TERMINAL EVALUATION REPORT

for

UNDP/GEF PROJECT

Project Title	Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
UNDP PIMS	5270
GEF Project ID	00094026
Terminal Evaluation Time Frame	1 October to 30 November 2019
Project Country	Malawi
GEF Operational Focal Area/Strategic Program	CCM Objective 2: Promote investment in renewable energy technologies
Executing Agency/Implementing Partner	UNDP/Ministry of Natural Resources, Energy and Mining
Evaluators	Robert Aitken and Lameck Nkhonjera

3 December 2019

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Acronyms and Abbreviations

AWP	Annual Work Plans
BRD	Development Bank of Rwanda
BoQs	Bill of Quantities
DC	District Councils
DEA	Department of Energy Affairs
DFID	Department for International Development
DO	Development Objectives
EEP	Energy Environment Partnership
EGENCO	Electricity Generation Company (Malawi)
EIA	Environmental Impact Assessment
EMP	Environmental Master Plan
EoI	Expression of Interest
ESCOM	Electricity Supply Corporation of Malawi
EUD	European Union Delegation
GEF	Global Environmental Facility
GEWE	Gender Equality and Women Empowerment Programme
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMG	Green mini grids
IACADES	Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
ICS	Improved Cookstoves
IRP	Integrated Resource plan

IP	Implementation Plan
JICA	Japanese International Cooperation Agency
KfW	Kreditanstalt fur Wiederaufbau
KPI	Key performance indicators
LoCAL	Local Climate Adaptive Living facility
MAREP	Malawi Rural Electrification Programme
MEGA	Mulanje Electricity Generation Agency
MERA	Malawi Energy Regulatory Authority
MGDS	Malawian Growth and Development Strategy III
MTR	Midterm Review
NGO	Non-Governmental Organization
NIM	National Implementation Modality
PA	Practical Action
PPA	Power Purchasing Agreement
PPP	Public Private Partnerships
ProDoc	Project Document
PSC	Project Steering Committee
R&D	Research and Development
REFIT	Renewable Energy Feed-in-Tariff
REIAMA	Renewable Energy Industry Association of Malawi
RET	Renewable Energy Technology
SHS	Solar Home Systems
SMME	Small, Medium and Micro-sized Enterprises
TAC	Technical Advisory Committee
ToC	Theory of Change

TRAC	Target for Resource Assignment from the Core
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UP	United Purpose
USAID	United States Agency for International Development
WB	World Bank

Executive Summary

This report is for a Terminal Evaluation (TE) of the UNDP/GEF project that sought to increase access to clean and affordable decentralized energy services in selected vulnerable areas of Malawi through establishing of green mini grids (GMG). The summary of the project information is presented in Table 1.

Table 1: Project Information Table

Project Title:	Increasing access to clean and affordable decentralized energy services in selected vulnerable areas of Malawi			
GEF Project ID:	PIMS#5270		at endorsement (Million US$)	at completion (Million US$)
UNDP Project ID:	00094026	GEF financing:	$1,725,000	$1,725,000
Country:	Malawi	IA/EA own:		
Region:	Africa	Government:	$1,290,000 in kind	$1,290,000 in kind
Focal Area:	Climate Change	Other:	UNDP $ 1,875,000	UNDP $ 3,368,426
FA Objectives, (OP/SP):	CCM-3 Promote investment in renewable energy technologies	Total co-financing:	$$22,785,000	$22,785,000
Executing Agency:	UNDP/Ministry of Natural Resources, Energy and Mining	Total Project Cost:	$ 36,290,000	$ 36,088,426
Other Partners involved:	MEGA, Practical Action, Community Energy Malawi	ProDoc Signature (date project began):		26 May 2015
		(Operational) Closing Date:	Proposed: June 2019	Actual: 31 December 2019

The project was designed with three components vis-à-vis (i) expansion of the Mulanje Electricity Generation Agency (MEGA) Micro Hydro Power Plant (MHPP) and mini-grid scheme; (ii) Replication of MEGA model via piloting of new mini-grid schemes in other areas of Malawi; and (iii) Institutional strengthening and capacity building for the promotion of decentralized mini-grid applications across the country. These components were planned to be completed within 4 years (August 2015 – December 2019) and upon completion the following outcomes were envisaged;

- Enhanced access to electricity in rural areas through the increased installed capacity of GMGs;
- Strengthened enabling environment for building, owning and operating GMGs in Malawi,
- Improved social-economic status of the villages within the reach of GMGs, and
- Reduced greenhouse gas emissions.

Purpose and Methodology of the Terminal Evaluation

The purpose of the TE was to assess the achievement of project results, and draw lessons that can both improve the sustainability of benefits from the project, and aid in the overall enhancement of UNDP programming. The evaluation process followed both quantitative and qualitative research methods and the evaluation question matrix was developed as a guide to data generation, analysis and synthesis. The project was evaluated with regard to its design/formulation, implementation, and the results with a particular focus on relevance, effectiveness and efficiency, sustainability, and impact. The primary data was collected through face-to-face interviews with the key stakeholders and through field observations whereas the secondary data was obtained from document reviews. The collected data was cross-analysed and triangulated by means of cross-checking data through various collection tools, which were used in such a way as to provide a firm basis for its findings and the lessons learned. Contextual information was added to the team's findings and the quantitative data to make it easier to interpret and analyse them and formulate appropriate conclusions.

Findings

The key findings in relation to project design, implementation and results are outlined below.

Findings on project design/formulation

- In relation to project logic and indicators, the project was well designed; however, in some instances the baseline data was considered somewhat thin. Clear baselines enable improved measurement of impacts.
- The risk assessment was quite broad but overlooked a few additional risks that remain relevant going forward.
- The project formulation did draw to some extent on lessons learned from other relevant projects with the region, but these processes might have been somewhat more extensive and detailed.
- The composition of Project Board and Project Steering Committee was inclusive, ensuring some level of involvement of NGOs and the private sector, although their representation might have been enhanced.
- From a financing perspective, the replication approach was limited to donor financing without mid to long-term focus on strategies for unlocking the interest of private investment in GMG.
- The project design focused more on household connections as opposed to commercial communities which can diversify revenue streams for mini grids and simultaneously promote Small, Medium and Micro Enterprises (SMME) opportunities.

Findings on project implementation

- The management team displayed sufficient adaptive management but fell short in managing the delays and underperformance demonstrated by Practical Action.
- The project was fairly well publicised and networked in the country but may benefit from closer strategic engagements with other regional mini-grid centred programmes.
- Overall, the disbursement of GEF funds has been satisfactory. However, an over expenditure of 45% in the project management is found to be high. At the time of evaluation, UNDP has expended 87.6% of its committed TRAC funds of US$1,845,000 whereas co-funding from partner agencies amounted to US$679,519 out of which US$ 515,195 is not used by practical action.
- The M&E programme has delivered critical information of the meta results but the more subtle issues such as household energy savings may have been somewhat discounted by the M&E framework.
- Feedback from project stakeholders has been on the whole very positive with regard to the programme's management and implementation
- The evaluators rating for the implementation and execution of the IACADES programme is satisfactory.

Findings on project results

The project results in terms of the rating of project's performance in relation to relevance, effectiveness, efficiency, sustainability, and impact are summarised in Table 2.

Table 2: Project results rating summary

Rating Project Performance		
Criteria	**Rating**	**Comments**
Outcomes: Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)		
Overall Quality of Project Outcomes	S	High rate of achievement of all five outcomes with small percentage of targets not met.
Relevance: relevant (R) or not relevant (NR)	R	The project aligns to local and national environmental priorities and policies and to global environmental benefits to which the GEF is dedicated
Effectiveness	S	The project resulted in an operational mini-grid, in addition to important and strategic advances in developing the requisite enabling framework
Efficiency	S	Despite PA's undelivered installation, the project activities are completed to the extent that some project funds are being used to fund activities outside the approved ProDoc.
Sustainability: Likely (L); Moderately Likely (ML); Moderately Unlikely (MU); Unlikely (U).		
Overall likelihood of risks to Sustainability:	ML	Some of the risks are not yet addressed and pose a threat to sustainability
Financial resources	L	The business models are likely to generate resource to maintain and sustain GMG
Socio-economic	L	The observed enhanced socio-economic status to connected customers likely to be sustained
Institutional framework and governance	L	Interest of MERA and Malawi Gov. on GMG likely to sustain institutional framework and governance
Environmental	L	The use of green and renewable energies as primary energy for GMG likely to sustain the environment.

Impact: Significant (S), Minimal (M), Negligible (N)		
Environmental Status Improvement		Too early to measure
Environmental Stress Reduction		Too early to measure
Overall Project Results	S	The objectives are mostly attained.

Conclusions

The conclusions drawn from the current terminal evaluation are structured based on a basic yet reliable framework of 'strengths, weaknesses, and outcomes'.

Strengths

- Overall the project was a success as key objectives have been achieved across the three project components and the future prospects of the green mini grid development in Malawi are far more credible now than they were at the start of the project.
- The key project strengths lie in the pragmatic design, commendable project management, strengthened MEGA template; and the established green-fields min-grid.

Weaknesses

- The project lacked comprehensive market intelligence and hence yielded reduced generation of renewable electricity.
- The management team was slow in managing PA's progress, a situation which has negatively affected number of GMGs which the project intended to install.
- There was inadequate investment in baseline data and the ability to measure impacts over time. Besides, there were a number of assumptions made in the Project Document which needed to be tested within the implementation framework.
- The training was not exclusively targeting individuals who are active in energy space, a situation that has resulted to providing training to persons that may not apply the knowledge.
- There is some level of ambivalence detected in the absolute commitment of the GoM to the role of mini-grids going forward.

Outcomes

- On the whole, the programme outcomes were positive. With the exception of the weaknesses already noted, the programme has significantly strengthened and advanced the position of GMGs in Malawi. Critical foundational legacies include a stronger MEGA, an operational Greenfields solar PV mini-grid, close to 1,000 additional customers connected to RE based electricity, an increasingly supportive policy and regulatory framework, enhanced technical expertise and awareness within the public sector as well as an improved information access platform.

Lessons Learnt

The following are the key lessons learnt through the evaluation process;

- Technologies mature over time and expectations and requirements need to develop with them
- Off-grid generally and mini-grids specifically require active and constant championing to reduce uncertainty and facilitate progress and investment
- An Electrification Masterplan is strategically important but even more so if it is consistently and predictably applied.
- More detailed M&E frameworks need to be developed to deepen understanding of the socio-economics of electricity adoption, consumption and changing patterns over time.
- There is considerable interest in the GMG sector in Malawi. This is reassuring going forward.
- Training needs to be more targeted and developed using a more 'bottom-up' approach based on a need's assessment at DC level.

Recommendations

Table 3 gives a summary of recommendations on programme design and enabling framework that should be considered for future GMG programmes in Malawi.

Table 3: Recommendation summary Table

No	Recommendation
Programme design	
1	The provision of training needs to target the right people while the training content/focus should be determined at District Council level using a bottom up approach. The District Councils should be supported by energy officers that will be instrumental in energy planning for a district.
2	Adequate baseline measurements should be undertaken before project inception in order to adequately measure impacts and underpin more effective planning. Generally more nuanced socio-economic M&E framework is required.
3	The subsequent UNDP funded GMG projects/programmes should include the UNCDF as the 'responsible party' (through a UN to UN Agency Agreement) for disbursement of funds to the private sector in order to promote private sector participation in GMG.
4	The agreements signed between future programmes and associated project developers should adopt a more outcome based technical assistance agreement that is linked to measurable progress in project implementation
5	Future programme designs need to balance the need to distribute resources evenly or equitably (Infrastructure sprinkling) with the need to understand and replicate impacts (more concentrated investments).
6	Productive use of electricity within the overall min-grid plans needs to be promoted with more concerted effort.
7	There are a number of ownership options, as opposed to a single option, which should be explored further in subsequent GMG programmes
Enabling framework	
8	While programme related grant finance from GEF and other donors is critical at this stage, accessing commercial finance will have to be increasingly formalised over time, with each subsequent GMG initiative increasingly institutionalising financial access as the technology

	and market for GMGs matures.
9	There is a need to develop a realistic electrification masterplan and consistently apply the plan in order to stabilize and de-risk the mini-grid sector.
10	There is a need to advance the currently untested mini-grid framework through subsequent GMG implementation and additional engagement with issues such as GMG selling electricity to the grid through PPAs, GMGs assuming the role of local distributor, etc.
11	Communities need to be well informed about the options, intensions and implications of the range of energy services. Consistent and constant messaging around the need for grid and off-grid is important to reduce potential tensions around perceptions of superior/inferior service options.

1 Introduction

1.1 Purpose of the evaluation

According to Terms of Reference (ToR) attached in Annex A, the purpose of the Terminal Evaluation (TE) of IACADES project was to assess the achievement of project results, and draw lessons that can both improve the sustainability of benefits from the project and aid in the overall enhancement of UNDP programming. While the TE is the final assessment of the IACADES project and in that sense cannot significantly influence its immediate outcomes, the TE does nevertheless have a broader responsibility to share insights and provide guidance to current and future green mini grid (GMG) programmes elsewhere in the country and on the continent. In addition, the TE insights and observations can provide guidance and support to Malawian stakeholders both public and private who have committed to taking the GMG sector forward.

1.2 Scope & Methodology

The scope of the TE was broad and inclusive, looking at all the project components and associated activities and outcomes, over-arching issues such as project management and stakeholder buy-in as well as 'meta' issues examining the programme's overall relevance, effectiveness, efficiency, sustainability and impact. To achieve the objectives of the TE, the evaluation process followed a methodology with six (6) main phases as outlined below.

Phase 1: Preliminary documentation review

The evaluation team carried out a preliminary documentation review which helped to identify the evaluation questions and indicators that guided the evaluation process. An evaluation matrix presenting these various items is provided in Annex B. This evaluation matrix was central to the structuring and implementation phases of this evaluation.

Phase 2: Inception report

Once the documentation review was completed, an inception report was produced and presented at an inception meeting and validated. This inception report included a proposed methodology, field mission timetable as well as an updated work plan for the remainder of the evaluation process.

Phase 3: Field mission

After the inception report was approved, the evaluators followed the itinerary provide in Annex C to conducted interviews with key stakeholders in Lilongwe, Mchinji, Blantyre, and Mulanje as well as visiting mini grids in Mchinji and Mulanje. The list of persons interviewed alongside their institutions is provide in Annex D while Annex E contains the summary of field trips.

Phase 4: Documentation review and detailed analysis

Based on documents made available to the evaluators before the field mission and the data gathered during the interviews, the evaluation team conducted an in-depth documentation review, following evaluation indicators, in order to answer the evaluation questions (a full list of the documents reviewed is provided in Annex F). The evaluators then cross-referenced and triangulated the quantitative and qualitative data gathered on the basis of the results of the interviews, the observation and the documentation review. The triangulation was done by cross-checking data through various collection tools, which were used in such a way as to provide a firm basis for its findings and the lessons learned. Contextual information was added to the team's findings and the quantitative data to make it easier to interpret and analyse them and formulate appropriate conclusions.

Phase 5: Draft report

The evaluators developed a draft report, which was submitted on 8 November 2019 to UNDP Malawi for circulation to relevant stakeholders for a review before being validated during a validation workshop held on 15 November 2019.

Phase 6: Final report

Comments received from UNDP and key stakeholders on the draft report were taken into account in the development of the final report.

1.3 Structure of the evaluation report

The evaluators made an effort to keep this report brief, to the point and easy to understand. It is made up of four substantive parts guided by the structure and scope in the Guidance for Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects[1] and is according to the standards established by UNEG[2].

Following the executive summary, the first section of the report provides the introduction and the background to the assignment. It starts with the purpose of the evaluation, exactly what was evaluated and the methods used. This is followed by Project description and development context that covers information on project timeline, problems the project sought to address, objectives, baseline indicators, main stakeholders and the expected results.

The next section is the main substantive component of this report and comprises four inter-related sections. It presents the findings of the evaluation exercise in terms of the basic project design and formulation, its implementation, administration and management, its achievements, results and impacts, and the potential for sustainability of the products and services that it produced. The

[1] UNDP (2012), Guidance for Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects.
[2] UNEG United Nations Evaluation Group (2005) Standards for Evaluation in the UN System

findings are based on factual evidence obtained by the evaluators through document reviews and consultations with stakeholders and beneficiaries.

The final component of the report is the Conclusions, lessons learnt and recommendations section which provides a summary of the ratings given and conclusions reached and lessons learnt from the evaluation. This component includes the final sub-component comprising the recommendations following the TE. A number of annexes provide supplementary information.

2 Project description and development context

2.1 Introduction

Given the low rates of electrification in rural Malawi, and indeed, the country as a whole, it comes as no surprise that a project of this nature was designed and implemented in the country. As a recent report[3] noted, only 11% of Malawi's 18 million people have access to electricity while this figure is considerably lower for the country's rural majority where an access figure of 3.9% is provided. The Malawi government in partnership with UNDP and GEF, under the GEF Climate Change focal area, are implementing *the Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi* project (IACADES) in order to improve access to electricity in rural areas.

There are essentially two established *off-grid* strategies for promoting access to electricity in rural areas; more distributed access solutions centred at the household level including Solar Home Systems (SHS), pico-solar, solar lanterns, etc. and more localised mini-grid solutions. The IACADES project aims to establish mini-grids as a priority option in promoting rural electrification in Malawi. The project design acknowledges both the need to demonstrate mini-grids, 'learn by doing' so to speak, as well as laying the foundations for an active and sustainable mini-grid sector in a post-IACADES Malawi. The latter objective requires the development of a solid foundation and enabling framework, including supportive policies, regulations, access to finance, planning, amongst others that will continue to encourage and support mini-grid investments and operations long after the IACADES project has concluded.

The project design has three complementary components;

Component 1 - Expansion of the Mulanje Electricity Generation Agency (MEGA) Micro Hydro Power Plant (MHPP) and mini-grid scheme: The Component supports the technical optimization of the existing MEGA micro-hydro plant and the implementation of a second micro-hydro powered mini-grid operated by MEGA at Namainja. The component will additionally provide institutional support for the development of several other MEGA MHPPs bringing the installed capacity of their power production up to 216 kWp by end of project (the existing or baseline capacity going into the project was 56kWp). The Component is also designed to provide institutional and technical assistance to MEGA to ensure that the organisation becomes increasingly self-sufficient. The key

[3] Borgstein, E. et al. Malawi Sustainable Energy Investment Study: Summary for Decision Makers. Rocky Mountain Institute, 2019.

objectives of the component is to optimize the performance of the existing MEGA mini-grid plant, something of a mainstay in the under-developed Malawian mini-grid sector, co-finance and support the installation and operation of an additional micro-hydro plant and ensure the MEGA operations and business model become more commercially sustainable. Success in this regard will ensure greater access to electricity for rural households in the expending reach of MEGA's mini-grid and in doing so, deliver additional benefits and financial savings to customer households.

Component 2 - Replication of MEGA model via piloting of new mini-grid schemes in other areas of Malawi: This Component will initiate an open competitive-based mechanism (Request for Proposals – RfP) to select and support the establishment of Public-Private-Partnership (PPP) service delivery platforms for clean energy mini-grids with an emphasis on business models such as Build-Own-Operate (BOO). It is envisaged that Green Mini-grids (GMG) with an installed capacity of at least 84 kWp will be supported. The objective of this component is to augment the activities in Component 1 by supporting green-field mini-grid developments based on the foundational experiences that MEGA represents. Whereas Component 1's MEGA focus is about establishing the blue-print, Component 2 is about expansion and diversification (in modest terms to be sure) through supporting the private sector to replicate and expand on the lessons and experiences gained through MEGA's operations.

