered.

77. **Exchange Rate losses of approximately US\$8.7 million.** Throughout 2014, the US Dollar appreciated significantly. This caused an unforeseen situation where the project amount (denominated in SDR) had lost approximately US\$7million equivalent. A number of procurement packages were being processed at the time. If all procurement contracts in process were to be signed, there would have been a shortfall of US\$4.5million. In addition, there were about US\$2.1million worth of activities (under the MIREME component) for which procurement had not yet started. Under these circumstances, the funding shortfall was too large to meet planned commitments. Consequently, a prioritization exercise was undertaken to establish priorities for the use of the remaining funds. To address this challenge, the Bank team and the Government agreed to (i) Honor current commitments; (ii) Not to launch additional procurement and cancel superfluous spending (non-essential training, etc.); (iii) Plan for contingencies (current activities under implementation and additional exchange loss contingencies); (iv) Prioritize between activities under procurement, with priority for urgent investments; and (v) Look for alternative sources of funding at the World Bank and other partners. This shortfall eventually led to cancellation, postponement, and/or reduction in scope of some project activities.

78. Some activities that were initially planned, such as the development of a strategy for engaging with private sector, as well as a maintenance strategy for the solar PV systems, were financed by the Norwegian government and are ongoing. Development of the National Electrification Strategy (NES) which was postponed as a result of the funding gap was also eventually successfully developed under the SE4All initiative.<sup>45</sup>

#### **Under-Performance of a Solar PV Contractor and a Supplier.**

79. The installations of solar PV systems in Inhambane and Niassa provinces suffered significant delays due to the non-performance of subcontractors retained by one of FUNAE's primary contractors for system installation. The primary contractor was subsequently obliged to change its subcontractors to accelerate implementation. Another unanticipated

<sup>44</sup> The Commission for Foreign Economic Relations (CREE) consists of ministers and is chaired by the Prime Minister.

<sup>45</sup> National Electrification Strategy & Plan for Universal Access to Energy by 2030, September 2017.



event was the sub-standard quality of some of the solar panels delivered by a supplier. Upon close inspection, solar panels rated by the manufacturer as 75W panels were falsely certified as 100W panels by the supplier. Replacement of these panels and completion of system installations were therefore delayed by several months, contributing to the need for project closing date extensions.

#### **IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME**

##### **A. QUALITY OF MONITORING AND EVALUATION (M&E)**

Overall Rating of Quality of M&E: Substantial.

###### **M&E Design**

80. The first three of four PDO level indicators focused on measuring the number of people provided with access to electricity through (i) household connections to the grid; (ii) off-grid household electrifications; and (iii) off-grid community electricity connections (rural schools and health centers). The fourth PDO indicator was designed to assess the satisfaction level of EdM's customers in project target areas. This last indicator did not directly address an aspect of the project's PDO but was included as a legacy indicator from the ERAP (APL1) project which directly supported the establishment of CNELEC as an advisory body to monitor and advise on EdM's performance.

81. The PDO indicators were adequate for measuring increased access to electricity services under the project. The M&E system did not, however, explicitly define what was meant by sustainability and affordability, or include measures for assessing the "sustainable and affordable manner" in which these connections were to be made.

82. The beneficiary indicators were formulated as the "number of people provided with access to electricity under the project by household connections", or "Number of community electricity connections under the project", for which the baseline should have been zero since at the start of EDAP no connections had been made under the project. Nevertheless, the Results framework provided baseline values and targets which were defined as the sum of the baseline values and project outputs.

83. Under the intermediate outcome indicators, some of baseline and target values listed were problematic. For example, the average interruption frequency per year in the project area in Tete province, or electricity losses per year in the project area in Nampula province were not (and could not be easily) collected by EdM for the specific project target areas within these provinces. Therefore, the baseline values provided for these indicators were based on average values of operational data collected by EdM for much larger geographic areas, and did not reflect the situation at the specific project target areas. Furthermore, some of these indicators (such as the System Average Interruption Frequency Index [SAIFI] for measuring interruption frequency) were calculated based on incorrect definition of the indicators. These indicators could have been defined, accurately and selectively, to be more project-specific (e.g., monitoring the number of interruptions linked to the failure of specific high-capacity transformers installed under the project, or failures at substations financed by the project, or failures along a specific length of transmission/distribution line financed by the project, etc.). The definition used by EdM for SAIFI is inconsistent with the industry standard definition of SAIFI, and the values are provided in Results Framework updates in Implementation Status Reports throughout



project implementation are erratic and unreliable.<sup>46</sup> Furthermore, SAIFI alone is not sufficient to assess the improved access. System Average Interruption Duration Index(SAIDI), a system index of average duration of interruption in the power supply indicated in minutes per customer, could complement the reliability or improved access.

84. The above considerations notwithstanding, the PDO indicators were reasonably adequate for monitoring progress of project implementation and progress toward achievement of the project outcomes. The institutional arrangement was for MIREME to be responsible for integrating the M&E reports from the other two implementing agencies (EdM and FUNAE) and submitting a consolidated report to the Bank together with the quarterly progress reports which were agreed upon between the Government and the Bank.<sup>47</sup>

### M&E Implementation

85. During implementation, the original arrangements for the collection and reporting of monitoring data were modified. In practice, to avoid unnecessary delays, each implementing agency provided its own share of data updates directly to the Bank during supervision missions. Starting with the mid-term review mission (March 2014), Aide Memoires and Implementation Status and Results Reports (ISRs) generally included an updated results monitoring table, along with succinct implementation progress summaries reflecting the latest project status by each implementing agency. For example, FUNAE reports would include a table showing the number of solar PVs and other equipment installed in schools and health centers, etc. Direct submission of the updates to the Bank missions (albeit not consistent with the formal agreements in the Financing Agreement [FA]) proved effective in bringing all project teams on the same page in terms of project implementation status. These monitoring data updates also informed discussions and communications between the Bank team and implementing agencies regarding required next steps for ensuring timely and successful completion of project implementation and delivery of results.<sup>48</sup>

86. There were, however, minor inconsistencies in the updates to the Results Monitoring data reflected in the ISRs. For example, the target value for the indicator measuring the “Transmission lines constructed under the project” was stated as 156 km, whereas after the final design was prepared for the Transmission line extensions, it was clear that the Transmission -line extensions required to achieve the objectives of the project would be only about 6 kilometers. This revised target value, however, was not reflected in the results framework, and was only acknowledged in the final ISR.<sup>49</sup>

87. Prior to the start of EDAP, FUNAE had carried out an impact evaluation in five villages based on earlier off-grid solar PV installations similar to those planned under EDAP. FUNAE’s assessment focused on consumer satisfaction, system functioning, use and conservation. Overall, use of solar PV systems had gone well in health facilities, but issues existed in schools. For health facilities, they found the performance satisfactory, with an increase in number of patients, quality of services and the number of services provided. For example, clinics now had the ability to test for malaria and

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46 The definition provided by EdM for SAIFI is:  $SAIFI = (\text{Number of interruptions} / \text{Number of Delivery Points})$ . However, the industry standard is that SAIFI is measured in units of interruptions per customer. The industry standard SAIFI definition is: the average number of outages that a customer would experience during a predefined period of time. The SAIFI is an index calculated using the following formula:  $SAIFI = \sum(O_i N_i) / N_t$ , Where,  $\sum$  = Summation function;  $O_i$  = the outage rate in area  $i$ ,  $N_i$  = Number of customers interrupted in area  $i$ ;  $N_t$  = Total number of customers served.

<sup>47</sup> EDAP Financing Agreement, June 23, 2010.

<sup>48</sup> At a higher level, these status updates and the actions required were also highlighted further in Management transmittal letters which accompanied the formal distribution of the Aide Memoires to the Government.

<sup>49</sup> See ISR 13, June 15, 2017.



human immunodeficiency virus (HIV). Furthermore, use of fuel consumption had decreased due to the use of PV for lighting. In schools, there was an increase in the number of students due to more class sessions, including at night. Introduction of audio-visual equipment had increased interest from students. In villages, it was found that some postos administrativos now had computers, there was a reduction in the use of oil for lighting, and the time for collecting water had decreased. Villagers had also benefited from public lighting, gaining an increased sense of security. There was a decrease in crime, and small businesses had increased their working hours. Issues were found in O&M of systems, and FUNAE's conclusion was that "Monitoring might help reduce the issues."<sup>50</sup>

88. From an objective-driven perspective, the above-mentioned shortcomings in project monitoring arrangements were minor since the PDO level data collection and verification arrangements were reasonably adequate and effective for monitoring both the on-grid and off-grid electricity connections. In addition, the project status summaries were prepared by each implementing agency on their respective project implementation activities and shared with the Bank during supervision missions. These updates were utilized as part of the project monitoring approach, and provided adequate details on the status of project inputs, outputs, and outcomes under each project activity. They also included updates on the status of procurement, delivered outputs, progress toward delivery of on-grid and off-grid connections, number of electrified schools and health centers, and other relevant details. Therefore, the ICR's assessment is that while there were some shortcomings in the M&E arrangements, the PDO outcome indicators were adequately defined for measuring increased access to the grid and off-grid electricity services in peri-urban and rural areas, and that the monitoring arrangements which emerged in practice during implementation - while not flawless- were adequate and effective for the successful monitoring of project implementation and its progress toward achievement of the project objectives.

89. Some of the elements of the M&E system will be sustained under EdM's recently installed Integrated Management System for the Electricity Utility of Mozambique (SIGEM) which was funded through EDAP. SIGEM can generate reports on system operations, outage frequency, and other information at an aggregate level. However, while the accounting and financing modules of SIGEM have been used very effectively and successfully, the incident recording and management system (IRMS) module of this system is currently not utilized by EdM. Utilization of IRMS and the commercial management system (CMS) modules of the SIGEM could enhance the performance of EdM's customer service, revenue collection, and network management (including the grid extensions and reinforcements carried out under EDAP.<sup>51</sup> FUNAE will continue to monitor the operations and performance of the off-grid systems installed under this project.

### **M&E Utilization**

90. EdM and FUNAE utilized their respective consultants' monthly and quarterly implementation monitoring and progress reports to inform their respective project implementation adjustments. EdM had made arrangements with its consultants to hold weekly briefings with EdM field staff to review project implementation progress and to address any issues that required project implementation unit's (PIU's) attention or intervention. The consultants were also preparing detailed monthly and quarterly progress reports which were shared and discussed with the EdM PIU to find practical and timely solutions for any problems that may have occurred.<sup>52</sup> One example of utilization of this project monitoring arrangement was when a noticeable discrepancy in the speed of pole installation between one specific project target

<sup>50</sup> EDAP Mini-retreat, November 2-3, 2010, Key Action Points

<sup>51</sup> *SIGEM Post Implementation Review – PM Assessment Report*, EdM, December 2016.

<sup>52</sup> EdM shared several of these monthly and quarterly reports with the ICR team for information.





area and others was identified. After using this information to examine the reasons for these differences, EdM found that the area in question was located on hard rocks and required additional workers/equipment for increasing the speed of installation. Based on this information, EdM was able to make the necessary adjustments by introducing appropriate equipment and increasing the number of workers to improve project implementation performance in that area and to bring it up to expected levels.

91. Monitoring data updates and the implementation progress summaries that were shared with the Bank supervision missions proved helpful to the Bank team in dealing with implementation bottlenecks. It was also helpful that the assigned project Task Team Leaders (TTLs) were stationed in Mozambique and could therefore interact and follow up directly with each of the project implementation teams on a daily basis to facilitate and advance project implementation activities.

92. Regular sharing of the monitoring data with the Government as well as with the Bank's sector and country management teams also helped facilitate the discussions around restructuring and other decisions when necessary. Overall, this real-time information sharing with the Bank TTL in the field helped inform the decisions required for timely follow up actions by the Bank team in supporting the implementing agencies in keeping project implementation on track.

93. FUNAE utilized an in-house database for monitoring of the off-grid connections and other initiatives that are carried out under its various projects.

#### **Justification of Overall Rating of Quality of M&E**

94. The original monitoring arrangements and the subsequent modifications to them were adequate for monitoring progress toward achievement of the project objectives. Given the choice of adequate and appropriate monitoring indicators for the PDO outcomes, and the practical approach used by the project implementing teams to collect and share the relevant monitoring data and implementation progress updates with the World Bank (both in the field office and during supervision missions) the overall rating of Quality of M&E is rated as Substantial.

## **B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE**

### ***Social and Environmental Safeguards***

95. Under the Bank's Operational Policy (OP/BP 4.01) on "Environmental Assessment" screening and classification, the project was assigned as Category B. The original project triggered a safeguard policy: Involuntary Resettlement (OP/BP 4.12). An Environmental and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF) were prepared since the exact locations and impacts of the planned investments could not be determined at Appraisal. The draft ESMF and RPF were disclosed in Mozambique and at the World Bank Infoshop on July 21, 2009; and the final ESMF and RPF were disclosed in Mozambique and at the World Bank Infoshop on October 16, 2009. During project restructurings, no modifications were required to the safeguards instruments as restructured activities were not expected to have any additional environmental and/or social implications and the environmental management aspects were handled according to the standards described in the safeguards instruments.



96. The ESMF was prepared in consultation with MIREME, FUNAE, EdM and reflects experience gained with similar types of sub-projects under other operations, including ERAP. At the time of Appraisal, EdM was in the process of establishing an Environment Unit with support from Danish technical assistance. The establishment of this unit was introduced as a condition of effectiveness under EDAP. The EdM Environmental and Social Unit, with 4 Environmental and Social Specialists, raised Safeguards awareness among EdM management and improved implementation performance of EDAP and other EdM projects. The unit also continuously carried out supervision of the implementation of the ESMP and RPF requirements. During the Restructuring of March 2015, the Environmental Category was reviewed and reconfirmed as Category B.

97. During construction of some lines, EdM's safeguards unit was short staffed and could not adequately monitor the compliance of contractors with workers health, sanitation and safety, and environmental safeguards requirements. With assistance from the Bank's Social and Environmental Specialists, EdM took these issues seriously and developed and implemented an action plan to address these issues. Examples included enforcing the use of protective equipment and posting of signs to inform workers and nearby local residents.

98. EdM's selected site for the Kongolote substation required involuntary resettlement. After consultations with the affected people, the affected houses were marked, and it was determined that 9 resettlements were required. EdM prepared and implemented the required site specific Resettlement Action Plan (RAP). The Bank's social and environmental experts carried out several site visits and confirmed that all project affected people (PAPs) were fairly compensated and vacated the site where the substation was subsequently built in compliance with World Bank Safeguards Guidelines. The World Bank's Safeguards and Gender Review of February 2016 praised the project for its effective negotiation and consultation with local communities for the adjustment of compensation to reflect changes in market value, thus avoiding conflicts with people affected by the project.<sup>53</sup>

99. The project was compliant with all applicable safeguards policies (OP/BP 4.01 and OP/BP 4.12), and the overall safeguards rating remained moderately or fully satisfactory throughout project implementation.

### ***Procurement***

100. The procurement rating at project closing was satisfactory, and throughout project implementation was rated as either moderately or fully satisfactory. This ICR assesses Procurement to be moderately satisfactory as there were both positive and adverse factors in play. On the positive side, all three implementing agencies (MIREME, EdM and FUNAE) were able to complete key planned procurements successfully and in full compliance with World Bank Procurement Guidelines, despite the challenges faced mostly by EdM due to delays caused by the required clearance of large contracts by CREE.

