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Terminal Evaluation Report

of the UNDP-GEF Project

"Removal of Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands"

(PIMS 4333), GEF Project ID 4099

by

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Region and countries included in the project: Mauritius, Africa
GEF Operational Focal Area: Climate Change (CC-4)
Strategic Program: / SP3 Promoting Market Approaches to Renewable Energy
Executing Agency/Implementing Partner: Ministry of Energy and Public Utility / Central Electricity Board
Project period evaluated: October 2011 to 3 March 2017

Acknowledgements

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The evaluators would also like to express their gratitude and special appreciation for the excellent support provided by the personnel of the UNDP Country Office in Mauritius, and the close collaboration and assistance received from the project management team at CEB.

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ACRONYMS

AFD	Agence Française de Développement
APR	Annual Project Review
CC	Climate Change
CEB	Central Electricity Board
EA	Executing Agency
EIA	Environmental Impact Assessment
ER	Emission Reduction
FIT	Feed-in Tariff
FSP	Full-Sized Project
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gases
GoM	Government of Mauritius
IA	Implementing Agency
LSDG	Large Scale Distributed Generation
MCB	Mauritius Commercial Bank
MTE	Mid-Term Evaluation
MEPU	Ministry of Energy and Public Utilities
MFED	Ministry of Finance and Economic Development
MITD	Mauritius Institute of Training and Development
MSDG	Medium Scale Distributed Generation
OIDC	Outer Island Development Corporation
PIR	Project Implementation Report
PV	Photovoltaic
RE	Renewable Energy
RTA	Regional Technical Advisor
ROAR	Results-oriented Annual Report
SBM	State Bank of Mauritius
SC	Steering Committee
SSDG	Small Scale Distributed Generation
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNDP-CO	United Nations Development Programme Country Office

Executive Summary

Project Summary Table

Project Title:	Removal of Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands			
GEF Project ID:	4099		*at endorsement (Million US$)*	*at completion (Million US$)*
UNDP Project ID:	4333	GEF financing:	2.005	1.99
Country:	Mauritius	IA/EA own:	0.050	0.044
Region:	Africa	Government:	1.438	42.427
Focal Area:	Climate Change CC-4: promote on-grid electricity from renewable source	Other:	17.500	40.047
FA Objectives, (OP/SP):	SP3: Promoting market approaches to renewable energy	Total co-financing:	18.988	83.324
Executing Agency:	Ministry of Energy and Public Utilities / Central Electricity Board	Total Project Cost:	20.993	85.329
Other Partners involved:	Rodrigues Regional Assembly, Outer Islands Development Corporation	Project Document Signature (date project began):		October 2011
		(Operational) Closing Date:	Proposed: December 2015	Actual: - GEF Funds exhausted: 31 Dec 2016

Brief Description of the Project

The project objective was to assist the Government of Mauritius in addressing the various barriers with a view to achieving at least 2% of grid-connected electricity generation from PV by 2025, as outlined in the "Long Term Energy Strategy 2009-2025". The project designed to accelerate sustainable on-grid PV electricity generation in Mauritius by installing a total solar PV energy capacity of 3 MW, and leveraging $17.5 million in private sector investment over its four-year implementation period. This, in turn, was expected to generate direct global benefits of about 13,295 tons of CO2 over the same period, and about 5,318 tons CO2/yr thereafter in avoided greenhouse gas (GHG) emissions. The project would do this by creating favorable legal, regulatory and market environment and building institutional, administrative and technical capacities to promote the utilization of the country's favorable solar radiation potential for PV grid-connected electricity generation, and introducing a conducive fiscal incentive programme that would facilitate private sector participation in supplying the national grid with PV-generated electricity at market-determined prices and assisting the Government in promoting private sector funded PV investments. More specifically, the project would comprise the following key components:

Component 1: To formulate and introduce a streamlined and comprehensive market-oriented energy policy and legal/regulatory framework to promote PV grid-connected electricity generation in the country.

Component 2: To develop capacity within MEPU and other key Government/Financial institutions to evaluate the economic and financial viability of grid-connected PV systems, to formulate incentives and sustainable

financing mechanisms to attract private sector investors, and to develop possible Carbon finance potential related to future on-grid PV investments outside of the project framework.

Component 3: To develop capacity within MEPU / CEB / MMS / Training Institutions, as appropriate, to upgrade existing solar radiation data, expand geographical coverage for solar resource measurement, to formulate technical guidelines and standards for PV system components, to determine grid absorption capacity (this is required in order to maintain the stability and integrity of the grid at all times, in view of the fluctuating nature of the electricity input from PV) and provide oversight, monitoring and certification of PV systems, and provide installation, operation, maintenance and repair services. Proposals for viable delivery models for technology transfer will also be formulated

Component 4: To support the Feed in Tariff scheme developed by funding part of the price differential to be offered to selected promoter connecting to the grid.

Component 5: To formulate an outreach programme and document/disseminate project experience/best practices/lessons learned for replication within the country and in the region.

Project Results

Under the project, despite a 30-month delay in project start-up due to four failed recruitment attempts by MEPU, the project has been able to achieve~~d~~ most of the planned activities and targets. Most significant achievements included streamlining of the SSDG approval procedures which were quite labor-intensive involving, among others, the need for an applicant to put a notice in the newspaper of his/her intention to install solar roof-top PV panels, EIA and approval from the Prime Minister's Office (PMO). The Electricity Act has been revised to remove the need for PMO's approval, and a much simplified one-stop-shop approach is now in place within CEB for the SSDG programme, under which three different schemes have been successfully piloted and implemented: Feed in Tariff, Net Metering, and No Tariff. The institutional and technical capacities of CEB have been greatly strengthened, both in terms of grid-related requirements (e.g. grid absorption capacity and grid codes) and in terms of project management. To promote and accelerate the growth of the solar PV sector, the Government of Mauritius has approved exemptions, first on import duties in 2014 and in 2016, on VAT on solar PV systems and accessories. The Evaluators consider that the project has already achieved its overall objective of contributing to CO2 emission reduction and various set targets.

Table 1 – Summary of Key Project Targets and Results Achieved

Item	Targets	Status	Actual Achieved
1.	3 MW PV (revised to 10 MW at project inception) commissioned during project	Achieved - Exceeded	11.208 MW
2.	USD17.5 m. leveraged in private sector investment	Achieved - Exceeded	USD 39.87 million
3.	Government cash contribution of USD 80,000 (FIT)	Achieved - Exceeded	USD 31.76 million
4.	Government in-kind contribution of USD 278,000	Achieved - Exceeded	USD 6.17 million
5.	Direct emission reductions of 98,400 tons CO_2 over the 20 year lifecycle of PV installations	Achieved - Exceeded	Direct ER of 352,262 tons CO_2
6.	National goal of 2% of energy generated by solar by 2025	Achieved - Exceeded	16%

Table 2 - Evaluation Rating Table

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

Summary of Conclusions

The project has been very successful and achieved its objectives in terms of key targets, institutional and capacity building, providing an enabling environment for PV market uptake, and leveraging co-financing from the government both in cash and in-kind, private sector investment, and follow-up programme. The PV plants installed under the project will realize a direct GHG emission reduction of 352,621 tons CO2eq over the lifecycle of investments and have thereby exceeded original ER targets. The project has clearly played a catalytic role in promoting both medium scale and small scale (rooftop) installations, and significantly contributed to the take-off of PV sector market as well as raising awareness among the population to reduce GHG. Various financial incentives such as FIT provided by the project, the exemption of import duties and VAT on PV systems, and favorable interest on green loans, provided an impetus for the PV market take-off. The future of PV energy generation in Mauritius is sound and sustainable.

The management of the project within the state-owned utility CEB was a key factor contributing to the project success. CEB took over the leadership role in the project and became the champion (rather than the opponent) for grid-connected PV in Mauritius. Their know-how, intellectual leadership, technical expertise and enthusiasm have ensured the overall success and sustainability of the project.

Even though the project experienced a 30-month implementation start-up delay, the project was able to complete most of the planned activities within a period of only 32 months - as opposed to the planned four years (48 months); it has even carried out additional essential activities such as the Smart Grid Roadmap which was not originally planned, as well as achieved results far exceeding the original targets of 3 MW and co-financing amounts.

Recommendations

Recommendation 1: It is recommended that the few remaining project activities be completed as soon as possible, including the booklet for awareness campaign, SSDG and PV market review by Deloitte, early implementation of the Smart Grid Roadmap, and the operationalization of the solar mapping system. For the latter, it is recommended to complete the installations of the pyranometers in Mauritius first, latest by the second quarter of 2017, then test and fine-tune the system if need be. This will help reduce any technical or operational problems that could arise for the pyranometers in Rodrigues and Agalega.