Component 3 - Institutional strengthening and capacity building for promotion of decentralized mini-grid applications across the country: Where Component 1 is designed to provide something of a mini-grid 'blueprint' and component 2, the practical and managed replication, the task of Component 3 is to support the future investment and growth of mini-grids across the country. The Component includes training and capacity building at sub-national and national levels on GMGs and establish a national information clearing house to facilitate mini-grid based rural electrification. The Component also makes the policy and regulatory changes to mainstream GMGs into rural electrification activities and will also synthesise and show-case the lessons from the GMG based rural electrification experience in Malawi to develop a Toolkit for policy makers and project developers.

Table 4: Summary of Component Outputs

	Component	Objectives	Outputs
1	Expansion of the Mulanje Electricity Generation Agency (MEGA) Micro Hydro Power Plant	Increase the MEGA's generation capacity from the baseline to 216 kWp through partial financial and institutional supports	• Commissioning of the Micro-hydro powered Mini-grid • Operation and energy generation from the MHPP mini-grid • Institutional support to MEGA • Strategies to improve business model viability
2	Replication of MEGA model via piloting of	Establish Public-Private-Partnership	• Commissioning of pilot green mini-grids

	new Mini-grid schemes in other areas of Malawi	(PPP) Service delivery platforms for clean energy mini-grids with an emphasis on business models such as Build-Own-Operate (BOO).	• Operation and Energy Generation from the mini-grids • Institutional Support to Mini-grid operators • Independent Review Mechanism
3	Institutional Strengthening and Capacity Building for promotion of decentralised mini-grid applications across the country:	Build capacity on Clean Energy Mini-grids at sub-national and national levels	• Information Clearing House for Mini-grids • Training and Capacity Building • Mainstreaming Mini-grids into Policy and Regulation • Case Study and Toolkit Development and Knowledge Management

2.2 Project start and duration

Table 5: Key project milestones

Key project milestones	
Validation workshop	July 2014
Project start	August 2015
Annual Workplan approved	September 2015
Mid-term Review	May 2018
Project close	December 2019
Terminal Evaluation	November 2019

2.3 Problems that the project sought to address

As indicated, Malawi has a particularly low level of electricity access. Only 11% of the country's 18 million people have access to this critical development service. While the Department of Energy Affairs (DEA) principally through the Malawi Rural Electrification Programme (MAREP) and the state electricity utility company 'Electricity Supply Corporation of Malawi' (ESCOM) are working to expand

the national grid with the support of strategic partners and donors (for instance, The World Bank[4]), addressing the electrification deficit will take considerable resources and will require a multi-pronged approach. Such an approach will necessarily include both grid and off-grid initiatives.

The focus of the IACADES programme is on developing and supporting a sustainable renewable energy mini-grid sector in the country. The key challenge in Malawi is that current efforts, mostly grid-centred with some nascent activities around distributing SHSs and pico-solar products, will not achieve the country's objectives of 30% electrification by 2030. Clean energy mini-grids can provide additional impetus and opportunity to support current efforts to achieve electrification targets with additional benefits of Greenhouse Gas (GHG) emissions reduction as this clean energy source displaces the use of kerosene and diesel. However, to achieve this is not without its challenges.

The IACADES programme identified a number of Key barriers to promoting sustainable green mini-grids in Malawi;

- *Policy and regulation*; the issue here is the extent to which current policies and regulations promote or inhibit the future prospects of mini-grids in Malawi. The key issues in this regard include: exclusion of mini-grids from accessing funds from the Rural Electrification Fund (REF)[5], the potentially onerous licencing requirements for these generally smaller or 'micro' power plants, limited and/or untested role of the private sector in mini-grid infrastructure service delivery, amongst others.

- *Institutional capacity and information*; the programme design indicated a critical lack of capacity at district and village level. The various formations of local government and village organisations lack a proficient understanding of mini-grids and their potential role in rural electrification. Without such capacity, the potential for 'bottom-up' planning is severely constrained and the governments' efforts to increasingly decentralize governance similarly frustrated. While capacity constraints at the local level are arguably more pronounced, the project also identified a need for capacity building and awareness at national level as well (more specifically within the DEA and MERA). Capacity requirements at national level referenced by the project include a more detailed understanding of mini-grid best-practice, policy, regulation, technology, business models, ownership, etc. Importantly,

- *Business and finance*; programmes such as IACADAS succeed (or fail) on their ability to create a commercial model that is capable of attracting finance and investments. Various forms of finance are required at different stages of developing mini-grids from start-up or 'seed' finance at the earlier or pre-commercial phase to equity and debt finance as mini-grids become increasingly commercial and sustainable. At the programme outset, such finance was not really available. For instance, commercial banks charge high interest rates, favour short-term loans and place high (risk mitigating) collateral requirements on finance,

[4] The World Bank is supporting an initiative to connect more households within 1km of the existing electricity grid through an 'in-fills and densification programme' with a target of 270,000 households over the next few years. Personal communication with Paul Mukiibi, an energy specialist with the World Bank in Malawi.

[5] The REF is supported by a rural electrification levy which all those licenced to sell electricity (Licensees) are required to pay. The levy forms part of the electricity tariffs which consumers pay. The levy is collected by the Malawi Energy Regulatory Authority (MERA) and distributed to the MAREP programme.

conditions which are collectively fairly unfavourable in terms of green mini-grids accessing finance. Most importantly, this kind of investment, notably its scale, unfamiliar technology and for the most part, untested markets, are not the kind of realities that will embolden financial institutions to invest. The challenge for the programme is to reduce the risks and unlock greater access to [increasingly] commercial finance. A key focus in this regard is to identify and develop appropriate business models that reduce overheads, target varied markets/customer bases, incorporate the necessary technical/professional expertise, integrate available technology to promote efficiencies, etc.

A number of activities aimed at addressing these barriers has been integrated in various ways into the programme design. It is the task of the Terminal Evaluation to determine to what extent this has been achieved within the project implementation framework and to what extent these action will facilitate the role of green mini-grids going forward in the post-programme environment. Importantly, the problems and challenges the programme faced and which needed to be addressed through relevant activities included the lack of traction and project experience within the country. While the MEGA operation is something of a mini-grid flag bearer within Malawi the IACADES programme needed to ensure that not only was the MEGA initiative made more commercially and operationally robust, but that other similar mini-grid initiatives were supported in order to develop a portfolio of mini-grid initiatives demonstrating different RE technologies, operators, scales and markets. While financial access, institutional capacity and a host of other 'enabling pillars' are critical going forward, one cannot underestimate the value of mini-grids in the ground; *learning by doing*. Success in this regard presents an important consideration in the overall evaluation.

2.4 Immediate and development objectives of the project

The immediate objective of the IACADES programme is to 'increase access to energy in selected remote, rural areas in Malawi by promoting innovative, community-based mini-grid applications in cooperation with the private sector and civil society'.

Development objectives include the following;

- Enhancing energy access to clean and modern energy services in-line with the GoM's energy access policies
- Contribute to climate change mitigation objectives and commitments of the GoM
- Build capacity on mini-grid and rural electrification at sub-national and national levels
- Ensuring energy policy and regulatory frameworks support mini-grid developments going forward
- Support energy expenditure savings at the household and institutional level through access to more cost effective energy services
- Generate greater quantities of renewable energy through supporting green mini-grids

2.5 Baseline Indicators and expected results

Given the undeveloped nature of the mini-grid sector in Malawi, the baseline profiles going into the programme were small to negligible. A summary of the programme baseline appears in column three (3) in Table 6.

A summary of the expected results is included in column four (4) of the same table. It is important that the evaluation is cognisant of the less quantitative but equally significant objectives of the IACADES. This is centred on the future viability of mini-grids. To be sure, the achievement of the more quantitative results will strengthening the mini-grid sector going forward but other less quantifiable requirements in this regard must be factored in. This would include issues such as shifting [positively] attitudes towards the mini-grid sector within national/district governments, improving access to finance, more stable and predictable planning in the energy sector, greater private sector participation within the sector, greater support for commercial mini-grid models, amongst others.

Table 6: Summary baseline indicators and expected results

	Indicator	Baseline	Expected results
Component 1	Accumulative installed capacity	56kWp	168 kWp (from mini-grids directly supported by project INV i.e. Lujeri). 216 kWp (all new MEGA MHPPs supported by the project plus the baseline
	Cumulative renewable electricity generation (kWh/year)	220,752 kWh/Year	851,472 kWh/Year
	Household energy expenditure savings among customer base (US$)	$65,969	$296,560/Year by 2018
Component 2	Cumulative installed renewable energy mini-grid capacity (kWp)	0	84 kWp greenfield minigrid(s)established
	Cumulative renewable electricity generation kWh	0	294,336 kWh/Year
	No. of new minigrid operators replicating MEGA model	0	2 MGs established using BOO model
	Household energy expenditure savings among customer base (US$)	0	$55,711/Year
Component 3	Number of districts where sub-national training and capacity building programmes on clean energy minigrids conducted	0	28 districts covered by clean energy mini-grid training programmes.
	Number of people trained on planning and implementing clean energy minigrids.	0	At least 300
	% share of women recipients of the capacity building	0	at least 30%
	No. of area-based electrification plans that include minigrids developed and adopted	Area based electrification plans do not consider electrification through mini-grids	5 area-based electrification plans that include clean energy mini-grids, prepared and adopted
	Number of websites in Malawi which stakeholders could use to plan and implement clean energy minigrids.	Websites don't provide much info	Information Clearing house on clean energy mini-grids with a GIS interface available to all stakeholders.
	Number of case studies and toolkits on Malawi on clean energy mini-grids	no real relevant toolkits of case studies in Malawi	mini-grids toolkit with case studies published and presented in a national workshop and available to all stakeholders.
	Extent to which policies/regs integrate GMGs	Policies/Regs do not consider GMGs	Recommendations put forth to government for the Rural Electrification Act, 2004 and Energy Regulation Act 2004 to be amended to include clauses promoting clean energy minigrids
	Number of local (gov. supported) financing mechanisms for clean-energy minigrids	REF not presently funding mini-grids	REF able to finance GMGs - through policy and Reg changes

2.6 Key stakeholders

- *Department of Environmental Affairs*: DEA was established in 1992 and is responsible for energy sector policy making; renewable energy and rural electrification. DEA sets targets for rural electrification and renewable energy and facilitates the achievement of targets through appropriate policy and incentives. The DEA also coordinates the Malawi Rural Electrification Programme (MAREP) and also guides the rural electrification and renewable energy

development plans of ESCOM, leveraging the 99% ownership of the company by the government.

- *Local Government* bodies at the sub-national level are also responsible for electrification of the local areas and villages in coordination with MAREP and DEA. In each of the districts, the District Executive Committee (DEC) headed by the District Commissioner (DC) are supposed to coordinate the electrification activities but in practice have a limited role. Below the district level, the Area Development Committee (ADC) headed by the traditional authority coordinates rural electrification and at village level the Village Development Committee (VDC) headed by the Group Village Headman (GVH) coordinates local village electrification.

- *MERA* is responsible for implementing the electricity regulatory framework and approves licences for generation, transmission and distribution of electricity. MERA also approves the electricity tariffs across the country based on tariff proposals by ESCOM. MERA also develops regulations to encourage private sector participation in the electricity sector and to facilitate deployment of renewable electricity

- *ESCOM* is Malawi's national electricity company which until fairly recently was a vertically integrated electricity utility company. Recent sector reforms has seen an unbundling of the sector with ESCOM now entrusted with a more limited mandate focusing on procurement, transmission and distribution of electricity[6]. Electricity generation is now the mandate of Electricity Generation Company Limited (EGENCO).

- *EGENCO*; is a company established with the mandate of generating electricity in Malawi. As a result of the unbundling of ESCOM, EGENCO was mandated with the responsibility of generating electricity while ESCOM's mandate was limited to procurement, transmission and distribution. The generation fleet includes a number of hydro-electric power stations as well as diesel powered peaking plants.

- *International development agencies, donors and local NGOs;* there are a number of key agencies involved in the energy sector including UNDP, World Bank, Japanese International Cooperation Agency (JICA), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Kreditanstalt fur Wiederaufbau (KfW), European Union Delegation (EUD), United Kingdom Department for International Development (DFID), United States Agency for International Development (USAID), the Government of Scotland as well as a number of NGO's including Practical Action (PA), United Purpose (UP), amongst others. While many of these organisations are involved in grid related activities there are a number, including the Government of Scotland, USAID, GIZ, PA and UP that are getting increasingly involved in off-grid activities such as SHSs, Improved Cookstoves (ICS) and, to a somewhat limited extent, mini-grids as well (Government of Scotland, GIZ and PA). The Mulanje Mountain Conservation Trust (MMCT) has established an electricity company (MEGA) and is a key local NGO active in environment and energy activities.

- *Education and Research Institutions* have also played a role in training and capacity building for clean energy and rural electrification and testing and quality control, as well as for research,

[6] http://www.escom.mw/about.php

advisory and consulting services to clean energy and electrification initiatives. Mzuzu University offers bachelor's degree programmes in renewable energy and the Malawi Polytechnic offers bachelor's degree in energy engineering and manages the Government of Scotland's Malawi Renewable Energy Acceleration Programme (M-REAP). The Malawi Industrial Research and Technology Development Centre (MIRTDC) has technology development and assessment capabilities in solar and hydro energy technologies.

- *Private sector and industry associations* have been incubated by a previous UNDP/GEF project on Barrier Removal to Renewable Energy in Malawi (BARREM) and several international initiatives around supporting improved cook stoves. The Renewable Energy Industry Association of Malawi (REIAMA) was originally established and supported by the UNDP/GEF BARREM project but has now morphed into CONREMA

- *Banking and Financial institutions* have not yet played any significant role in financing rural electrification through project financing, enterprise financing or end user financing. A Credit Guarantee Fund (CGF) was established by BARREM through National Bank (NB) managed by Malawi Environmental Endowment Trust (MEET) to serve as a risk management mechanisms for financing Solar Home System (SHS) lenders but is no longer operating.

3 Findings

3.1 Project Design / Formulation

3.1.1 Analysis of LFA/Results Framework (Project logic /strategy; Indicators)

The IACADES programme has a useful dual-focused design, integrating the practicalities of establishing mini-grids in Malawi with an accompanying focus on creating the necessary enabling framework to support and encourage existing and future mini-grids. This structure captures important backward and forward linkages in the process of establishing an active and sustainable mini-grid sector. Much is revealed through the process of establishing mini-grids from procurement right through to commissioning and operating systems. These valuable lessons learned through establishing mini-grids, the 'learning by doing', are able inform and guide the establishment of an effective enabling framework. In turn, an effective enabling framework will support existing and future mini-grids. The programme's components and associated activities and objectives are reassuring in this regard.

It is not the task of the evaluation to address the question of whether or not the focus on green mini-grids in Malawi is a practical and strategic choice as the argument for and the ratification of this position is contained in the Project Document. If there is a strategic question of this nature that should be asked, it has more to do with the specific approach and the associated assumptions supporting such approach as opposed to the validity of the question itself. There are a number of affirming studies on the potential role of green mini-grids in enhancing access to modern energy services in developing countries[7]. The evaluation is tasked with determining whether the approach

[7] See, for instance, IEA. 2014. *World Energy Outlook 2014*. Electricity Database. http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/. World

implemented within the IACADES programme is aligned with the socio-economic and political realities that characterise Malawi and, related, the likelihood of the programme succeeding.

This is a recurring theme within the evaluation and will be continuously addressed at the relevant stages of the review. Suffice it to say here, the Malawian off-grid sector in general and the mini-grid sector specifically are relatively under-developed. For instance, Kenya has at least four known private sector companies operating over 21 mini-grids[8], while Tanzania has already developed a 'third generation' Small Power Producer Framework[9] and boasts over 100 mini-grids. Rwanda is enjoying the dividends of the SOGER programme which is supporting over 30 pico-hydro mini-grids in the country[10]. These countries have a far more established mini-grid sectors when compared to Malawi's and this reality, a relatively immature and untested mini-grid sector, needs to inform the nature of programme's activities and interventions.

While collectively the programme components appear to address both the need to demonstrate sustainable business models and mini-grid technologies as well as expanding mini-grid activities through supportive frameworks, the sequencing of these activities is important. Component 1 was intended to provide the lessons, the template so to speak, for future mini-grid investments falling under Component 2. Component 1 represented the foundations while component 2 the expansion. But for Component 2 to build on Component 1, the former needed to be implemented once the lessons were learnt. This did not strictly appear to be the case with the Expression of Interest (EOI) associated with Component 2 being published mid-2016, less than a year after the first Annual Work Plan (AWP) was approved and at a time when supportive activities were still very much on-going at MEGA (as part of Component 1's activities). By the time the finalists were invited to submit full-length proposals[11] it was October 2016, and Component 1 was still being implemented[12]. In all fairness, as indicated by the Project Manager (PM), there simply was insufficient time to implement the Components in a more optimal fashion. This is arguably more question of programme design as opposed to implementation. While four years may appear sufficient, this will depend on the level of preparedness on the ground. These kinds of considerations should inform the design of any follow-on mini-grid programmes in Malawi.

Overall the results expectations appear achievable. There is a balance between working on existing infrastructure (MEGA) to produce more efficient and sustainable outcomes and then to leverage off

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Bank, 2014, From the Bottom Up: *How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa.* Bernard Tenenbaum, Chris Greacen, Tilak Siyambalapitiya, and James Knuckles

[8]Powerhive, Talek, PowerGen, and RVE.Sol.
https://openknowledge.worldbank.org/bitstream/handle/10986/29022/ESM-cKenyaMiniGridsCaseStudyConfEd-PUBLIC.pdf?sequence=1&isAllowed=y

[9] See, for instance, https://www.wri.org/news/2017/10/release-report-tanzania-mini-grid-sector-doubles-bold-policy-approach. The framework supports investment in mini-grids through light handed regulation such as multiple location mini-grids operating at a single location, additional clarity on grid arrival/resolutions, tariff considerations, amongst others.

[10] https://www.energy4impact.org/news/energy-4-impact-unveils-new-programme-scale-grid-energy-rwanda

[11] Practical Action and Community Energy Malawi,

[12] Personal communications with the Project Manager.

these lessons and insights in the procurement of additional 'greenfields' mini-grid capacity. These infrastructural investment activities are complemented by investments in softer issues with regard to institutional strengthening and capacity building. While the evaluation will assess the degree to which these results have been achieved, the task at this stage is to reflect on just how realistic these targets or results are. General comments include;

Component 1;

- With a baseline of 56kWp, the target was an overall installed capacity of 168kWp, an increase in capacity (or output) of 112kWp. Appears reasonable given MEGA's existing operations, commitment to the IACADES programme[13] and 4 year project timeframe to achieve these outcomes.

- Accumulative RE generation, target 851,472 kWh/year. At 70% operational efficiency a micro-hydro plant with 168kWp capacity can produce over 1 million kWhs/year[14]. Therefore the target was realistic going in (all things being equal).

- HH energy expenditure savings. The baseline savings were indicated as $65,96915 p.a. which would increase to $296,560 p.a. Average annual savings per household were estimated to be $65.61/year16. This suggest that there were already 1,000 customers ($65,969/$65.61 = 1005) receiving MEGA electricity and that this would increase to 4,500 customers by 2018. These figures are unrealistic. MEGA's customer base has only just reached the 1,000 mark. At the launch of the IACADES programme the customer base was estimated to be around the 200 mark.