101. On the adverse side, a significant source of delay was the long time required for contract approval by CREE,<sup>54</sup> contributing to the need for the project closing date extensions.<sup>55</sup> Project implementation planning could have benefited from identifying this potential source of delay and incorporating it into the procurement clearance schedule of major packages based on CREE's track record.

<sup>53</sup> Mozambique Social and Environmental Safeguards and Gender Performance Portfolio Review Project – P151719, February 22, 2016.

<sup>54</sup> CREE consists of ministers and is chaired by the Prime Minister. CREE approves contracts above US\$1 million.

<sup>55</sup> ISR sequence 11 (November 2013) mentions the approval delays from CREE and the resulting delays in making the down payment to the contractor to commence works.



102. These challenges notwithstanding, the three implementing agencies were diligent in complying with the Bank’s Procurement Guidelines, and the Task Team was effective in working closely with the implementing agencies to resolve procurement issues, provide advice, and issue no objections in a timely manner.

**Financial Management**

103. The overall financial management performance was rated as Moderately Satisfactory throughout most of the implementation period, except for a brief period near the end of 2016, when there were delays in payments at EdM due to challenging internal procedures. Financial management arrangements were implemented and maintained adequately by MIREME, FUNAE, and EdM throughout the life of the project. All three implementing agencies were compliant with the Bank’s policies and procedures, and the “Financial Management, Financial Reports and Audits” requirements as stipulated in the Project Financing Agreement. In each of the implementing agencies, the project assigned suitably qualified financial management specialists who had the appropriate skills to manage the project’s accounting, financial reporting, and disbursement issues. The interim financial reports and annual audit reports were prepared and submitted to the World Bank on a regular basis, albeit with some delays. The annual audit reports were submitted regularly and were unqualified. There were no major financial management issues during the life of the project.

104. MIREME’s Designated Account (DA) reports an account balance of US\$2.6 million. This ICR notes that the bulk of monies remaining in the DA are not due to unfinished project activities but rather due to the Ministry of Finance’s reimbursement of the project account for the balance of the US\$4 million of project funds which were converted to local currency in 2015 without consultation with the implementing agencies. Due to exchange rate fluctuations, by the time these local funds were transferred by the Ministry of Finance to the implementing agencies in 2017, they were equivalent to less than US\$1.9 million. Therefore, at the World Bank’s request, the Government returned the balance of these funds to IDA to account for the full US\$4 million original allocation.

A summary of ISR ratings for Safeguards and Fiduciary aspects is provided below.

No.	Date ISR Archived	DO	IP	Procurement	FM	Safeguards	Actual Disbursements (SDR millions)
1	6/29/2010	S	S				0.00
2	3/15/2011	S	S				0.00
3	12/15/2011	S	M S	S	S	S	0.82
4	12/11/2012	S	M S	S	S	S	1.94
5	7/10/2013 <sup>56</sup>	M U	M U	M S	M S	S	9.84
6	01/18/2014	M U	M U	M S	M S	S	14.49
7	07/06/2014	M U	M S	M S	M S	S	17.44
8	12/15/2014	M U	M S	M S	M S	M S	20.08
9	06/30/2015	M S	M S	M S	M S	S	27.64
10	12/28/2015	M S	M S	M S	M S	S	29.69

<sup>56</sup> Starting with ISR-5, the actual *Archived* date appears in each ISR.



11	06/07/2016	M S	M S	M S	M S	M S	38.66
12	12/28/2016	M S	M S	S	M U	S	46.06
13	6/28/2017	S	S	S	M S	S	49.67

**Covenants**

105. The EDAP Financing Agreement and the EdM Project Agreement introduced several Covenants. While not directly relevant to the project’s PDO, project ISRs monitored six key covenants throughout the implementation period. The compliance status of these covenants by project closing was as follows:

<b>Covenant</b>	<b>Frequency</b>	<b>Status</b>
<p><i>Project Agreement: PA -IDA and EdM; Schedule, Section II, B., 3 and 4.</i></p> <p>Description: EdM needs to maintain throughout the project implementation period: (i) current ratio of 1.1 (current assets/current liabilities); (ii) debt service coverage ratio of 1.1 (cash generated from operations/debt service requirement)</p>	Yearly	<i>Not complied with</i>
<p><i>Financing Agreement: FA, Schedule 2, Section 2, B.</i></p> <p>Description: The Recipient shall have its Financial Statements audited in accordance with the standards and submit it within 6 months</p>	Yearly	<i>Complied with</i>
<p><i>Financing Agreement: FA, Schedule 2, Section 1, A, 4.</i></p> <p>Description: Annual submission to IDA of EdM annual self-assessment and of CNELEC annual report on EdM Performance Contract no later than September 30 of each year</p>	Yearly	<i>Not complied with</i>
<p><i>Financing Agreement: FA, Schedule 2, Section II, B, 4.</i></p> <p>Description :Hiring external auditors within 3 months of credit effectiveness</p>	Due Date Oct 29, 2010	<i>Complied with</i>
<p><i>Financing Agreement: FA, Schedule 2, Section II, B, 3.</i></p> <p>Description :The Recipient shall prepare and furnish to the WB not later than forty five (45) days after the end of each calendar quarter, interim unaudited financial reports for the Project covering the quarter</p>	Quarterly	<i>Complied with</i>
<p><i>Financing Agreement: Section V.A. of Schedule 2 to the Original Financing Agreement</i></p> <p><i>Financing Agreement: FA, Schedule 2, Section V.</i></p> <p>Description: Electricity tariff setting mechanism will be put in place for EdM by December 2015 which sets and thereafter maintains throughout the project implementation period average tariffs that reflect full cost recovery.*</p>	December 2015	<i>Not complied with**</i>



\* EDM has implemented a tariff adjustment in April and November 2016 as well as August 2017 but this has not been sufficient to cover the full cost. A recent tariff increase of 40 percent has been approved which applies to customers with a consumption above 100kWh. However, the Metical has depreciated by approximately 70 percent against the US dollar over the course of 2016, having had already depreciated by 36 percent in 2015.

\*\* This ICR rating differs from the ISR Seq. 12 rating which has rated this Covenant as Complied with based on the previous footnote.

106. The Bank team consistently raised the requirement for the Government’s compliance with the Covenants throughout project implementation. Particular emphasis was placed on the three covenants that remained non-compliant to the end.

107. The Government and EdM, however, did not (or were unable to) comply with these covenants for different reasons, including the fluid and complex political economy of the sector and the country. The introduction of cost reflective tariffs (in the absence of several other pre-requisites) could be a non-starter politically, and practically very complex as noted in World Bank team’s supervision aide memoires<sup>57</sup>. In effect, the deadline for one of these dated covenants (establishment of electricity tariff setting mechanism) had to be extended from 2011 to 2015 (and remained non-compliant). Despite persistent efforts of the Bank team to encourage compliance, at least two other covenants (see Covenants Table above) also remained non-compliant to the end.

108. It is worth noting that the financial health of EdM and keeping a healthy current ratio are very important for the long term viability of EdM. The covenants were introduced because IDA was eager for EdM to proceed on a financially sustainable path. However, project design did not include any investments that would address financial health. The Bank’s alternatives in the case of non-compliance (i.e. suspension or cancellation of the credit) did not offer any practical options for helping project implementation and achievement of the PDOs. Therefore, the introduction of covenants that are not (or could not practically be) enforced, or whose fulfillment is not directly supported by the activities financed under the project, appear to be unlinked to the achievement of project development objectives. This could have been addressed in project design.

**EdM Key Financial Indicators (2011–2016)**

Indicator	2011	2012	2013	2014	2015	2016
Net profit margin (percent) <sup>a</sup>	8.67	1.23	-0.69	-0.57	-11.90	-3.38
Operating margin (percent) <sup>b</sup>	7.73	4.32	3.72	0.94	-9.69	-8.34
Current ratio <sup>c</sup>	1.21	1.12	1.03	0.83	0.72	0.69
Leverage <sup>d</sup>	0.62	0.36	0.48	0.75	1.29	2.17

Source: World Bank analysis based on EDM’s financial statements.

Note: a. Net profit margin is the percentage of revenue left after all expenses have been deducted from sales. The measurement reveals the amount of profit that a business can extract from its total sales.

<sup>57</sup> For example see Aide Memoire of Sept 2011: “It is well understood and accepted by the Bank that the political environment in Mozambique is currently not one in which significant tariff increases can occur, particularly for the first tariff blocks for household connections”.



- b. Operating margin is the ratio of operating income divided by net sales presented in percent. This is an indicator of profitability and is often used to compare the profitability of companies and industries of differing sizes.
- c. Current ratio is a liquidity and efficiency ratio that measures a firm's ability to pay off its short-term liabilities with its current assets.
- d. Long-term debt-to-equity ratio

## **C. BANK PERFORMANCE**

### **Overall rating of Bank Performance: Moderately Satisfactory**

#### **Quality at Entry**

109. EDAP APL2 was the second phase of an APL series. EDAP's design was suitable considering the range of activities that were planned. Being part of an APL series, it necessarily inherited aspects of the design of the restructured ERAP APL1. The project's development objectives were highly relevant at the time of appraisal and remain relevant to power sector development in Mozambique given the vast energy access gap at appraisal. The PDO's monitoring indicators were aligned with the project objective and targets were appropriate. Project design had incorporated experience gained from ERAP APL1 and the implementing agencies were engaged to oversee aspects of the project under their purview.

110. A post-completion evaluation revealed the following shortcomings:

- Design of disbursement arrangements and project cost estimates: While the intention of the Government and the Bank to strengthen national institutions, and decrease governance challenges was sound, it led to significant delays that later needed to be rectified. Cost estimates did not account for electrification of staff housing of local schools and clinics, and taxes and duties applicable to importing solar PV equipment were not considered.
- M& E design: Some of the baseline and target values for intermediate outcome indicators were problematic in that they were developed on average values over a large geographical area. They did not provide information specific to project target areas. In addition, the SAIFI index for measuring interruption frequency were not based on an established industry standard. The design of these indicators could have been constructed to be more project specific, leading to more accuracy.
- Covenants: Tariff increases in investment lending operations, even under an APL, would have limited influence. An investment project even when complemented by development policy operations would have difficulty in supporting tariff reform (e.g., Côte d'Ivoire Urgent Electricity Rehabilitation Project, P112573).

#### **Quality of Supervision**

111. Project supervision was generally adequate after effectiveness. Regular project supervision was undertaken throughout the project implementation period. Detailed Aide Memoires and a total of 13 ISRs, over the roughly seven-year project life, documented the progress made and the key issues to be addressed at regular intervals. The task team leader (TTL) was based in Maputo for most of the implementation period and this allowed regular communication with the client and was helpful in resolving implementation challenges fairly quickly.



112. The Aide Memoires were detailed in identifying bottlenecks and suggesting the actions required for improving implementation performance. The ISRs were candid in summarizing challenges and bringing the key issues to management's attention, albeit with some inconsistencies in quality (e.g. partial data updates, slightly re-worded statement of the PDO throughout implementation period, etc.).

113. The field presence of the assigned TTLs and their on-going interactions with the project staff of all three implementing agencies (EdM, FUNAE, and MIREME) in practice led to the relaxing of the reporting requirements as stated in the legal agreements. Consequently, the formal M&E and the regular project status reporting requirements were replaced with monitoring data collection and preparation of implementation status summaries per component during missions.

114. Compliance with project Covenants was persistently encouraged by the Bank team and formally raised with the Government and implementing agencies throughout implementation, but was not enforced. Lack of enforcement, however, did not directly impact project implementation.

115. The mid-term review mission was held in March 2014 and assessed progress and next steps. As a result of the review and to address various project implementation issues that were identified as described elsewhere, the project was belatedly restructured in February 2015. This was a level 2 restructuring to address the higher-than-expected costs of the biomass sub-component of about US \$7.3 million and the need for dropping some technical assistance (TA) activities such as the development of the Rural Electrification Strategy and Investment Plan (RESIP) under component 3, and a few other changes required as a result of the Government's changed priorities.

#### **Justification of Overall Rating of Bank Performance**

116. Both the quality of entry and quality of supervision aspects of the project had shortcomings as described above. However, none were sufficiently severe to derail the project. The Bank team and the Government both actively worked to keep the project on track and brought the project to satisfactory closure.

The overall rating of Bank Performance is Moderately Satisfactory.

#### **D. RISK TO DEVELOPMENT OUTCOME**

##### **Risk to Development Outcome Rating: Moderate**

117. The key risks to the PDO outcomes included: (1) waning of the Government of Mozambique's support for the access agenda at policy, regulatory and financial support levels; (ii) EdM and FUNAE's lack of adequate resources and/or capacity to deliver and maintain on-Grid and off grid electricity access, respectively; and (iii) private sector's inability or reluctance to actively participate in off-grid access expansion investments.

118. On the Government side, provision of access to electricity remains a key priority as outlined in various Government and World Bank documents.<sup>58</sup> Most recently, the Government, with support from the World Bank, developed a National Electrification Strategy, and a complementary plan to accelerate universal access to electricity in

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<sup>58</sup> See *Mozambique Country Partnership Framework FY17-FY21*.



Mozambique by 2030.<sup>59</sup> Providing access to electricity is also integral to the Bank Group’s corporate goals of increasing shared prosperity and ending extreme poverty by 2030.<sup>60</sup> Various bilateral development partners are also actively supporting the Government’s access agenda, particularly in the off-grid sub-sector.<sup>61</sup> Therefore, considering the current policy dialogue and the growing efforts made by the Government of Mozambique in supporting increased access to electricity services, it is likely that this support will continue to increase as a matter of Development Policy in the foreseeable future. The government is also encouraging the private sector to invest in new power generation and renewables, and is continuing to seek further concessional funding for investments in transmission and distribution infrastructure and increased access. The risk that Government’s interest and support would wane is therefore considered low.

119. The main risk to sustaining the continued expansion of on-grid access to electricity services is EdM’s potential lack of resources for proper maintenance, refurbishment and upgrading of transmission and distribution grid extensions and customer connections. In recent years, in parallel with EDAP, other development partners have been providing significant financial support to EdM in the rehabilitation and reinforcement of the primary network, grid extensions, and new customer connections.<sup>62</sup> These on-going initiatives will help improve the reliability of the transmission and distribution infrastructure, thus improving the efficiency of the system and reducing the technical and financial losses of EdM in the respective project target areas. The new lines and other transmission and distribution system upgrades under EDAP and other projects are standard technologies that EdM has the capacity to operate and maintain, and the routine maintenance of the equipment is within the existing maintenance budgets for EdM. Therefore, it is expected that EdM will be in a position to effectively afford the standard operation and maintenance costs associated with these new installations.

120. FUNAE’s model for operating and maintaining rural electrification systems may pose a risk in the long term. FUNAE has been developing and implementing rural electrification projects and promoting renewable energy technologies for more than 20 years.<sup>63</sup> The O&M of the community systems is the responsibility of local committees that are setup by FUNAE and funded through part of the local usage fees (25 percent of monthly fees) collected from the solar PV system users on a fixed monthly rate basis discussed earlier in the ICR. Any additional costs related to replacement of batteries or faulty parts are the responsibility of FUNAE and are expected to be covered by the remaining (75 percent) part of the collected monthly fees. While these arrangements have been functional, it is unlikely that in the long run they will be cost effective or practical to manage for FUNAE, particularly as the number on solar PV installations continue to grow. In this context, establishing a user-fee-adjustment mechanism that is affordable for customers and adequate for covering O&M, equipment replacement cost, and outsourcing of the operations to private sector (once such capacity becomes locally available at reasonable levels) could be a more sustainable alternative for maintenance and operation of these systems.