Recommendation 2: There should be increased quality control on PV panels at the point of import. CEB/MEPU to request Ministry of Trade, Commerce and Consumer Protection (MTCCP) to declare importation of PV panels as controlled product and to establish acceptable certification standards.

Recommendation 3: Grid absorption capacity presently has limitations to meet the increased solar energy to be produced by future PV installations. CEB should fast-track the upgrading of its grid absorption capacity in order not to block the huge momentum in the PV market created under the project.

Recommendation 4: During the TE Workshop with project stakeholders, the need for norms and standards for solar PV installation works, including mechanical mounting and electrical wiring, was strongly voiced. While the electrical specifications are prescribed in the grid codes, the mechanical and electrical works and

installations should be regulated and monitored, for quality controls, safety and ensuring that the installations can withstand cyclonic exposures. It is therefore recommended that MTCCP consider introducing a system of licensing of trained and certified PV installers, and their performance be tracked; this necessarily requires putting in place a system of performance feedback from end-users on PV installers contracted. The performance record should be taken into consideration at the time of their license renewals. It may be envisaged to register independent PV Inspectors much in the way of the Machinery and Boiler Inspectors scheme.

Recommendation 5: To maintain the uptake momentum of solar PV installations, it is recommended that all present fiscal incentives be maintained at least for the next 8 years to 2025, including but not limited to zero customs duty (including on partial shipments) and VAT on all solar PV components including their spare parts, and green energy investment tax relief.

Recommendation 6: MITD offers courses on solar PV installation and students benefit from on-site demonstration and hands-on practice. It is ~~recommendation~~ recommended that a 5 kW PV system be installed in Rodrigues for training and demonstration purposes so that students can have actual hands-on, practical experience in installing solar PV panels.

Recommendation 7: Presently, local insurers are sharing and re-insuring their risks with international insurers at high premium rates. It is recommended that CEB/MEPU, MTCCP and the Association of Commercial Banks in Mauritius negotiate for a group insurance policy for all the solar PV owners - and even for all renewable energy installations – in order to benefit from economies of scale.

Recommendation 8: The performance data from solar PV installations and the grid would be of great value for analyzing and planning future market development. It is recommended that data on actual PV generation and electricity use be cross-validated with the solar maps to be generated, to guide plans for future solar PV programmes.

Recommendation 9: PV generation remains more expensive than conventional electricity generation, even with the drop in price of PV installations, at about 15% worldwide over the past years. With the added removal of the 15% VAT by the government of Mauritius in 2016, in the Mauritian context, this comes to about 30% overall cost reduction for PV investors. While the price differential between conventional generation and RE is decreasing, the price gap needs to be tracked. Tracking the differential will help determine the future of PV sector in Mauritius and to plan the extent of future funding necessary to close the gap between conventional generation and solar PV and other renewable energy technologies.

1. INTRODUCTION

The Terminal Evaluation of the UNDP~~/~~-supported GEF-financed Project "Removal of Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands" was carried out in two parts: from 21 January through 26 February, 2017 for desk reviews, data collection, analysis and interviews; and from 27 February to 3 March 2017 for evaluation mission in the field.

1.1 Purpose of the evaluation

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. This report concerns the Terminal Evaluation (TE) of the project, Removal of Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands" (PIMS 4333) to assess project results achieved since October 2011.

The evaluation process is intended to promote accountability and transparency, assess whether the project has achieved its objectives, synthesize lessons to help guide future design and implementation of GEF-funded UNDP activities, and contribute to the overall assessment of results in achieving GEF strategic objectives aimed at global environmental benefits.

1.2 Scope and Methodology

This Terminal Evaluation has been conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects. It is founded on evidence-based information that is credible, reliable and useful. The evaluation has followed a participatory and consultative approach and sought to ensure close engagement with key government counterparts, UNDP Country Office, project team, the UNDP GEF Regional Technical Adviser, and key project stakeholders. The evaluation included a field mission to Mauritius and visits to sample PV installation sites. The TE was carried out in strict adherence to the Terms of Reference received (***Annex 1***), and included the following three stages:

(i) Preparatory Evaluation Work

This initial stage involved extensive desk reviews by the three evaluation team members of project-related documentations such as the project document, progress and annual reports, mid-term evaluation report, focal area tracking tools, project files, national strategic and policy documents, and any other materials (***Annex 2***) that the evaluators considers useful for an evidence-based evaluation assessment. The documents were partly provided by the UNDP Country Office and partly obtained through research on internet.

As part of the preparatory work, an Inception Report was prepared and submitted to UNDP CO for approval; it included a preliminary itinerary for the field mission including site visits (***Annex 3***), a tentative list of interviewees selected to provide a broad sample of the achievements and influence of the project, and a general interview (questionnaire) format for project team, stakeholders and beneficiaries.

(ii) Evaluation Mission

Preparatory Work (27 January to 26 February 2017):

During the period 27 January through 26 February 2017, the local consultant team ~~had~~ held extensive working sessions ~~were held~~ with the project management team and the responsible Programme Officer and his team at UNDP country office, for work planning and data collection purposes. Interviews were held with a broad sample of stakeholders and beneficiaries in the private sector, and selective site visits were also conducted (***Annex 4*** for list of persons interviewed and ***Annex 5*** for Summary of field visits).

As per the TORs, an evaluation mission in Mauritius took place from 26 February to 3 March 2017. Inception Meetings were held separately with several key project stakeholders at the beginning of the mission to brief on the purpose and methodology of the TE, to obtain latest update on the project, and to finalize the mission schedules and arrangements. Key participants included UNDP Mauritius Country Office (UNDP CO), International Implementing Agency (IA), Central Electricity Board (CEB), Implementing Partner, and MEPU, Executing Agency (EA).

The evaluation mission consisted of interviews with the UNDP team, the project management unit, key stakeholders and selective beneficiaries and PV suppliers. Discussions with other relevant stakeholders (i.e. the UNDP Regional Technical Advisor, and a manager of MCB) were conducted remotely via Skype and telephone respectively. In addition, visits to selective solar PV installations were also conducted. The evaluation team also met with members of the GEF Operational Focal Point team in the Ministry of Finance and Economic Development to seek additional inputs and views on the project, and on GEF activities in the country. The mission was concluded on 3 March 2017 with a (a) Terminal Evaluation Workshop on 3 March 2017 to present and discuss preliminary evaluation findings and recommendations with key stakeholders at the TE Workshop (3 March 2017), (b) Knowledge Management Workshop, and (c) wrap-up meeting with UNDP Resident Representative and his environment team.

(iii) Preparation of the Terminal Evaluation Report

Following the mission, the collected data, updates and materials received during the mission were carefully reviewed and analyzed in accordance with UNDP Project Evaluation Methodology. All data was then consolidated, and based on accountable information and opinions of the stakeholders with all sources and assumptions given, a draft Terminal Evaluation Report was prepared and submitted to UNDP CO for review and feedback.

UNDP Mauritius Country Office shall subsequently circulate the report to key project partners for review. Consolidated questions and comments on the draft TE Report received from UNDP CO shall be reviewed, responded to and incorporated into the final Report. An "audit trail" will be included to indicate how the comments received were (or were not) addressed in the final TE Report.

1.3 Structure of the evaluation report

The structure of this Terminal Evaluation Report corresponds to the *Evaluation Report Outline* as documented within the TOR for the assignment.

This Terminal Evaluation is based on a performance assessment approach guided by the principles of results-based management. The evaluation tracks impact per the project's Logical Framework. The contribution of project outputs and project management is evaluated with reference to the achievement of the project outcomes and overall objective. This Terminal Evaluation reviews the implementation experience and achievement of the project results against the Project Document endorsed by the GEF CEO, including any changes made during implementation.

2. Project description and development context

2.1 Project start and duration

In October 2011, the the UNDP-supported GEF-financed project was signed between the Government of Mauritius, Ministry of Energy and Public Utilities (MEPU), the Ministry of Finance and Economic Development and UNDP Mauritius. After four failed rounds of attempts by MEPU to recruit the project manager, the project implementation responsibilities were delegated in early 2014 to the Central Electricity Board (CEB), a parastatal body under MEPU. A project management team comprising of a project director, 2 project managers and a dedicated team of SSDG staff was formed. Following a delay of some 2½ years, the project inception workshop took place in April 2014, with the initial project end date of September 2015. As recommended by the Mid-term Evaluation undertaken in April 2015, in September 2015, the project was granted a no-cost extension to end of December 2016.

2.2 Problems that the project sought to address

The Republic of Mauritius is an island nation off the southeast coast of Africa with a total population of 1,277,853 (2009). The main islands of Mauritius and Rodrigues are fully connected to the Central Electricity Board (CEB) electricity grid. Electricity generation in the Republic is highly dependent on fossil fuels. In 2009, 79% of the electricity generation in Mauritius was from fuel oil (diesel and heavy fuel oil), kerosene (used exclusively at the 70 MW Nicolay gas turbine plant) and coal, with the rest of the energy mix provided by hydro

(5%) and bagasse (pulpy residue left after the extraction of juice from sugar cane).