Component 2;

- Additional greenfields mini-grid installed capacity of 84kWp. Given that Community Energy Malawi (CEM) were able to develop to the point of commissioning an 80kWp solar PV mini-grid, an overall target of 84kWp seems realistic

- 2 additional mini-grid operators; again, since the programme was able to successful support CEM there is no obvious reason that it could not do so for a second mini-grid operator

- Renewable energy produced; the target for the component was 294,336kWh/year. This target depends on the technologies supported. For instance, if the technology was solar PV then 84kWp would produce, at 100% efficiency, just over 150,000kWh/year. This is 50% below the target. In a more likely scenario of 50% of the installed capacity (42kWp) being solar PV and the remaining 50% micro-hydro then the potential output (100% efficiency) would be closer to 450,000kWp/year which would exceed these expectations. At a more likely 70% efficiency, the kWh output would be reduced to just over 300,000kWh/year which is in line with the results expectations.

[13] Personal communication with MEGA's General Manager
[14] 168kWp operating at 24hrs/day, 365 days/year will produce more than 1.4 million kWhs. At 70% operational capacity this output is reduced to slightly over 1 million kWhs. At 60% the output falls to 883,008 kWh.
[15] Figures gleaned from the Project Document
[16] Project Document, p40.

- Enhanced household energy savings; the target indicated an overall savings of $55,711/year. If the savings factor was consistent with the MEGA customer assumptions[17] then this target suggest that there will be 850 customers connected to the two green mini-grid systems supported under component 2. Given that MEGA took many years to achieve a customer base of over 1,000 (9 years) and that there would be considerable project time spent on setting up the greenfields mini-grids with only limited operational time towards the close of the project, the target of 850 customers by project close was not realistic.

Component 3;

- The less technical outputs when compared with the previous components suggest that, at least on paper, these results were realistic going into the project. Within the appropriate section, the evaluation will address the successes in this regard. As a preliminary observation, it is interesting to note that the training and support offered at district level was across the board as opposed to more in-depth and targeted. A more targeted or piloted approach, limited to a select number of districts, may have generated greater insights into the kind of training required which could then be re-packaged for the balance of the districts. On the whole, the outputs and results associated with Component 3 were achievable.

3.1.2 Assumptions and Risks

There were a number of risks identified in the Project Document. Ten in total.

Table 7: Risk assessment table

Risk	Impact (I) & Probability (P)[18]	Evaluation comment
Rainfall	Lower predicted water-flow I=5, P=2 Flash-flooding I=5, P=2	Probability considered too low. Droughts are common in Malawi[19] and may become more marked through the impact of climate change[20]. The programme's predominant focus on hydro mini-grids (MEGA and PA) does not address these issues although the success with the CEM solar PV mini-grid remains encouraging
Potential government	Was considered marginally likely	The evaluation did not observe or detect any unwarranted interference by government entities

[17] $65.61 saved per household per year.
[18] Measured on a scale of 1 – 6 with 6 the highest
[19] See, for instance, https://www.theguardian.com/world/2017/dec/08/malawi-blackouts-drought-hydro-power
[20] See, for instance, https://www.sciencedirect.com/science/article/pii/S0048969718344504

influence over mini-grid site selection under component 2.	I = 5; P = 3	or representatives. The RfP appears to be been managed in a transparent fashion.
Proposed policy and regulatory changes may be delayed	I = 4; P = 2	The evaluation noted that the relevant policies and regulations have been successfully amended to provide a more supportive framework to mini-grids in Malawi
MERA capacity constraints	I = 5; P = 3	MERA has drafted a new mini-grid framework which has eased licencing and application processes. Risk addressed
Insufficient interest in the RfP under Component 2.	I = 5; P = 3	Despite some technical issues associated with on-granting to the private sector, there were 13 applications in response to the RfP published under component 2. Risk addressed.
Risk around pervious government supported mini-grids particularly with regard to community sensitization and involvement	I = 3; P = 2	Risk remains. The proposed model that would replicate the management and operational structure of MEGA has not emerged. CEM is unsure of the ownership model moving forward[21] and PA's mini-grid has not even reached final design stage. There is still much to learn from CEM and the whole concept of 'community ownership'
MEGA facing operational challenges	I = 5; P = 2	Risk somewhat diminished. MEGA greatest challenge at this stage is two-fold; selling all its electricity[22] and engaging with MAREP over the arrival of the grid in certain areas of its operation. Operational challenges appear somewhat secondary at this stage.
Planned clean mini-grids may suffer from lack of capacity at district level.	I = 4; P = 3	Risk possibly understated. There are no energy officers at District Level and, related, no real off-grid planning capacity (and to some extent, authority). Risk remains.

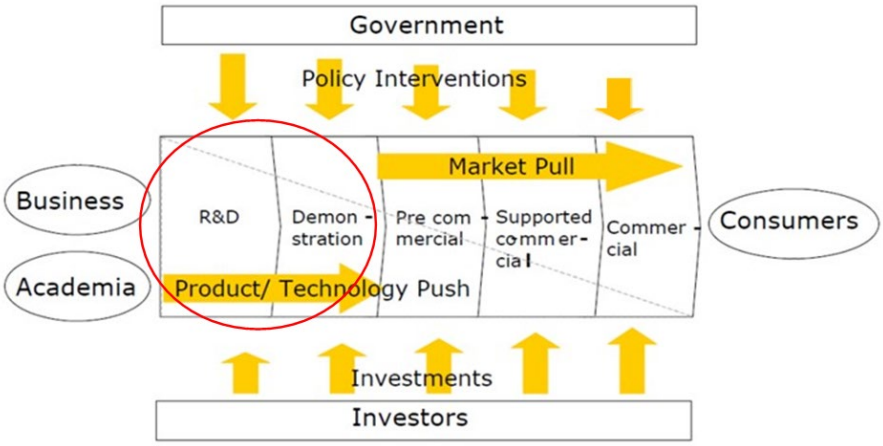
[21] Interview with CEM staff

[22] MEGA currently only operates BONDO 3 – a 100kWp plant – with its 2 x 60kWp plants not required due to low demand.

Localised environmental risks associated with the installation of micro-hydro	I = 3; P = 2	Environmental management plans (EMP) and Environmental Impact Assessments (EIAs) are implemented but some questions remain over the level of detail associated[23]
Commitment from MEGA and selected BOO operators to provide matching finance	I = 5; P = 2	Risk remain. While MEGA and CEM have been successful in attracting and investing additional finance[24] and PA was successful with an Energy Environment Partnership grant (EEP) none of these entities are committing their own funds which would represent an important step.

A number of other issues or potential risks which are not reflected in the Project Document but which remain relevant going forward include the following;

- Commercial expectations of green mini-grids. It need to be acknowledged that green mini-grids have not achieved the same commercial success as small-scale SHSs[25] and programme expectations need to be governed by these realities. Technologies take time to mature and do so at different rates. Programme expectations should be more squarely focused on the enabling framework, pilot projects and initiatives (such as targeted training) with increased research and public sector support as opposed to large scale mini-grid portfolio's, private sector investment and consumer 'pull'. An example of how technologies develop and where mini-grids in Malawi are positioned within this framework is indicated in Figure 1.



[23] A representative from the Mchinji District Council informed the evaluation that the EMP and EIAs are considered 'light weight' comprising for the most part a 'community check list'.
[24] The Government of Scotland being prominent in both cases.
[25] See, for instance, https://www.bloomberg.com/press-releases/2019-06-04/solar-pioneer-azuri-technologies-announces-26-million-equity-investment, https://www.lightingglobal.org/2018-global-off-grid-solar-market-trends-report/

Figure 1: How technologies mature

- Public sector support; on-going and unambiguous support for mini-grids is required from the public sector including the Department of Energy Affairs, ESCOM, MERA amongst others. While there are certainty positive signs including the government's commitment to supporting 50 green mini-grids by 2025[26], a mini-grid framework has been drafted, etc. there are other indications that the GoM is not completely convinced about the need for mini-grids. Such a position is made clear by comments such as 'Malawi is small so cannot have rigid on/off-grid divide'[27], 'are we supporting a social or business energy service model', the 'government does not like to subsidize the private sector', amongst others. The ambiguity or mixed messaging will not create the political certainty required to support green mini-grids going forward.

- The role of the private sector; the interest and involvement of the private sector has been the key catalyst in growing the off-grid sector across Sub-Saharan Africa over the past decade or so[28]. Green mini-grid programmes in Malawi need to make sure they attract and engage with the private sector from a long-term sustainability point of view. While community ownership models are interesting in terms of broader empowerment and the devolution of benefits, they are not without their challenges and where applied successfully, are generally in partnership with rather than to the exclusion of the private sector[29]. The fact that UNDP cannot on-grant to private sector organisations is somewhat exclusionary in this regard[30]. This challenge is addressed in more detail in subsequent sections of the evaluation.

3.1.3 Lessons from other relevant projects incorporated into project design

The Project Document does make reference to certain features of the mini-grid frameworks of other countries (for instance, Tanzania's licencing procedures[31]) and underlines the importance of 'best-practice' on a number of occasions. The Programme also supported a number of learning visits both locally[32] and regionally[33]. As suggested, the overall project design, which integrates both technical demonstrations as well as supporting broader enabling conditions, is aligned with best-practice in terms of growing the sector.

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[26] Personal communication with the Director at DEA.
[27] All these comments were made by senior government representatives during the course of the evaluation.
[28] See, for instance, https://www.lightingglobal.org/wp-content/uploads/2018/02/2018_Off_Grid_Solar_Market_Trends_Report_Summary.pdf
[29] For instance the community trusts associated with South Africa's Independent Power Producer programme generally own around 5% of the shares https://citizen.co.za/news/south-africa/2089839/renewable-energy-benefits-are-many-and-is-here-to-stay-radebe/. The Rwandan model under the SOGER programme sees communities owning between 20 – 45% of the mini-grid business shareholding https://www.energy4impact.org/news/energy-4-impact-pioneers-innovative-model-mini-grid-development-and-ownership-rwanda with the balance owned by the plant operators.
[30] UNDP can only on-grant to civil society and non-governmental organizations, including academic or educational institutions that are not state-owned or for-profit. https://popp.undp.org/UNDP_POPP_DOCUMENT_LIBRARY/Public/PPM_Design_Select%20Responsible%20Party%20and%20Grantees.docx
[31] Project Document p49
[32] Including a field trip to MEGA as well as other mini-grid operations in the north of the country.
[33] Included a field visit to Tanzania.

However, lessons from mini-grid initiatives within the region should have been more explicitly integrated into the project design. For instance;

- Ownership models; Tanzania has over 90 isolated mini-grid with approximately 50% of these being hydro powered with the balance a mix of biomass and solar PV[34]. The programme should have reviewed the various ownership models (including public, private, community and faith-based ownership models) at work and integrated these expectations – working closely with interested and successful project developers – into the programme.

- Regulatory frameworks; staying with Tanzania, they have just published the 3rd generation mini-grid regulatory framework[35]. Being the regional leaders in terms of suitable regulations and policies, these frameworks should provide the template for MERA's mini-grid framework.

- Access to finance; at this stage of the mini-grid market development, greater donor funding will be required to finance the initial mini-grids. There are a number of references to 'local banks and financing institutions' in the Project Document[36] which is very unlikely at this stage[37]. Instead, this and future mini-grid programmes need to mature the technology which will, as suggested, require grant and/or highly concessional finance. Seeking full commercial financial solutions at this stage is premature. As indicated in Figure 1, finance in the early stages of a technologies maturing will not come from private investors.

3.1.4 Planned stakeholder participation

There are a number of activities and instruments that draw on the broader energy stakeholder sector. These include the Programme Steering Committee as well as the Technical Evaluation Committee. Project Management members also participate in the 'Donor Working Group on Energy'[38].

Based on quite extensive consultations, it is clear that the IACADES programme is very familiar to most organisation within the energy sector.

One observation is that the GoM is very heavily represented on the Steering Committee. For instance, the February 2017 Progress Report includes mostly UNDP and DEA officials with only one non-public sector representative in attendance[39]. Going forward, it is important to include more representatives from NGOs and the private sector.

[34] https://www.wri.org/publication/tanzania-mini-grids
[35] https://www.wri.org/news/2017/10/release-report-tanzania-mini-grid-sector-doubles-bold-policy-approach
[36] See, for instance, Project Document p15.
[37] This position was confirmed during interviews with the Bankers Association of Malawi.
[38] This working group includes organisations such as UNDP, WB, KfW, Embassy of Ireland, USAID, amongst others.
[39] A representative from Renewable Energy Industry Association of Malawi (REIAMA).

3.1.5 Replication approach

A key question to be considered here is to what extent the IACADES programme, based on its successful implementation, would be sufficient to ensure subsequent replication or multiplying of green mini-grids in Malawi. While the programme does address foundational and enabling issues, the immature state of the market and lack of traction around these activities would limit natural or spontaneous market growth. For instance, the need for grant and/or programme financing would remain as mini-grids are not yet commercially viable. The approval of and adherence to an electrification masterplan still needs to be demonstrated. Knowledge, planning and support functions at District Council level would still require additional support.

While the IACADES programme has demonstrated considerable success, a discussion that is further unpacked during the results component of the evaluation, the sector is still very much at the introductory or pilot stage and requires additional programmatic support to transition to mature or growth market stages. The prospects of a follow-on mini-grid programme have been raised[40] and should be pursued in earnest to ensure the achievements of the IACADES programme, the green shoots, are further nurtured into a sustainable and successful mini-grid sector.

3.1.6 UNDP comparative advantage

UNDP Malawi has a comparative advantage in the socio-economic sector in Malawi, its widely acknowledged leadership amongst donor organisations on matters socio-economic was attested to by most stakeholders. While a mini-grid project with strong infrastructural components may carry a footprint beyond the 'socio-economic', this sector leadership is nevertheless important. UNDP has a distinctly people-centred approach, very often looking at issues and solutions in a bottom-up fashion. Understanding the service needs, ability to pay, investigating more community centred business models, working with local government, providing training, these are all important grass-roots activities that will contribute to a sustainable mini-grid programme. Complementing these community centred capacities is the UNDP's relationship with the GoM and its various ministries as well as its partnerships with other donor organisations, civil society and the private sector. The twin portfolios of *Responsive Institutions and Citizen Engagement* as well as *Resilience and Sustainable Growth* means that the organisation is engaged with the range of important cross-sectoral issues from civic engagement to job creation to supporting renewable energy which underlines the organisation's comparative advantage.

3.1.7 Linkages between project and other interventions within the sector

The IACADES programme has been closely linked with the Sustainable Energy Malawi (SEM) programme[41] at the outset with a number of joint Steering Committee meetings being held. Other linkages include a possible partnership with UNICEF on a 'Power and Health' Masterplan[42] which

[40] This possibility was raised at the Inception Meeting of the evaluation.
[41] The Sustainable Energy Management Program (2013-2016) aimed at facilitating a process of change from unsustainable use of biomass for energy to a sustainable use thereof, and from lack of modern energy sources for productive end-uses and clean household utilization to a situation with access to modern energy.
[42] Personal communications with UNICEF solar engineer.

would exploit the energy requirements for vaccine refrigeration to promote renewable energy interventions at public health facilities.

A slightly more critical observation is the primacy of household energy requirements that appears to drive the mini-grid programme. While universal access to energy remains a laudable goal of the UN/SE4All initiative and speaks to Malawi's own policy commitments[43] greater emphasis needs to be placed on commercial opportunities which will diversify revenue streams for mini-grids while at the same time promoting SMME opportunities. To be sure, there are a number of indications that productive use was promoted – particularly with regard to the Practical Action proposed business plan which include a strong emphasis on supplying tea-growing estates as well as SMMEs – however the overall impetus remains centred on households. Stronger linkages with more commercially orientated initiatives[44], and possible opportunity mapping or planning to that end, will open up possible linkages and opportunities with other sectors and initiatives that have the potential to add rigor and sustainability to the overall mini-grid strategy.

3.1.8 Management arrangements

The IACADES programme is implemented under the National Implementation Modality (NIM). The Implementing Partner is the Ministry of Natural Resources, Energy and Mining – Department of Energy Affairs (DEA). The Responsible Parties include the DEA and MEGA. The recruitment of consultants and other contractual arrangements, such as procurement of goods and services of significant value, were provided by UNDP.

The Programme Manager (PM) is employed by UNDP but seconded to the DEA. The PM has considerable experience in the Malawian energy sector having been Practical Action's Country co-coordinator in Malawi prior to his appointment. He has worked in the energy sector since 2007.

The project was supported by a Steering Committee (SC) that met bi-annually to review implementation progress, endorse work plans, provide guidance and assist in the resolution of any issues experienced during implementation. See Table 8 for details of SC composition

Table 8: Composition of the Steering Committee

NO.	NAME	ORGANISATION	DESIGNATION
1	Patrick Matanda	MoNREM	PS
2	Chimwemwe Gloria Banda	MoNREM	Chief Director
3	Mr. Joseph Kalowekamo	DoE	Project Coordinator

[43] For instance, the Third Malawian Growth and Development Strategy (MGDSIII), The National Energy Policy (2018) and The Malawian Renewable Energy Strategy (2017)

[44] For instance, Coffee, Tea, Dairy Sectors, larger scale millers, etc. The point being made is that if household access is the defining focus and not an attendant opportunity then the overall strategy is invariably social rather than commercial and presents the kinds of sustainability issues that one would expect.

4	Ms. Claire Medina	UNDP	DRR-Co- Chair
5	Ms. Etta, R. M`mangisa	UNDP	Project Analyst
6	Mr. Diliza Nyasulu	REIAMA	
7	Mr. Emmanuel Mjimapemba	UNDP	Project Manager
8	Mr. Thokozani Malunga	DoE	PEO
9	Mr. Frank Mphulupulu	MERA	
10	Vitumbiko Ndovie	UNDP	Accountant
11	Charles Mazinga	Min of Gender	Director of Administration
13	Moses Zuze	MoLRGD	Principal Economist
14	Samson Phiri	LUANAR	
15	Andrew Spezowka	UNDP	Portfolio Manager
16	Sithembile Tembo	UNDP	MREPG Coordinator
17	Mr. Goodluck Chaphulika	Treasury	Budget Officer
18	Prof.G.K. Kululanga	Polytechnic	Principal
19	Ms. Elsie Salima	EP & D	Chief Economist

3.2 Project Implementation

Based on the project documentation provided and stakeholder interviews undertaken, the success and effectiveness of the project's implementation was assessed along a number of criteria which are detailed in the sections that follow.

3.2.1 Adaptive management

It is to be expected that certain requirements and activities included in the Project Document will not be able to be implemented as planned. The programme's management team must demonstrate the necessary flexibility or 'adaptive management' to ensure that these challenges are addressed and the programme's outcomes are achieved even if the strategies to do so are adapted. There is encouraging evidence that the management team displayed sufficient adaptive management with key examples including;

- MEGA determined based on a feasibility study that the proposed hydro-generation site on the Lujeri River would not be feasible given the lower than anticipated water flows[45]. Instead, the generation site was shifted to Lichenya River (where MEGA's current hydro-generation plants are located) which demonstrated more suitable and reliable water flows. The management of this challenge indicates a level of adaptive management.

- A second somewhat lighter example was the reworking of mutual expectations amongst the project management team. Expectations on how the programme should be implemented were initially considered somewhat prescriptive and inflexible by certain members of the management team. These issues were addressed early on in the programme's implementation which resulted in 'more join planning and flexible and realistic target setting'[46].