121. Participation of private sector in renewable energy supply and support has been limited in Mozambique. A recent European Union (EU) report on the role of private sector in Mozambique’s renewable energy subsector finds that “For local companies, high national commercial interest rates are the most important hindrance. The launch of a

<sup>59</sup> Draft National Electrification Strategy & Plan for Universal Access to Energy by 2030 (NES), September 2017.

<sup>60</sup> IEG: *World Bank Group Support to Electricity Access, FY2000-2014*, page xiv, 2015

<sup>61</sup> Including the Norwegian government and the Department for International Development (DfID), among others.

<sup>62</sup> See “Consultancy Services for Rehabilitation and reinforcement of Primary Network & Grid Extension and Customer Connections”, Final Draft Report, February 2017.

<sup>63</sup> Source: “Renewable Energy Project Portfolio – Hydro and Solar Resources”, FUNAE, 2017.





renewable energy credit line under preparation and the adoption of Pay As You Go business models are expected to have market impact. Unfortunately, micro-finance is currently not available for energy products, but other options include investment funds, and climate finance mechanisms. These could be complemented by tax exemptions as a recent study showed that the benefits would largely outweigh the costs, and supported by international energy programs for Africa.”<sup>64</sup> One impediment to the growth of solar PV market in Mozambique has been import tariffs which increase the cost of these systems to levels that are often beyond affordability for most rural residents. In this regard, the Government could reduce or exempt Solar PV equipment and components from import duties and Value Added Tax (VAT) and simplify the classification of duties to help reduce the end-user price of Solar PV electricity, thereby encouraging the private sector participation.

122. Based on these considerations, it is likely that the majority of current sector developments will have a positive impact on the sustainability of the project’s development outcomes. Therefore, the risk to development outcomes of the project is assessed as Moderate.

## V. LESSONS AND RECOMMENDATIONS

The following key lessons emerged from the project:

123. Re-evaluating the use of the APL instrument during project design would have been useful. EDAP as the second in the APL series was subject to the completion of triggers formulated in APL1, none of which were met. The first trigger was deemed irrelevant due to the cancellation of the Inhambane concession and the other incomplete trigger (customer satisfaction survey) received a waiver from the Board at approval and was never completed during project implementation. Considering that the triggers could not flexibly respond to a changing policy and/or macroeconomic environment, the efficacy of the use of the APL instrument was low. The Bank’s own analysis acknowledged this aspect of APLs and retired the APL instrument in the Investment Lending Reform package of reforms in 2012. It would have been useful to consider a break in the APL series during project design and fully respond to the change in GoM’s priority which had changed from sector reform to access in the near term.

124. The decision to use country systems for processing project level payment transactions must be made judiciously. The decision to use Government accounts and systems such as a single treasury account for processing all project related payments – including those for power utilities (which are not government entities, and are normally free standing legal entities) can create significant unintended delays in processing of invoice payments and other complications. To ensure that the flow of funds and disbursements take place efficiently under the project, it would be prudent for each implementing agency which is a free-standing legal entity to open and manage its own Designated Account.

125. Balancing social objectives and financial viability objectives requires careful project design. The use of covenants that address the financial health of a utility in a project whose primary objective is expanding access is debatable. In countries with very low electrification where it is imperative to increase access, there is a tradeoff between financial health and expanding access, making it difficult for both to coexist in the same project.

126. Off-grid components can offer valuable experience and lessons in expanding off-grid access. Component 2 was envisioned to include a range of pilot RETs and expected to deliver lessons in rapidly accelerating access in rural, geographically dispersed populations in an environmentally friendly, decentralized, lower cost manner using modern

<sup>64</sup> *Renewables in Mozambique – National Status Report / October 2017 Second Edition, Africa –EU Renewable Energy cooperation Program*



energy sources that could be used as a template for scaling up while also building institutional capacity to work with other donors. FUNAE now has a program of US\$13.5 million under preparation with BTC and the EU is preparing a US\$59 million program in the Off-Grid sector. FUNAE also approached private companies such as Galp Energia to develop Off-Grid electrification projects. A conclusion that can be drawn is that this component has been useful as FUNAE and new financiers are looking for private sector participation to ensure sustainability of systems. In ERAP APL1 there was very little interest by the private sector to participate in renewable energy access programs. It is unlikely to be the case after EDAP APL2. With prices of PV having dropped dramatically, the financial landscape of RETs has changed significantly which bodes well for private sector participation in future access programs.

127. Understanding government clearance procedures for large contracts and planning accordingly can substantially improve quality of implementation. Many countries have laws requiring the clearance of all large contracts by a legally designated Government entity before the contracts can be signed. This process is often slow and bureaucratic. Potential procurement delays can be mitigated by understanding these government procurement clearance requirements and incorporating them in project procurement planning. Some Governments may be willing to consider special arrangements for fast-track review and clearance of World Bank-funded procurement packages. Assessment of the Government procurement clearance requirements during project appraisal will help in more realistic design of procurement plans and implementation schedules.

128. Timely restructuring of projects and examination of the appropriateness of the results framework and PDO can further improve achievement of outcomes. Experience of this project and many other Bank projects in the energy and other sectors shows that once the need for restructuring is recognized and agreed upon by the Borrower and the Bank, timely restructuring of the project is critical. Restructuring also provided opportunities to revisit the results framework, in particular to define indicators to measure sustainability and affordability. If indeed affordability and sustainability were features to get to expanded access rather than the primary project objective, the PDO could have been restructured to drop affordability and sustainability from the PDO statement. Timely restructuring and using restructuring to reconfirm or refine the results framework/PDO provides clarity on project status and allocation of resources and implementation roles and responsibilities. The key aspect is to carry out the restructuring as soon as the need is identified, and not to postpone the formal processing.



**ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS**

**A. RESULTS INDICATORS**

**A.1 PDO Indicators**

**Objective/Outcome:** 1. To increase access to electricity in peri-urban areas in a sustainable and affordable manner

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
People provided with new or improved electricity service	Number	255000.00	405000.00	405000.00	513240.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
People provided with access to electricity by hhold connections-Grid	Number	255000.00	405000.00	405000.00	497538.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017

**Comments (achievements against targets):** Outcome achieved at 172.2 percent of the target

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Direct project beneficiaries	Number	0.00	240730.00	240730.00	247578.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
Female beneficiaries	Percentage	50.00	0.00	50.00	50.00



		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
<b>Comments (achievements against targets):</b> Outcome achieved at 103% of the target					

**Objective/Outcome:** 2. To increase access to modern energy services in rural areas in an affordable and sustainable manner

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Community electricity connections constructed— Other RE: Off-grid	Number	300.00	800.00	800.00	823.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
Number of health centers electrified	Number	150.00	400.00	400.00	345.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
Number of schools electrified	Number	150.00	400.00	400.00	403.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017

**Comments (achievements against targets):** Outcome achieved at 104.6% of the target

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Direct project beneficiaries	Number	0.00	240730.00	240730.00	247578.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017



Female beneficiaries	Percentage	50.00 01-Jun-2010	0.00 30-Jun-2015	50.00 15-Jun-2017	50.00 01-Jun-2017
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**Comments (achievements against targets):** Outcome achieved at 103% of the target

**Unlinked Indicators**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved engagement of customers for measuring satisfaction.	Text	Assessment of customer satisfaction survey in course until December 31, 2009 01-Jun-2010	Assessment of customer satisfaction survey closure of EDAP 30-Jun-2015	Assessment of customer satisfaction survey closure of EDAP 15-Jun-2017	Assessment of customer satisfaction survey closure of EDAP not completed 01-Jun-2017

**Comments (achievements against targets):** Outcome not achieved.

**A.2 Intermediate Results Indicators**

**Component:** 3. Energy Sector Planning, Policy, and Institutional Development

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
IBMS deployed	Text	Not deployed	System functional	System functional	Systems functional



		01-Jun-2010	30-Jun-2015	15-Dec-2016	01-Jun-2017
<b>Comments (achievements against targets):</b> Intermediate outcome achieved.					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of Solar Water Heaters installed	Number	0.00	0.00	6.00	6.00
		31-Jan-2015	15-Jun-2017	15-Jun-2017	01-Jun-2017

**Comments (achievements against targets):** Intermediate outcome indicator achieved at 100 percent

**Component: 1. Rehabilitation and Reinforcement of the Primary Network and Grid Expansion**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Transmission lines constructed or rehabilitated under the project	Kilometers	0.00	156.00	156.00	6.00
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
Transmission lines constructed under the project	Kilometers	0.00	156.00	156.00	6.00
		05-Nov-2012	30-Jun-2015	15-Jun-2017	01-Jun-2017

**Comments (achievements against targets):** The target value for this indicator was stated as 156 km, whereas after the final design was prepared for the Transmission line extensions, it was clear that the Transmission line extensions required to achieve the objectives of the project would be only about 6 kilometers. This revised target value, however, was not reflected in the results framework, and was only acknowledged in the final ISR



Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Distribution lines constructed or rehabilitated under the project	Kilometers	0.00 01-Jun-2010	256.00 30-Jun-2015	256.00 15-Jun-2017	256.00 01-Jun-2017
Distribution lines constructed under the project	Kilometers	0.00 01-Jun-2010	256.00 30-Jun-2015	256.00 15-Jun-2017	256.00 01-Jun-2017
<b>Comments (achievements against targets):</b> Intermediate outcome was achieved at 100% of the target value					
Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of new peri-urban connections established	Number	0.00 01-Jun-2010	42500.00 30-Jun-2015	42500.00 15-Jun-2017	42500.00 01-Jun-2017
<b>Comments (achievements against targets):</b> Intermediate outcome was achieved at 100% of the target value					
Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Electricity losses per year in the project area	Percentage	20.00 01-Jun-2010	17.00 30-Jun-2015	17.00 15-Jun-2017	26.00 01-Jun-2017



Nampula	Percentage	17.00	14.00	14.00	25.80
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017
Tete	Percentage	23.00	20.00	20.00	26.50
		01-Jun-2010	30-Jun-2015	15-Jun-2017	01-Jun-2017

**Comments (achievements against targets):** Electricity losses per year in project areas were not (and could not be easily) collected by EdM. Baseline values provided for this indicator in Nampula and Tete were based on average values of operational data collected by EdM for much larger geographic areas. Therefore information on baseline and target values is unreliable and cannot be attributed to project specific activities.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Average interruption frequency per year in the project area	Number	0.00 01-Oct-2015	0.00 30-Jun-2015	0.00 15-Jun-2017	0.00 01-Jun-2017
Average Interruption frequency per year in Nampula	Number	1067.00 31-Mar-2012	800.00 30-Jun-2015	800.00 15-Jun-2017	830.00 01-Jun-2017
Average Interruption frequency per year in Tete	Number	679.00 31-Mar-2012	400.00 30-Jun-2015	400.00 15-Jun-2017	424.00 01-Jun-2017

**Comments (achievements against targets):** Indicators to collect the interruption frequency in project areas was problematic because the definition used to measure SAIFI (System Average Interruption Frequency Index) was inconsistent with the industry standard. Therefore, values provided in the results





framework updates in Implementation Status Reports (ISRs) were erratic and unreliable throughout project implementation.

**Component: 2. Investments in Rural and Renewable Energy**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of systems installed in rural schools and clinics	Number	300.00 01-Jun-2010	800.00 30-Jun-2015	800.00 15-Dec-2016	840.00 01-Jun-2017
Number of systems installed in rural schools	Number	150.00 30-Jun-2010	400.00 30-Jun-2015	400.00 15-Jun-2017	330.00 01-Jun-2017
Number of systems installed in rural health clinics	Number	150.00 01-Jun-2010	400.00 30-Jun-2015	400.00 15-Dec-2016	510.00 01-Jun-2017

**Comments (achievements against targets):** Indicator on number of systems installed in rural schools was achieved at 87 percent. Indicator on number of systems installed in rural health clinics was achieved at 127 percent.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of villages successfully electrified	Number	0.00 30-Jun-2014	30.00 30-Jun-2015	30.00 15-Jun-2017	30.00 01-Jun-2017



**Comments (achievements against targets):** Intermediate outcome indicator achieved at 100 percent

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**B. KEY OUTPUTS BY COMPONENT**

<b>Objective/Outcome 1:</b> To increase access to electricity in peri-urban areas in a sustainable and affordable manner	
Outcome Indicators	1.) People provided with new or improved electricity service
Intermediate Results Indicators	1.) Number of new peri-urban connections established 2.) Transmission lines constructed or rehabilitated under the project 3.) Electricity losses per year in the project area 4.) Average interruption frequency per year in the project area
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1.) People provided with new or improved electricity service: 513,240 2.) People provided with access to electricity by household connections- Grid: 497, 538 via 82,923 households at 6 per household 3.) Transmission lines constructed or rehabilitated under the project: 6 km constructed or rehabilitated 4.) Number of new peri-urban connections established: 42,500
<b>Objective/Outcome 2:</b> To increase access to modern energy services in rural areas in an affordable and sustainable manner	
Outcome Indicators	1.) Community electricity connections constructed—Other RE: Off-grid 2.) Number of health centers electrified 3.) Number of schools electrified
Intermediate Results Indicators	1.) Number of systems installed in rural schools and clinics 2.) Number of villages successfully electrified
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1.) Community electricity connections constructed – renewable energy: 523 community connections constructed 2.) Number of health centers electrified: 195 3.) Number of schools electrified: 253

**ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION****A. TASK TEAM MEMBERS**

<b>Name</b>	<b>Role</b>
<b>Preparation</b>	
Boris E. Utria	Sector Leader SD/TTL
Rob Mills	Economist
Vonjy M. Rakotondramanana	Senior Power Engineer
Arun Sanghvi	Institutional Specialist (Consultant)
Midori Makino	Senior Financial Analyst
Reto Thoenen	Economist
Elvis Langa	Financial Management Specialist
Edeltraut Gilnan-Hunt	Senior Environmental Specialist
Mohamed Arby Ben-Achour	Lead Social Development Specialist
Antonio Chamuko	Senior Procurement Specialist
Amos Malate	Procurement Analyst
Jutta U. Kern	Senior M&E Specialist
Suzanne Morris	Senior Disbursement Specialist
Marjorie Mpundu	Counsel
Anne Louise Grinsted	Economist
Arlete Q. Comissario	Team Assistant
Regine Mpoyi	Team Assistant
Salma Chande	Team Assistant
<b>Supervision/ICR</b>	
Zayra Luz Gabriela Romo Mercado	Task Team Leader
Antonio Laquene Chamuco	Procurement Specialist
Elvis Teodoro Bernado Langa	Financial Management Specialist
Maria Isabel Nhassengo-Massingue	Team Member



Gulgoren A. Cansiz	Team Member
Rahmoune Essalhi	Team Member
Cheikh A. T. Sagna	Social Safeguards Specialist
Pedro Antmann	Team Member
Francesca Fusaro	Team Member
Paulo Jorge Temba Sithoe	Environmental Safeguards Specialist
Eden Gabriel Vieira Dava	Social Safeguards Specialist
Claudio Miguel Jamisse Buque	Team Member
Chita Azuanuka Obinwa	Team Member

**B. STAFF TIME AND COST**

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US\$ (including travel and consultant costs)
<b>Preparation</b>		
FY09	24.035	137,604.16
FY10	30.387	197,588.00
<b>Total</b>	<b>54.42</b>	<b>335,192.16</b>
<b>Supervision/ICR</b>		
FY11	27.572	223,511.98
FY12	22.467	165,233.65
FY13	16.155	132,798.66
FY14	18.763	158,003.42
FY15	12.455	96,437.61
FY16	14.008	130,200.79
FY17	25.897	106,551.06
FY18	1.574	11,462.39
<b>Total</b>	<b>138.89</b>	<b>1,024,199.56</b>



**ANNEX 3. PROJECT COST BY COMPONENT**

<b>Components</b>	<b>Amount at Approval (US\$M)</b>	<b>Actual at Project Closing (US\$M)</b>	<b>Percentage of Approval (US\$M)</b>
1 - Rehabilitation & Reinforcement of Primary Network & Grid Extension	50.00	49.30	98.6 percent
2.- Investments on Rural and Renewable Energy	18.00	17.7*	96.1 percent
3.- Energy Sector Planning, Policy & Institutional Development	10.20	4.70	46.1 percent
Unallocated	1.80		
<b>Total</b>	<b>80.00</b>	<b>71.70</b>	<b>89.6 percent</b>

\*FUNAE financed about US\$439, 279 for additional PV systems



## ANNEX 4. EFFICIENCY ANALYSIS

1. The economic and financial analysis at the project completion followed World Bank guidance documents (2001, 2014a, 2014b, 2016, 2017a and 2017b) and Bank Directive: Investment Project Financing.<sup>65</sup> Following the guidance note (2014a), this analysis addressed (i) the project’s development impact, (ii) the public-sector provision or financing as the appropriate vehicle, (iii) the World Bank’s value added, (iv) financial, fiscal and environmental sustainability and (v) the project justification nexus — results, risks, and economic rationale. The analysis examined the causal chain that links project activities and inputs to these objectives in Annex 1. Results Framework and Key Outputs. The risk and sensitivity analysis to those results were included in Section D. Risk to Development Outcome. Major data sources for the analysis comes from invoices, interim financial reports, contracts, World Bank Client Connections website, and other reports in the internal World Bank documents, the client and the Bank team. Following the ICR Guidance (2017b), the analyses at appraisal in the PAD and at project completion were compared.