Mauritius has viewed the expansion of its electricity generation capacity through the utilization of renewable energy resources, including grid-connected PV, as central to its longer-term development prospects. The objective is to utilize renewable sources of energy to the maximum extent possible thereby reducing reliance on imported fossil fuel. This project was intended to promote and accelerate a climate-friendly solution to the energy situation in Mauritius through harnessing its abundant solar radiation for PV-based electricity generation to supply the grid. This was also consistent with Mauritius' First National Communication to UNFCCC in April 1999 which identified solar PV electricity generation as one of the priority options for climate change mitigation.

2.3 Immediate and development objectives of the project

The project objective was to assist the Government of Mauritius in addressing the various barriers with a view to achieving at least 2% of grid-connected electricity generation from PV by 2025, as outlined in the "Long Term Energy Strategy 2009-2025". The goal was to reduce GHG emissions by creating favorable legal, regulatory and market environment and building institutional, administrative and technical capacities to promote the utilization of the country's favorable solar radiation potential for PV grid-connected electricity generation.

The project was designed to accomplish this by supporting the Government of Mauritius in:

- formulating and introducing a streamlined and comprehensive market-oriented energy policy and legal/regulatory framework to promote PV grid-connected electricity generation in the country, and developing standardized PPAs to be signed with PV investors; this includes streamlining and simplifying the administrative procedures for PV-based power producers and assisting MEPU to monitor/enforce regulations;
- strengthening capacity within MEPU and other key Government/Financial institutions to evaluate the economic and financial viability of grid-connected PV systems, to formulate incentives and sustainable financing mechanisms to attract private sector investors;
- formulating technical guidelines and standards for PV system components and determining grid absorption capacity; developing institutional and technical capacity within MEPU/CEB to provide oversight, monitoring and certification of PV systems; and upgrading and expanding existing geographical coverage of solar radiation measurement;
- supporting the Feed in Tariff scheme developed by funding part of the price differential to be offered to selected promoter connecting to the grid to generate 11,662 MWh of electricity for the national grid as a result of the 3 MW capacity brought on-line;
- formulating an outreach programme and document/disseminate project experience/best practices/lessons learned for replication within the country and in the region

2.4 Baseline Indicators established

The key baseline indicator was that GHG in the electricity generation sector was scheduled to increase from 2.03 million tons/year (2008 figures) to almost 3.3 million tons/year by the year 2020. Negligible investments were taking place in on-grid PV electricity generation. Further, in the baseline scenario there were;

- no policy and legal/regulatory framework to promote PV grid-connected electricity generation,
- negligable capacity within MEPU and other key Government/Financial Institutions to evaluate the economic and financial viability of grid-connected PV systems and to formulate incentives to attract investors,
- insufficient available solar radiation data to accurately design on-grid PV systems,
- no suitable methodology for the economic/financial evaluation of on-grid PV systems available,
- no capacity within MEPU/CEB to determine grid absorption capacity and provide oversight, monitoring and certification of on-grid PV systems available,
- no local capacity for installation, operation, maintenance and repair services,
- a lack of financial and other incentives

- no financial assistance through Feed-in-Tariffs for projects supplying electricity to the CEB grid
- no standard financial evaluation methodology available for calculating feed-in tariffs for investors with installed capacities over 50 kW,
- Financial institutions lacked capacity to appraise PV projects for lending,
- no ownership model or investment scheme and
- no risk mitigation instruments to protect lenders and developers available.

The project addresses a key development priority of the National Development Plan and provides a basis for achieving one of its goals stated in the Long Term Energy Strategy 2009-2025 of Mauritius. A Project Logical Framework was established for each of the five project outcomes, with clearly defined Outputs, Indicators, Baselines, Targets, and Assumptions/Risks which served as a very useful tool during project implementation and for the Terminal Evaluation. A Project Implementation Plan was also included detailing project activities to be undertaken to achieve each of the outputs, as well as Timeline of implementation of the activities during the 4-year implementation period. A detailed cost breakdown is also provided for each of the five outcomes.

2.5 Main stakeholders

Main stakeholders of the project were identified at project formulation stage and their respective roles in project implementation were adequately defined in the Management Arrangements section of the project document. The project was executed by the MEPU/CEB with support of UNDP Mauritius Country Office under Country Office Support to National Execution (NEX) modality. The project was monitored by a Steering Committee which reviewed implementation progress, endorsed work plans, provided guidance and assisted in the resolution of issues experienced during implementation. The Steering Committee was chaired by the National Project Director of CEB, and included the following key stakeholders: Ministry of Energy and Public Utilities – Executing Agency; Central Electricity Board – Implementing Partner/Executing Agency since February 2014; UNDP CO – Implementing Agency of GEF, provides quality assurance and support services; UNDP / GEF RCU – Monitoring and Evaluation of the project at the regional level; Ministry of Environment Sustainable Development, Disaster and Beach Authority; Ministry of Finance and Economic Development – GEF OFP, involved in Components 1,2, 4; Rodrigues Regional Assembly – Represents Rodrigues; Mauritius Institute of Training and Development – Provide training for solar PV, Component 3; Outer Islands Development Corporation – Represents Agalega; Mauritius Meteorological Services – Identified to support solar mapping under Component 3; Project Promoters from Private Sector – To participate in pilot projects under Component 4; Suppliers of Solar PV equipment – Technical personnel benefit from capacity building, Component 3; University of Mauritius – Identified during MTE for possible collaboration to prepare solar maps; and Private sector and individual households under SSDG schemes

2.6 Expected Results

The project was designed to accelerate sustainable on-grid PV electricity generation in Mauritius by leveraging $17.5 million in private sector investment over its four-year implementation period. This, in turn, was expected to generate direct global benefits of almost 13,295 tons of CO2 over the same period and almost 5,318 tons CO2/yr thereafter in avoided greenhouse gas (GHG) emissions. The project ~~was~~ intended to accomplish this by introducing a conducive regulatory framework that would facilitate private sector participation in supplying the national grid with PV-generated electricity at market-determined prices and assisting the Government in closing private sector funded PV investments. It was envisaged that this project would enable Mauritius to meet (and maybe even surpass) its target of 2% of electricity generation from on-grid PV by 2025, as established in its "Long Term Energy Strategy 2009-2025".

3. FINDINGS

3.1 Project Design / Formulation

The Project Document was designed with clearly defined objectives, outcomes, outputs, activities and milestones. The overall objective to implement at least 3MW of on-grid PV generation forms the clear basis for the subsequent supporting outcomes, outputs and activities. The intended outputs were designed to be goal-oriented and comfortably achievable within the four-year implementation timeframe

The Project Document is concise and includes the required level of details. It addresses barriers and opportunities for larger uptake of grid connected solar PV in its different components and responds to the national requirements through an appropriate list of outcomes and outputs. The project objective, the 5 components of the project, the outcomes and outputs as mentioned in the Project Document are clear and practical.

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

Log-Frame presented the indicators against the project objective at the aggregate level, for each of the five Outcomes of the project and for different Outputs of each of the Outcomes. The evaluators analyzed the intended project outcomes by using the "SMART" (Specific, Measureable, Achievable, Relevant, Time-bound) approach and found them reasonable and appropriate.

As an instrument for planning activities under the implementation framework defined in the Project Document, the logframe was adequate for reporting to GEF and for project management and reporting to UNDP. The logframe adequately facilitated the tracking of implementation targets for each year of project implementation and was thereby suited for the operational evaluation of project progress.

Although indicators, targets and deadlines were defined in the logframe, several lacked a clear means for tracking progress and impact outside the project with definitive sources of validation in the market, such as external indicators and targets with which to track the real market uptake of PV technologies; numbers of applications for installations and bank loans, for example, from Government spending on RE programmes would have provided reliable indications of project progress with a clear link to the project's CO2 ER targets.

The project budget and co-financing levels were appropriate for the planned level of intervention. Responsible parties were clearly identified.

Assumptions and Risks

The **barriers** towards larger uptake of Solar PV included Institutional barriers were identified as due to overlapping responsibilities of CEB and MEPU; Regulatory barriers due to absence of legal framework for grid connected solar PV; Financial barriers by way of higher cost of generation for solar PV technology; Technology barriers due to lack of experience, demonstration, resource mapping; Information Barrier due to limited awareness. The project has effectively addressed each of these barriers towards a larger sustainable uptake of solar PV in the country, and to reducing the dependence of Mauritius on fossil fuels for its energy needs.