On the whole the management team demonstrated sufficient insight and understanding to ensure the programme progressed from a management point of view. If a counter point is to be made it would concern the fact that Practical Action's (PA) under-performance was not called out at an earlier stage. PA was invited to submit a full proposal in response to their successful Expression of Interest (EOI) in October 2016[47] and at the time of the review (October 2019), they had not been able to successfully submit the official design. It is uncertain whether the programme will benefit from PA's designs or possible future installations and yet the programme has invested over $200,000 in Technical Assistance[48]. This is a learning process and the temptation to give PA 'more time' to assist with achieving the programme objectives was obviously very powerful[49].

While it is difficult to pinpoint exactly why PA failed to deliver as expected, given the number of factors and explanations presented, it is nevertheless important to unpack the circumstances under-which this *under-performance* took place. To start, the temptation to provide PA with a little more leeway and flexibility may have come about based on their previous involvement in Malawi's off-grid sector and their experience with mini-grids[50]. Of the two selected project implementers, only PA had previous experience with mini-grids as the extent of CEM's involvement in off-grid energy was limited to 'solar kiosks'[51]. This is a demonstration project, the success of which will be measured, in no small part, based on the number and size of operational mini-grids. Project management would have, to some extent, 'banked' on the success of PA which unfortunately did not materialise within the project's timeframe.

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[45] MEGA Annual Progress Report 2017.
[46] Interviews with unnamed senior programme representative
[47] Interview with the Programme Manager.
[48] As above.
[49] It should be noted that PA intended project was a 300kWp micro-hydro plant which would have single handed surpassed the Component 2 results expectation in terms of new installed capacity and renewable energy produced (in the long-run).
[50] The importance of the involvement of Practical Action in the project context was underlined in the Project Document where it was noted that 'One of the key international NGOs have been Practical Action (PA) which is supporting mini-grid based electrification in Malawi through hydro and solar energy' (p16). PA also has regional experience with mini-grids including countries such as Mozambique and Zimbabwe https://mediamanager.sei.org/documents/Publications/SEI-DB-2016-SADC-mini-grids.pdf
[51] Personal communication with CEM representatives.

The number of delays PA experienced were also critical. The initial site selection clashed with a proposed 150MW hydro-plant which meant time was lost. Additional time (4 months) was spent identifying an alternative site and proposing/sizing a technical solution. The new proposal was for a 150kWp installation which was accepted by the TAC. While waiting for the feasibility study and Bill of Quantities (BoQs), PA then indicated to project management that the 150kWp proposal 'was just a draft' and an up-scaled 300kWp installation at the same site was proposed in its place[52]. The feasibility study and BoQs for the proposed 300kWp was not produced at the time of the Terminal Evaluation. The delays, as suggested, were obviously critical. However, funding became an increasingly challenging issue as well. As the size of the proposed installation increased so too did the costs. While PA was able to secure funding commitments from the EEP programme, this was conditional on co-funding and was only available on an outcomes basis, to refund costs of money spent or investments made. Additional resources were earmarked from the UNDP's Target for Resource Assignment from the Core (TRAC) system to address the funding gap but these were later reassigned to other projects as PA's ability to fulfil the conditions of TRAC funding fell short.

In addition to the planning based delays[53], it would appear that PA attempted to circumvent the financial sustainability challenges of a small mini-grid by constantly increasing the size (100kWp, 150kWp, 300kWp) and developing a complex set of future customer relations that would underpin the revenue streams. This included the 'ABC' model[54]. While sustainable mini-grids is a vision shared by the IACADES programme, it is also a process that needs to develop over time. As noted, technologies mature over time and require different supportive frameworks and levels of experience as they progress from technology demonstration initiatives to fully sustainable and bankable investments. While PA's challenges certainly involved a number of factors, at the forefront of these was [project] management's over-reliance on PA's contribution to the project which resulted in a certain latitude in expectations as well as PA's inability to effectively manage the increasingly complex demands of larger installations including funding requirements, design and planning issues. The solution, in addition to the lessons clearly learnt, is to establish stricter monitoring and performance regimes and ensuring the technical and other forms of assistance are conditional and linked to tangible project development Key Performance Indices (KPIs)[55].

3.2.2 Partnership arrangements

As suggested, the IACADES programme has been well networked within the energy and broader sectors. The project development process included extensive engagements with stakeholders and the current management framework includes a Steering Committee which includes representatives from various government ministries, the national regulator, Universities as well as the Renewable Energy Industry Association. Preliminary discussions between UNDP and UNICEF have been undertaken around co-operation on a 'Power and Health Masterplan'. The UNDP participates in the

[52] Personal communications with Project Manager.
[53] The fact that PA (and by extension project management), were not aware that DEA/MAREP/ESCOM had power generation plans for the area speaks to the lapses in planning and/or consultations.
[54] The ABC model stands for 'Anchor consumers, Businesses and Communities', personal communications with PA representatives.
[55] Concerns about Practical Action were raised in the MTR

'Donor Working Group on Energy[56]' which includes a range of development and donor organisations. Unfortunately, the DEA does not play a prominent role in this informal working group[57]. The programme is certainly well networked in the country but may benefit from closer strategic engagements with other regional mini-grid centred programmes. UNDP Lesotho has a mini-grid programme[58] entitled Development of Cornerstone Public Policies and Institutional Capacities to accelerate Sustainable Energy for All (SE4ALL) while Energy 4 Impact is implementing an interesting mini-grid programme in Rwanda[59]. Engagements or 'partnering' opportunities should be explored.

3.2.3 Feedback from M&E activities used for adaptive management

The various reports including Quarterly Progress Reports, Annual Reports, PIRs, Annual Work Plans, etc. are all used as feedback platforms for M&E purposes. It is based on these on-going evaluations and communications that the incidents of adaptive management were implemented.

3.2.4 Project Finance

As per the signed IEA ProDoc, the total resources required for the project was estimated at 24,510,000 US$ whose breakdown per source are shown in Table 9. The resources from donor community like World Bank, and other donors were not necessarily committed to the project but it was an indication of the funds allocation set aside for renewable energy projects.

Table 9: Breakdown of the estimated resources for the project

Source	Total Estimate (US$)
GEF	1,725,000
UNDP TRAC	1,845,000
World Bank	11,000,000
Practical Action	4,050,000
MEGA	1,700,000
Scottish Government	1,110,000
Malawi Government	1,290,000
Other Donors	1,790,000

GEF Financing

A review of project budget found in the ProDoc and the UNDP financial reports (CDRs and Audit reports), yielded results shown in 10 that compares planned and actual expended GEF funds per the five(5) project outcomes. Overall, the disbursement of GEF funds has been satisfactory. However, we find an over expenditure of 45% in the project management to be high. This is attributed to covering of costs that were not budgeted under project management for example subsistence allowance and transportation equipment. However, financial delivery efficiency of component 3 is nearly 100%, an

[56] This was initiated by USAID.
[57] A JICA position paper (published April 2019) noted that the working group 'had yet to meet the government' https://www.jica.go.jp/malawi/english/activities/c8h0vm00004bpzlh-att/energy.pdf
[58] https://www.ls.undp.org/content/lesotho/en/home/projects/Sustainable-Energy-for-All.html
[59] https://www.energy4impact.org/news/energy-4-impact-unveils-new-programme-scale-grid-energy-rwanda

indication that GEF funds were used efficiently in that area. The low delivery efficiency in component 2 can be attributed to the delays in project execution by Practical Action.

Table 10: GEF Co-financing

Outcome	Approved Amount (in ProDoc) US$	Expenditure by Nov. 2019 US$	Variance US$	Efficiency
Component 1: Expansion of the Mulanje Electricity Generation Agency (MEGA) Micro Hydro Power Plant	500000	425427.68	74572.32	85%
Component 2: Replication of MEGA model via piloting of new Mini-grid schemes in other areas of Malawi	463000	346533.27	116466.73	75%
Component 3: Institutional Strengthening and Capacity Building for promotion of decentralised mini-grid applications across the country	535000	544375.99	(9375.99)	102%
Monitoring, Evaluation, Learning, and Adaptive Feedback	87000	70000.75	16999.25	80%
Project Management	140000	202387.1	(62387.1)	145%
Total	1725000	1588724.79	136275.21	92%

Co-Financing

The GEF funds were not enough for full implementation of the mini-grids and hence co-financing from other sources was evident. UNDP, through its TRAC funds, co-financed the expansion of MEGA and the upscaling of Solar PV mini grid at Sitolo Village in Mchinji from an initial proposed capacity of 42kW to 80kw as well as being proposed as a funding source for the upscaling of Practical Action hydro-power plant in Usingini from 150kW to 300kW. Additionally, the Malawi government co-financed all three components in-kind and purportedly supported transmission, distribution and connecting materials at Sitolo Solar PV mini grid while committed to co-finance the transmission, distribution and house connection materials at the Usingini mini-grid. From the interviews with Operating Partners, it was found that Practical Action has secured a grant of 500,000 Euros (551,195 US$) from EEP, while Community Energy Malawi secured aid from Scottish Government of 100,000 British Pounds (128,320 US$) for softer issues.

Table 11 provides a summary of the planned versus actual disbursements by November 2019 from UNDP TRAC funds, Malawi Government, and partner agency. From the UNDP committed funds, 87.6% has been disbursed, and this is satisfactory from the evaluators' point of view. It should be noted however that TRAC funds were only available from 2018 and to larger extent were used as extra funding for procurement of power generation facility at Sitolo owing the increase in capacity from an initial 42kw to 80kw. The evaluators have regarded the in-kind funding from government as 100% achieved because the in-kind provisions e.g. working space, staff etc. were present during the execution of the project. On the other hand, the government's co-financing on policy/regulation amendments, transmission, distribution as well as connection costs at the new mini-grid sites have not been quantified. Besides, the actual funds disbursed by partner agency is not exhaustive because the evaluators did not manage to get all information of actual funds dispersed co-financiers. However, suffice to say that there is great potential for other partners to co-finance mini-grids in Malawi.

Table 11: Co-finance

Co-financing Type/Source	UNDP own financing (US$)		Government (US$)		Partner Agency (US$)		Total (US$)	
	Planned	Actual by (Nov 2019)	Planned	Actual by (Nov 2019)	Planned	Actual by (Nov 2019)	Planned	Actual by (Nov 2019)
Grants						679,515		679,515
Loans/Concessions								0
In-kind support			1,290,000	1,290,000				1,290,000
Other	1,845,000	1,617,074			19,650,000		21,495,000	1,617,074
Totals	1,845,000	1,617,074	1,290,000	1,290,000	19,650,000	679,515	21,495,000	3,586,589

3.2.5 Monitoring and evaluation: design at entry and implementation

The Project Document outlined a monitoring and evaluation framework in line with the UNDP/GEF M&E policies and procedures. The Project Management team were required to produce two deliverables[60];

- A project monitoring plan: the project manager will prepare a monitoring plan which will consist of output indicators and process indicators. The output indicators will include both UNDAF/CPD indicators and non-UNDAF/CPD indicators.
- Quarterly progress and results report: this report will contain data/information on the quarterly results achieved on the UNDAF/CPD and non-UNDAF/CPD outputs. The report will also contain quantitative and qualitative information on situational analysis, process, financial management, risks and mitigation and partnerships.

Evaluation; Quarterly reports were developed and distributed amongst key project stakeholders (as well as the Project Steering Committee) and reflected the components' progress and underlying data.

[60] Project Document p68

A detailed results framework was developed as required by the project document and the Quarterly Progress Reports (as well as the AWP) have been detailing the progress towards these results. There are however, areas where the M&E framework might require a more nuanced approach. When, for instance, measuring achievement against results such as 'household energy expenditure savings' which is a key result in both Component 1 & 2, more detailed baseline information is required. What are households currently spending on candles, kerosene, and cellular phone charging and to what extent (possibly entirely) has access to electricity displaced these household energy expenses? Not only is this important in terms of providing a baseline and measuring progressive savings, which is a key programme outcome, but it may also provide insights into how households make the transition to electricity. How households respond to the opportunity to connect to these mini-grids provides critical feedback on future demand, forming part of the system sizing considerations, as well as contributing to overall market intelligence. So, while the M&E programme has delivered critical information of the Meta results, the more subtle issues, such as household energy savings[61], may have been somewhat discounted by the M&E framework.

Based on the above evaluation, the evaluators rate the Monitoring and Evaluation Design at entry and implementation as Satisfactory (S).

3.2.6 UNDP and Implementing Partner implementation / execution coordination, and operational issues

Overall the Programme Management with DEA as IP and UNDP in a facilitating capacity appears to be working. There has been a level of adaptive management as mentioned and the management processes and instruments are being implemented effectively[62]. The Project Implementation Review (PIR) documents[63] have generally attributed a 'satisfactory' rating to the progress towards the Development Objectives (DO) and Implementation Plan (IP) while there have been some 'moderately satisfactory' ratings (2018) the most recent ratings (2019) were 'Highly Satisfactory' in the case of the IP and 'Satisfactory' in the case of the DO. While the programme has been extended for a year, this is not uncommon for UNDP/GEF programmes, and for the most part the additional time has ensured enhanced outcomes[64]. Feedback from project stakeholders including MEGA, CEM and PA has been on the whole very positive with regard to the programme's management and implementation.

Where concerned stakeholders have raised issues they reflect concerns about the broader environment, including the DEA and by extension the GoM commitment[65] to promoting mini-grids, the sustainability of mini-grids (costs versus revenue) and, related, the more narrow focus on

[61] While MEGA has some insights into energy use in un-electrified households the data is incomplete (only includes lighting) and does not include understanding how households progressively utilise electricity over time. CEM has little or no information of pre and post household electrification energy use patterns. Personal communication.
[62] Quarterly Progress Reports,
[63] The PIRs for 2016, 2017, 2018 and 2019 were reviewed.
[64] Motivations for the extension include CEM and PA's delays in developing and implementing their respective mini-grid developments.
[65] For instance, providing consistent support to the implementation of an Electrification Masterplan and promoting the involvement of the private sector in energy service delivery.

households as opposed to a more diversified market including SMEs, agro-processing businesses and public sector services. Concerns were also expressed about the capacity of District Councils to play a lead role in local level electrification planning[66]. These concerns have less to do with overall capacity to implement and execute the programme as they do the inherent complexities of off-grid rural electrification in developing countries. These are challenges the IACADES programme and partners are required to address and the evaluators' view is that the management team have made important strides in this regard.

The evaluators rating for the implementation and execution of the IACADES programme as **Satisfactory (S)**.

3.3 Project Results

3.3.1 Overall results (attainment of objectives) Satisfactory

Table 12: Component 1 Results Framework

	Indicator	Baseline	Targets	Achievement
Outcome 1. Increasing the installed capacity of the Mulanje Electricity Generation Agency's (MEGA) MHPP scheme	Accumulative installed capacity	56kWp	168 kWp (from mini-grids directly supported by project) 216 kWp (all new MEGA MHPPs supported by the project plus the baseline	Programme supported the increase from 56kWp to 65kWp (Bondo 1), the refurbishment of Bondo 2 (60kWp[67]) and supported the development of Bondo 3 (100kWp) = 169kWp MEGA's installed capacity is 65kWp + 60kWp + 100kWp = 220kWp including baseline.
	Cumulative renewable electricity generation (kWh/year)	220,752 kWh/Year	851,472 kWh/Year	Only Bondo 3 (100kWp) is required to meet current demand. A 100kWp micro-hydro plant operating at 50% capacity factor would produce 438,000kWh/year[68]

[66] These sentiments were expressed by various influential and active energy sector stakeholders who shall remain anonymous.
[67] Bondo 2 was damaged by floods and is now operational
[68] See, for instance, https://www.renewablesfirst.co.uk/hydropower/hydropower-learning-centre/how-much-energy-could-i-generate-from-a-hydro-turbine/

				All three generators combined (220kWp) have the potential to produce 963,000 kWh/year[69]
Outcome 1.2 Achieving MEGA's business plan target of increasing the aggregate household energy savings among the customer base	Household energy expenditure savings among customer base (US$)	$65,969	$296,560/Year by 2018	MEGA has 1,000 customers[70] which are assumed to save $65.6/year[71]. This results in an annual saving of $65,600 in 2019[72]

Component 1 has achieved the installed capacity of renewable energy generation (220kWp including baseline) but has fallen significantly short in terms of demand. MEGA has achieved a customer connection total of 1,000 which represents a demand that can be met by operating only 100kWp of installed capacity. There Project Document as well as the assumption behind the numbers both in terms of renewable energy produced and accumulative household savings had assumed that MEGA would have over 4,500 customers at this stage[73]. This means that only 50% of the annual generation of renewable energy was achieved and only slightly more than 20% of the projected household energy expenditure savings. The reason that MEGA has not achieved the anticipated demand (which has resulted in a significantly lower than anticipated annual generation of renewable energy) is because the rate of customer connections assumed within the Project Document and Results framework was not aligned with the growth rate experienced by MEGA prior to the IACADES programme. While customer connections have increased somewhat exponentially[74], the rate of change, i.e. the increase in customers over time, has not aligned with project expectations. Other factors to consider would be the intensity of household energy use over time (i.e. how much electricity do households consume and to what extent this intensifies over time).

While the generation and consumption figures are noticeably below expectation, the important thing is that the capacity to meet these expectations is there from a generation point of view. The engineering, design and construction, and obviously the finance required to underwrite this, has been achieved. It is now a question of market penetration. MEGA's rate of customer growth has

[69] Capacity factor of 0.5 applied – as above.
[70] Personal communications with MEGA General Manager
[71] Project Document p34
[72] The PIR 2019 reported a savings in the region of $568,000 based on '608 directly connected households and over 4,000 households indirectly benefiting…'. We cannot include indirect benefits as the indicator for this output is 'customer base' not broader community.
[73] Project Document p35
[74] Personal communication with MEGA General Manager.

been increasing 'exponentially'[75], the positive momentum of which should be taken into account. This is effectively a socio-economic issue which forms an important 'soft-component' to the programme. There are research responsibilities (M&E) such as monitoring the rate of up-take, the profile of early users or pioneers, the potentially inhibiting impact of upfront costs such as deposits and wiring, the increase in consumption over time and the overall settlement time or transition period that defines the staggered shift to wholesale electrification. These are critical socio-economic factors which the project and its stakeholders such as MEGA and CEM need to better understand and which can be built into system sizing and design and expectations around rate of uptake.

[75] Personal communication with MEGA General Manager.

Table 13: Component 2 Results Framework

	Indicator	Baseline	Targets	Achievements
Outcome 2.1 Investment in Installed capacity of mini-grid schemes established, replicating the MEGA model and using a Build-Own- Operate (BOO) Public Private Partnership model	Cumulative installed renewable energy mini-grid capacity (kWp)	0	84 kWp greenfield minigrid(s) established	80kWp of greenfield mini-grid (CEM) has been achieved
	Cumulative renewable electricity generation kWh	0	294,336 kWh/Year	80kWp solar PV array will generate 135,000kWh/year [76] at full operation. Current demand is around 12% which translates to 16,250kWp.
	No. of new minigrid operators replicating MEGA model	0	2 MGs established using BOO model	Only 1 operator exists and there is uncertainty about commitment to BOO model[77]
Outcome 2.2: Increased the aggregate household energy savings among the customer base	Household energy expenditure savings among customer base (US$)	0	$55,711/Year	CEM has connected approx. 150 households. This will result in the saving of $9,840/year

As in the assessment of the progress made under Component 1, Component 2 has all but achieved the installed capacity expectation of the Greenfield RET mini-grids but falls short on the quantum of renewable energy produced as well as the household energy expenditure savings. 80,4kWp is the

[76] Input assumptions includes Malawi daily mean solar global radiation of 5.86kWh/m2/day http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1021-447X2015000200003 and an efficiency factor of 80% https://medium.com/the-mission/what-size-of-a-solar-system-do-you-need-and-how-to-pay-or-it-e59b70917502

[77] The suitability of the BOO model is discussed in greater detail under the sustainability sections that follow.

installed capacity of the CEM solar PV mini-grid at Sitolo village in Mchinji district which means the outcome is just 3,4kWp off target. The amount of renewable electricity produced was considerably below the target (46% of the target can be reached operating the system at full capacity but only 12% of target is currently being achieved) while household energy savings only achieved around 18% of the results frame target. To some extent, a similar observation made with regard to future potential in the case of Component 1 is equally valid for Component 2. Demand will increase over time and the amount of renewable energy produced and household energy savings accrued will increase with it. However, unlike Component 1, there is inadequate latent capacity in the existing solar PV system (80kWp) to ever produce the required renewable electricity. The target is close to 300,000kWh/year while the CEM system will, at full operation, produced less than half of the targeted amount[78].