2. The economic and financial analysis at the project completion covered 91 percent of the total project cost.<sup>66</sup> The reminder was policy or sector-wide related capacity building activities in Component 3, which per ICR guidance, was to be assessed at the efficacy level. At appraisal, economic analysis was estimated to have covered 81 percent of the total project<sup>67</sup> and financial analysis covered EdM as a whole entity. The appraisal analysis included Component 1 except institutional development activities and PV activities in Component 2. The appraisal analysis did not clearly note the year of price level. However, page 133 of the PAD was based on 2009 prices. The PAD used 12 percent discount rate for economic analysis. To be consistent, the analysis at completion was presented in 2009 prices (in local currency compared to US dollar at appraisal) and at a 12 percent discount rate. However, pursuant to the World Bank’s guidance (2016) noted above and guided by the country economist and the program leader of the World Bank, an economic discount rate of six percent was also used for the economic analysis as economic opportunity cost of capital (EOCK) as presented in Table A4-1. Also, following the same guidance (2016), an economic discount rate for the long term project life period available forecast data from 2010-2022 was estimated at eight percent, which was used for a comparison purpose.

### Economic analysis

3. Both analysis at appraisal and at completion used the cost-benefit analysis approach but had following differences in the overall project:

<sup>65</sup> Operations Policy and Quality (OPSPQ). 2014a. Investment Project Financing Economic Analysis Guidance Note; Belli P., J. R. Anderson, H. N. Barnum, J. A. Dixon, and J-P Tan. 2001. Economic Analysis of Investment Operations: Analytical Tools and Practical Applications; P. Meier. 2017a. Power Sector Investment Projects: Guidelines for Economic Analysis; Fay, M., S. Hallegate, A. Kraay, and A. Vogt-Schilb. 2016. Discounting Costs and Benefits in Economic Analysis of World Bank Projects; World Bank 2014b. Guidance note on social value of carbon in project appraisal September 2014; and OPSPQ 2017b. Bank Guidance Implementation Completion and Results Report (ICR) for Investment Project Financing (IPF) Operations.

<sup>66</sup> In addition to IDA credit, the analysis includes the FUNAE’s funding contribution to PV system and Belgium Technical Cooperation (BTC) Grant-financing support to borehole drilling for solar water pumping system, which resulted in about one percent increase of the IDA credit. BTC grant disbursed for borehole drilling activities for water pumping under EDAP after the project closing date and was therefore not included in 91 percent of total project cost.

<sup>67</sup> Estimated investment costs in the economic analysis in the PAD were about 35 percent more than the IDA credit. This increase was estimated based on the technical assistance consultancy (page 107, PAD) that the economic analysis did not cover (page 114, PAD), and investment costs (pages 117 and 123, PAD). Hence, the percentage of the project cost that economic analysis was estimated based on 135 percent of the IDA credit.



- The completion analysis converted all values into economic values and conversion factors were estimated, such as foreign exchange premium (shadow exchange rate), economic opportunity cost of labor (shadow wage rate), etc.
- The completion analysis included distribution analysis and risk analysis.
- The completion analysis included greenhouse gas emission and other emissions impacts (PM10, NOx and SOx).

4. Component 1 had following major differences in the analysis between appraisal and completion.

- **Consumer Benefits.** At appraisal, the EdM customers' benefits were estimated to start at 40 percent of the value of sales in 2009 and increased to 60 percent as of 2022. This assumption at appraisal could not be applied at the completion because the actual tariff and sales were different and the information of how "40 percent and 60 percent" were estimated in the PAD (tariff is discussed below). At completion, proxy values of electricity consumers' benefits were assumed to be per kWh value of PV monthly fees.
- **SIGEM Benefits.** At appraisal, Integrated Business Management System (IBMS or SIGEM) was estimated to cause a five percent reduction in annual total operating costs of EdM. At completion, there were no evidence of benefits except having achieved the clean audits and the better organized human resource management. EdM required further capacity building to fully implement the SIGEM. The capacity building was financed under the PERIP. Therefore, the completion analysis assumed two days of annual personnel costs to address audit recommendation and human resource management were avoided under the project.
- **System Loss Reduction Benefits.** The appraisal assumed a five percent non-technical and technical loss reduction. At the completion, since the new and rehabilitated network was only commissioned when the project closing date was nearing, there was no evidence of reduction. The completion analysis assumed an avoided one percent technical system loss.
- **Counterfactual Scenario.** The completion analysis that in the counterfactual scenario, the EdM's connections to new customers per year would be one percent of those under the EDAP. One percent was the annual EdM electrification rate in their all service areas during the project implementation period for 2010-2016. In addition, EdM Update of Master Plan Project 2012-2017 (2014) noted that they expected on-grid electrification would be also about one percent. The appraisal analysis did not indicate the counterfactual scenario.
- **Demand forecast.** The appraisal analysis assumed the EdM's power purchase to be increased. Based on EdM annual reports, from 2014 to 2015 (the most recent year available) the consumption growth in the provinces where EDAP Component 1 was located (Maputo, Chimoio, Tete and Nampula) was five percent, which was higher than the number of customer growth at one percent. However, the completion analysis was conservatively kept the demand constant because (i) the demand curve was not estimated due to the data constraints and the constant use of the same value of willingness to pay may not be appropriate, (ii) energy efficiency improvement activities would be strengthened and (iii) the analysis cannot control exogenous shocks in the long term that affect the demand.





- **Tariff.** The appraisal assumed EdM using long run marginal cost (LRMC) based tariff indexed to United States (US) Consumer Price Index (CPI) from 2010 reaching a weighted average tariff of nominal US\$ 0.125/kWh or MZN 8/kWh in 2018. This tariff was estimated to fully meet EdM financial needs and obligations. At completion, the EDAP connected EdM consumers were all residential consumers with lifeline tariff at nominal 1.07/kWh in 2017.

5. For Component 2, following are major differences in the analysis between appraisal and completion.

- **PV Benefits and Counterfactual Scenario.** The appraisal assumed that the counterfactual would be the off-grid power supply. The completion analysis used the on-grid supply cost estimated in EdM Master Plan Update Project, 2012 – 2027 (2014). This avoided alternative source of electricity served the benefits.
- **Improved Cookstoves Benefit and Counterfactual Scenario.** The appraisal analysis did not include the improved cookstoves. The completion analysis included the improved cookstoves and the benefits were estimated to be fuel saving and labor, compared to the counterfactual where the benchmark cookstove with the preliminary national baselines.<sup>68</sup> According to FUNAE, for firewood stove, before the IDA financing, the customers were using three stone stoves for cooking purposes as well as heating (further details discussed below).
- **PV System Life.** The appraisal assumed the PV project life of 15 years and the constant number of PV system and energy output. At completion, each PV system category would last up to 10 years and the number of system and output level would decline. Equipment spare parts were kept minimum under one of the two PV contractors and two contractor's PV systems were not standardized, which would reduce the flexibility in using the spare parts. ERAP ICR (page 33) noted around 5 percent to 15 percent of the systems suffered from theft and vandalism. Average life of PV equipment in Mozambique reported as: Module, 25 years; Controller, 5 years; Inverter, 7 years, and Battery, 4 years and Connectors, 20 years.<sup>69</sup> For example, EDAP PV Kit 2, had 200 watt-hour/day, with lead acid battery and 400 cycle -- about 3 years per the product information. FUNAE reported that the failures were battery deep discharge and fuse failure due to system overload.
- **Capital Cost Recovery.** The appraisal assumed that PV customers would repay the PV capital cost. Actually, PV customers only pay fee for PV maintenance cost.

6. For Component 3, difference is the following.

- **Solar Water Heater Benefits and Counterfactual:** The appraisal analysis did not include the solar water heater because the solar heater was not included in the EDAP at the appraisal and

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<sup>68</sup> Biomass Energy Certification and Testing Center – BECT 2014. Universidade Eduardo Mondlane - Maputo / Mozambique Interim Stove Thermal Efficiency Test Report Testing period July - August 2014. Woodstove "Poupa Lenha". BECT August 2014 Universidade Eduardo Mondlane - Maputo / Mozambique Stove Thermal Efficiency Test Report Charcoal Stoves Testing period June - July 2014 "Mbaula".

<sup>69</sup> Source: Estratégia para a Manutenção de Sistemas Fotovoltaicos Instalados pelo FUNAE Plano estratégico 2014-2020.



added during the implementation. The completion analysis included the solar water heater benefits comparing the counterfactual of the traditional electric water heaters (five out of six hospitals under EDAP had electrical geysers before the EDAP financing to solar water heaters).

7. Key data and estimates used for the completion analysis are summarized in Table A4-1.



Table A4-1: Summary of Key Data and Estimates (in MZN 2009 prices)

TIMING				Economic opportunity cost of labor (EOCL)	Conversion Factor (CF)
Base year	2009			Component 1 Supervision	0.91
Residual year Network	2026			TA, Network Planning, Master Plan	0.93
Residual year PV	2029			ERP	0.85
Residual year Solar water heater	2026			OMS	0.85
				IRMS	0.87
				IRMS	0.85
INFLATION AND EXCHANGE RATES				SEGEM	0.85
Inflation rate (Mozambique)	11% in 2018 and 6% thereafter			SIGEM Project Manager	0.83
DISCOUNT RATES AND FEP				PV Supervision	0.90
Target return on equity, real (%)	16.6%			PV Specialist	0.96
Financial Opportunity Cost of Capital, FOCC (%)	1.3%			Biomass specialist	0.96
Economic cost of capital, EOCC real (%) in PAD	12%			SIGEM	0.71
Foreign exchange premium, FEP (%)	7%			Coordination of the Project Implementation	0.70
New World Bank Guidance default EOCC	6%			Translator	0.69
New World Bank Guidance EOCC estimate, 2010-2022	8%			Procurement Specialist	0.72
				Solar Water Heater specialist	0.69
TAXES (mostly used from actual invoices and interim financial reports)				PV Local labor	0.44
Value Added Tax (VAT) (%)	17%			Cookstove producers	0.45
Social security (4%) (employer)	4%			EdM network unskilled labor	0.45
Social security (3%) (employee)	3%				
Imports raw materials (%)	3%			PV fee/kWh based on the fixed monthly charge from 2014 as of 2017,	
Fuel and Capital goods (class K) Import (%)	5%			used as proxy for Willingness to Pay discounted in 2009 prices annually	
Intermediary goods (%)	8%			Households	27
Consumption goods (%)	20%			Commercial & General	13
Annual income (MZN) Personal Income Tax (IRPS)	Deduction (Rate (%)			Lighting	32
Over	Not Over				
	0	42,000	10%	On Grid Prepaid and Lifeline Tariff in 2009 prices MZN/kWh	
	42,000	168,000	15%		2016 2017
	168,000	504,000	20%		0.73 0.61
	504,000	1,512,000	25%		
	1,512,000	141,540	32%	On Grid Prepaid Tariff for General Customers in 2009 prices MZN/kWh	
Corporate Income Tax (IRPC)					2016 2017
IRPC Foreign					4.08 6.74
				Power Purchase cost MZN in 2009 prices	
O&M Cost MZN/kWh in 2009 prices				2014 2015 2016 2017 2018 2019 thereafter	
Transmission	0.8		0.5 1.0	1.9 1.9 1.8 1.7	
Distribution	1.0				
				Transmission loss (%)	6%
Share of Open Cycle Gas Turbine (OCGT) of On Grid supply	40%			Distribution loss (%)	20%
Open Cycle gas turbine BTU/kWh HHV	10,801			Avoided technical loss (%)	1%
Audits and Human Resource Management Improvement by SIGEM				Saving 2 days/year of personel cost	
FUNAE PV fee collection rate	90%			PV Degradation Rates (%) Year 1, 2-10	2.5% 0.7%
Solar Water Pump Maintenance costs/Year, % capital cost	2%			PV system gradually out of use, including repairs, replacing parts, maximum 10 years	
Solar Water Pump Mulfunction rate/Year	5%			PV Kit 2, 200 wh/day, lead acid battery, 400 cycle -about 3 years (product information)	
Average life of PV equipment in Mozambique in Estratégia para a Manutenção de Sistemas Fotovoltaicos Instalados pelo FUNAE Plano estratégico 2014-2020:					
Module, 25 years	Controller, 5 years	Inverter, 7 years	Battery, 4 years	Connectors, 20 years	
Weighted average distribution network per new connection cost in EDAP PV areas (MZN in 2009)				147,574	
Improved Cookstoves (ICS)					
Fuel type	Amount con	Amount con	Saving in MZN 2009 prices		
Firewood, bundles	25	15	69	ICS use, year 1 and 2 70% 50%	
Charcoal, bag/kilogram (kg)	50	30	171		
Solar Heater	Traditional electricity heater energy factor (EF)			0.9 Solar EF	2.5



8. **PDO Achievements.** The summary results Table A4-2 showed that the project’s activities and inputs would meet the PDO with an economic net present value (ENPV) of MZN 401 million (US\$15 million), or about 0.1 percent of GDP in 2016, and an EIRR at 34 percent. Table A4-2 compared the results at completion with those at appraisal. The appraisal analysis’ total ENPV was more than twice that of the completion analysis, MZN 1 billion. The appraisal analysis did not provide the economic internal rate of return (EIRR) of the entire project but provided an EIRR at 26 percent for Component 1 and 18 percent for Component 2. By contrast, the completion analysis resulted in an EIRR at 25 percent for Component 1, eight percent for Component 2 and 68 percent for Component 3. The reason for the high return of Component 3 was due to the estimated higher solar energy factor than the energy factor for the traditional electricity water heater. Using the default six percent discount rate as EOCK under the 2016 World Bank guidance, the ENPV would become MZN 982 million, and using the estimated EOCK at 8 percent, the ENPV would become MZN 726 million.