The **strategy** of the project was centered on removing the barriers leading to larger uptake of solar PV, and provided for five different components with each component targeting a specific set of barriers. The project strategy provided an effective route towards the intended result of larger uptake of grid connected solar PV. The underlying assumption that the removal of barriers will lead to higher uptake of solar PV has proven to be correct when seen in the present-day context.

6 **risks** are identified in the Project Document (pp.13-14). These include regulatory, political, financial and technical risks. All risks were rated low.

1 Regulatory: The putting in place of a fair and transparent project selection process, appropriate financial incentives and licensing regime for the targeted PV installations does not happen or is delayed; the establishment of an independent regulator is not established on a timely basis.
2 Political: There is some risk that the final (adopted) version Renewable Energy Master plan contravenes key assumptions or policy directives for this project
3 Institutional: Apprehension in some quarters in Rodrigues of the likelihood that it may not be covered

under the project although mention is made in the project title and text.
4 Financial: Lack of commitment from private and public sector to invest in RE
5 Financial: The government does not agree to fund the proposed feed-in-tariffs at a level required for private sector developers to invest
6 Technical: Lack of technical information, knowledge and skills to design and implement on-grid PV projects

The risks outlined were logical and robust, whereby the strong uptake of solar PV in the public and private sectors was already evident by the delayed project start in 2014; under CEB's initiative, and with the support of AFD and the international consultant Mercedes, many regulatory and technical issues had already been addressed and the implementation of small and medium scale PV installations through private sector investment was well under way. With CEB as leader and technical and regulatory competence, the project was able to accelerate a movement which was taken up enthusiastically by both public and private sectors

Lessons from other relevant projects (e.g., same focal area) incorporated into project design

The project design included reference and links to projects and programmes already completed or underway, including the UNDP-supported GEF-financed project Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings completed in 2015. Further, the project design included coordination with other donors including Agence Française de Développement (AFD) which continues to play an active role in supporting Mauritius on sustainable development issues. The GEF-funded project has greatly benefitted from the contributions of AFD, which included both technical assistance as well as line of credits through two commercial Mauritian banks, MCB and SBM.

Further, the project design intended to establish strong linkages with Réunion Island (located some 220 km to the southwest of Mauritius) to capitalize on the valuable experience it had already accumulated on grid-connected PV. Some technical support exchanges took place but the experience of Réeunion Island in its PV strategy was deemed not appropriate for application in Mauritius.

In addition, the project intended to seek the support of countries in Africa/Asia which have also developed solid experience ~~to capitalize on the valuable experience it had already accumulated~~with on grid-connected PV under UNDP-supported GEF-financed projects. However, there were no indications that lessons from such projects were incorporated into the design of this project.

A broader corporate initiative which should have had important linkages with this project is Deutsche Bank's Global Energy Transfer Feed-in Tariffs (GET FiT) programme, an initiative launched in April 2010 to help facilitate the installation of Feed in Tariffs in developing countries. GET FiT looked to combine public financing with the experience of national and international partners to help address project development and remove financing barriers in developing countries. GET FiT was conceived in January 2010 when the United Nations Secretary General's Advisory Group on Energy and Climate Change (AGECC) invited Deutsche Bank Climate Change Advisors (DBCCA) to present new concepts to drive renewable energy investment in developing regions. DBCCA responded with GET FiT, a proposal designed to catalyze the private sector investment necessary to achieve the goals of renewable energy scale-up and energy access. The GET FiT research partnership included UNDP and they cooperated in various dialogue and research platforms to explore how public sector resources might be realistically mobilized to support renewable energy scale-up, and how GET FiT might be practically implemented. The FiT-related activities of the project were seen an excellent opportunity to apply best practices from GET FiT and mobilize additional resources and expertise.

Planned stakeholder participation

The partnership strategy was well designed to allow key local stakeholders and decision makers to actively participate in project implementation. This included the necessary top-level policy and decision makers, the public electricity utility, key state institutions and design organizations, universities, other specialized expert organizations, and the active participation of the private sector and civil society.

A Steering Committee (SC), chaired by the CEB/Ministry of Energy and Public Utilities, was established as prescribed in the project document and met regularly to provide strategic and management directions to guide

project implementation.

Replication approach

The Project design included consideration of the great potential for replicability at various other sites in Mauritius, Rodrigues and Agalega. The project was designed to adopt a bottom-up approach within the overall policy/investment framework that was envisaged to be developed to promote on-grid PV electricity generation at several sites in Mauritius and Rodrigues. Technical assistance for barrier removal and institutional strengthening to be provided under the FSP were to facilitate replicability by creating the required institutional, policy, and technical conditions which would enable the mobilization of additional investor interest in the development of further PV projects. Moreover, it was considered that the lessons learned would be of great value to the neighbouring countries sharing similar resource base should they also decide to follow suite and to tap their respective solar potential for on-grid PV electricity generation. The results achieved under the project to-date far exceeded the original targets in terms of installed solar PV capacities and sites, thus ascertaining the replicability of the project approach and design.

UNDP comparative advantage

The project ~~has~~ effectively builds on UNDP's strong experience in Mauritius and Africa in promoting, designing and managing sustainable energy and environmental protection programmes in the RE sector, while strengthening the capacity of government institutions. UNDP involvement in Mauritius has included projects related to resource use including energy efficiency. The UNDP Country Office in Mauritius was active in ensuring quality assurance, transparency and due process, closely guiding and supporting the project management team to overcome bottlenecks and adopt appropriate adaptive management measures to achieve results. Staff and consultants were contracted according to the established Rules and Regulations of the United Nations and the financial transactions and procurement activities similarly followed due process and the same Rules and Regulations.

Linkages between project and other interventions within the sector

As mentioned earlier, the project effectively collaborated with other programmes and activities funded by AFD, World Bank, and the Reunion Island in the PV sector.

Further, the project was implemented under the MEPU which was also directly responsible for implementing the UNDP-supported GEF-financed project "Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings" implemented between 2009 and 2015. It was envisaged that a Energy Efficiency Renewable Energy Management Office would be established within MEPU to house both projects and facilitate the development, coordination and management of activities, synergies and further initiatives which would then continue beyond the lifetimes of the projects.

Management arrangements

At the project design stage, the arrangements were prescribed for implementation of the project under the NEX execution modality, with the Ministry of Energy and Public Utilities (MEPU) as the Executing Agency / Implementing Partner and UNDP as the Implementing Agency. The Ministry was to appoint a National Project Director to assume overall responsibility for project implementation, ensure the delivery of project outputs and the judicious use of project resources. The National Project Director was to be assisted by a Programme Management Unit headed by the Project Manager (PM) responsible for overall project coordination and implementation, consolidation of work plans and project papers, preparation of quarterly progress reports, reporting to the project supervisory bodies, and supervising the work of the project experts and other project staff.

A Steering Committee (SC) was to provide strategic decisions and management guidance to implement the project. The SC was to be made up of representatives of relevant ministries and government departments, and UNDP, and to be chaired by the NPD.

In the subsequent implementation phase, the procurement of a Project Manager by MEPU proved to be a

more political and complex task than expected. After 4 rounds of unsuccessful recruitment for the PM position which caused a 30-month delay in the project start-up, MEPU, on 17 February 2014, finally delegated the responsibilities to implement the project to one of its three parastatal bodies under its purview, the Central Electricity Board (CEB). The Corporate Planning and Research Manager of CEB was nominated as the NPD, and a team of two engineers from CEB assumed the responsibilities of PMs on a part time basis; the PMs were/are supported by a dedicated team of other CEB staff working on SSDG programme.

CEB managed the project very well and it was the central hub of technical, managerial and policy competencies for issues dealing with energy generation and the grid. An external PM would not necessarily have this level of expertise and experience, as well as authority and political influence. CEB became the obvious champion of the project rather than a critical opponent, and coordinated the programmes and activities of further donors including the ADF and the WB.

In retrospect, it would have been more effective and efficient had the project management responsibilities been assigned to CEB instead of MEPU right from the project design stage, this would have avoided unnecessary delays and saved considerable frustrations all around.

3.2 Project Implementation

As noted above, the project start-up was seriously delayed by 30 months due to difficulties in the recruitment of the project manager. After 4 rounds of unsuccessful procurement rounds, the implementation arrangement was altered, so that the Central Electricity Board (CEB) became the responsible Implementation Partner (IP). The Project Management positions and responsibilities were then shared by 2 CEB staff on a part-time basis, and additional support staff was also provided to support them over time. During project implementation phase, with the increased demand under the SSDG scheme, a separate SSDG team of five staff was formed within CEB to handle the SSDG applications review and approval processes.

Within CEB, the Project provided a platform for good partnership arrangements between other international donors and programmes (including the ADF and the WB), public institutions and the private sector. CEB became a champion for PV growth in Mauritius providing valuable technical inputs and a wide range of support services. International technical experts were brought on board to provide detailed best practice regarding technical, capacity building and contractual aspects.