The challenge the programme faces with Component 2 is that the second mini-grid operator (Practical Action) did not develop the proposed hydro-powered mini-grid as planned and will not before the end of the programme[79]. This is a performance issue and does not necessarily reflect the level of interest in developing mini-grids[80] and/or the future potential to achieve these targets. However, this is where Component 2 finds itself with few or no short term remedial options[81]. What is more important is that lessons are learnt and that they are carried over into subsequent green mini-grid initiatives in Malawi.

Table 14: Component 3 Results Framework

	Indicator	Baseline	Targets	Evaluation
Outcome 3.1: Increased capacity of key stakeholders, especially at the sub-national levels to effectively plan and implement clean energy mini-grids	Number of districts where sub-national training and capacity building programmes on clean energy mini-grids conducted	0	28 districts covered by clean energy mini-grid training programmes.	28 Districts covered by training[82]
	Number of people trained on planning and implementing clean energy mini-grids.	0	At least 300	Over 400[83] people have been trained
	% share of women recipients of the capacity building	0	at least 30%	96 or 25% of the people trained were women[84].

[78] The targeted kWhs/year produced required under Component 2 would always require a contribution from hydro-power as 84kWp of solar PV alone would not be capable of producing this output.
[79] This was the general sentiment amongst programme management based on interviews.
[80] Testimony to this is the fact that the Request for Proposals received 13 EOIs – personal communication with the Programme Manager.
[81] That does not discount the importance of ensuring PA produces the plants designs and business plans which can be used to inform current and future mini-grid designs and represent important intellectual property of the programme.
[82] Information gleaned from PIR 2019 as well as various training reports produced. It should be noted that the training summary (February 2018) only indicated that 128 people had been trained. However, the Fortuner Training Report was not included in the summary which involved a further 65 people trained. The other training reports did not inclusively indicate a figure of 400+. However, the TE will assume the figures approved in the PIR 2019 are correct.
[83] As above.

	No. of area-based electrification plans that include mini-grids developed and adopted	Area based electrification plans do not consider electrification through mini-grids	5 area-based electrification plans that include clean energy mini-grids, prepared and adopted	There is no evidence available to confirm that 5 such plans have been prepared and adopted.
Outcome 3.2 Increased awareness about relevant business models, policy/ regulatory issues, and financing of mini-grids in the Malawian context	Number of websites in Malawi which stakeholders could use to plan and implement clean energy mini-grids.	Websites don't provide much info	Information Clearing house on clean energy mini-grids with a GIS interface available to all stakeholders.	An information Clearing House has been established although this was not live during the evaluation[85].
	Number of case studies and toolkits on Malawi on clean energy mini-grids	no real relevant toolkits of case studies in Malawi	mini-grid toolkit with case studies published and presented in a national workshop and available to all stakeholders.	The website (as above) includes case-studies but the website is not live[86].
Outcome 3.3 Improved policy and regulatory environment to facilitate the sustainable development of mini-grids in Malawi	Extent to which policies/regs integrate GMGs	Policies/Regs do not consider GMGs	Recommendations put forth to government for the Rural Electrification Act, 2004 and Energy Regulation Act 2004 to be amended to include clauses promoting clean energy mini-grids	The National Energy Policy (2018) and the Malawi Renewable Energy Strategy (2017)[87]
	Number of local (government supported) financing mechanisms for clean-energy mini-grids	REF not presently funding mini-grids	REF able to finance GMGs - through policy and Reg changes	National Energy Policy (2018) [88] Confirms that the REF will fund 'off-grid rural electrification'

By and large Component 3 has achieved its objectives with only two issues to note; the lack of any confirmed area-based rural electrification plans that include clean energy mini-grids[89] and the fact

[84] PIR 2019

[85] The TE team attempted to access the website but it was not active. Its contents were confirmed in communications with the Technical Advisor.

[86] As above.

[87] The Strategy proposes 'at least 50 clean energy mini-grids by 2025' https://www.meramalawi.mw/index.php/resource-center/other-regulatory-tools/send/20-other-regulatory-tools/61-malawi-renewable-energy-strategy while the National Energy Policy contains various provisions with regard to mini-grids including grid arrival resolutions (net-metering, feed-in-tariffs) as well as mini-grid concessions. https://energy.gov.mw/index.php/resource-centre/documents/policies-strategies?download=15:energy-policy

[88] The National Energy Policy (2018) includes provisions for ensuring the Rural Electrification Fund supports off-grid solutions. The policy states, 'Committing funds from the Rural Electrification Fund to off-grid rural electrification' https://energy.gov.mw/index.php/resource-centre/documents/policies-strategies?download=15:energy-policy p16

that the website is not yet live. While the contents of the website have been confirmed, the TE team was not able to view and assess the effectiveness, ease of use, strategic value, etc.

The rating for the 'Overall Results' is **Satisfactory**

3.3.2 Relevance: Relevant

Relevance: "Extent to which the activity is suited to local and national environmental priorities and policies and to global environmental benefits to which the GEF is dedicated."

Malawian Growth and Development Strategy III (MGDS III) identifies a number of key priority areas many of which are aligned with the broader aims and dividends associated with the successful implementation of the IACADES Programme. These include;

- *Agriculture, Water Development and Climate Change Management*; key IACADES impacts include access to modern energy services for irrigation, reduction in use of and reliance on kerosene and diesel, reduction in the unsustainable use of woodfuel and/or charcoal, amongst others. (Climate Change and Land Degradation are GEF priority areas)[90]

- Education and Skills Development; The IACADES programme has a strong training component designed to ensure the requisite skills are available to support a sustainable mini-grid programme and the market beneficiaries include schools and training centres.

- Energy, Industry and Tourism; enhanced access to modern and clean energy services in rural areas is important to improve standards of living and support economic and industrial development

- Health and Population; improved access to modern and reliable energy for rural health infrastructure.

The Country's National Energy Policy (2018)[91] underlines the importance of mini-grids in rural electrification while the Malawi Renewable Energy Strategy (2017) proposes that 'at least 50 operational clean energy mini-grids [are supported] by 2025'[92]. In addition, MERA has developed a 'Regulatory Framework for Mini-grids'. The promotion and development of green mini-grids is clearly aligned with stated government policy and specific GEF Priority Areas. Other factors such as longer-term reduction in household use of kerosene and reduced indoor pollution through switching to electricity for thermal applications should acknowledged as well. Rating for relevance is **Relevant**.

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[89] On a positive note, District Councils have included reference to off-grid electrification options within their 'District Socio-Economic Profile (for instance, Blantyre District Council 2018) Personal Communication with District Officials. However encouraging, this is not equivalent to 'area based electrification plans'

[90] https://www.thegef.org/sites/default/files/publications/GEF-7%20Programming%20Directions%20-%20GEF_R.7_19.pdf

[91] https://energy.gov.mw/index.php/resource-centre/documents/policies-strategies?download=15:energy-policy

[92] https://www.meramalawi.mw/index.php/resource-center/other-regulatory-tools/send/20-other-regulatory-tools/61-malawi-renewable-energy-strategy

3.3.3 Effectiveness & Efficiency: Satisfactory

Effectiveness: "Extent to which an objective has been achieved or how likely it is to be achieved."

To achieve the 'Satisfactory' rating for the evaluation of the 'Overall Results' suggests that the IACADES programme has been fairly effective. Most of the primary objectives and outputs were achieved particularly with regard to the installed capacity of renewable energy generation technology as well as most of the actions associated with enhancing the enabling environment. Some of the other intended outcomes will be achieved over time as more and more households, institutions and SMEs take-up the increasingly available green power supply. There have been a few areas where the programme's objectives have not been completely achieved (including PA's inability to develop the proposed micro-hydro plant) but for the most part these are counterbalanced by visible and tangible process that has highlighted the potential and challenges of a sustainable green mini-grid programme. A key achievement and one that underlines the rating given for programme effectiveness, is the successful implementation of a turnkey, greenfields solar PV mini-grid under the IACADES programme. There is little that inspires more than actual doing. The fact that the programme resulted in an operational mini-grid, in addition to important and strategic advances in developing the requisite enabling framework, results in an Effectiveness rating of **Satisfactory**

Efficiency: "Extent to which results have been delivered with the least costly resources possible."

As part of understanding how technologies mature[93], one needs to anticipate that considerable resources need to be invested to develop the green mini-grid sector. With little in-country traction and experience with green mini-grids, the ability to leverage commercial investment or co-financing off the development/private finance institutions as well as private individuals and organisations will be very limited. These pilot initiatives will invariable require a large portion of grant financing which will increase the resources required. In addition, the training commitments, toolkit developments, information clearing, etc will obviously add to the overall programme costs. However, despite these resource requirements, the efficiency of their use must be determined.

The IACADES programme has been able to implement most of the intended activities and has earned a '**Satisfactory'** rating for *Overall Outcomes*. While not always ideal, the IACADES programme will reach project close with unspent funds. The programme has provided a platform for considerable co-finance through donor organisations such as the Scottish Government as well embracing efficiencies in project overheads with the project manager being accommodated within the DEA's offices. The IACADES programme has also taken on additional tasks not captured in the Project Document including a 50kWp micro-hydro scheme in the Kavuzi area[94] as well as exceeding the training target of 300 people by over 100 additional people trained.

While positive overall, the evaluation must consider the investment made into the thus far unsuccessful attempt by Practical Action (PA) to establish a 300kWp micro-hydro plant in the Usingini area in Nkhatabay District. Accounts vary but it is estimated that the IACADES project invested $100,000 - $200,000 in technical assistance on an initiative which has, at the point of the

[93] With reference to Figure 1.
[94] https://www.energy.gov.mw/index.php/projects/mini-grids-projects/kavuzi

terminal evaluation, not yet delivered. The programme will attempt to ensure the technical designs and other valued technical insights are available as part of the intellectual property and learnings going forward but this financial contribution remains a concern.

In terms of overall cost-effectiveness, there is little that the project could or should have done to be more cost-effective. The programme's design was effective in terms of investing in both the enabling framework as well as active mini-grids on the ground. The resources associated with the costs of technical assistance provided to PA are one example of how resources might have been deployed more effectively although additional 'unscheduled' tasks such as the support for the 50kWp micro-hydro scheme referred to above as well as the additional people trained may offset these observations somewhat. A programme entering an immature market such as the mini-grid sector in Malawi cannot be realistically expected to make 'smaller' grants, attract greater investment and reduce expenditure on the enabling framework. That is simply not where the sector is in terms of capacity and readiness.

The overall rating for the Efficiency of the IACADES programme is **Satisfactory**

3.3.4 Country ownership

A number of sector relevant national plans and frameworks including the National Energy Policy (2018), the Malawi Renewable Energy Strategy (2017) and MERA's Regulatory Mini-grids framework, attest to the integration of green mini-grids into the national solution framework. The approval of facilitating policies is a notable statement of *country ownership*. In addition, these policy developments affirm that the IACADES programme fits within the stated sector development priorities. Reference to Green Mini-grids has been included in national planning documents such as the Annual Economic Report (2018)[95] as well as District Level socio-economic reports[96]. The GoM has co-financed the project to the tune of $1,290,000 in kind over the life of the programme.

3.3.5 Mainstreaming

The IACADES aligns with the two main portfolio frameworks contained in the UNDP Country Programme Document (CPD)[97] for Malawi;

- Responsive Institutions and Citizen Engagement; the IACADES programme focuses on capacitating national and local government to be better able to provide energy services, delivering the associated benefits

- Resilience and Sustainable Growth; the IACADES programme economic innovation through promoting renewable energy service companies, community ownership models, SME beneficiaries, job creation and, importantly, renewable energy access.

Gender issues have been effectively integrated into the training component of the IACADES programme however other opportunities exist to further mainstream gender for instance, into the

[95] This annual publication is produced by the Ministry of Finance, Economic Planning and Development.
[96] Socio-Economic Profile for Mchinji District (2008)
[97] https://www.undp.org/content/dam/undp/library/corporate/Executive%20Board/2018/Annual-session/DPDCPMWI3_Final.docx

Electrification Masterplan[98]. It is too early to determine the actual impact of these gender mainstreaming initiatives as the value of training is fairly passive until actively applied and it is too early to measure in that regard. There are a number of gender framework initiatives which future mini-grid programmes are encouraged to more actively integrate with. This would include programmes run by the Ministry of Gender, Children, Disability and Social Welfare such as the Gender Equality and Women Empowerment Programme (GEWE)[99] as well as other NGOs committed to the issues of gender equality[100]. The point here is to work in collaboration with appointed and prominent gender focused entities to ensure alignment of impacts and outcomes.

There are other important cross cutting issues such as developing income generating opportunities (SMEs, productive use, etc.), as well as enhancing public services through training and capacity building that the programme has supported[101] and which align closely with various priorities outlined in the MGDS III including;

- Agriculture, Water and Climate Change
- Education and skills development
- Energy, Industry and Tourism

3.3.6 Sustainability Likely (L)

Sustainability: "Likely ability of an intervention to continue to deliver benefits for an extended period of time after completion; projects need to be environmentally as well as financially and socially sustainable."

The IACADES programme is designed to both demonstrate the requirements of sustainable green mini-grids as well as creating the enabling conditions for promoting these green power solutions go forward. There are at least two ways in which sustainability in the case of the IACADES programme needs to be assessed;

- Will the mini-grids that have been supported during the programme continue to operate, expand and achieve greater financial sustainability?
- Will the work of the IACADES programme ensure that Malawi is able to ensure continued and successful development in the green mini-grid sector beyond the conclusion of the IACADES programme?

[98] Such efforts are currently underway in an allied UNDP mini-grid programme in Lesotho and may provide insights into such requirements. https://www.ls.undp.org/content/lesotho/en/home/projects/Sustainable-Energy-for-All.html

[99] See, for instance, http://www.gender.gov.mw/index.php/2013-08-19-17-29-14/gender-equality-and-women-empowerment-programme

[100] Many such NGOs are affiliated under the banner of the NGO Gender Co-ordination Network http://www.soawr.org/content/ngo-gender-coordination-network-malawi

[101] Particularly at the District Level which strengthens the GoM's decentralisation programmes.

Sustainability considerations of current green mini-grids

A number of important sustainability issue emerged during the evaluation. These include[102];

Encouraging;

- Level of interest; 13 applications submitted for IACADES' RfP
- MEGA's financial sustainability enhanced as they pass 1,000 customer mark
- Full turnkey, greenfields mini-grid conceived, design, implemented and operational within the programme's implementation.
- New skills/capacities evident in project developers and operators including medium voltage and safety as well as GIS planning
- District Council capacity; a number of District Councils indicated greater awareness of and interest in green mini-grids
- Policy support; National Energy Policy (2018), the Malawi Renewable Energy Strategy (2017) and MERA's Regulatory Mini-grids framework all indicate support for green mini-grids

Concerning;

- Low levels of energy consumption and rate of uptake; the MEGA mini-grid has taken around 9 years to achieve a customer base of 1,000. A number of financial sustainability scenarios undertaken on behalf of MEGA indicated that, in the absence of selling surplus electricity to the grid (ESCOM), MEGA requires a customer base in the region of 4,000 to achieve financial sustainability[103]. CEM's Sitolo solar PV mini-grid will be 'sustainable at 500 customers'[104]
- Sustainable business models; there are a number of references to 'social models'[105], the replication of the 'MEGA model'[106] the need for community owned models[107], Build, Own, Operate (BOO), coupled with the fact that the private sector was excluded from participating in the GMG RfP, suggests there is some uncertainty or at least lack of rigour when it comes to the way forward with regard to business models.
- MERAP has arrived in the MEGA operational area; the existence of an Electrification Masterplan does not count for much when it is not reliably applied. Malawi has less than 4% rural

[102] The evaluation proposed solutions to these issues under the Conclusions, Recommendations & Lessons section
[103] Communication with MEGA General Manager.
[104] Personal communication with CEM representatives.
[105] Project Document.
[106] Project Document.
[107] Personal communication with senior DEA representative.

electrification[108] and the fact that there are two different energy service providers in a single rural locale suggests a disturbing lack of planning.

- Integrating technologies and innovations; it is important that current and future mini-grid integrate new technologies particularly around payment methodologies. Customers from MEGA indicated that electricity credits purchased 'can take three weeks to process'[109].

- Cost reflective tariffs; there remains some uncertainty about cost reflective tariffs although this is permitted by MERA.

Sustainability considerations of the enabling framework

A number of important sustainability issue emerged during the evaluation. These include[110];

Encouraging;

- Government commitment; as mentioned, a number of key policy documents and regulatory frameworks developed within the programme's implementation

- Local government capacity building; all 28 District Councils covered by clean energy mini-grid training.

- General training and awareness; 400 people have been trained in various aspects of clean energy mini grid planning, design, regulations, standards and construction methods. Thirty-two percent of which were women.

- Access to information; information clearing house and case-study based toolkit developed (some issues around accessibility remain)

- Access to finance; the Malawi Renewable Energy Strategy (2017) indicates that green mini-grids will be eligible for REF finance.

- General awareness; of the potential role of GMGs in rural electrification[111]

- TAC experience; the role and composition of the Technical Advisory Committee (TAC) will contribute towards long-term capacity building

Concerning;

- Policy commitment; the overwhelming focus of the DEA appears to be on grid extensions. The specific role and targets of GMGs (and not just policy reference) needs to be clarified/

[108] Borgstein, E. et al. Malawi Sustainable Energy Investment Study: Summary for Decision Makers. Rocky Mountain Institute, 2019

[109] Personal communications with MEGA customer.

[110] The evaluation proposed solutions to these issues under the Conclusions, Recommendations & Lessons section

[111] For instance, the need for mini-grids are referenced in the RMI study; Borgstein, E. et al. Malawi Sustainable Energy Investment Study: Summary for Decision Makers. Rocky Mountain Institute, 2019. The Annual Economic Report (2018) referenced the IACADES programme.

quantified. Much of the donor emphasis within the energy space[112] is on grid and/or grid connected generation. The GoM and DEA need to make the commitment to off-grid generally and mini-grid specifically.

- Consistency in planning; the DEA, MERAP and ESCOM need to stick as far as possible to the EMP. Incidents such as the arrival of the MERAP financed grid in the MEGA area creates uncertainty.

- Role of the private sector; sentiments expressed by various senior figures in government and public sector more generally cast doubt on the role of private sector in energy service provision. The preference is non-profit and/or community organisations as operators[113]

- Targeted training; the long-term training needs for a successful GMG sector are not well understood at this stage. At time the training activities appeared to be more influenced by the need to achieve certain numerical targets rather than any particular capacity requirement. Certain types of training, particularly focused on District Councils, may need to be more in-depth and targeted as opposed to evenly spread with the possible dilution of impact.

- Maturing technologies; technologies mature over time and the targets of programmes such as the IACADES need to reflect this. A four year (plus) programme of this nature will in all likelihood not create a thriving commercial GMG sector but they can and will contribute to the process required to achieve this. Programme targets and expectations as well as terminal evaluations need to align with these realties.