Table A4-2: Economic Analysis Results Summary

Summary of Economic Analysis at economic opportunity cost of capital (EOCK) at 12 percent (real, in 2009 MZN prices, unless noted otherwise)											
A1 Completion	Total Project Costs (IDA and FUNAE)	Economic Analysis Conducted (%)	Total ENPV	Total EIRR	Component 1 EIRR	Component 2 EIRR	Component 3 EIRR (Solar water heater)	Total ENPV with CO2e	Total EIRR with CO2e	Total ENPV with CO2e, NOx, PM10, SOx	Total EIRR with CO2e, NOx, PM10, SOx
MZN in 2009 prices	2,250,650,065	91%	401,267,416	34%	28%	8%	68%	551,571,478	31%	551,571,478	31.5%
US\$ in 2009 prices	66,547,119		14,562,596					12,041,859		12,041,859	0
% of GDP in 2016	0.5%		0.1%					0.2%		0.2%	0
A1 Appraisal (in PAD)	Total Project Costs (IDA and additional costs)	Economic Analysis Conducted (%)	Total ENPV	Total EIRR	Component 1 EIRR	Component 2 EIRR	Component 3 EIRR	Total ENPV with CO2e	Total EIRR with CO2e	Total ENPV with CO2e, NOx, PM10, SOx	Total EIRR with CO2e, NOx, PM10, SOx
MZN in 2009 prices	2,349,071,451	80%	1,056,615,624	Not presented	26%	18%	Solar Water Heater not included at the appraisal	Not presented	Not presented	Not presented	Not presented
US\$ in 2009 prices	67,559,485		27,750,000								
% of GDP in 2016	0.5%		0.2%								
Levelized Costs energy costs, real (MZN/kWh)	Component 1	Component 2 (PV equipment costs only)	Component 3 (water heater equipment and installation cost only)	New World Bank Guidance (default ENPV @ 6% discount rate)		New World Bank Guidance Project period up to 2022 ENPV @ 6% discount rate					
	0	97	2	982,251,514	726,446,540						
Net Benefit Distribution											
FUNAE @ EOCK			Externalities Stakeholders @ EOCK								
MIREMTE	FUNAE	EdM	Labor	Women in Hospital	Off Grid Benefits	On Grid Benefits	Water pumping benefits	Other people in Hospital	Cookstove fuel saving	The society (EdM working capital)	Government
		-154%									
-8%	0.02%	-17.5%	39%	0.04%	1%	-1%	411%	0.1%	2%	0.02%	-1.51%
Fiscal Impact (MZN 2009 prices)			Avoided Emissions for 2014-2025 (negative means increase)								
IDA Credits and Belgium Technical Cooperation Grant for Borehole Drilling PV @ EOCK	-14,25,942,599				CO2e	NOx	PM10	SOx			
Service Charge PV @ EOCK	-22,672,466				Tons (undiscounted)						
Commitment Charge	0										
Net of Serv. social security contribution and MSP MZN PV @ EOCK	56,054,475				MZN PV @ EOCK						
Net Fiscal Impact MZN PV @ EOCK	-1,507,665,540				Share of the project CO2e emission of total Mozambique in 2014	3%	Share of the project CO2e emission of Global CO2e emission in 2014	0.002%	Mozambique CO2e emission 106th in the world in 2014		
Net Fiscal Impact US\$ PV @ EOCK	-91,127,542				GHG Marginal Abatement Cost (MZN/CO2e t)				-1.155		
Percent of General government total expenditure in 2016 (in 2009 prices)	-0.06%										
Percent of concessional loans and grants in 2014 (in 2009 prices)	-11%										

9. The main development impacts are access to on-grid electricity for residential customers of EdM, which was presented in the distributional impacts (stakeholder externalities analysis) in Table A4-2. As published in the feature story



of EDAP in the World Bank website<sup>70</sup>, EdM took advantage of the IDA-financed new distribution network and connected new commercial customers with own funding, with following quotations from the website:

“My life is not the same anymore,” said a resident of Moamba district who recalls how life has changed for better. “Now that we have electricity, we have been able to earn MZN 5,000 to 7,000 a month from the sale of ‘badjias’ and other cookies. We even started to use a conventional oven that allowed us to diversify our products and expand the business.”

“A wood artisan in the Maputo province, who owns a small business with over 10 workers, is another satisfied beneficiary who tells us how his business is thriving these days thanks to electricity. “*We are now using electric tools, which means working faster and getting better finishing quality, something that hardly ever happened before,*” he recalls visibly happy. “*We have bigger orders today, and our lives improved significantly.*”

10. Solar water heating systems (SWHS) in the hospitals also benefited people there, including women and new born babies. The project’s modest support to solar water heater would contribute the Mozambican Solar Thermal Technology Roadmap, which was developed in 2015, with an aim to install 0.1 square meters (0.07 kWh) of solar water heater collector area per inhabitant and the goal of deploying one million SWHS in residential areas nationwide by 2030.<sup>71</sup> Solar water pumping system also benefit the users and FUNAE do not charge them for maintenance fee. Local labor, including cookstove producers, PV local team, and unskilled labor of Component 1 were also benefited due to the higher payment paid for the work supported by international organizations and due to the high unemployment rate in Mozambique.<sup>72</sup> Approximately 95 percent of households in Mozambique was estimated burn solid fuels for cooking.<sup>73</sup> Improved cookstove benefits were fuel wood and charcoal consumption saving. The improved firewood cookstoves were made to improve a heat transfer by enclosing the fire, and both improved firewood and charcoal cookstoves were estimated to reduce about 40 percent reduction of fuel consumption.<sup>74</sup> These stoves were made from local materials and produced artisanal. Emission performance was not tested. Since actual usage data was not available, the analysis assumed about the

<sup>70</sup> World Bank Supports Rural Electrification to Decisively Curb Poverty in Mozambique. March 1, 2017. <http://www.worldbank.org/en/news/feature/2017/03/01/world-bank-supports-rural-electrification-to-decisively-curb-poverty-in-mozambique>

<sup>71</sup> This road maps was developed with the Austrian Government support, through the Austrian Cooperation for Development, finances the Soltrain - Southern African Solar Thermal Training and Demonstration Initiative - regional project, which views the establishment of strategies for harnessing solar energy in Mozambique, South Africa, Namibia, Zimbabwe and Lesotho. Soltrain is backed by a regional consortium composed of higher education and research institutions, researchers, quality certification agencies, consultants, producers and users of thermal solar equipment. In Mozambique, this project is coordinated by the National Science and Technology Parks Company (ENPCT), in partnership with EDM, the Eduardo Mondlane University and FUNAE. Source: Associação Lusófona de Energias Renováveis (ALER) 2017. Renewables in Mozambique – National Status Report (Second Edition).

<sup>72</sup> Unemployment rate was 24 percent as an average of availed years 2012 and 2014 data from World Bank data source. Sector based salary was estimated based on the new minimum wage in Mozambique in 2017 <http://clubofmozambique.com/news/from-3642-to-10400-meticais-per-month-meet-mozambiques-16-new-minimum-wages/> and World Bank 1991. Mozambique Public Sector Pay and Employment Review.

<sup>73</sup> Bonjour S., Adair-Rohani H., Wolf J., Bruce N. G., Mehta S., Pruss-Ustun A., Lahiff M., Rehfuess E. A., Mishra V. and Smith K. R. 2013 Solid fuel use for household cooking: country and regional estimates for 1980-2010. Environmental Health Perspectives doi:10.1289/ehp.1205987.

<sup>74</sup> Biomass Energy Certification and Testing Center – BECT 2014. Universidade Eduardo Mondlane - Maputo / Mozambique Interim Stove Thermal Efficiency Test Report Testing period July - August 2014. Woodstove “Poupa Lenha”. BECT August 2014 Universidade Eduardo Mondlane - Maputo / Mozambique Stove Thermal Efficiency Test Report Charcoal Stoves Testing period June - July 2014 “Mbaula”.



cookstove users would use the EDAP's improved cookstoves for 70 percent of their cooking for the first year and the 50 percent in the second year. However, cookstove activities were not efficient in achieving results; the share of improved cookstove production costs was only 13 percent of the total cookstove activities (in terms of present value [PV] at EOCK) including the production costs, a consultant, contractors and project management by FUNAE, with an uncertain scope for sustainability. Excluding project management, cookstove production cost is only 14 percent, the rest was paid for the consultant and contractors (in term of PV at EOCK).

11. Off grid electricity consumers who pay PV fees would lose their consumer surplus because under the counterfactual scenario was on-grid electrification that allow them to pay very low lifeline tariff. On the other hand, EdM would save on-grid electrification to the EDAP PV project areas under Component 2. EdM under Component 1 would lose due to the life line tariff that could not meet their operation and maintenance costs. As the EdM has high accounts payable (average 253.2 weeks for 2015-2021) and cash balance (average 12.5 week for 2015-2021), the rest of society would be affected.<sup>75</sup> Public expenditures of the Government (with taxes and social security revenues, IDA given to FUNAE as grant, and FEP loss) and MIREME (no charge for solar water heaters in hospital) were for the benefit of society, FUNAE has slightly positive benefits because IDA was given as grant.

### Aspects of Design and Implementation Efficiency

12. Following were assessed in aspects of design and implementation efficiency

- **Actual component costs compared to the estimated component cost at appraisal.** The main reasons for divergences were due to a strong appreciation of the US dollar against the SDR, reducing the project amount in US dollars by US\$ 8.7 million which amounted to 11 percent of the total project amount. Also, the Government priorities were changed. Although some of the sub-components of Component 2 were cancelled, that itself did not have impacts on efficiency. The cookstove sub-component was scaled down, but the low efficiency was related to outputs (13 percent) and inputs (87 percent) ratios in terms of present value (PV) at EOCK (costs of improved cookstove productions versus costs of consultant, contractors and the project management). On the other hand, the addition of water heater systems in Component was more efficiently executed, 88 percent of the cost (in PV team at EOCK) were used for the equipment and installation of the water heating systems, and supported the solar thermal roadmap.
- **Actual administrative costs compared to expected costs.** PAD did not include specific allocation of the administrative costs. However, the completion analysis found that Component 1's administration cost was one percent of the total IDA allocation in Component 1 (e.g., vehicle, computer, printer, binding machine, and furniture, bank charge, translator, etc.) and Component 2' administration cost was seven percent of the IDA allocation in Component 2 (e.g., vehicle, tires, car maintenance, cell phone, computer, telephone and internet fees, office supplies, office rent, procurement consultant fee, procurement advertisement cost, custom clearing agent for one of the solar PV contractor, audit agent for solar PV supervising consult firm, (in PV terms at EOCK). While Component 3 is not subject to efficiency assessment (per ICR Guidance on sector

<sup>75</sup> Source: World Bank 2017. Project Appraisal Document. Mozambique Power Efficiency and Reliability Improvement Project (PERIP) (P158249).



efficiency), occasionally, excessive bank charge was observed. For example, as much as US\$2,227 (in nominal prices) was recorded in the IFR quarter ending September 30, 2014.

- **Cost or time overruns impact on efficiency.** One of the PV systems contracts did not include the tax payment. That resulted in hiring a special clearing agent to pay the tax on behalf of contractor, which was unnecessary expenditure (MZN 168,251 in PV terms at EOCK) and reduced the efficiency of implementation. Time overrun including the procurement delay incurred additional service charge for the Government. The PAD did not include the expected service charge but based on the estimated disbursement table in the PAD, the expected service charge was estimated.<sup>76</sup> It was found that due to the high inflation rate during the project extension period of 2016-2017 (19 percent per year), the actual service charge in PV terms was 27 percent less than that was estimated from the PAD. However, the project closing date extension for two years would indicate negative impacts on efficiency, especially given the limited results achieved on SIGEM, the potential reduction on technical loss and the eventual cancellation of the PV maintenance of the PV contractor who also could not installed all the PV systems. Procurement delay and time overrun reduced the NPV due to the discounting impacts and the high inflation rate during the 2016-2017.
- **High TTL turnover on inefficiency.** TTLs were changed four times during the seven-year project period. An Aide Memoire dated October 7 - 11, 2013 noted “Ministry of Energy (ME) emphasized that absence of the Bank’s TTL for the project in the country partly contributed to project delays. ME nonetheless welcomed that new TTL based in Maputo is assigned.” Hence, the TTL location outside the country might have contributed to the inefficiency but the turnover of the TTLs itself did not demonstrate an evidence of the efficiency.

## Financial Analysis

13. The financial analysis was conducted for each EdM and FUNAE but did not cover MIREME (except levelized cost/kWh) because their IDA-financing to solar heater system in the hospitals did not generate revenues for MIREME. Component 1 was financed by IDA and on-lent to EdM from the Ministry of Finance without equity. Without equity and with low lending rate at 1.3 percent (IDA on-lending from the Ministry of Finance to EdM) and high inflation rate, the simple calculation of weighted average cost of capital would become negative. After consultation with Senior Financial Analyst of the World Bank and Senior Investment Officer at International Finance Corporation, for financial analysis of EdM component, a discount rate of 1.3 percent is used as a financial opportunity cost of capital. For FUNAE, as IDA was given as a grant, a return on equity (ROE) of 16 percent based on the cost of capital estimated from Treasury Bill of the Central Bank of Mozambique and an inflation rate. The results summary Table A4-3 showed that EdM and FUNAE had negative financial net present values (FNPV) due to their inability to recover the costs of services. However, FUNAE’s financial internal rate of return (FIRR) was positive as 13 percent. EdM’s Annual Debt Service Coverage Ratio (ADSCR, Net revenue over project debt repayments) and Loan Life Cover Ratio (LLCR, present value [PV] of net revenue over PV of project debt repayments) up to the end of the project life of Component 1 were negative. This indicated the EdM may not be able to repay IDA funding to the Ministry of Finance based on the project revenue alone.

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<sup>76</sup> Estimated based on the PAD’s estimated disbursement table in the data sheet, which had no page number, but before the main text.



**Table A4-3 : Financial Analysis Results Summary**

Summary of Financial Analysis at financial opportunity cost of capital (FOCC) at 1.3 percent for EdM and return on equity (ROE) at 16.6 percent for FUNAE and MIREME (in MZN 2009 prices)

Total Project Costs	Financial Analysis Conducted (%)	EdM NPV	FUNAE NPV	FUNAE FIRR (EdM in computable)	Levelized Costs energy costs, real (MZN/kWh)	Component 1	Component 2 (PV equipment costs only)	Component 3 (water heater equipment and installation cost)				
2,230,630,065	91%	-4,912,046,424	-80,263	13%		4	106	3				
EdM early years of repayment (project life) to the Government at 1.3% interest				2020	2021	2022	2023	2024	2026	2028	2027	
Annual Debt Service Coverage Ratio (ADSCR) = Net revenue over project debt				-2.52	-2.75	-2.94	-3.08	-3.19	-3.40	-3.62	-3.86	
Loan Life Cover Ratio (LLCR) = PV of net revenue over PV of project debt rep				-3.25	-3.03	-1.89	-1.87	-1.84	-1.80	-1.76	-1.72	
				2028	2029	2030	2031	2032	2033	2034	2036	2038
				-4.11	-4.38	-3.31	-3.55	-3.80	-4.07	-4.37	-4.68	-29.89
				-1.66	-1.80	-1.54	-1.48	-1.40	-1.32	-1.22	-1.12	-0.99

**Sensitivity Analysis**

14. A number of sensitivity tests were carried out to identify critical parameters affecting the project’s performance. The sensitivity analysis addressed some of the risks in Section D. Risk to Development Outcome, which includes EdM and FUNAE’s lack of adequate resources and/or capacity to deliver and maintain on-Grid and off grid electricity access. Tables below show the summary of the key results of the indicators. In the summary, Table A4-4, sensitivity indicators show the ratio of the percentage change in the NPV to the percentage change in the parameter tested. Sensitivity indicators in Table A4-4 show the bars indicating the level of negative or positive sensitivity.