Adaptive management (changes to the project design and project outputs during implementation)

Several major adaptive management measures were necessary during project implementation. Firstly, in February 2014, following 4 rounds of unsuccessful tendering for the position of Project Manager, it was decided that the responsibilities to implement the project should be delegated to CEB within MEPU. After a delay of almost 30 months between the date of signing of project document and the project inception meeting which was held in April 2014, it was necessary to review and revise the Log-Frame of the project to take into consideration the development stage of the solar PV sector in Mauritius. Some indicators, targets and outputs were revised and/or cancelled. For example, considering the PV installations which were already built and/or commissioned at the time, the overall project target of 3MW solar PV was revised and upgraded to 10MW to be installed by the end of 2015. In addition, output 2.5 for carbon finance trading potential was cancelled due to uncertainty of the Kyoto Protocol and the unfavorable carbon trading environment globally.

The MTE reported five (5) 2MW PV farms were being implemented. It is to be noted that during the last quarter of 2016, during the project extension period, two of the selected PV farms (Fuel and La Gaulette) had to be cancelled due to non-compliance of the two selected firms to the terms and conditions of the agreements signed, in spite of a one-year extension. Three Agreements have meanwhile been signed by CEB under the MSDG programme and these are planned to be commissioned in 2018 and 2019.

Major adaptive management measures applied included the Smart Grid Roadmap which was not in the original Log Frame, and the change of implementing partner from the identified Mauritius Meteorology Services to University of Mauritius (UoM) which was developing a similar solar tracking module. A life-time MOU has been entered into between CEB and UoM for the operation, maintenance and servicing of the solar mapping system. The pyranometers have been obtained in mid-February 2017 and will be installed in selected CEB buildings

throughout Mauritius (10), Rodrigues (2) and Agalega (1).

Another effective adaptive management is evidenced through the inclusion of MSDG under the project's FIT programme. This has created a favorable condition for attracting business investors and created an impetus for the rapid uptake of the solar PV sector commercially. The number of solar PV vendors has increased from a few in 2011 to over 20 at the time of the Terminal Evaluation. Thus, it can be safely deduced that the removal of the financial barrier through FIT has played a catalytic role in the rapid uptake of the solar PV sector in Mauritius.

The changes to the project were duly approved by the project steering committee. Despite the cancellation of some outputs (and the addition of others), the project able to achieve and exceed its global targets.

Partnership arrangements (with relevant stakeholders involved in the country/region)

As the central hub for technical, management and political issues concerning energy generation and distribution, the CEB was able to coordinate the involvement of international donors (including the GEF, the WB and ADF), the government counterparts and the private sector participants. Through the promotion of activities and coordination of key stakeholders including government bodies, private sector and other international organizations active in the country, the CEB was able to efficiently augment the impact and results of the project and to avoid overlapping of efforts. It was generally appreciated that the achievements and successes realized through the synergy far exceeded the sum of what could have been achieved individually. Further, the project provided a platform for promoting good cross-ministerial coordination and collaboration.

UNDP and CEB exercised timely and effective management actions and provided quality support to ensure the timely realization of project outputs and outcomes.

Feedback from M&E activities used for adaptive management

The actual project implementation period was effectively quite short, when one considers the 30-month delay at the project start. The Mid-Term Evaluation effectively took place only one year after the project inception in April 2014 and about 8 months before the planned project completion date of December 2015. As such, the Mid-term Evaluation which was conducted in May 2015 was the key M&E activity providing feedback for adaptive management. The MTE made 10 recommendations for the successful completion of the project. The TE mission reviewed these 10 recommendations and, except for recommendation 4 relating to Outreach activities, and recommendation 9 relating to solar mapping which are both well underway and about to be completed, all the recommendations have been completed. The evaluators' assessment of the 10 recommendations of the MTE is presented in ***Annex 6***.

Further, M&E instruments such as the Annual PIR were carefully reviewed, discussed and acted upon at the Steering Committee meetings. In the 2 final years of the project, the Steering Committee met often and was pro-active in resolving any problems or delays in implementation

Project Finance

The total project budget at CEO Endorsement/Approval was USD 20,993,000, broken down as follows:

GEF Grant:	USD	2,005,000
UNDP regular resources:	USD	50,000
Government (MID Fund):	USD	1,080,000
Government:	USD	80,000
Private Sector:	USD	17,500,000

At the time of the terminal evaluation, the cumulative GEF funds disbursement totaled $1.99 million, with a 99.7% delivery rate.

Table 4 - Project Expenditures under the Project

Source	Planned Amount (USD)	Actual Amount Disbursed (USD)	Disbursed (USD)		
			2014	2015	2016
GEF	2,005,000.00	1,999,006.00	595,978.00	79,728.00	1,323,300.00
UNDP	50,000.00	44,368.00	3,544.00	18,425.00	22,399.00
Sub-total:	**2,055,000.00**	**2,043,374.00**	**599,522.00**	**98,153.00**	**1,345,699.00**

The disbursement of the GEF funds by outcomes is summarized in the table below.

Table 5 - UNDP/GEF Approved Budget and Annual Disbursement by Outcomes (in USD)

Outcome	Approved Budget (Prodoc)	Total Disbursed (as at 31 Dec 2016)	New Govt Cost-Sharing Funds Planned for 2017
Outcome 1 - Streamlined and comprehensive market-oriented policy and legal/regulatory framework to promote PV grid-connected electricity generation. Power Purchase Agreements formulated and signed by selected investors.	190,000	190,000	84,000
Outcome 2 - Capacity available within MEPU and other key Government and Financial Institutions to evaluate the economic and financial viability of grid-connected PV systems and to formulate incentives to attract investors.	199,500	140,000	40,000
Outcome 3 - Capacity available to upgrade existing solar radiation data, expand geographical coverage for solar resource measurement, formulate technical guidelines and standards for PV system components, determine grid absorption capacity and provide oversight, monitoring and certification of PV systems, and provide installation, operation, maintenance and repair services. Development of solar maps and procurement of equipment.	215,000	122,000	166,000
Outcome 4 - Promoters assisted financially through Feed in Tariffs and projects implemented and supplying electricity to the CEB grid.	1,300,000	1,500,000	0
Outcome 5 - Outreach programme and dissemination of project experience/best practices/lessons learned for replication throughout the country.	80,500	35,000	145,987
Project Management	20,000	12,000	0
Total:	**2,005,000**	**1,999,000**	**435,987**
Balance:		6,000	6,000
GRAND TOTAL:	**2,005,000**	**2,005,000**	**435,987**

With the agreements of the Steering Committee, funds reallocations among budget lines and/or outcomes were approved to finance required study and additional activities, such as the Smart Grid Roadmap, 50% of

the cost of the 4 PV installations in Rodrigues, pyranometers for the solar mapping operation.

In terms of co-financing under the project, both in cash and in-kind, a table with overall co-financing mobilized is presented in ***Annex 7***.

Investment from the private sector was some 40 million USD which is over double the original target. The private sector interest and uptake of the technology is further evident in the overwhelming response to the programmes and calls issued by CEB. CEB expects that at least a further 100MW of PV will be installed by 2025. Government cofinancing in the form of in-kind support, feed-in-tariffs (32 million USD) and tax exemptions for PV equipment (estimated 43 million USD) has also contributed to the high impact and sustainability of the project.

Monitoring and Evaluation Design at Entry and Implementation (*): Satisfactory

The project document contained a Monitoring and Evaluation Plan and Budget that would be conducted in accordance with established UNDP and GEF policies and procedures. M&E activities, lead responsible parties, budget and timeframe were clearly identified in the Monitoring and Evaluation section of the project document. The project logframe contains detailed indicators of achievement, means of verification, and assumptions and risks that provide milestones for measuring project implementation progress and performance.

The Project Inception Workshop took place in 2014. During project implementation, CEB as the Implementing Partner under MEPU, the EA, and UNDP CO undertook effective and timely monitoring activities through quarterly and annual progress reports (APRs) as well as the Project Implementation Reviews (PIRS) submitted by the project team to the Project Steering Committee. An independent mid-term evaluation of the project was carried out in April 2015. The Steering Committee met regularly and was informed of project progress. The Steering committee reviewed progress towards achievements and approved the Annual Work Plans and Budgets. The Terminal Evaluation Mission took place in Mauritius 26 February to 3 March 2017.