- Finance; while the ability of the REF to finance GMGs marks significant progress, the long-term sustainability of GMG programmes within Malawi will require a dedicated development finance institutions and/or fund. Blended finance whether it be grant, concessionary or other forms, will be required going forward and appropriate sources and institutions will be required to address this. If UNDP Malawi implement future GMG programmes, which the evaluation would certainly consider desirable, then the policy/procedural limitations of on-granting to private sector organisations will have to be addressed.

While it is important to provide a balanced assessment of the longer-term sustainability of development programmes, the raising of concerns can tend to dominate the appraisal. This should not be the case. While concerns around sustainability are certainly there they are, with equal certainty, addressable. Malawi represents an immature market for GMGs and there is much work to be done and progress to be made and the IACADES programme represents an important step in this process. The Project Sustainability rating for the programme is **Likely (L).**

3.3.7 Impact

From an ecological position; while addition RE capacity will reduce reliance on unsustainable harvesting of woodfuel and consumption of diesel and kerosene products in household, commercial and public sector, it is too early to quantify the impacts.

[112] Based on discussions with the WB, EUD, KfW, DFID, USAID amongst others.
[113] The merits or otherwise of this are discussed in greater detail in the Conclusions, Recommendations & Lessons

The most significant impact is catalysing interest in GMGs. From a fairly unsuccessful public sector experiments with mini-grids some decades ago and a lone GMG operator in the form of MEGA, the IACADES programme has restored belief in and commitment to GMGs through technology demonstrations and work on the enabling framework which are the fundamental first steps in establishing a sustainable GMG sector.

4 Conclusions, Recommendations & Lessons

4.1 Conclusions

The positions adopted, observations made and ratings applied within the evaluation process have been presented in the preceding sections. The conclusion presents an opportunity to summarise the key characteristics of the IACADES project. The conclusions will be structured based on a basic yet reliable framework of 'strengths, weaknesses and outcomes'.

4.1.1 Strengths

Overall the IACADES programme was a success as reflected by the various ratings. Key objectives have been achieved across the three project components and the future prospects of green mini-grid developments in Malawi are far more credible now than they were at the start of the programme. Key programme strengths include;

- Pragmatic design; The IACADES programme designed offered a strategic balance between technology demonstration in terms of strengthening the MEGA operations and establishing a greenfields GMG, as well as technology facilitation in terms of strengthening the enabling framework including its focus on regulatory and policy frameworks, access to finance, training, information gathering and dissemination, amongst others.

- Programme management; the management team in terms of personnel and organisations involved (UNDP & DEA) was certainly up to the task and did a commendable job in implementing the programme, enhancing the profile of GMGs within the sector and underpinning future success of GMG in Malawi.

- Strengthened MEGA template; as a result of the IACADES programme, MEGA has achieved a number of important practical and symbolic milestones; they have connected over 1,000 customers, their planning capacities have been enhanced through technical training, they have engaged (unsuccessfully this far) with the prospects of grid connecting with ESCOM and have strengthened their position as the market leaders in terms of GMGs.

- Green-fields mini-grid established; the commissioning and operation of CEM's solar PV mini-grid is a very significant programme achievement and underlines what can be done in the GMG sector of Malawi.

4.1.2 Weaknesses

There are a number of areas of concern that the evaluation has identified and discussed and these are summarised in the points presented below.

- The management of PA's progress; the issue has been discussed at some length in the relevant sections of the report. Suffice it to say here that PA's sustained under-delivery should have been called earlier. There are a number of plausible explanations for the delays prominent amongst which is their professional reputation and past success. However, while some latitude was worth extending given the potential importance of their contribution and their ability to deliver, more active monitoring and an earlier intervention appears to have been required based on the evaluation.

- Reduced generation of renewable energy; one of the key outcomes was the production of a certain quantum of electricity from both an enhanced MEGA operation (851,472kWh/year) as well as the anticipated green-fields mini-grids to be established under the programme (294,336kWh/year). In both cases the amount of RE electricity produced is significantly lower than expected (50% in the case of MEGA and only 12% in the case of CEM). In the case of MEGA, the utility simply has not been able to connect enough customers/users to justify the generation of that amount of electricity, although it has the installed capacity to do so. In the case of Component 2, two issues account for the reduced electricity outputs. First, while the targeted and actual installed capacity (84kWp versus 80.4kWp) for Greenfield GMGs are very close, the technology deployed is not able to achieve the generational outputs expected (all 80.4kWp capacity installed is solar PV as opposed to micro-hydro or a mix of the two technologies[114]). Secondly, the number of customers and/or the level of electricity consumption per customer is lower than anticipated resulting in a maximum demand of only 12% of the installation's capacity. While there are a number of ways to rationalise these short-falls, a key explanation relates to inadequate baseline data, insights into consumer demand and behaviour and, collectively, adequate monitoring and evaluation.

- Monitoring and Evaluation; while the overall M&E plan was acceptable there were components within the plan that required greater attention. There was inadequate investment in baseline data and the ability to measure impacts over time. There were a number of assumptions made in the Project Document which needed to be tested within the implementation framework. For instance, the number of household connections that would be made (as a corollary of energy expenditure savings) over a certain time, the amount of electricity they would consume (and energy expenditure saved), the number of SMEs that would be connected, etc. How households and other market sectors respond to electricity access is crucial for calibrating business models. In new and emerging markets it is important to understand how consumers behave, who are the pioneers or 'first responders', how patterns of energy consumption change over time, how other market sub-sectors like SMEs and public services respond. These are elements of market intelligence that will shape the approach of project developers, the willingness of project financiers and the expectations of public sector support.

- Training; while the provision of technical training was well received by certain parties (for instance, MEGA) other responses to the value of the training were more circumspect. At the District Level, concerns were expressed about the beneficiary of the training (very often forestry

[114] Solar PV can only operate while the sun shines while hydro can, all things being equal, operate 24 hours a day and therefore potentially generate more electricity.

officials in the absence of the existence of energy officers) and the job mobility of these individuals. Concerns were also expressed regarding the candidates chosen[115] to receive the training.

- Government commitment; without overstating this point, there was some level of ambivalence detected in the absolute commitment of the GoM to the role of mini-grids going forward. Positive signs which cannot be ignored include the inclusion of GMG in the REF fund as well as a commitment to developing 50 GMGs by 2025 as contained in the Malawi Renewable Energy Strategy but these commitments need to be actively championed. It was perhaps the unmistakable voice of a GMG champion that was missing.

4.1.3 Outcomes

On the whole, the programme outcomes were positive. With the exception of the weaknesses already noted, the programme has significantly strengthened and advanced the position of GMGs in Malawi. Critical foundational legacies include a stronger MEGA, an operational Greenfields solar PV mini-grid, close to 1,000 additional customers connected to RE based electricity, an increasingly supportive policy and regulatory framework, enhanced technical expertise and awareness within the public sector as well as an improved information access platform. Of course, it remains difficult to predict how successful these foundational activities will be in promoting green mini-grids going forward. But that uncertainty is not a reflection of programme design or implementation weakness but rather the need to push the GMG agenda into the next phase of development. It is encouraging that the UNDP is interested in a follow-up GMG programme in Malawi for it is important to understand that technologies mature over time and that while a four (4) year programme such as IACADES is absolutely essential it is arguably insufficient, on its own, to guarantee the success of the GMG sector going forward. Indeed, the most opportune and truthful moment to evaluate the success of the IACADES programme will be in 5 – 10 years from now when there is either a growing and increasingly sustainable mini-grid sector or not.

It is worth reiterating the various stages of technology maturation. The graphic in Figure 1 indicates the stages that a technology goes through to reach maturity in terms of technical/financial performance as well as consumer acceptability.

While this is not a prescript but rather an indication, the UNDP/GEF and importantly, national partners, will have to consider the 'next steps' in terms of advancing the role and sustainability of GMGs in Malawi. No further programmatic action and support for GMGs may well undo the positive foundation work that the IACADES programme has achieved. The specific needs in this regard are discussed in more detail under the section that follow. However, despite the future programmatic caveats, the current programme can only be evaluated against what it was intended to achieve within its implementation framework and to that extent, as indicated, it has been relatively successful.

[115] A beneficiary of the training indicated that there was a sense, given the presence of 'departmental secretaries' at certain technical training events (such as GIS management) that the programme was trying to ensure they 'achieved the numbers rather than capacitating the right people' [personal communication].

4.2 Lessons Learnt

The evaluation has identified a number of key lessons, achievements and requirements going forward. It is perhaps worth reiterating the key lesson that appears to provide the thread that connects many of these observations. The key conceptual lesson here, and one which subsequent GMG programmes need to take on board, is that technologies mature over time and that subsequent GMG programmes need to pose more progressive questions and set more challenging targets across the various facets of programme design and contextual expectations.

- Most significantly; what it takes to develop a Greenfield GMG from eliciting project developers' interest right through to commissioning and operating a GMG. The process not only contributed to successful project outcomes but will continue to assist future GMG programmes deliver more effective and efficient outcomes.
- Technologies mature over time and expectations and requirements need to develop with them
- Off-grid generally and mini-grids specifically require active and constant championing to reduce uncertainty and facilitate progress and investment
- An Electrification Masterplan is strategically important but even more so if it is consistently and predictably applied.
- More detailed M&E frameworks need to be developed to deepen understanding of the socio-economics of electricity adoption, consumption and changing patterns over time.
- There is considerable interest in the GMG sector in Malawi[116]. This is reassuring going forward.
- Training needs to be more targeted and developed using a more 'bottom-up' approach based on a needs assessment at DC level.

4.3 Recommendations

While a terminal evaluation of a programme with one month left before it concludes cannot make any meaningful and substantive recommendations around adjustment to be made within this programme, it can provide recommendations and considerations for future GMG programmes in Malawi. The recommendation that follow are intended to do precisely that. While the programme has been successful there are key elements that need to be reconsidered, adjusted and progressively advanced under subsequent GMG initiatives in Malawi.

4.3.1 Programme design

Training

- District/regional energy officers; currently the District Councils are without energy officers capable of providing the assistance and expertise required to capacitate District Councils to fulfil the decentralised expectation of local energy planning and support. The long-term value of

[116] Based on the 13 applications submitted in response to the EOI.

providing training to non-energy officers[117] is questionable given their professional training/background.

- Future energy access programmes (GMG focused or otherwise) should explore various options with regard to energy officers. It would seem practical to support the piloting of this role within a limited number of well positioned District Councils[118] as opposed to a blanket support of energy officers across the 28 District Councils. The specific requirements and expectations of such a role should be more closely explored in order to understand the responsibilities and requirements of the energy officer and then rolled out to subsequent districts.

- Given the resource requirements of having an energy officer at all District Councils, a subsequent programme/initiative might explore the concept of a Regional Energy Officer who provides relevant technical assistance to a number of District Councils at the same time.

- Determining training requirements at DC level using a bottom up approach; Given that District Councils have not played a significant role in energy planning and energy technical support, the precise training and/or capacity needs are arguably not well understood. Greater insight into these requirements will be achieved through more limited and focused piloting of the Energy Officer concept which can then inform, bottom-up, what these capacity and training needs are which can then be effectively procured and delivered more effectively and their impact better understood (given the training would be based on identified needs). There are two key issues that need to guide future training in this regard; first, identify the capacity gaps/training requirements through closer analysis of the [future] role of DCs and, secondly, to make sure the impact and effectiveness of this training is monitored over time, making adjustments in terms of content, level of complexity and focus areas over time.

- Participation of the 'Local Climate Adaptive Living (LoCAL) facility[119]; the future focus on building planning capacity within the DCs in Malawi may benefit from the experience of the LoCAL programme. While Malawi is not one of the current focus countries of the LoCAL programme, there are considerable publications and resources which can add value to efforts to capacitate DCs in terms of planning and budgeting around energy access and climate change issues.

- Supporting District Council overheads; it may be necessary for project resources to cover some of the additional overheads associated with the recruitment of energy officers at DCs, at least on an interim basis. A combination of public sector resource constraints and the uncertainty (at least untested) about the role, value and need of an energy officer might require programme resources to cover these costs on a selective, short-term basis. The importance and functions of the energy officer will have to be proven before public funds will be committed across all DCs.

Monitoring and Evaluation

- M&E and impacts; to some extent an opportunity to understand and measure impacts was lost or under-leveraged. There were inadequate baseline measurements undertaken in a number of

[117] A number of environmental or forestry officers were trained.
[118] For instance, those with existing/future off-grid programmes and initiatives.
[119] https://www.uncdf.org/local/homepage

respects which limits the programme's ability to measure, understand and anticipate impacts. For instance;

- Inadequate data was collected on un-electrified households which represent the market for new and expanding mini-grids. It is important to establish unelectrified households energy spend in a number of respects including energy burden[120], the costs of specific energy services and resources, level of multiple-fuel use as well as basic demographic and socio-economic data on household size, education levels, assets, etc. This data will assist in understanding and being able to measure the impact(s) of access to electricity in terms of costs, convenience, early up-takers, etc.

- Related, a better understanding of household profiles will assist in determining patterns and market predictors in terms of early adoption of new energy services. Programme managers and project developers will need to understand the rate at which new electricity services are taken up, who the early adopters are (do they exhibit similar household characteristics?) and how patterns of energy consumption change/intensify over time. This feedback and market insight can assist in not just market identification and mobilisation but more technical issues as well such as system sizing.

- This kind of data is important for future project developers from a market intelligence point of view and should be made increasingly available through the Information clearinghouse.

Private sector participation

- Promoting participation of the private sector; once the policy constraints around UNDP's ability to on-grant to the private sector were noted[121], the programme simply excluded the private sector and focused on the more eligible applicants such as non-profit organisations. It is suggested that in future, to ensure the option of private sector participation, that any subsequent UNDP GMG programme include the UNCDF as the 'responsible party' through a UN to UN Agency Agreement[122].

Technical assistance

- Conditional Technical Assistance; the technical assistance provided to the project developers (in the region of $100,000) was largely unconditional and/or not closely monitored. It is recommended that the agreements signed between future programmes and the associated project developers adopt a more outcomes based TA agreement that is linked to measurable progress in project implementation. The case of Practical Action demonstrates that there are

[120] A household's energy burden is the proportion of overall income spent on energy resources and services. See, for instance, http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1021-447X2015000300007

[121] The UNDP is not permitted to on-grant to private sector organisations according to UNDP/UNCDF Micro Finance Policy. Of the UN sister organisations, only the United Nations Capital Development Fund (UNCDF) is permitted to on-grant to private sector organisations. https://www.uncdf.org/financial-inclusion

[122] https://www.unfpa.org/sites/default/files/admin-resource/PROG_UN%20Agency%20to%20UN%20Agency%20Contribution%20Agreement.docx

considerable uncertainties which such agreements need to factor in in order to ensure such support adds value to the programme. While these mini-grid initiatives are high risk and require considerable grant funding, these contributions need to be linked to very specific sustainability or technical requirements and be closely monitored in the process.

- Practical action mini-grid designs; the programme will have to acquire the micro-hydro designs produced (with the support of programme resources) by PA. A 300kWp micro-hydro design, with overall business plan which includes significant productive use components, would be a useful template and valuable programme outcome going forward.

Targeting resources

- Targeting resources; future programme designs need to balance the need to distribute resources evenly or equitably with the need to understand and replicate impacts. 'Infrastructure sprinkling' may result from programmes that spread their resources too thinly for equitable intensions which will at the same time minimise or dilute impacts. As part of the piloting processes, strategic impact and understanding is important before wide-scale replication. For instance, it is important to understand the role and requirements of an Energy Officer through more targeted interventions or 'pilots' before this role is established at all DCs.

Productive use

- Productive use; there needs to be a more concerted effort to promote productive use of energy within the overall mini-grid plans. To be sure, MEGA and CEM installations both support a number of SMMEs from small retailers to more energy-intensive hammer mills. In addition, the PA business plan[123], however incomplete at this stage, included a reassuring focus on a number of commercial users. However, there needs to be a more formal and focused efforts to ensure a prominent role for commercial users[124]. Rural households are generally poor and low and fairly inconsistent users of energy. This reality coupled with the overall 'household centred' approach to electrification planning means that subsequent GMG programmes will have to focus more strategically on building the commercial customer base to sustain their operations. Success in this regard must be data driven/supported. A clear picture of what commercial activities and category of activities exist is crucial, what their energy needs are, their current 'displaceable' expenditure and possible additional latent opportunities can be supported. Future initiatives will also have to monitor the impact and influence of access to electricity, with the distinct possibility of local businesses moving to access electricity and in the process creating commercial hubs.

Ownership/business models;

- Single ownership models; there are a number of issues to consider when reviewing ownership models which will have to be further explored in subsequent GMGs programmes;

[123] Their commercial interest are captured by the 'ABC' model they are promoting which refers to 'Anchor, Businesses and Communities' – personal communications with PA representatives.
[124] The evaluation acknowledges the role of the Government of Scotland is supporting CEM's productive use a

- The issue of ownership models has not been resolved or sufficiently addressed; there are a number of ownership options, as opposed to a single option, which should be explored further in subsequent GMG programmes. There are multiple options, including private sector, public owned/operated as well as community owned (with hybrid options as well). Future programmes need to explicitly examine the optimal ownership models with particular regard to technology type, system size, customer service agreements, future IPP options, etc. The complexities and options surrounding ownership models have not been explored sufficiently within the confines of this programme.

- The current preference for community ownership models expressed by certain senior public sector officials needs to be explored more closely[125]. While a sense of local ownership can be empowering and mitigate against potential theft and vandalism, this fact alone does not resolve the other challenges indicated. While an equity stake or shareholding in the Energy Service Company appears to align with economic and community development, it does not serve these purposes if there is no profit generated and benefits distributed. MEGA is as yet, 9 years into its operation, not financially sustainable[126]. The concept of community ownership and specific options need to be more rigorously explored going forward.

- Business models; 'Selling electricity is not enough'[127] was a comment which provides some insight into the challenges of developing financially sustainable mini-grids. While it would be unreasonable to expect the IACADES programme to resolve the issue of GMG business models within four years it would be equally unreasonable not to expect this issue to be central to GMGs programmes going forward. Key issues include;

    - Mixed revenue streams/customer bases through productive use, unlocking energy service options for public sector (health, education, administration, policing, etc.) and, of course, households

    - Multi mini-grid programmes; where single entities own and operate more than one mini-grid the overall costs per kW installed are reduced[128]. Future GMG programmes need to consider piloting multiple mini-grid in order to reduce capital costs and increase financial sustainability.

4.3.2 Enabling framework issues

Access to finance

[125] It should be noted that a recent World Bank study on solar PV mini-grids noted that community owned mini-grids had the highest capex (capital expenditure) per kWh of all mini-grids (including those community owned, privately owned and public utilities.). Privately owned mini-grids had the lowest capex cost/kWh. http://documents.worldbank.org/curated/en/569621512389752401/Benchmarking-study-of-Solar-PV-mini-grids-investment-costs-preliminary-results

[126] It does not generate revenues that cover overheads, costs and asset depreciation yet alone a profit.

[127] Comment made by senior representative from CEM.