15. The bar charts in the sensitivity indicators in the tables indicate the levels of sensitivity to the results. Solar energy factor would be sensitive to the results of the economic assessment. For financial analysis, the FUNAE’s PV fee collection rate and operations and maintenance costs would be sensitive to the results.





Table A4-4: Sensitivity Analysis Results Summary

EDAP		Economic sensitivity analysis					
Parameters	Base case	Change	ENPV (MZN in 2009 prices)	EIRR (%)	Sensitivity Indicator	Switching Value	
<b>Component 1</b>							
Inflation rate (%)	6%	10%	245,672,192	24%	-0.4	20%	
Power Purchase Cost MZN/kWh, nominal 2017 prices	3.4	2	497,014,743	29%	-0.9	7.0	
Distribution Technical System Loss	20%	23%	327,225,193	25%	-0.6	49%	
Distribution O&M Cost	1	1.5	269,012,965	23%	-0.6	2.8	
<b>Component 2</b>							
Inflation rate (%)	6%	9%	16,992,619	8%	0.006	-2221%	
Power Purchase Cost MZN/kWh, nominal 2017 prices	3.4	4.5	17,763,433	8%	0.2	-18.9	
PV O&M costs increase	0%	50%	13,500,496	9%	0.0	247%	
PV degradation rate	0.7%	9%	16,217,236	8%	0.00	338%	
Cookstove use (% year 2)	50%	80%	16,955,889	8%	0.002	-24005%	
<b>Component 3</b>							
Solar Energy Factor	2.5	1.5	10,744,358	77%	1.5	1.2	
EDAP All with CO2e or VVth CO2e, NOx, PM10 and SOx - both results nearly the same							
Efficiency of Gas Fired Power Plant (BTU/kWh HHV)	10,801	11,000	330,086,081	31%	-0.2	61,995	
Share of Gas Fired Power Plant in Power Purchase %	40%	70%	278,934,525	29%	-0.2	230%	
EDAP		Financial sensitivity analysis					
Parameters	Base case	Change	FNPV (MZN in 2009 prices)	Sensitivity Indicator	Switching Value		
<b>Component 1</b>							
Inflation rate (%)	6%	10%	-4,118,812,138	-0.21	0.4		
Power Purchase Cost MZN/kWh, nominal 2017 prices	3.4	2	-4,197,095,104	0.4	-6		
Distribution Technical System Loss	20%	23%	-5,064,213,711	0.2	Not computable		
Distribution O&M Cost	1	1.5	-5,360,949,643	0.2	-4		
Account Payable (weeks)	253	290	-4,567,756,247	-0.5	778		
Cash Balance (Weeks)	13	15	-4,935,236,954	0.02	-512		
<b>Component 2</b>							
Inflation rate (%)	6%	9%	-78,648	-0.03	Not computable		
PV O&M costs increase	30%	50%	-2,519,828	48	0.3		
Fee Collection Rate	90%	98%	309,676	-55	0.9		

**Risk Analysis**

16. Based on the above sensitivity analyses, the key variables were identified. An appropriate probability distribution and the likely range of values for each risk variable were estimated, based on a historical observation of those variables. Even if an independent variable in the sensitivity analysis may indicate an insignificant impact on the result, it could be possible that multiple variables’ interactions could result in significant impacts. Therefore, the following variables have been selected from different risk categories (e.g., operational, technical, etc.): annual utilization factor of PV systems; crude oil prices (which is linked to economic value of natural gas for EdM’s power purchase); transmission loss; distribution loss; avoided technical system loss rate; transmission cost; distribution cost; Open Cycle gas turbine (OCGT) efficiency (British thermal unit [BTU]/kWh at higher heating value [HHV]); OCGT share of the EdM’s on-grid power supply; FUNAE PV fee collection rate; solar water pumping malfunction rate; cookstove use; solar energy factor; energy factor; EdM accounts payable; EdM cash balance; operation and maintenance (O&M) cost of PV and water pumping system; and Mozambique inflation rate.

17. Monte-Carlo risk simulation was carried out over 10,000 trials with the help of Crystal Ball™ software. The results suggested a high risk of economic and financial outcome of the project, especially for EdM (Figures A4-1 and A4-2). The Tornado analysis of Crystal Ball was also conducted to analyze the critical variables. This high risk to the economic outcome was, exogenous, out of the project’s control, i.e., due to the historically extremely volatile oil prices in 1960-2016 and inflation rate in Mozambique in 1980-2016, which were the base for the probability distribution. In fact, originally, more recent historical oil prices of 1980-2016 was used for the probability distribution but that was also very volatile and



uneven. Then, a longer period back to 1960 was used but still it was very volatile. The high financial risk to FUNAE was strongly influenced by the O&M costs. The high financial risk to EdM was slightly reduced in the Monte-Carlo analysis compared to the base case, which was only because of the changes in accounts payable.

Figure A4-1: Probability Distributions of Economic Outcomes

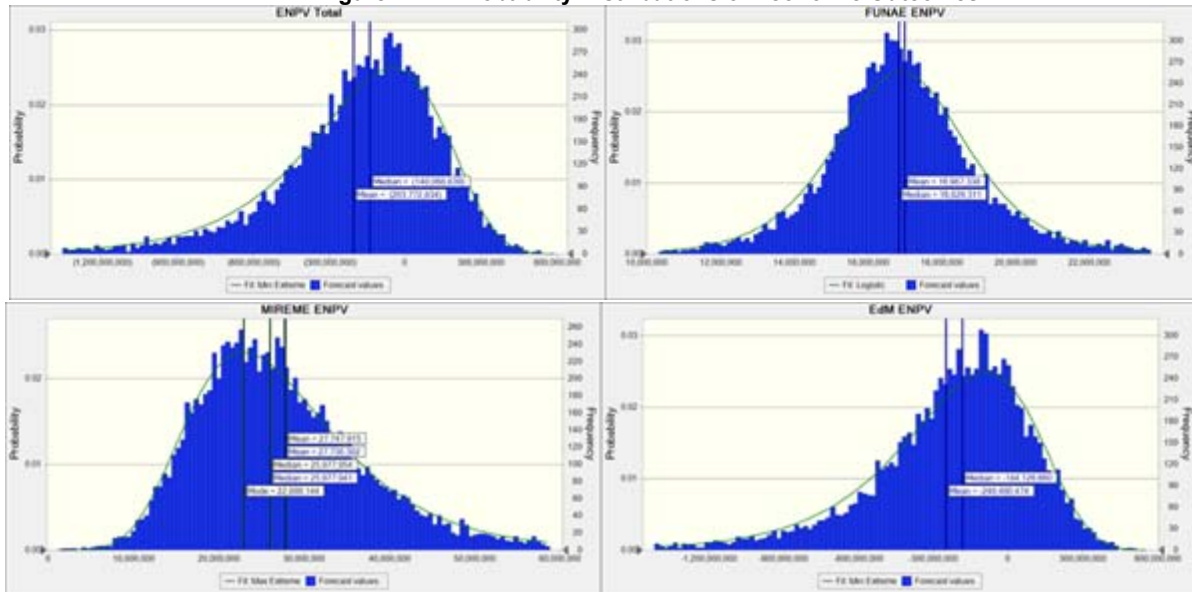
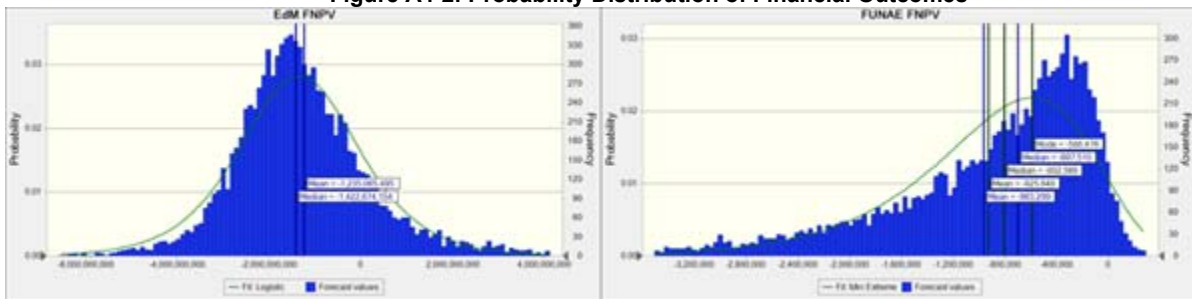


Figure A4-2: Probability Distribution of Financial Outcomes



18. **Environmental Sustainability.** The project is expected to be environmentally sustainable but there are some cautions on solar water pumping. No studies or analysis on the aquifer depletion was conducted to regulate the solar water pumping. FUNAE has done some investigations before drilling the boreholes to see if there is any water in the area. The project would increase emissions of greenhouse gas emission from the OCGT, but the amount is negligible, as shown in Table A4-3<sup>77</sup>. The project’s CO<sub>2</sub>e emission was three percent of the total emission of Mozambique in 2014 and 0.001 percent of the Global CO<sub>2</sub>e emission in 2014. Mozambique’s CO<sub>2</sub>e emission 108th in the world in 2014 (in the order of the highest emission to the lowest emission)<sup>78</sup>. Under the project, the estimated OCGT’s emissions of particulate matter 10 micrometers or less in diameter (PM10), oxides of nitrogen (NOx), and oxides of Sulphur (SOx) were negligible.<sup>79</sup>

<sup>77</sup> Source of CO<sub>2</sub>e emission factors are 2006 The Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. Volume 2 Energy. <https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html>

<sup>78</sup> Source: World Bank.

<sup>79</sup> Local emissions costs were estimated based on the methodology advised in P. Meier. 2017. Power Sector Investment Projects:



19. Provision of Public-sector Financing. During the project period, the private sector would be unlikely to take the risk of financing EDAP activities due to the insufficient revenue prospects to recover costs. The lack of a clear legislation for solar PV systems is causing considerable market uncertainties. Investors perceive the fluid regulatory environment, and the lack of safeguards of their investments. Private sector operators sense the Government prefers solar PV companies to operate in only rural and difficult areas and would limit the capacity of businesses to operate freely in the market.<sup>80</sup> There are few private initiatives or projects for the installation of solar water heating system in the country due to lack of demand in the market and the low price of electricity, which makes the private financed business financially unviable.<sup>81</sup>

20. **World Bank Value Added.** The World Bank's value added is the scale of financing, the potential longer term partnership in the sector, and the building of the Government's sector capacity. For example, the capacity building required to implement SIGEM under EDAP was supported by the following PERIP. The technical assistance and capacity building aspects of the project are a key part of the Bank's value added and will help ensure sustainability of the project after the IDA credit closure. This contrasts with simply providing a capital grant (or capital grant with all project procurement and management done by a grant provider or a third party). The World Bank Group, as a global organization, can draw on its global experience in the energy sector, including with renewable energy, that can be readily shared with Mozambique.

### **Conclusion**

21. Overall, the analysis demonstrated the project's achievement of PDO. However, there are considerable financial, technical, and operational risks. The risk analysis identified the major risks were international oil prices and Mozambican inflation rates. While these risks were exogenous, out of the project's control, if the financial and operational stance of the EdM and FUNAE is robust, they would be more resilient to withstand these exogenous shocks.

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Guidelines for Economic Analysis.

<sup>80</sup> Source: Business Environment Reform Facility 2016. Business Environment Constraints in Mozambique's Renewable Energy Sector: Solar PV Systems and Improved Cook Stoves. November 2016

<sup>81</sup> Associação Lusófona de Energias Renováveis (ALER) 2017. Renewables in Mozambique – National Status Report (Second Edition).



**ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS**

**Energy Development and Access Project (EDAP-APL2)**

**Crédito Nr: 4681-0 MZ**

IMPLEMENTATION COMPLETION REPORT

Submitted to the World Bank by

EDM's Project Implementation Unit

October 2017

**1. Introduction.**

This report concerns the Energy Development and Access Project (EDAP-APL2). The Project Agreement between IBRD and The Government of Mozambique (GoM), through Electricidade de Moçambique EP – EDM as implementing Entity, dated **21<sup>st</sup> September 2010**, sets out the requirements for this report. Specifically, Section II.A.2.(c) provides that EDM prepare and furnish to the Ministry of Finance and the World Bank not later than four (4) months after the Closing Date:

- (i) a report of such scope and in such detail as the Bank shall reasonably request, on the execution of the Project, the performance by EDM of its obligations under this Agreement and the accomplishments of the purpose of the Loan, and
- (ii) a plan designed to ensure the substantiality of the Project's achievements.

**2. Assessment of objective, design, implementation, and operational experience.**

The Project's development objective was to reinforce, rehabilitate, extend the distribution electrical network and perform service connection in the provinces of Maputo, Tete and Nampula.

**Assessment of outcome against the objectives.**

Our overall assessment of the extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently, is:

Highly Satisfactory. There were no shortcomings in the operation's achievement of its objectives, in its efficiency, or in its relevance.

This rating is based on the following criteria.

**2.1 Achievement of objectives.** The objectives were fully as follows.

- Reinforcement - The project was able to solve the problem where the network or the transformer were overloaded. This was done by installing additional distribution network and additional transformer.
- Rehabilitation - There were cases where the distribution network was done in an unconventional way, it was done by simple wires which were exposing people to a permanent danger, the quality



of energy was very poor and was contributing to technical and none technical losses. The project put full stop in this situation in the project areas.

- Extension: The project was able to take energy to new areas which accelerated the development in them. Just after starting the implementation of the project in the new areas, big constructions and investment projects started and developed in high speed.
- Service connection - The project was able to connect around 20.550 new clients in Maputo, Tete and Nampula Provinces.

**2.2 Efficiency.** The operation has or has not achieved a return higher than the opportunity cost of capital, and is/is not the least cost alternative. **NA**

**2.3 Relevance.** The operation's objectives, design, and implementation are fully consistent with the country's current development priorities and with current country and sectoral assistance strategies and corporate goals. The project was able to intensify the connection of energy to more clients which is aligned with poverty reduction strategy. The project was also able to increase the installed capacity of energy by supplying 4 transmission transformers which were installed in 4 different provinces. This has increased the capacity to supply more clients and industries.

**Evaluation of own performance during preparation and implementation, with special emphasis on lessons learned that may be helpful in the future.**

Our assessment of the extent to which the Government and implementing agencies ensured quality of preparation and implementation, and complied with covenants and agreements, toward the achievement of development outcomes, is as follows.