The Monitoring and Evaluation has been adequately designed and implemented according to the GEF/UNDP practice and in line with the monitoring and evaluation plan described in the Project Document. Based on the above evaluation, the TE evaluators rate the Monitoring and Evaluation Design at Entry and Implementation as **Satisfactory (S).**

UNDP and Implementing Partner Implementation / Execution (*), Coordination, and Operational Issues: Satisfactory

UNDP as IA and CEB/MEPU as EA exercised prudent and quality management actions to ensure achievement of project outcomes and objectives in a timely manner. UNDP as the International Implementing Agency, as stipulated in the Management Arrangements, provided strong support to and worked very closely with CEB during project implementation, recommended adaptive management to ensure achievement of project results. CEB as the main Implementing Partner worked collaboratively with UNDP and other key stakeholders, and collectively with other team members within CEB, they carried out the planned project activities with enthusiasm and great professionalism, in addition to their regular CEB workload. In turn, MEPU as EA provided the necessary policy support and guidance. Working together with UNDP, CEB team quickly embraced the need for adaptive management as and when implementation bottlenecks arose, which were numerous.

Despite delay in the project start-up and the operational completion of the project by December 20~~2~~16, CEB has from the start of project implementation taken the leadership role and has become the champion for grid-connected PV in Mauritius. Even before taking over the project management in 2014, CEB was already proactive in promoting PV and undertook technical studies on the feasibility and relevance of PV. Their intellectual leadership, technical expertise and enthusiasm have ensured the overall success and sustainability of the project impact.

The project benefited greatly from a broad qualitative ownership. In addition to the proactive management of the project under MEPU and CEB, other institutions also contributed in an active and sustainable manner. These include national stakeholders such as the University of Mauritius who are completing solar studies and

maps, and international stakeholders such as AFD and World Bank.

The Project Management Unit did a very good job. The quality of outputs is high (in particular, the Grid Codes and the Grid Absorption Capacity studies) and these have contributed to the relevance and sustainability of the project. For all their individual and collective efforts and strong support exercised throughout project implementation to successfully achieve the project results and ensure sustainability, the evaluators rate the UNDP and the Implementing Partner Implementation/Execution, Coordination and Cooperation as **Satisfactory (S).**

Project Results

Overall results (attainment of objectives) (*): Highly Satisfactory

As illustrated in Table 2 under the Executive Summary and reproduced below, the overall project objectives and outcomes have been generally met or exceeded, with the exception of two remaining outputs still to be completed before June 2017 (the solar map and the publication of knowledge products.)

Total installed PV capacity realized under the project total 11.21MW, which is well above the original target of 3MW and exceeded the revised target put forward at the inception workshop in 2014. CEB has estimated 22.68 GWh of electricity have already been generated by PV installations commissioned under the project at the time of the TE in early March 2017. The direct GHG Emission Reduction is therefore estimated at **352,621 tons CO_{2eq}** considering the complete 20 year lifecycle of the PV installations.

The overall project targets and results achieved are summarized in the Table 1 presented earlier under the Executive Summary.

Table 6 - PV capacity installed under project - all SSDG and MSDG (as at 2 March 2017)

Installation	Capacity (MW)	Energy Generated (GWh)
SSDG (604)	4.21	17.89
MSDG – 3 Green Fields	5.60	0.58*
Other MSDG (3)	1.4	4.16*
Total:	11.21	22.63
***Commissioned and operational in December 2016 and January 2017.**		

The PV Solar energy sector in Mauritius has clearly taken off, with a very effective public-private partnership catalyzed by the project. Private sector has shown a willingness to take proactive action and invest in PV and reduce Green House Gas emission. 604 household PV installations have been connected to grid under SSDG schemes, with total installed capacity of 4.21 MW. In addition, 3 PV farms with 2 MW capacity each have been realized under the MSDG scheme with total installed capacity of 5.6 MW, and 3 other entities with total installed capacity of 1.4 MW also benefitted from the FIT under the MSDG programme.

Public sector investment in PV systems directly related to project activities is estimated at over 81 million USD; this includes the indirect loss of revenues to the Government resulting from exemptions of import duties and VAT. Further, about 20 solar PV suppliers (including engineers, sales staff, and technicians) are active on the islands. The future market prospect is generally seen as very good. CEB has plans for an additional 100MW PV installations before 2025 based on tenders already issued and its PV pipeline projects.

Based on the review of all available information, the Overall Results are rated **Highly Satisfactory**.

Table 7: Achievement of Outcomes against Original ProDoc (2011) and against Revisions in Inception Report (2014)

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Project Objective: To assist the Government in addressing the barriers with a view to promoting PV grid-connected electricity generation.	Direct investment in **at least 3 MW of on-grid PV installations by end of project**. Amount of reduced CO_2 emissions compared to the projected baseline	GHG in the electricity generation sector scheduled to increase from 2.03 million tons/year (2008 figures) to almost 3.3 million tons/year by the year 2020. **Negligible investments taking place in on-grid PV electricity generation**.	11,662 MWh of electricity generated (as a result of the **3 MW** capacity brought on-line) by project completion[1]. **Direct reduction** of **13,295 tons of CO_2** over the 4-year FSP project life cycle and **98,400** over the full lifetime of the plants. Estimated cumulative **indirect GHG emission** reduction of at least **350,000 tons of CO_{2eq} by 2025** on the basis of a conservative policy scenario and a GEF causality factor of 80%.	Investment in the PV sector are taking place and 5 solar PV plants of capacity 2 MW each will be set up by 2015, subject to Power Purchase Agreements being singed	Assuming that the **10 MW** start to produce electricity from 2015 and 1500 hours of sunlight. It is anticipated that **15000 MWH** of electricity will be produced before the end of the project. Direct reduction of CO2 emissions will therefore exceed the initial target	By the end of 2016, **11~~,~~208 MW** PV capacity have been realized & commissioned within the project and have already generated **22~~,~~860 MWh** of electricity. An additional **325,717 MWh** are expected over the remaining lifecycle (20 years total) of the PV plants. This corresponds to a total direct ER of **352,621 tons CO_{2eq}** which is 3.6 times the original target of 98400 tons.	Both the original target of 3MW and the revised target of 10MW following the inception workshop in 2014 have been met and surpassed. An additional 17 MW capacity (PV farms) has also been realized outside the project. The project has played a catalytic role in expanding the PV market in Mauritius. CEB forecasts over 100MW additional PV capacity by 2025. Considering this data & causality factor of 80%, Indirect ER (bottom up) is estimated at 1058 $ktCO_2$ or 3 times target. Private sector investment under the project exceeds 40 million US$.	**HS**
Component / Outcome 1: Streamlined and comprehensive market-oriented energy policy and legal/regulatory framework to promote PV grid-connected electricity generation. Power Purchase agreements formulated and signed by selected investors	Framework finalized and available for consultation by potential investors. **Standardized PPAs formulated and the SSDG scheme reviewed**	None available at the present time.	To be completed within 15 months of project initiation and approved by Government one and a half years after start of project	With the help of EDF a competitive bidding exercise was carried out using a standard RFP and PPAs to procure five 2 MW solar PV plants	To be completed by September 2015 Standardized PPAs to be completed by September 2014	Procedures for SSDG have been streamlined in 2016. 1 Grid Codes for SSDG and 2 for MSDG were established~~-~~ and in use. PPAs are developed and in use. 3 PPAs with investors have been signed under MSDG scheme, and 604~~-~~ ESPAs signed under the SSDG scheme.	The project has accomplished a great deal in terms of streamlining the process for assessing and realizing grid connected PV installations. Some 2000 applications for the next phase of the SSDG scheme have been received at the time of the terminal evaluation.~~-~~	**HS**

[1] This electricity generation figure reflects the expectation at project outset that all new plants specifically targeted for installation as part of the project would be fully operational by January 2013