[128] http://documents.worldbank.org/curated/en/569621512389752401/Benchmarking-study-of-Solar-PV-mini-grids-investment-costs-preliminary-results

- Access to development finance; there are encouraging discussions about a subsequent GMG programme within Malawi although the details are not clear at this stage. While positive, the emphasis will have to include advancing access to more standardized or institutionalise forms of finance. While programme related grant finance from GEF and other donors is critical at this stage, accessing finance will have to be increasingly formalised over time, with each subsequent GMG initiative increasingly institutionalising financial access as the technology and market for GMGs matures. One of the areas where the IACADES programme was arguably a little light was in terms of financial access. While the evaluation acknowledges the gains made in terms of GMGs being technically able to access funds from the REF through important policy developments, this will be inadequate going forward. Development finance, as part of the supportive framework, will have to be made increasingly available if the GMG sector is to mature and become increasingly sustainable. The government's involvement in the NBM Development Bank[129] is encouraging towards this end as the development focus of the bank will ensure more accessible and suitable terms such as longer loan periods which are terms generally not available from commercial banks in Malawi[130]. The NBM Development Bank is the second development finance initiative after the establishment of the Malawi Agricultural Industrial and Investment Corporation[131]. However, while both of these development finance initiatives are critical in terms of diversifying financial access opportunities within the development sector, these are very recent initiatives and not yet fully or formally operational.

- Best-practice; arguably one of the leaders with regard to providing development finance to the off-grid sector including mini-grids is Rwanda. An initiative entitled Scaling-Up Energy Renewable Program[132] is an agreement between the Rwandan Government and the World Bank which will see the Government of Rwanda establishing a renewable energy fund which will be hosted in the Development Bank of Rwanda (BRD). This fund will allow private financial institutions to access these funds on a concessional basis to on-lend to the private sector. While Rwanda's off-grid market is somewhat more established than Malawi, these developments in Rwanda do indicate the path that the Malawian off-grid sector will need to follow to achieve full maturity and the steps required in achieving this should be factored into subsequent GMG programmes.

Planning

- Consistent application of the masterplan; a key part of stabilizing and de-risking the sector is the development of realistic electrification plans and the consistent application of these plans. The evaluation observed that the Electrification Masterplan (EMP) is currently being reviewed/approved by cabinet. However, the key issue here is not the existence and approval of the EMP but the consistent application of the plan. The fact that the MAREP programme financed a grid that encroached on MEGA's operational area despite the fact that less than 4% of rural households have access to electricity is a concern. While SHS access programme are

[129] https://www.mitc.mw/index.php/media-centre/latest-news/150-malawi-development-bank.html
[130] Personal communication with the CEO of the Banker Association of Malawi
[131] http://www.mccci.org/index.php?option=com_content&view=article&id=200:malawi-agricultural-industrial-investment-corporation-to-be-launched&catid=19:news&Itemid=138
[132] https://www.worldbank.org/en/news/press-release/2017/07/07/government-of-rwanda-and-the-world-bank-sign-agreement-to-increase-access-to-electricity-through-off-grid-renewable-energy

somewhat less vulnerable to grid encroachment as they can recover assets and refocus energy service activities elsewhere, mini-grids are not as mobile and require more certainty in planning. Consistent application of the EMP is a critical de-risking activity and needs to form part of GMG initiatives going forward.

- *Constant engagement*; both CEM and PA demonstrated the need to engage more effectively with the DEA about identifying suitable mini-grid areas. PA's original site was later revealed to be targeted for a significant hydro-power plant under the Integrated Resource Plan (IRP)[133] which resulted in delays as PA sought an alternative site.

- *Integrating commercial opportunities* into planning; unsurprisingly given the 'universal access' motive for rural electrification, households appear to be the principal target and planning influence for off-grid electrification. Given the relatively impoverished character of rural households and the revenue requirements of sustainable GMGs, it would seem prudent to integrate more commercial opportunities into electrification planning process as well, particularly within the off-grid sector. Dovetailing with the heightened involvement of District Councils through the country's decentralisation policy[134], this local government strata is well placed to identify commercial loads/opportunities at the local level and to integrate these into local level planning. Indeed, there is an element of reluctance within the public sector to view electrification on more commercial terms[135] which is an issue that needs to be unpacked and resolved as part of the continuing de-risking of the GMG sector. The recently released RMI study underlined the importance of including the private sector in accelerating access to energy within the country.

- *Training at the DC level;* this issue aligns with the earlier reference to the training and capacity requirements of Energy Officers. In short, these DC representatives will have to be trained and supported in energy planning[136].

Policy & regulation

[133] Personal communications with the programme manager.
[134] See, for instance, https://participedia.net/case/4996
[135] Engagements with senior public sector officials within the sector often revealed an ambivalence with regard to the commercialisation of energy service delivery. Comments such as 'social model or business model' in terms of mini-grid operations as well as 'we [government] will not subsidize the private sector' with regard to increasing that sector's involvement in energy service delivery
[136] The Stockholm Environment Institute and Practical Action Eastern Africa implemented the project "Developing a framework for local participation in county level energy planning in Kenya" funded by the International Development Research Centre. The project focussed on developing and testing a participatory energy planning framework to guide County energy planning. The progress of this study may provide a useful learning experience for the GoM. https://www.sei.org/projects-and-tools/projects/developing-a-framework-for-local-participation-in-county-level-energy-planning-in-kenya/

- Advancing the Mini-grid Framework; while the Mini-Grid Framework (MGF) is a public document it has not yet been tested[137]. Future GMG programmes will have to assist with completing this framework in terms of finalising the details of the MGF[138] and to determine whether they address the different parties' interests[139].

- Explicit policy commitment; while the importance of the new National Energy Policy (2018) and Malawi Renewable Energy Strategy (2017) in terms of stabilising and de-risking the off-grid sector cannot be understated, these policy commitment need to be followed up with supportive sentiments and actions. The ambivalence of some of the sentiments expressed by senior energy sector representatives towards off-grid, the role of the private sector, commercial models amongst others may dilute the impact of these important policy documents.

An informed community

- Community mobilisation; where the government supports a range of energy service options, communities need to be well informed about the options, intensions and implications. Consistent and constant messaging around the need for grid and off-grid is important to reduce potential tensions around perceptions of superior/inferior service options.

- Cost and tariff issues; it is somewhat disingenuous to compare the costs of off-grid electricity with grid electricity when the targeted community's only realistic prospect for accessing electricity (within the short-term) is off-grid. It would be more accurate to compare current energy expenditure of un-electrified households with off-grid electrified households (and the quality of the incoming service). As one mini-grid operator remarked; 'the only thing more expensive than electricity is no electricity'[140].

[137] Personal communication with senior MERA representative.
[138] Particularly issues about resolutions associated with the arrival of the national grid as well as policy options with regard to grid connecting through IPPs, Feed-in-Tariffs, etc.
[139] The further investigation of the prospects and policy/technical requirements of enabling MEGA to feed into the local ESCOM managed network would provide critical precedence in terms of making the MGF more robust and useful.
[140] Personal communication with senior MEGA representative.

ANNEXES

Annex A: Terms of Reference (TOR)

Terminal Evaluation: Terms of Reference

INCREASING ACCESS TO CLEAN AND AFFORDABLE ENERGY SERVICES IN SELECTED VULNERABLE AREAS OF MALAWI

(Formatted to be entered in UNDP Jobs website)

BASIC CONTRACT INFORMATION

Location:	Malawi
Application Deadline:	7th August 2019
Category:	Energy and Environment
Type of Contract:	Individual Contract
Assignment Type:	National Consultant
Reports to:	UNDP Malawi, RSG Portfolio Manager
Duty Station:	Home Based
Languages Required:	English
Starting Date:	9th September 2019
Duration of Initial Contract:	9th September 2019 – 18th October 2019
Expected Duration of Assignment: 19 working days	

1. INTRODUCTION

Malawi is one of the least electrified countries in the SADC region, with an average per capita consumption of 85 kWh per annum – among the lowest in the world. Provision of sufficient, reliable and clean energy in Malawi is a critical challenge, as recognized by the Government which has put energy as a focus area in its Growth and Development Strategy.

To increase access, effort is needed to develop power plants and mini-grids close to the end users in the rural areas and since financial resources are scarce, investments for new generation can only be leveraged by involving the private sector and social enterprises.

This project addresses rural electrification barriers in rural Malawi where 96% of people do not have electricity access.

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) set out the expectations for a Terminal Evaluation (TE) of *the Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi* (PIMS #5270).

The project is implemented by the Government of Malawi, through the Ministry of Natural Resources Energy and Mining with support from Global Environment Facility (GEF) and United Nations Development Programme (UNDP). The project started May 2015 and is in its final year of implementation.

The essentials of the project to be evaluated are as follows:

PROJECT SUMMARY TABLE

Project Title:	**Increasing access to clean and affordable decentralized energy services in selected vulnerable areas of Malawi**			
GEF Project ID:	PIMS#5270		*at endorsement (Million US$)*	*at completion (Million US$)*
UNDP Project ID:	00094026	GEF financing:	$1,725,000	$1,725,000
Country:	Malawi	IA/EA own:		
Region:	Africa	Government:	$1,290,000 in kind	$1,290,000 in kind
Focal Area:	Climate Change	Other:	UNDP $ 1,875,000	UNDP $ 3,368,426
FA Objectives, (OP/SP):	CCM-3 Promote investment in renewable energy technologies	Total co-financing:	$$22,785,000	$22,785,000
Executing Agency:	UNDP/Ministry of Natural Resources, Energy and Mining	Total Project Cost:	$ 36,290,000	$ 36,088,426
Other Partners involved:		ProDoc Signature (date project began):		26 May 2015
		(Operational) Closing Date:	Proposed: June 2019	Actual: 25 May 2019

2. OBJECTIVE AND SCOPE

The project was designed to: To increase access to clean energy in selected remote, rural areas in Malawi by promoting innovative, community-based mini-grid applications in cooperation with the private sector. The project's outcomes are as follows:

Outcome 1: Expansion of the Mulanje Electricity Generation Agency (MEGA) Micro-Hydro Power Plant.
Outcome 1.1 Increasing the installed capacity of the Mulanje Electricity Generation Agency's (MEGA) MHPP scheme.
Outcome 1.2 Achieving MEGA's business plan target of increasing the aggregate household energy savings among its customer base.

Outcome 2: Replication of MEGA model via piloting of new clean energy mini-grid schemes in other areas of Malawi.
Outcome 2.1 Investment in installed capacity of clean energy mini-grid schemes established, replicating the MEGA model and using a Build-Own-Operate (BOO) Public Private Partnership (PPP) model.
Outcome 2.2 Increased the aggregate household energy savings among the customer base.

Outcome 3: Institutional strengthening and capacity building for promotion of decentralized clean energy mini-grid applications across the country.
Outcome 3.1 Increased capacity of key stakeholders, especially at the sub-national levels to effectively plan and implement clean energy mini-grids.
Outcome 3.2 Increased awareness about relevant business models, policy and regulatory issues, and financing of mini-grids in the Malawian context.
Outcome 3.3 Improved policy and regulatory environment to facilitate the sustainable development of mini-grids in Malawi.

The UNDP-GEF project was developed soon after the start of implementation of the UNDP-supported project on Sustainable Energy Management (SEM), which was concluded in December 2016. The SEM project provided advisory support; assisted in updating policies; developed standards; and established coordination mechanisms and implementation arrangements.

The Scope of the Terminal Evaluation:

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects.

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

3. EVALUATION APPROACH AND METHOD

An overall approach and method[141] for conducting project terminal evaluations of UNDP supported GEF financed projects has developed over time. The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact,** as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. A set of questions covering each of these criteria have been drafted and are included with this TOR (*Annex C*) The

[141] For additional information on methods, see the Handbook on Planning, Monitoring and Evaluating for Development Results, Chapter 7, pg. 163

evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Advisor and key stakeholders. The evaluator is expected to conduct a field mission to Mulanje, Nkhata-Bay and Mchinji district councils. Interviews will be held with stakeholders including organizations and individuals.

The evaluator will review all relevant sources of information, such as the project document, project reports – including Annual APR/PIR, reports, project budget revisions, midterm review, quarterly progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, technical studies and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in Annex B of this Terms of Reference.

4. EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework (see Annex A), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact.** Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in Annex D.

Evaluation Ratings:			
1. Monitoring and Evaluation	***rating***	**2. IA& EA Execution**	***rating***
M&E design at entry		Quality of UNDP Implementation	
M&E Plan Implementation		Quality of Execution - Executing Agency	
Overall quality of M&E		Overall quality of Implementation / Execution	
3. Assessment of Outcomes	**rating**	**4. Sustainability**	**rating**
Relevance		Financial resources:	
Effectiveness		Socio-political:	
Efficiency		Institutional framework and governance:	
Overall Project Outcome Rating		Environmental:	
		Overall likelihood of sustainability:	

5. PROJECT FINANCE / COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

Co-financing (type/source)	UNDP own financing (mill. US$)		Government (mill. US$)		Partner Agency (mill. US$)		Total (mill. US$)	
	Planned	Actual at MTR	Planned	Actual at MTR	Planned	Actual at MTR	Planned	Actual at MTR

Grants								
Loans/Concessions								
• In-kind support			1,290,000	1,290,000				
• Other	1,845,000	1,845,000			19,650,000	19,650,000	21,495,000	21,495,000
Totals	1,845,000	1,845,000	1,290,000	1,290,000	19,650,000	19,650,000	22,785,000	22,785,000

6. MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender. In addition, the evaluation will be included in the country office evaluation plan.

7. IMPACT

The evaluators will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, and/or c) demonstrated progress towards these impact achievements.[142]

8. CONCLUSIONS, RECOMMENDATIONS & LESSONS

The evaluation report must include a chapter providing a set of **conclusions**, **recommendations** and **lessons**.

9. IMPLEMENTATION ARRANGEMENTS

The principal responsibility for managing this evaluation resides with the UNDP CO in Malawi. The UNDP CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the evaluation team. The Project Team will be responsible for liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

10. EVALUATION TIMEFRAME

The total duration of the evaluation will be 19 days according to the following plan:

Activity	Timing	Completion Date
Preparation	3 days	9th September 2019
Evaluation Mission	10 days	27th September 2019
Draft Evaluation Report	5 days	4th October 2019
Final Report	1 days	18th October 2019

[142] A useful tool for gauging progress to impact is the Review of Outcomes to Impacts (ROtI) method developed by the GEF Evaluation National Consultant submits to International Consultant Office: ROTI Handbook 2009

11. EVALUATION DELIVERABLES

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
Inception Report	Drafting of Inception Report, support in arranging logistics and liaising with local stakeholders	No later than 2 weeks before the evaluation mission.	National Consultant submits to International Consultant
Presentation	Recordings and findings from the field mission and stakeholder meetings, including translation where necessary, drafting of Draft Final Report	Within 3 weeks of the evaluation mission	National Consultant submits to International Consultant
Draft Final Report	Support in revising the final report	Within 1 week of receiving UNDP comments on draft	National Consultant submits to International Consultant
Final Report*	Drafting of Inception Report, support in arranging logistics and liaising with local stakeholders	No later than 2 weeks before the evaluation mission.	National Consultant submits to International Consultant

*When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report.

12. REQUIREMENTS FOR NATIONAL CONSULTANT

The evaluation team will be composed of two evaluators; 1 International lead Consultant and 1 National Consultant who will be a team member. The consultant shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an advantage. The National Consultant will support the International Consultant. The International consultant will have the overall responsibility for the conduct of the evaluation exercise as well as quality and timely submission of reports (inception, draft, final etc). The International consultant will be accountable to UNDP for the delivery results on this assignment. The evaluators selected should not have participated in the project preparation and/or implementation and should not have conflict of interest with project related activities.

Academic Qualifications and Experience Requirements for National Consultant:

- Minimum postgraduate degree in Engineering, Sciences, Renewable Energy, Economics and/or related subjects (5 points).

- Minimum seven (7) years of relevant professional experience in conducting evaluations of development programmes and projects supported by the UN or other similar international organizations (10 points).
- Experience working with the GEF or GEF-evaluations (15 points);
- Experience working in Malawi or other African countries with similar context (10 points);
- Demonstrated understanding and work experience in designing and/or implementing renewable energy and/or climate mitigation activities in developing countries (15 points).
- Proven and extensive international experience in renewable energy projects, particularly decentralized energy platforms and mini-grids (10 points)
- Ability to conduct detailed quantitative GHG emission reduction calculations (direct and indirect) according to GEF policies and procedures (5 points)
- Excellent communication skills in English;
- Fluency in local languages of Malawi is not a must but is an advantage

13. EVALUATOR ETHICS

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluations'

14. PAYMENT MODALITIES AND SPECIFICATIONS

%	Milestone
10%	Upon approval of the final TE Inception Report
40%	Following submission and approval of the 1st draft terminal evaluation report
50%	Following submission and approval (UNDP-CO and UNDP RTA) of the final terminal evaluation report

15. APPLICATION PROCESS

i. Letter of Confirmation of Interest and Availability using the template provided by UNDP;

ii. CV including at least 3 references and a Personal History Form (P11 form);

iii. Brief description of approach to work/technical proposal of why the individual considers him/herself as the most suitable for the assignment, and a proposed methodology on how they will approach and complete the assignment; (max 1 page)

iv. Financial Proposal that indicates the all-inclusive fixed total contract price and all other travel related costs (such as flight ticket, per diem, etc), supported by a breakdown of costs, as per template attached to the Letter of Confirmation of Interest template.

Travel: All envisaged travel costs must be included in the financial proposal. UNDP does not accept travel costs exceeding those of an economy class ticket. Should the International Consultant wish to travel on a higher class he/she should do so using their own resources. In the case of unforeseeable travel, payment of travel costs including tickets, lodging and terminal expenses will be agreed upon, between the respective business unit and Individual Consultant, prior to travel and will be reimbursed

v. If an applicant is employed by an organization/company/institution, and he/she expects his/her employer to charge a management fee in the process of releasing him/her to UNDP under Reimbursable Loan Agreement (RLA), the applicant must indicate at this point, and ensure that all such costs are duly incorporated in the financial proposal submitted to UNDP.

All application materials should be submitted by email to procurement.mw@undp.org or in sealed envelopes by **7th August 2019**. Please include "Increasing Energy Access UNDP-GEF Terminal Evaluation 2019" in the subject line of the email.

Criteria for evaluation of proposal:

Only those applications which are responsive and compliant will be evaluated. Offers will be evaluated according to the Combined Scoring method – where the educational background and experience on similar assignments will be weighted at 70% and the price proposal will weigh as 30% of the total scoring. The applicant receiving the Highest Combined Score that has also accepted UNDP's General Terms and Conditions will be awarded the contract.