### **3.1 For the Government Overall:**

**Highly Satisfactory.** There were no shortcomings in Government performance.

- There was commitment at Government level for providing enabling environment including supportive macro, sectorial, and institutional policies (legislation, regulatory and pricing reforms, etc.).
- The government played a very important role in the preparation phase, such as the issuance of project environmental impact licenses, among other activities.
- In the preparation phase the government also provided a matrix of the strategic energy plan and the overall plan for the energy sector.
- In the implementation phase it also played an important role in the issuance of entry visas to the foreign technicians of the Consultant as well as the Contractor. Issuance of DIRE for foreign resident technicians of both firms. Also played a very important role in giving tax and duty free to the imported materials under the project.



### 3.2 For implementing agency

**Satisfactory.** There were minor shortcomings such as getting the right of way due to the people who had to be compensated and removed from the project site (specifically for substation area). In general the payment process was slow due to the involvement of lot of people and institutions to authorize the payment. Throughout the implementation of the project, EDM exhibited;

- Ownership and commitment to achieving development objectives (timely meetings);
- Adequacy of beneficiary/stakeholder consultations and involvement (timely meetings);
- Readiness for implementation, implementation arrangements and capacity, and appointment of key staff;
- Timely resolution of implementation issues by resolving issues related to provision of information and coordination of shut downs;
- Fiduciary (financial management, governance, provision of counterpart funding, procurement, reimbursements, compliance with covenants);
- Relationships and coordination with donors/ partners/stakeholders;

### 3.4 Lessons learned

- The financing agreement should include a budget for compensations;
- Never include government (Ministry of Finance or Ministry of Energy) in the payment of invoices during the project implementation.
- The approval process for payment should be shorten, the signature of Project Manager, Project Director and Financial Director would be enough and short the process. It takes time to get signature of two Board Members.

Evaluation of the performance of the World Bank, cofinanciers, and other partners during preparation and implementation, including the effectiveness of their relationships, with special emphasis on lessons learned.

**4.1 World Bank: Quality at entry.** Our assessment of the extent to which services provided by the Bank ensured quality at entry of the operation is as follows.

**Highly Satisfactory.** There were no shortcomings in identification, preparation, or appraisal.

- The World Bank team was always ready to help implementation agency both with its technicians based in Mozambique as well as from abroad.
- It has always been helpful in overcoming a delicate subject matter of the approval process from the government as well as from other co-financiers.

**4.2 World Bank: Implementation.** Our assessment of the extent to which the Bank supported effective implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of supported activities after loan/credit closing) is as follows.



Highly Satisfactory. There were no shortcomings in the proactive identification of opportunities and resolution of threats.

- The Bank was always concerned about the disbursement monitoring and status as well as the projections. The local team made possible EDM's financial department technicians to be linked to the Project financial status via Client Connection system so that the technicians could best follow the financial health of the Project. Various payments were made through the client connection which accelerated the disbursements.
- The World Bank team traveled to the site on service missions and warned about the delays the project was exposed. The Bank has visited the compensated and resettled people from the project area; The bank has also visited the project areas to check the environmental issues and gave their recommendations.

#### **4.3 Other partners (if any)**

NA

#### **4.4 Lessons learned**

- It was very useful the Project Manager to have access to the client connection, it enabled the Project Manager to monitor what was pending for signature so that could trigger the concerned people to sign.
- The minimum invoice amount to be paid through the client connection should not be set very high, 100,000USD should be.

**Description of proposed arrangements for future operation.** Plan to ensure the substantiality of the Project's achievement.

#### **5.1 Future arrangements.**

Arrangements to achieve or maintain the same development outcome include:

- Continuing financing in distribution and transmission projects in order to cover the areas that were not included.

#### **5.2 Risk to development outcome.**

Our assessment of the risk, at present, that development outcomes (or expected outcomes) will not be maintained (or realized) is Negligible to Low;



**EDAP PROJECT 2 (ENERGY DEVELOPMENT AND ACCESS PROJECT)**

IMPLEMENTATION COMPLETION REPORT  
ON A CREDIT NUMBER 4681 –MOZ- FINANCING AGREEMENT BETWEEN  
REPUBLIC OF MOZAMBIC  
AND  
INTERNATIONAL DEVELOPMENT ASSOCIATION (IDA)

**COMPONENT 2 - FUNAE**

July 30<sup>th</sup>, 2017





## **1. Introduction**

This report concerns the **EDAP** project (**Energy Development and Access Program**). The Project Agreement between IDA and The Government of Mozambique, dated June 23, 2010 which sets out the requirements for this report. Specifically, Section II.A.2.(c) provides that the Project Implementing Entity such as FUNAE through the Ministry of Mineral Resources and Energy, prepare and furnish to the Ministry of Finance and the World Bank not later than four (4) months after the Closing Date: (i) a report of such scope and in such detail as the Bank shall reasonably request, on the execution of the Project, the performance by the implementing entity of its obligations under this Agreement and the accomplishments of the purpose of the Loan, and (ii) a plan designed to ensure the substantiality of the Project's achievements.

The EDAP project is composed of three (3) component in which FUNAE is responsible of implementing the component 2 "Investment on Rural and Renewable Energy" in the amount of 18 Million United State Dollar, for 5 years. The end date for the project was extended to 30<sup>th</sup> June 2017.

The outputs of the project had positive impact in rural communities of Mozambique taking into consideration that it provided access to renewable energy to rural households, schools and clinics and villages and contributed to increasing sustainable access to affordable electricity and modern energy services in rural populations for poverty alleviation. This impact could be translated into people's welfare, through improving social services like evening classes and health care including promotion of economic activities such as communications through cell phone battery charges and also protecting environment by using clean energy.

## **2. Assessment of objective, design, implementation, and operational experience.**

The Project's development objective was set as **Part 2 of the Agreement** on regard to the Investment on Rural and Renewable Energy (FUNAE) which aimed to:

- a) Scaling up of micro and small investments on renewable energy production and distribution including: (i) Installation of solar PV systems in rural school and health clinics; (ii) electrification of selected rural villages using renewable energy technologies; and (iii) carrying out a program of activities aimed at developing the market for photovoltaic products in rural areas and stimulating the participation of private sector.
  
- b) Carrying out a program of activities aimed at promoting the use of biomass energy systems including: (i) distribution of improved wood fuel stoves to households and small and medium enterprise sectors; (ii) Introduction of improved charcoal kilns; (iii) support to interfuel substitution for traditional biomass in households and institutions such as schools and clinics; (iv) Carrying out demonstration projects to accelerate the sustainable market penetration of clean renewable energy technologies including deployment of multifunctional platforms in rural villages.
  
- c) Carrying out a program of activities aimed at capacity building of FUNAE for the implementation and management of this Part 2 of the project, including financing of operating costs.



**3. Assessment of outcome against the objectives.**

Our overall assessment to which the operation's major relevant objectives were achieved efficiently, is Satisfactory. There were minor shortcomings in the operation’s achievement of its objectives, efficiency, or relevance.

This ICR follows the methodology set out in the ICR Guidelines on Outcomes: “Rating the Outcome of Projects with Formally Revised Objectives”. The ICR mandate to use the following measures to assess outcomes (i) Relevance of Objectives, Design and Implementation, and (ii) Achievement of the project Objectives.

This rating is based on the following criteria.

**3.1 Achievement of objectives.** Our evaluation is that the objectives were mostly achieved, taking into account the following results:

**3.1.1. Activity 1: Installation of solar PV systems in rural school and health clinics and villages.**

FUNAE contracted installation firms to carry out supply, installation and commissioning of the systems installed including training for local staff on PV systems management. As per Bidding Document (BD) the installation programme included 250 schools, 242 health centers and 30 villages in the provinces of Cabo Delgado, Niassa, Manica and Inhambane. The contractors were CAA (Communications and Accessories) for Cabo Delgado and Manica, and BATTECH for Niassa and Inhambane provinces respectively. The supervision was in charge of consortium IT Power/Tese.

The achievement of the objectives are described in the table here below:

**Table 1:** Installation of solar PV systems in rural school and health clinics and villages

Indicator	Baseline Value	Original target (from approval Document)	Contract Revised Target Value	Actual Value Achieved at Completion or Target Years
<b>Indicator 1:</b>	<b>Number of Schools Solar Photovoltaic (PV) System Installed</b>			
Value (Quantitative or Qualitative)	150	250	250	223
Last Date Achieved		May, 2010	09/12/2012	12/31/2016
Comments:	Due to natural disaster or vandalism in some of schools the target could not be reached since there were no security for the system. Therefore, the material of systems not installed were delivered to FUNAE to be used for the maintenance or installation of other systems.			
Percentage of the target achieved (percent)				89 percent



Indicator	Baseline Value	Original target (from approval Document)	Contract Revised Target Value	Actual Value Achieved at Completion or Target Years
<b>Indicator 2:</b>	<b>Number of Health Centers Solar Photovoltaic (PV) System Installed</b>			
Value (Quantitative or Qualitative)	150	242	242	178
Last Date Achieved		May, 2010	09/12/2012	12/31/2016
Comments:	Due to natural disaster or vandalism in some of schools the target could not be reached since there were no security for the system. Therefore, the material of systems not installed were delivered to FUNAE to be used for the maintenance or installation of other systems.			
Percentage of the target achieved (percent)				74 percent
<b>Indicator 3:</b>	<b>Number of selected rural villages electrified using renewable energy technologies (SPV)</b>			
Value (Quantitative or Qualitative)	40	30	30	30
Last Date Achieved		May, 2010	09/12/2012	12/31/2016
Comments:	The 30 villages above, include the electrification of 30 schools, 30 health centers 300 Street lights, 144 Commercial including fridges, 382 residences, 9 Police Posts, 21 Administrative Posts (PA) 68 Solar Home Systems and distribution of 607 solar lanterns.			
Percentage of the target achieved ( percent)				100 percent

**Location of systems and overall quantities**

As per Bidding Document (BD) the project planned to be 3.152 system types to be installed in schools, clinics, and villages in Cabo Delgado, Niassa, Manica and Inhambane provinces. From that baseline, about 2.519 systems were installed which represents 80 percent of achievement. Detailed information of system installed is summarized below:

**Table 3: Type of solar PV systems installed in the overall project as per the Bidding Document**

NUMBER OF SYSTEMS TYPES INSTALLED IN EACH PROVINCE													
Description	Designation	Code	Lot 1		Lot 2		Lot 3		Lot 4		TOTAL		
			Cabo Delgado		Niassa		Manica		Inhambane		TARGET	INSTALLED	BALANCE
			Original Target	Installed	Original Target	Installed	Original Target	Installed	Original Target	Installed			
PV System 1	School	CR3AC	44	42	32	14	22	22	22	23	120	101	19
PV System 2	School	CR2AC	41	40	53	44	28	28	36	37	158	149	9
PV System 3	School	CR2A	0	0	0	0	0	0	2	3	2	3	(1)
PV System 4	Health Center	HC-I	72	54	33	8	23	23	35	15	163	100	63
PV System 5	Health Center	HC-II	5	5	51	40	27	27	19	23	102	95	7
PV System 6	Vaccine Fridge	VAC	77	77	75	44	50	50	47	18	249	189	60
PV System 7	Administrative Post	PA	10	9	10	10	0	0	4	2	24	21	3
PV System 8	Police Post	PP	5	5	4	4	0	0	0	0	9	9	-
PV System 9	Street Light	SL	10	100	10	89	0	0	5	100	25	289	(264)
PV System 10	PV Pump System	PVP	7	0	6	0	0	0	5	0	18	-	18
PV System 11	Commercial Fridge	COMM	43	43	113	60	0	0	59	41	215	144	71
PV System 12	Residencial with Fridge	RES-F	0	0	0	0	0	0	0	0	-	-	-
PV System 13	Residencial	RES	253	215	262	199	119	119	256	211	890	744	146
PV System 14	4 Lamps Kit	A4	30	24	20	15	0	0	14	29	64	68	(4)
PV System 15	3 Lamps Kit	A3	0	0	0	0	0	0	0	0	-	-	-
PV System 16	2 Lmaps Kit	A2	214	203	274	200	0	0	100	42	588	445	143
PV System 17	1 Lamp Kit	A1	213	122	212	40	0	0	100	0	525	162	363
<b>TOTAL</b>											<b>3,152</b>	<b>2,519</b>	<b>633</b>
<b>Percentage of Execution</b>											100 percent	80 percent	20 percent

### 3.1.2. Activity 2: Carrying out a program of activities aimed at promoting the use of biomass energy systems.

Regarding the Biomass activity, the initial approved document had a coverage of 5 provinces: Gaza, Inhambane, Manica, Niassa and Cabo Delgado. The target was set for the (i) production and distribution of 50.000 improved cook stoves, for use in the household and SME sectors, (ii) introduction of 500 improved charcoal kilns, and support to interfuel substitution for traditional biomass in household and institutions (schools, clinics.); (iii) demonstration projects to accelerate the sustainable market penetration of clean Renewable Energy Technologies including deployment of 70 multifunctional



platforms in rural villages.

Due to budget restriction, the initial objectives above were revised and therefore, the project was only implemented in Manica, Inhambane and Gaza provinces. The revised target was the following: (i) production and distribution of 4.000 improved cook stoves; (ii) training for local communities/institutions on correct use of improved cook stoves and local producers of improved cook stoves for the replication of the technology and biomass market development including knowhow transfer to local people. The activities concerning to the improved charcoal kilns and multifunctional platforms did not proceed due to the budget restriction.

Concerning the promotion and distribution of biomass energy systems, FUNAE contracted two NGO’s ADEL and KULIMA, to carry out the activities in Manica, Inhambane and Gaza provinces respectively. The relevant achievements of these activities are detailed here below:

**Table 2:** Promoting the use of Biomass Energy Systems

Indicator	Baseline Value	Original target (from approval Document)	Contract Revised Target Value	Actual Value Achieved at Completion or Target Years
<b>Indicator 4:</b>	<b>Number of improved wood fuel stoves distributed to households and institutions such as schools and clinics.</b>			
Value (Quantitative or Qualitative)	0	50.000	4.000	4.000
Last Date Achieved		May, 2010	Sep, 2014	12/31/2016
Comments:				
Percentage of the target achieved ( percent)				100 percent
<b>Indicator 5:</b>	<b>Number of households trained on improved cook stoves production</b>			
Value (Quantitative or Qualitative)		-	123	123
Last Date Achieved		May, 2010	Sept, 2014	12/31/2016



Comments:	The number of people trained was not previously defined in the original plan. The number achieved was set during the project implementing stage.			
Percentage of the target achieved ( percent)				100 percent
<b>Indicator 6:</b>	<b>Number of multifunctional platforms deployed in rural villages.</b>			
Value (Quantitative or Qualitative)		135	135	0
Last Date Achieved		May, 2010	Year of 2014	-
Comments:	The multifunctional platform activity was canceled due to the budget restriction. The prices submitted by the firms as result of the tender launched by FUNAE to carry out this activity was higher than the available budget.			
<b>Indicator 7:</b>	<b>Introduction of improved charcoal kilns</b>			
Comments:	The improved charcoal kilns activity was canceled due to the budget restriction.			

**Main Beneficiaries:**

The project targeted rural communities. The **Solar PV systems** installed could cover positively the rural people in communities of Cabo Delgado, Niassa, Manica and Inhambane provinces.

On regard to **Biomass energy system**, the project targeted the provinces of Gaza, Inhambane and Manica. The original plan on this activity intended to cover also Cabo Delgado and Niassa provinces. The implementation of biomass projects had a positive impact on the conservation of Forest resources in the rural villages and consequently support village-level economic growth and social development although the introduction of the multifunctional energy service platforms and charcoal kilns could not be implemented due to the reasons mentioned above.

The secondary beneficiaries were the Ministry of Health and the Ministry of Education through the implementation of solar PV systems for schools and clinics and associated capacity building.