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Output 1.1: Report streamlining market-oriented energy policy and legal/regulatory framework to regulate on-grid PV electricity generation.	Report confirming that policy and framework arrangements are in place.	Potentially overlapping responsibilities of various Government institutions make the decision process quite cumbersome and complicated.	To be completed within 15 months of project initiation and approved by the Government 1.5 after start of project		Preparation of a report on the requirements for solar PV integration will be ready by September 2014	The Report 'Determination of the Grid Absorption Capacity of Mauritius and Preparation of a Grid Code, Feed-in Tariffs and Model Energy Supply Purchase Agreements for RE Systems between 50kW to 2MW was ready in October 2014.	The report prepared by Mercados was thorough and professional. It provided international expertise, best practice and technical competence for the efficient and effective implementation of project activities and future PV market expansion. Energy generation and distribution grid capacities reviewed.	**HS**
Output 1.2: Strategy document aimed at sharpening the focus of the respective roles and responsibilities of MEPU and CEB for on-grid PV.	Document available and procedures in place.	Not available at the present time.	To be completed within 15 months of project initiation and approved by the Government 1.5 years after start of project		Agreement of MEPU will be sought to launch a review of the roles and responsibilities of various organizations	Achieved	The GEF PV project has been very well managed by CEB. The public utility is the main competence hub for management and technical issues on PV investment and the grid.	**HS**
Output 1.3: Criteria and procedures for the introduction of a transparent process in the selection/award of projects for development.	Guidelines available and put into practice.	Not available at the present time.	To be completed within 15 months of project initiation and approved by the Government 1.5 years after start of project Competitive selection/award of projects completed by the end of 1.5 years after project start.	Bidding document has been prepared by EDF Technical criteria and procedures are being worked out by Mercados	September 2014 for technical criteria and procedures Completion of standard bidding document for power projects by March 2015	Standard bidding procedures and documents are in use. Technical specifications have been clarified with the Grid Codes.	Within the course of the evaluation, several PV operators and suppliers have requested a comprehensive and transparent bid evaluation process which takes into consideration the competence and experience of the companies.	**S**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Output 1.4: One-stop shop for issuance of construction licenses and permits to developers.	One-stop shop is operational. Information brochure and website are available.	Under the business-as-usual scenario, the average time to secure all required construction licenses and permits can take up to 12 months.	All construction licenses and permits are issued following completion of feasibility studies and selection of promoters		Agreement of MEPU will be sought to launch a consultancy in this respect	Streamlined one-stop-shop approach is in place for SSDG. For L/MSDG, procedures have been greatly improved but a streamlined inter-ministerial review and coordination still needs to be pursued, e.g. for land conversion approval and EIA for LSDG.		**MS**
Output 1.5 Review of the SSDG scheme including financial model, technical specifications towards improving the scheme and moving to the next phase	Document available on the results achieved by the scheme and options for improvement suggested for next phase	Not available at the present time. SSDG scheme expected to be over by end of 2011	To be completed within 18 months of project initiation and applied by Government thereafter	This is being done by Mercados	Report to be ready by September 2014	The Mercados Report provided very useful blue print for operationalization of SSDG. A second SSDG and PV market Review by Deloitte/India was initiated and a stakeholders workshop held on 28 February 2017. Similar workshop in Rodrigues was to be held by mid-March.	The SSDG scheme remains highly attractive to building owners as evidenced by over 2000 new applications under review. CEB is also launching further SSDG schemes including a Social Low Income scheme aimed to install a total of 10MW over the next 5 years.	**S**
Output 1.6: Standardized and signed Power Purchase Agreements with identified developers/investors	Power Purchase agreements signed.	Not presently available.	Completed within 15 months of project start.	EDF has prepared standard PPAs for 2 MW bidding exercise	Standardized PPA to be completed by September 2014	PPAs are developed and in use. 3 PPAs have already been signed under MSDG scheme	The PPAs have been developed taking into consideration international best practice as outlined in the Mercados report 2014	**HS**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Component / Outcome 2: Capacity available within MEPU and other key Government /Financial Institutions to evaluate the economic and financial viability of grid-connected PV systems and to formulate incentives to attract investors.	Number of staff who participated in and successfully completed capacity development programme.	None available at the present time.	At least 2 projects evaluated by the end of year 2. Ten staff trained during first 15 months of project.		By July 2015 training to be provided to the concerned staff	- Capacity building on Financial and Economic Assessment was conducted by Mercados in October 2015; 47 participants attended, and 7 of them are women. -Both MITD and UoM are also providing courses on PV installations.	CEB now has a **dedicated team for handling review and approval of SSDG applications, and for processing M/LSDG in close coordination with MEPU and other Ministries**)	**HS**
Output 2.1: Suitable methodology for the economic/financial evaluation of on-grid PV systems.	Methodology applied by entities on large scale PV projects	Not available at the present time.	To be completed within 15 months of project initiation and applied by Government thereafter.		By July 2015 standard methodology will be available	CEB has dedicated technical team to appraise applications and conduct audit and commissioning of PV installations.	Cooperation mechanism established between CEB with other entities including Banks, Ministries, vendors)	**S**
Output 2.2: Standard financial evaluation methodology for calculating feed-in tariffs for investors with installed capacities more than 50 kW.	Methodology applied by MEPU and used in PPAs	No such evaluation methodology available.	To be completed within 15 months of project initiation and applied by Government thereafter.		By July 2015 standard methodology will be available	Achieved	This was an integral part of the Mercados Report.	**S**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Output 2.3: Financial and other incentives to be provided to project developers. Ownership model and investment scheme created	Document available and incentives operationalised. Financially sustainable mechanisms developed to support Feed in Tariffs	No comprehensive document available at the present time.	To be completed within 15 months of project initiation and applied by Government thereafter.		In the next budget aim is to remove VAT and customs duties on all connected equipment 2015. As part of the strategy document consultancy the ownership models and investment schemes will be looked into by July 2014	Different Feed-in-Tariff schemes were successfully piloted and implemented. Other financial incentives include: -15% VAT removed in 2016 for all PV system components. -15% of PV investment cost can be deducted from income tax each year; -8% is given as grant on green loans.		**S**
Output 2.4: Capacity developed within financial institutions to appraise PV projects for lending. Risk mitigation instruments developed to protect lenders and developers.	Number of financial institutions staff successfully trained. Risk mitigation instruments developed and operationalised.	None available at the present time.	Five to six financial institutions staff trained during first15 months of project. Risk mitigation instruments developed during first 15 months of project.		By end of July 2014, it is proposed that training be provided on RE project appraisal	Training conducted by Mercados in October 2015 included participants from local banks and financial services entities. The AFD's Green Line of Credit totally Euro 45 million through MCB and SBM are already fully committed, mostly by PV investors.	Insurance for PV installations, especially for SSDG owners, is still a major issue.	**S**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Output 2.5: Carbon finance potential developed regarding future on-grid PV investments outside of the project framework.	Options assessed and potential developed to access carbon finance in future investments.	None available at the present time.	To be completed within 15 months of project initiation.	As the Kyoto Protocol is still uncertain, there is a need to use the proposed budget for alternative activities	Funding will be allocated to a demonstration PV plant on the Rodrigues Regional Assembly Building	N/A Output Cancelled		**N/A**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Component / Outcome 3: Capacity available to upgrade existing solar radiation data, expand geographical coverage for solar resource measurement, formulate solar map technical guidelines and standards for and provide oversight, monitoring and certification of PV systems, and provide installation, operation, maintenance and repair services. Necessary technology transfer models formulated and operationalised	Teams trained in various categories of activities. Guidelines and technical standards for on-grid PV systems. Technology delivery models put in place	No such activity being implemented.	15 sites targeted for enhanced solar radiation assessment in year 1. Published guidelines and technical standards within 15 months of project start. Manual for installation, operation, maintenance and repair services developed by year 1.5, 40 people trained in the various categories by the end of the project.		Mauritius Meteorological Services will be tasked with the purchase of Pyranometers and measurement of solar data. As part of the strategic consultancy, the technology transfer models will be looked into	Services to be provided by MSS were too costly and limited. Since UoM already started developing a solar mapping system, CEB signed an MOU with UoM for life-time, continuous, mutually beneficial collaborations. -UoM already completed the solar map system. - 13 Pyranometers have been received in February 2017, and installations works on selected CEB buildings throughout Mauritius has started. 2 will be installed in Rodrigues, and 1 in Agalega (in June only due to availability of vessel).	Full solar mapping operation expected to begin by 3rd quarter of 2017, but latest by end 2017.	**MS**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Output 3.1: Programme for upgrading existing solar radiation data, expand geographical coverage for solar resource measurement. Publication of a solar Map for Mauritius, Rodrigues and the Outer Islands	Instrumentation to measure solar radiation data installed. Software developed for interpretation of data. Solar map developed and published	Presently available solar radiation data insufficient to accurately design on-grid PV systems...	Upgrade/expand coverage to 15 sites completed by the end of project. Four Meteorological Services staff trained within first 15 months of project.		By end July 2015 solar map will be produced for Mauritius, Rodrigues and Agalega. CEB will contact MRC for possibility of MRC working with the Meteorological services to produce solar map	Same as above.		**MS**
Output 3.2: Guidelines and technical standards for PV system components and grid-connected PV systems.	Guidelines and standards published and operationalised.	Not presently available.	Completed within first 18 months of project. Applied to sites identified for development.	Guidelines will be included as part of the Grid Codes being developed by Mercados for MSDG. PV plants have to be compliant with IEC Code	IEC standards are already applied. The guidelines will be ready by Sep 2014	IEC standards are already being applied. Grid Codes (including electrical specifications) for SSDG and MSDG have been developed and published.	Norms and standards are required for PV panels and system and installation works including mechanical mounting and electrical wiring. These should be regulated for quality controls and safety.	**MS**
Output 3.3: Capacity developed within MEPU/CEB to determine grid absorption capacity and provide oversight, monitoring and certification of on-grid PV systems.	Capacity development plan formulated and implemented.	Not presently available.	Six MEPU/CEB staff trained during first 18 months of project.	The capacity exists with CEB but not MEPU. Owning to the fact that MEPU is not concerned with technical installation parameters, training would concern CEB. Training is part of consulting assignment to Mercados	Training is intended to be delivered in August 2014	-Mercados' high voltage training conducted in Oct 2015. -CEB now has a dedicated technical team to appraise, implement, audit and commission PV solar installations.		**S**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Output 3.4: Local capacity for installation, operation, maintenance and repair services.	Availability of qualified and certified companies/individuals for installation, operation, maintenance and repair services.	None available now.	30 people trained by the end of the project.	MITD is providing training and capacity development	More than 30 persons have already been trained. The budget can be reallocated to Rodrigues Regional Assembly demonstration PV plant by March 2015	MITD has trained more than 300 persons have been trained to-date on PV installations.	-Both MITD and UoM are actively promoting PV training -MITD requested for a 5kV demonstration PV installation in Rodrigues for the students for hands-on practice.	**S**
Output 3.5: Technology transfer opportunities identified, and delivery models formulated and operationalized.	Report confirming that technology delivery models are being implemented.	None at the present time.	Completed within 2 years of project start.		Through the strategic consultancy the technology transfer models will be looked into and training delivered by March 2015	-The various Mercados reviews, reports and workshops conducted provided extensive and invaluable technology transfer to CEB/MEPU and other stakeholders. -3 persons from CEB and UNDP attended technology transfer workshop in Berlin in Aug 2016.		**S**
Component / Outcome 4: Promoters assisted financially through Feed in Tariffs and projects implemented and supplying electricity to the CEB grid	Funding used for toping part price differential in Feed in tariffs for a determined timed	Not presently available.	Construction of at least 3 MW of on-grid PV systems completed by the end of the project.	Discussions have already been engaged on how to allocate the funding to the PPAs being singed following competitive bidding	By end 2014 a MOU will be signed between CEB and UNDP on the use of the funding for part payment of the PPAs concerned over a period to be defined	Dedicated FIT account opened and a total of US$1.5 million of GEF funds has been transferred to this account by 31 December 2016.	Subsidies remain necessary for PV market because conventional generation with fossil fuels remains cheaper than PV.	**S**