UNDP applies a fair and transparent selection process that will take into account the competencies/ skills of the applicants as well as their financial proposals. Qualified women and members of social minorities are encouraged to apply

Annex B: Evaluation Question Matrix

Evaluation questions and sub-questions	Evaluation indicators	Data collection method	Sources of information
PROJECT FORMULATION			
Q1: Was the project formulation and implementation strategy, along with planned activities, satisfactory?			
Were the project components 1 and 2 well sequenced in terms of time of implementation considering that component 1 was to inform component 2?	• Time of completion of component 1 • Start time of component 2	• Document review • Interviews with project manager and mini grid operators	Annual work plans and progress reports
How realistic and achievable were the objectives?	The set targets	Document reviews	Program document
Were all pertinent risks consider? Was it deterministic whether the risks remain or diminish at the end of the project?	List of risks considered	Document reviews	Program document
Did the formulation considered crucial lessons learnt from other GMG?	Situational analysis	Document reviews	Program document
Was the planned stakeholder participation good and representative?	Proposed composition of project board and project steering committee	• Document reviews • Interviews with stakeholders	• Program document • Interviewees
Does the project formulation support transition to mature or growth market stages?	Replication strategies	Document reviews	Program document

A	Linkages and co-ordination strategies	Document reviews	Program document
EXECUTION AND IMPLEMENTATION			
Q2 Was the project execution and implementation satisfactory			
Did the management team display sufficient adaptive management?	Planned activities	• Document reviews • Interviews	• Progress reports • PIR • mid-term reviews • interviewees
Was the project well networked within and outside Malawi?	Stakeholder participation	• Document reviews • Interviews	• Progress reports • PIR • SC meetings • mid-term reviews • interviewees
Were there any feedback platforms for M&E purposes?	M&E plan	Document reviews	• Progress reports • PIR • SC meetings • mid-term reviews
How efficient were the disbursement of UNDP/GEF funds? Did the project actually sourced co-financing for other partner agencies?	Budget	• Document reviews • Interviews	• CDR, Audit reports •Interviewees
Was the M&E well planned	M&E plan	Document reviews	• Progress reports • PIR • SC meetings • mid-term reviews
OUTCOMES			

Q3. How has the project contributed to achieving the expected outcomes and the objectives? (Effectiveness and impact)			
To what extent were the objectives of components 1, 2 and 3 attained	Components Targets	• Document reviews • Interviews • Field observations	•Interviewees • Progress reports
Were the necessary pre-conditions for obtaining the impacts in place?	M&E plan	Document reviews	• Progress reports • PIR • SC meetings • mid-term reviews
Was the delivery of the project done in a cost-effective manner?	Planned expenditure	Document reviews	CDR, Audit repots
Are there any measurable ecological, social-economic impacts emanating from the project?	Baselines	Document reviews	• Progress reports • PIR • SC meetings • mid-term reviews
Q4. Do the project objectives align to national goals, strategies and government policies? Does the project align to GEF priority areas? (Relevance)			
		Document reviews	Program document MGDS III
Q5. What is the likelihood of outcomes and good practices being sustained, replicated and disseminated following project implementation? (Sustainability)			
Any evidence of GMG sustainability from the current GMG and enabling framework in Malawi?	Financial stability of the mini grid operator	• Document reviews • Interviews	• Business models • Operation and maintenance plans • Interviewees

Annex C: Itinerary of Field Mission

Date	Place	Activities
Monday 7-Oct-2019	Lilongwe	• Arrival of International Consultant
Tuesday 8-Oct-2019	Lilongwe	Meeting of International and National Consultant for a common understanding of the evaluation process Meeting World Bank TE Inception meeting with UNDP & TAC members
Wednesday 9-Oct-2019	Lilongwe	Meeting with Project Manager Meeting with Practical Action Meeting with Community Energy Malawi Meeting with UNICEF Meeting with Department of Energy Affairs Meeting with KFW Meeting with GIZ
Thursday 10-Oct-2019	Lilongwe	Meeting with EU Meeting with JICA Meeting with Irish Aid Meeting with Project Manager (continued)
Friday 11-Oct-2019	Lilongwe	• Lilongwe for Mchinji
	Mchinji	Meeting with Mchinji District Council Site visit to Sitolo Solar PV minigrid station Leaving Mchinji for Lilongwe
Saturday 12-Oct-2019	Lilongwe	• Recap of meetings/site visits
Sunday 13-Oct-2019	Lilongwe	• Leaving Lilongwe for Blantyre
Monday 14-Oct-2019	Blantyre	Meeting with Blantyre District Council Meeting with ESCOM Meeting with Bankers' Association of Malawi Meeting with United Purpose
	Mulanje	• Meeting with MEGA
Tuesday 15-Oct-2019	Mulanje	• Site Visit to MEGA microhydro power plants
Wednesday 16-Oct-2019	Blantyre	• Leaving Blantyre for Lilongwe
Thursday 17-Oct-2019	Lilongwe	Meeting with Department of Economic Planning & Development Meeting with MERA Meeting with USAID
Friday 18-Oct-2019	Lilongwe	• End of Mission debriefing and Presentation of preliminary findings to UNDP, CEM, EP&D
Saturday 19-Oct-2019	Lilongwe	• Departure of International Consultant

Annex D: Lists of Persons Interviewed

Date	Institution	Persons Interviewed	Position
Tuesday 8-Oct-2019	World Bank	Kagaba Paul Mukiibi	Energy Specialist
Wednesday 9-Oct-2019	UNDP	Emmanuel Mjimapemba	Project Manager
	Practical Action	Victor Chambayika	Country Director
		Dwight Kambuku	Project Manager
		Admore Chiumia	Energy Associate
	Community Energy Malawi	Edgar Kapiza Bayani	Country Director
		Lusungu Kumwenda	Project Manager
		Berias Unyolo	Energy Development Officer
	UNICEF	Jaivardhan Singh	Energy Specialist
	Department of Energy Affairs	Hestings Chipongwe	Director of Energy Affairs
	KFW	Oliver Gleiss	Director of KfW Office Lilongwe
	GIZ	Mathias Stumpf	Tema Leader, Energising Development(EnDev) Malawi
		Gift Chunda	Program Advisor
Thursday 10-Oct-2019	European Union (EU)	Odran Hayes	Program Manager
	JICA	Shitau Miura	Project Formulation Advisor (Economic Development)
		Godfrey Kapalamula	Chief Programme Officer
	Irish Aid	Anne Holmes	Deputy Head of Mission
		Chikumbutso Kilembe	Vulnerability Advisor
Friday 11-Oct-2019	Mchinji District Council	Chrispin Soko	Environmental Officer
		Dancan Kampini	Trade and Industry Officer
		Christopher Kakweche	Intern (Energy Specialist)
	CEM Trading	Moses Gondwe	Power House Technician
	CEM Trading Mini grid customers	Anonymous	Household and small business customers
Monday 14-Oct-2019	Blantyre District Council	Maxwell Mbulaje	Director of Planning and Development
	ESCOM	Charles Kagona	Senior Engineer (Electrical)
	Bankers Association of Malawi	Violette Santhe	Chief Executive Officer
	United Purpose	Lloyd Archer	Energy Program Manager
	MEGA	Daniel Kloser	General Manager
Tuesday 15-Oct-2019	MEGA mini grid customers	Anonymous	Household and small business customers
Thursday 17-Oct-2019	Department of Economic Planning & Development	Owen Honest Makaka	Economist

	MERA	Winfred Kasakula	Renewable Energy Senior Engineer
		Tufwane Mwagomba	Licencing Manager
	USAID	Littleton Tazewell	Mission Director
		Maurice L. Shines	Deputy Office Director

Annex E: Summary of Field Visits

SUMMARY OF FIELD VISITS TO SOLAR PV AND MICRO HYDRO MINI GRIDS

The evaluators carried out field trips to two mini grids implemented under IACADES Project in addition to conducting evaluation meetings/interviews with key project partners and stakeholders in their respective offices in Lilongwe, Mchinji, Blantyre, and Mulanje,. These visits meant to physically verify the existence of the operational mini grid; observe technical and operation issues; and obtain customers' perceptions. The site visits were done in the company of Ms. Sithembire Tembo of UNDP and the summary is provided below.

1. *Summary of a visit to Solar PV mini grid in Sotolo village, Mchinji District*

The evaluators met Mr. Moses Gondwe, a Power house Technician (CEM Trading) who gave technical explanation of the power house as well as the distribution network configurations.

Verification of operational mini grid

The evaluators verified that the solar PV mini grid is in place at a site in Sitolo Village. The solar PV arrays were clean, the containerised battery bank and DC-AC conversion system was air conditioned to maintain the system within the permissible operation temperatures, the data logging system was functional, the distribution network comprising of single phase and three phase distribution lines were up to standard, house wiring and grid connections were also up to standard. Additionally, the generation site is fenced and there is a security guard.

Technical and operational issues

The following are the observed issues.

- The generation capacity is currently oversized. Since the commissioning of the mini grid in August 2019, the power demand peaked at around 12kw against the installed capacity of 80 kW. Often times, the power demand is under 2kW. See Figure AD1. However, with the coming in of the 7.5 kW maize mill which was under installation during the visit and the anticipated increased number of connected customers, the peak demand is expected to increase.
- There is only one manual switchgear that isolates the grid from the generation. This leads to the unnecessary inconvenience of power cuts during any grid maintenance. For example, during the visit, installation of the maize mill was under way and there was no power on the grid to pave the way of the installation.
- The prepaid meter supplier had not equipped CEM Trading to generate prepaid kwh tokens as well as to decode tampered meters. Thus, CEM has not yet selling electricity and is unable to decode and encode tampered meters.

Customers Perceptions

Both domestic and business customers were excited with the coming of electricity in their area and are willing to buy power at the agreed tariff, which they find to be cheaper than what they used to spend on lighting and cell phone charging for example.

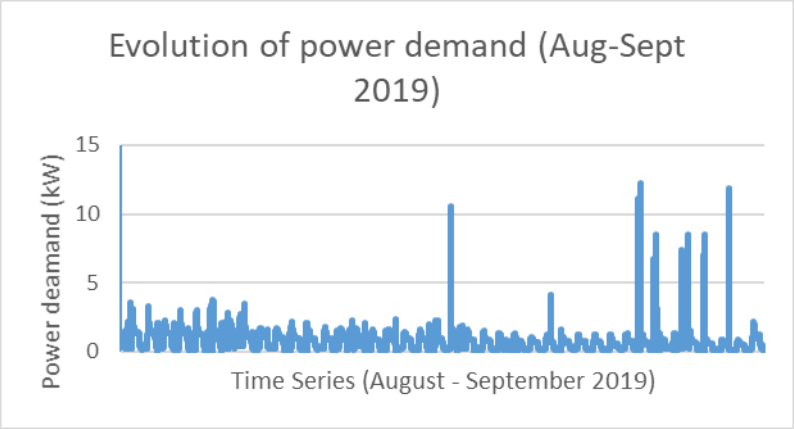

Figure 2: Evolution of power demand from August to September 2019

2. *Summary of a visit to MEGA's micro hydro power plant in Bondo Village, Mulanje District*

An Electrical Engineer at MEGA accompanied the evaluators to a newly installed and refurbished micro hydro power plant. The Engineer explained the powerhouse as well as the distribution network configurations.

Verification of the operational mini grid

The evaluators verified that the newly installed 100 kWp micro hydro power plant is up and running. The control system as well as energy, voltage, current, frequency monitoring panels were functional. Additionally, the plant operator was available and the manual data (hourly electricity consumption) logging system was in place, the transmission (11kV), and distribution networks, house wiring and grid connections were up to standard. The evaluators did not have access to the inside of the refurbished 60 kWp power plant (Bondo 2) because it was locked and besides it was off due to low power demand.

Technical and operational issues

The following are the observed issues.

- All three generating plants (Bondo 1, Bondo 2, Bondo 3) are cascaded on the same river with a single dam upstream. The newly installed Bondo 3 plant is downstream and faces generation challenges once the upstream water level goes down.
- The intake of Bondo 3 is located at the outlet of the Bondo 2 and the gate that controls the water flow is not secure and there are reported incidents that children close the gate and consequently interrupting the generation of Bondo 3.
- At the time we visited the plant, the demand was at around 43kw (calculated from phase currents, voltages and power factor displayed on monitoring panels shown in Figure AD2). This is lower than the installed capacity of 100 kw and hence the switching off of Bondo 1 and 2 generation plants.
- The plant operators are not given basic training on safe operations of the plant.
- The concrete channel penstock in the upstream (for Bondo 1) exhibits massive spillage which affects the water flow rate down stream and in hot seasons this affects power generation downstream of Bondo 3.

Customers Perceptions

- Both domestic and business customers were excited with the coming-in of the electricity in their area and are willing to buy power at the agreed tariff, which they find to be cheaper than what they used to spend e.g. on lighting and cell phone charging for example.
- The system of selling prepaid power is sluggish and inefficient. Sometimes it takes more than a month before the customer gets the ordered prepaid power.
- There is increasing power unreliability during the hot seasons due to perceived low water levels. Sometimes it can take a month without power.

Annex F: List of Documents Reviewed

1. Project document, Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
2. UNDP (2012), Guidance for Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects.
3. Progress reports
    - Quarterly report for the sustainable energy management project (2014)
    - DAE, progress report for September 2013 to May 2014
    - DAE, progress report for January to March 2016
    - DAE, progress report for April to June 2016
    - DAE, Progress report for January to June 2017
    - DAE, progress report for July to September 2017
    - DAE, progress report for January to March 2018
    - DAE, progress report for January to June 2019
    - CEM, progress report (2018)
    - MEGA progress report for July 2016 to June 2017
    - UNDP MTR Management Response
4. Minutes of Meetings
    - Minutes for the 3rd Sustainable Energy Management (SEM) Project and 2nd Increasing Access To Clean And Affordable Decentralised Energy Services To Selected Vulnerable Areas of Malawi Project Steering Committee Meeting Held On 4th February, 2016.
    - Minutes for the 4th Sustainable Energy Management (SEM) Project And Increasing Access to Clean And Affordable Decentralised Energy Services to Selected Vulnerable Areas Of Malawi Project Steering Committee Meeting Held On The 3rd February, 2017.
    - Minutes for the 6th Increasing Access to Clean and Affordable Decentralised Energy Services (IACADES) to Selected Vulnerable Areas of Malawi Project steering committee meeting held on the 7th december,2017.
    - Minutes Of The 7th Sustainable Energy Management (SEM) Project and Increasing Access to Clean And Affordable Decentralised Energy Service s (IACADES) to Selected Vulnerable Areas of Malawi Project Steering Committee Meeting Held On The 24th May, 2018.
    - Minutes of Local Appraisal Committee Meeting for the 2015-2018 Increasing Access to Clean and Affordable Decentralized Energy Services in Selected Vulnerable Areas of Malawi Held on 29th January 2015.
5. Annual work plans
    - 2016 Annual Work Plan Progress Report for Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
    - 2017 Annual Work Plan Progress Report for Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
    - 2018 Annual Work Plan Progress Report for Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
    - 2019 Annual Work Plan Progress Report for Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi
6. Field mission report
    - Field Mission: Baseline and scoping mission on MEGA Position prior to GEF Project funding disbursement.
    - Field Mission: Evaluation of the performance status of Solar PV Wind Hybrid Mini Grid

Systems installed in the Northern Region.

7. Project Implementation Reviews
   - 2016 Project Implementation Review (PIR) for Affordable decentralized energy services
   - 2017 Project Implementation Review (PIR) for Affordable decentralized energy services
   - 2018 Project Implementation Review (PIR) for Affordable decentralized energy services
   - 2019 Project Implementation Review (PIR) for Affordable decentralized energy services
8. Train Reports
   - A narrative report on the collaborative technical training and awareness on solar and power back up solutions presented to UNDP
   - Report for the renewable energy systems modelling and simulation- modelling tools for energy systems development short course
   - Report for the skills development in power quality and safety assurance for rural micro hydropower system short course
9. Sitolo Business Plan Draft Report, February 2019.
10. Clean Energy Mini-grids for Rural Electrification in Malawi (CEMREM): Validation Report
11. MERA (2019), Regulatory framework for mini-grids.
12. Malawi Sustainable Energy Investment Study: Summary for Decision Makers

Annex G: Results Framework

Component 1: Expansion of the Mulanje Electricity Generation Agency(MEGA) Micro Hydro Power Plant					
	Indicator	**Baseline**	**Targets**	**Source of verification**	**Risks/assumptions**
Outcome 1. Increasing the installed capacity of the Mulanje Electricity Generation Agency's (MEGA) MHPP scheme	Accumulative installed capacity	56kWp	168 kWp (from mini-grids directly supported by project INV i.e. Lujeri). *216 kWp (all new MEGA MHPPs supported by the project plus the baseline	Project reporting	Timely regulation, co-financing etc.
	Cumulative renewable electricity generation (kWh/year)	220,752 kWh/Year	851,472 kWh/Year	Project reporting, MERA data; MEGA Annual reports	Tech performance etc.
Outcome 1.2 Achieving MEGA's business plan target of increasing the aggregate household energy savings among the customer base	Household energy expenditure savings among customer base (US$)	$65,969	$296,560/Year by 2018	MEGA Annual reports, Project reporting	Tech performance and demand

Component 2: Replication of MEGA model via piloting of new Mini-grid schemes in other areas of Malawi					
	Indicator	**Baseline**	**Targets**	**Source of verification**	**Risks/assumptions**
Outcome 2.1 Investment in Installed capacity of mini-grid schemes established, replicating the MEGA model and using a Build-Own- Operate (BOO) Public Private Partnership model	Cumulative installed renewable energy mini-grid capacity (kWp)	0	84 kWp greenfield minigrid(s)established	Project reports	Regulation, Pvt sector, finance, etc.
	Cumulative renewable electricity generation kWh	0	294,336 kWh/Year	Project reports	As above
	No. of new minigrid operators replicating MEGA model	0	2 MGs established using BOO model	Project reports	Political desire, pvt sector appetite
Outcome 2.2: Increased the aggregate household energy savings among the customer base	Household energy expenditure savings among customer base (US$)	0	$55,711/Year	BOO operators	MG performance, market demand

Component 3: Institutional Strengthening and Capacity Building for promotion of decentralized mini-grid applications across the country					
	Indicator	**Baseline**	**Targets**	**Source of verification**	**Risks/assumptions**
Outcome 3.1: Increased capacity of key stakeholders, especially at the sub-national levels to effectively plan and implement clean energy minigrids	Number of districts where sub-national training and capacity building programmes on clean energy minigrids conducted	0	28 districts covered by clean energy mini-grid training programmes.	reports, course enrolment etc.	Level of interest and support
	Number of people trained on planning and implementing clean energy minigrids.	0	At least 300	as above	as above
	% share of women recipients of the capacity building	0	at least 30%	as above	as above
	No. of area-based electrification plans that include minigrids developed and adopted	Area based electrification plans do not consider electrification through mini-grids	5 area-based electrification plans that include clean energy mini-grids, prepared and adopted	project reporting	Interest & engagement of participants at sub-national level
Outcome 3.2 Increased awareness about relevant business models, policy/ regulatory issues, and financing of mini-grids in the Malawian context	Number of websites in Malawi which stakeholders could use to plan and implement clean energy minigrids.	Websites don't provide much info	Information Clearing house on clean energy mini-grids with a GIS interface available to all stakeholders.	project reporting	Will need ownership/commitment from gov etc.
	Number of case studies and toolkits on Malawi on clean energy mini-grids	no real relevant toolkits of case studies in Malawi	mini-grids toolkit with case studies published and presented in a national workshop and available to all stakeholders.	project reporting. Evidence of publication etc.	Ownership, inputs from BOO operators etc.
Outcome 3.3 Improved policy and regulatory environment to facilitate the sustainable development of mini-grids in Malawi	Extent to which policies/regs integrate GMGs	Policies/Regs do not consider GMGs	Recommendations put forth to government for the Rural Electrification Act, 2004 and Energy Regulation Act 2004 to be amended to include clauses promoting clean energy minigrids	reports, amended policies/regs etc.	MERA support, political priorities, etc.
	Number of local (government supported) financing mechanisms for clean-energy minigrids	REF not presently funding mini-grids	REF able to finance GMGs - through policy and Reg changes	as above	Ownership and support - political, etc.

Annex H: Evaluation Consultant Agreement Form

EVALUATION CONSULTANT CODE OF CONDUCT AGREEMENT FORM

Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and: respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study limitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form[34]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Robert Aitken

Name of Consultancy Organization (where relevant): _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at (place)on

Signature: 

EVALUATION CONSULTANT CODE OF CONDUCT AGREEMENT FORM

Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded
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7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form[34]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Lameck Kabambalika Nkhonjera

Name of Consultancy Organization (where relevant): _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at (place)on Blantyre, Malawi 1 December, 2019

Signature: 

[34] www.unevaluation.org/unegcodeofconduct