**3.1.3. Activity 3: Capacity Building of FUNAE for the implementation and management of the project.**

The EDAP project provided a substantial training opportunity to support FUNAE on the institutional development and capacity building. Under EDAP (APL-2) FUNAE carried out training activities in order to further up-grade FUNAE’s staff capabilities on good management practices, project evaluation, techniques of monitoring and assessment of performance indicators. The training had positive impact and contributed on technical knowledge and management skills in various field enabling FUNAE staff to improve their performance.



**3.2. Efficiency:** Due to the nature of its operation, mainly consisting of rural electrification and alternative energy, FUNAE does not envisage to operate as a commercially oriented utility. The financial statement it produces treats all cash inflows from the Government and donors as revenues, which means that these incoming funds are subsidizing FUNAE’s operations. In this context, EDAP investments and operating costs under the component implemented by FUNAE in the financing agreement, was made in a form of a grant. Therefore, there is no notable financial impact on FUNAE.

**3.3. Relevance.** The operation’s objectives, design, and implementation are fully consistent with the Country’s current development priorities and with the current country and sectoral strategic goals. The objectives and achievements are particularly aligned with the (i) Strategic Plan of the Government of Mozambique for the energy sector; (ii) The New and Renewable Energy development Strategy 2011-2025; The New and Renewable energy Development Policy; and other related policies aimed at expanding the access to modern energy sources in rural areas; and contributing to economic and social development and consequently to Poverty Reduction in Mozambique.

#### 4. Disbursement Profile

**Table 4: The disbursement profile of component of EDAP project is summarized here below:**

ACTIVITY/CONTRACT	Signed contracts as of now (USD)	Signed Adendum of contracts (USD)	Disbursed up to 31/03/2017 (USD)	percent disbursed	Remaining Amount for Payment up to 30 June 2017 (USD)	TOTAL PAYMENT	REMAINING FUNDS
Solar PV Systems -- Lot 1 CAA: Cabo Delgado	3,389,541		3,242,526	96 percent	147,014.70	3,389,540.70	-
Solar PV Systems -- Lot 2 Battech: Niassa	4,850,464		3,037,708	63 percent	1,812,756.00	4,850,464.00	-
Solar PV Systems -- Lot 3 CAA: Manica	1,663,953		1,627,121	98 percent	36,831.50	1,663,952.50	-
Solar PV Systems -- Lot 4 Battech : Inhambane	3,396,486		2,143,326	63 percent	1,253,160.00	3,396,486.00	-
Expected cost of duties & taxes for CAA Contract	1,180,885		1,145,654	97 percent	35,231.00	1,180,885.00	-
Motor vehicles	200,000		192,609	96 percent	7,391.00	192,609.00	7,391
Motor vehicles	150,000		-	0 percent	150,000.00	150,000.00	-
Office and field equipment	250,000		182,166	73 percent	67,834.07	250,000.00	-
Travel	250,000		141,709	57 percent	108,290.86	250,000.00	-
Package of improvements' for PV systems	89,591		89,591	100 percent	-	89,590.86	-
Acquisition of computers - Dataserv	115,875		-	0 percent	115,875.13	115,875.13	-



Acquisition of computers - Sahara	66,856		-	0 percent	66,856.47	66,856.47	-
Supervision Consultant for PV systems - IT Power/Tese	850,780	100,000	827,864	97 percent	122,916.00	950,780.00	-
Procurement Officer	68,544		68,544	100 percent	-	68,544.00	-
Solar PV Specialist	288,000		263,750	92 percent	24,250.00	288,000.00	-
Clearing Agent for CAA contract	20,000		20,000	100 percent	-	20,000.00	-
FUNAE training	500,000		483,865	97 percent	16,135.41	500,000.00	-
Team Building FUNAE	70,000		-	0 percent	70,000.00	70,000.00	-
Operating costs for FUNAE (including office rental)	500,000		259,610	52 percent	240,390.06	500,000.00	-
Improved cooking stoves-Inhambane Province	31,100		20,672	30 percent	10,427.83	31,100.00	-
Improved cooking stoves-Gaza Province	65,860		40,700	0 percent	25,160.44	65,860.00	-
Improved cooking stoves-Manica Province	93,710		51,455	0 percent	42,255.43	93,710.00	-
Biomass expert	114,000		114,000	100 percent	-	114,000.00	-
Proconsultores	50,000.00		50,000	100 percent	-	50,000.00	-
	<b>18,355,645</b>	<b>100,000</b>	<b>14,002,868.76</b>	<b>76 percent</b>	<b>4,352,775.90</b>	<b>18,348,253.66</b>	<b>7,391.00</b>

**5. Evaluation of own performance during preparation and implementation, with special emphasis on lessons learned that may be helpful in the future.**

Our assessment of the extent to which the Government and implementing agencies ensured quality of preparation and implementation, and complied with covenants and agreements, toward the achievement of development outcomes, is as follows.

**5.1 For the Government overall:**

The overall evaluation for the Government performance is Satisfactory. There were minor shortcomings in Government performance.

**5.2 For implementing agency**

Our evaluation as implementing agency is Satisfactory. There were minor shortcomings in the implementing agency’s performance.

- **Ownership and commitment to achieving development objectives**





FUNAE has been successfully implementing many rural electrification projects in Mozambique. Within the World Bank financed projects, it has been also successfully implementing its own component and several staff have been trained in Bank procurement and has retained significant knowledge to carry out the procurement and project management under EDAP project.

The solar PV systems installed in all locations within this project, will remain under its ownership and will ensure beneficiary satisfaction and local involvement through the solar PV system's management committees which were created for such purposes.

The long term operation and maintenance (O&M) of the systems also will require local community's capacitation and for that purpose, FUNAE and contractors during the project implementation has undertaken the local community training for the use (user manual) and maintenance. With the same purposes, FUNAE has created a Maintenance Unity at headquarter and at provincial level, which are carrying out the maintenance activities in all systems installed in the communities and also offer training and support to the local management committees for the system sustainability.

**For Government: Enabling environment including supportive macro, sectorial, and institutional policies (legislation, regulatory and pricing reforms)**

Through appropriate procurement activities of FUNAE as a public institution and aligned with the Renewable Energy Policy, the market of supply and installation of PV systems in Mozambique has grew significantly. The Renewable energy provided to the communities under EDAP project, has been focused on provision of solar PV systems and Biomass technologies to households, schools, clinics and villages in remote areas and therefore, improved the education, health and welfare in those locations.

The Government is highly committed in expanding the access to energy sources in rural and periurban areas. In order to accelerate the electrification process, in 2011 the Government approved the Renewable Energy Strategy which aims to introduce 450 MW of clean energy technology over a 15-year period (2011-2025). As result of the Government's commitment with the energy sector, the National Electrification Strategy (NES), and a complementary plan for accelerating the program to achieve universal access to electricity in Mozambique by 2030, is being elaborated and will be completed during this year of 2017 with a great support from the World Bank.

- **Adequacy of beneficiary/stakeholder consultations and involvement**

As indicated above FUNAE has been successfully implementing many rural electrification projects in Mozambique and has accumulated relevant experience and qualifications to implement projects in which local people/beneficiaries are involved. The creation of local management committees, demonstrates how FUNAE gives value to the involvement of local communities and other stakeholders in the project implementation.

- **Readiness for implementation, implementation arrangements and capacity, and appointment of key staff**

The implementation of EDAP (APL-2) was mostly based on the existing institutional arrangements of ERAP



(APL-1) which facilitated the continuation of this investment program which has been promptly implemented by FUNAE as Implementing Agency, on its own component within the financing agreement between the Bank and the Government of Mozambique.

As mentioned above, the experience accumulated from ERAP and other renewable energy projects previously implemented was well capitalized by FUNAE, and it has demonstrated its capacity to implement the EDAP project in satisfactory manner. Within FUNAE structure, the implementation and management of installation of solar PV systems, was in responsibility of an appointed staff in the Wind and Solar Systems Division (DSSE) while the Biomass energy systems, in the MiniHydro Division (DMH).

- **Timely resolution of implementation issues**

During the implementation period, most of technical issues related to the installation process raised in the field were promptly solved involving the main stakeholders of the project (supervision consultant, FUNAE and contractors). However, some of them such as the blue print snags correction in Niassa and Inhambane, were delayed due to deployment of non-approved 100wp solar panels. These issues took long time to be solved (about 12 months) and had negative impact on the implementation schedule. The contractor had to purchase and install the new panels as per the technical specifications requirements.

**Fiduciary (financial management, governance, provision of counterpart funding, procurement, reimbursements, compliance with covenants)**

FUNAE possesses relevant experience and qualifications in procurement and with Bank fiduciary requirements, and therefore has demonstrated its experience and capacity for the successfully procurement process under this project.

The Government of Mozambique approved an Anti-Corruption Law in 2004. The law stipulates that all contracts to which state or municipal bodies are party must incorporate an anti-corruption clause and that whistle blowers are protected. Public officials now have to present a list of their assets every year and a final list on leaving office. The Anti-Corruption entity (GCCC) carries out investigations of complaints in relation to corruption-related offenses within the public sector and has delegations at provincial level.

- **Adequacy of monitoring and evaluation arrangements, including the utilization of M&E data in decision-making and resource allocation.**

During the project implementation, some technical aspects of the project identified in the field were promptly revised between FUNAE, Contractors and Supervision firm in order to fulfill the local conditions or to better meet the good practices of system installations. In the other hand, beside the progress report issued by the supervision consultant, FUNAE has provincial delegations which frequently visited the project implementation sites for complementary supervision of project implementation.

In general, despite the lack of any integrated M&E system FUNAE made all efforts to consolidate the information regarding the solar PV system installations in all provinces through monitoring and site visit in order to improve the project implementation and data base elaboration.



- **Relationships and coordination with donors/ partners/stakeholders**

The Bank played strong role in the design, preparation and implementation stage of the component 2 of the project in consultation with local stakeholders. The coordination and relationship within the public institutions (FUNAE, Ministry of Education and Ministry of Health) and other local stakeholders, contributed positively for the successfully implementation of component 2.

## 6. Lessons learned

- **Procurement And Signed Contracts:** The majority of the tenders launched within the EDAP project, were viewed by international bidders in which national firms had difficulties to have access to it, due to lack of access to information or due to the requirements aspects related to that tender or due the fact that the bidding document was only in English version, which contributed them to not participating in the competition. For such situation, it's recommended to take into consideration the national legislation during the elaboration of Bidding Documents.
- As per the public institutions procurement regulation, (Decree nº 5/2016 of March, 8<sup>th</sup>), all the contracts signed with suppliers, must be submitted to the Administrative Court for Approval/No Objection before its execution. However, all eligibility documentation of the contract process must be in Portuguese according to the requirements of the above Decree, and part of the companies eligibility documentation submitted, could not be the same as required to national companies. This process took long period to be solved and it contributed negatively for all contracts to get approval from the Administrative Court. It's recommended to consider local legislation during the elaboration of general and special conditions of the project.
- **Contractor's Logistical:** The logistic aspects must be planned carefully by contractors to avoid significant delays during implementation projects. During the negotiation of contracts FUNAE assumed the responsibility of Duties and taxes and therefore the incoterms used for the material was changed from DDP to CIP. This alternative was not very well succeeded for FUNAE as a public institution and the process releasing goods was not very flexible in terms of customs and payment procedures. For this type of contracts it's recommended DDP modality for the supply and delivery of equipment by contractors.
- **Roof mounting installation:** The method of roof mounting systems did not accumulate good experience in this project. It does not guarantee the right tilt or orientation of the PV module taking into consideration that most of facilities (houses and commercial) in rural areas are not conventional, and the roof is not strong enough for routine maintenance without damages. Therefore, many beneficiaries that were initially listed for the project had to be replaced by those who had better solutions. The site visit and inception report are crucial in order to identify better technical solutions for the installations (roll out). For such situation, it's recommend the application of pole mounting systems.
- **Earth resistance:** The project was sized without taking into consideration local soil resistivity per province/region. As result of this, the number of copper spikes per system were not enough and earth resistance was above recommended standards and this may cause system failure or damages. For the next projects the number of copper spikes per system should be well determined based on the local conditions during the survey.



- **Water pumping:** The EDAP project also planned to install 18 solar PV water pumping systems in Cabo Delgado, Niassa and Inhambane provinces were the 30 villages was to be installed. However, the borehole information (data) for the selected locations wasn't available which. It's recommended that next project should include geophysical studies and borehole drilling and installation of water solar water pumping as a complete package.
- **FAT-Factory Acceptance Test:** The main PV equipment such as Panels, inverter, batteries and charge controller should be submitted to the FAT in which FUNAE staff appointed for the project management, would participate to guarantee the quality and technical specification.

## **7. Conclusions**

In general, our assessment on the implementation of EDAP Project-component 2 (FUNAE), is satisfactory.

Regarding the contracts for the installation of solar PV systems, the project achieved 80 percent of the target was while the on the Biomass energy systems, 100 percent of the target was achieved.

The outputs of its implementation had a positive impact in remote communities of Mozambique taking into consideration that it provided access to renewable energy to rural households, schools and clinics and villages and contributed to increasing sustainable access to affordable electricity and modern energy services in rural populations and contributing for poverty alleviation. This impact would higher life quality, opportunities for studying at night, better health assistance, and economic activities development and less environmental damages.

The project also provided a substantial opportunity to support FUNAE on the institutional development and capacity building trough training opportunity and equipment acquisition.

## **8. Recommendations**

Following project implementation and completion, following recommendations are proposed for future projects.

1. To implement off grid centralized PV systems including payment systems (pre-paid meter system). The centralized system have an advantage of low budget maintenance and they are easier to run compared to standalone systems.
2. To continue implementing stand-alone solar PV systems in locations where the beneficiaries are more scattered including payment systems such as PAYG (pay as you go) or other type.
3. The Solar Photovoltaic Water Pumping System should be delivered as full package. The service should consider to supply geophysical studies, drill the boreholes and install the solar PV water pumping system.
4. Roof mounting installation did not accumulate good experience in this project. As such, we recommend pole mounting installation to guarantee the right tilt or orientation of the panel.



**ANNEX 6. SUPPORTING DOCUMENTS (IF ANY)**

1. EDAP Project Appraisal Document (P108444; Report No.: 52204-MZ), January 6, 2010
2. Financing Agreement and Amendments for EDAP
3. Project Agreements with EdM and FUNAE
4. Subsidiary Agreements with EdM and FUNAE
5. Aide Memoires on file.
6. ISRs (13)
7. Mozambique Country Partnership Framework (FY17-FY21), March 2017
8. Mozambique Systematic Country Diagnostic, April 2016
9. World Development Indicators (WBG – Online DB)
10. Independent Evaluation Group. 2015. *World Bank Group Support to Electricity Access, FY2000-2014: An Independent Evaluation*. World Bank, Washington, DC.
11. UN Millennium Development Goals Indicators on-line Database
12. EdM Electricity Tariffs ( last verified on August 20, 2017 on EdM website at:  
[http://www.edm.co.mz/index.php?option=com\\_content&view=article&id=121&Itemid=83&lang=en](http://www.edm.co.mz/index.php?option=com_content&view=article&id=121&Itemid=83&lang=en))
13. POVERTY AND WELL-BEING IN MOZAMBIQUE: FOURTH NATIONAL POVERTY ASSESSMENT (IOF 2014/15), Ministry of Economics and Finance Directorate of Economic and Financial Studies, October 2016.