Component / Outcomes/ Outputs	Performance Indicators	Original Baseline (2011)	Original End of Project Target (2011)	Revised Baseline (2014)	Revised End of Project Target (2014)	2016 Project Status	Terminal Evaluation Comments	Rating
Component / Outcome 5: Outreach programme and dissemination of project experience/best practices/lessons learned for replication throughout the country.	Outreach programme formulated. Project experience compiled, analyzed and disseminated.	Lack of sufficient information to pursue programme.	Increased awareness among stakeholders in place to promote and develop the market for on-grid PV		By March 2015 a special section will be put in place on the CEB website for dissemination of information	Information and applications are available on CEB website. Pamphlets on PVs were distributed at various workshops held in 2016. And a KM workshop was held on 3 March 2017 within the scope of the TE	Private sector awareness and interest in PV schemes is high. Information and applications are available on CEB website.	**S**
Output 5.1: Plan to implement outreach/promotional activities targeting domestic (and international) investors.	Plan available and operationalised.	No such plan available.	Completed within 10 months of project initiation.		By January 2015 CEB will have an outreach programme with the support of a local advertising agency	The August 2016 study tour to Berlin included PV financing/resource mobilization activity. Booklet in English and French languages is under preparation; cover design is already completed.		**S**
Output 5.2: Capacity development of MEPU to monitor and document project experience.	Capacity development material prepared.	No capacity development programme.	10 Government staff trained by the end of project.		Training will be provided to the MEPU and CEB on knowledge management by March 2015	KM workshop was held on 3 March 2017 within the scope of the TE		**S**
Output 5.3: Published materials on project experience/best practices and lessons learned.	Project experience and best practices compiled, published and available on website.	Lack of information on best practices and lessons learned.	Completed within 3 months of project end.		By July 2015 best practices and lessons learned in Mauritius Rodrigues and Outer islands will be published	Booklet in English and French languages is under preparation; cover design is already completed.		**MS**

Relevance (*): Relevant

The project supports as priority the growth of the renewable energy sector as identified in the Mauritius Long-Term Energy Strategy (LTES) 2009-2025. The LTES target of 2% of energy produced by 2025 will be met and exceeded based on project activities. As such, the project is and remains relevant to national development priorities and interests in the country.

The project was implemented at an appropriate time in Mauritius; the PV market has increased steadily during the project implementation period. The project was able to catalyze rapid market uptake of the solar PV technologies.

Based on the review of all available information, the project was rated Relevant.

Effectiveness & Efficiency (*): Highly Satisfactory/Satisfactory

The high **Effectiveness** of the project strategy is evidenced by:

- Over 10 MW solar ~~energy~~ PV capacity installed, far exceeding the original target of 3 MW. A further 100 MW is forecasted by 2025.
- Cost-effectiveness demonstrated. The original target of 98400 tCO_{2eq} has been sur-passed by a factor of 3.6. The target of $20 GEF funding per tCO_2 is thereby reduced to $5.7 GEF funding per tCO_2
- Effective public-private partnership demonstrated. Sustainable private sector interest and investment in solar PV has been evident throughout the project. Private sector investment of $40 million is over double the original target. Government support in the form of FiT and tax exemptions further supports this trend.

Based on the review of all available information, Effectiveness was rated **Highly Satisfactory**.

The rating for project **Efficiency**~~:~~ is **Satisfactory**. This is supported by:

- Quality inputs and collaboration from stakeholders and national and international technical experts at established funding level contributed to high cost-efficiency
- High quality project results achieved in less than 3 years since implementation start-up in April 2014, less than the 4-year duration planned. As newly designated project manager, the CEB was able to bring its experience and technical expertise to the project and acted as the champion of solar PV in Mauritius. Further, CEB was able to act efficiently as a hub between different funding programmes, government bodies and the private sector. The international consultants Mercados were able to streamline the technical implementation of the project
-

Country ownership

The country ownership is evident in the strong interest and participation of stakeholders from the public and private sectors. The project supports National Development Plans and the Long Term Energy Strategy.

The takeover of ownership of the Project by the Central Electricity Board played a key role in the ultimate success of the project. The CEB became a champion of PV solar market growth rather than a critical opponent to the project. The CEB acts as the central hub for technical, political and managerial competence concerning electricity generation and distribution. As such it was able to coordinate the project activities among the key players in government, private sector and international donors.

The project benefited greatly from a broad qualitative ownership. In addition to the proactive management of the project under MEPU and CEB, other institutions contributed in an active and sustainable manner. These include national stakeholders such as the University of Mauritius who

are completing solar studies and maps, but also international stakeholders such as AFD and WB.

Further, the Project design was formulated with extensive contributions from national stakeholders. There was close involvement of major ministries and key stakeholders through participation in the Project Steering Committee.

Total government cash and in-kind contribution is estimated at US$ 40.0 million, far exceeding original targeted amount of $11 m. This does not include the estimated amount of US$ 43 million in loss of revenues through exemption of duties and VAT, and other in-kind contributions from other Ministries which have not been taken into account in this evaluation.

Mainstreaming

The project addresses the UNDP priorities of clean and affordable energy, responsible consumption and production, climate action and sustainable cities and communities. Further, industry, innovation and infrastructure were supported as were decent work and economic growth

- ## *Gender and Development*

During project implementation, due attention was given to including women participation in the various activities. The capacity building training on assessment of financial, economic and technical aspects of PV installations conducted by Mercados consultant included 7 professional women from various sectors. Since the solar PV sector is still in its infancy, women participation as technicians has not yet started. This is not surprising since, generally, there are few female technicians in the country, primarily due to family responsibilities. Nevertheless, this aspect will become much more widespread with the rapid expansion of the solar PV sector.

Sustainability (*): Likely

Financial:

GoM and UNDP has successfully applied to the Green Climate Fund for a 2-phase, 28 million USD follow-up project 'Accelerating the transformational shift to a low-carbon economy in the Republic of Mauritius' which was approved in December 2016. The new GCF project is directly linked to and builds upon the completed GEF project activities and results and is designed to include a broader spectrum of the public. The GCF project is a major success in terms of leveraged financing and post-project sustainability. Financial sustainability is rated **Likely**

Socio-politial:

Market subsidies (including tax breaks and Feed in Tariff schemes) continue to play critical roles. These subsidies are less significant now than at the project start (procurement and installation costs have dropped some 30%, including the 15% VAT exemption, since the project start). It is very likely that these subsidies would be continued, given the Government's long-term goal to reduce its dependency on fossil fuels, and the great interest and demand from the general population. Currently, with subsidies, the pay-back period is 6-8 years for domestic installations and 12-15 years for PV farms. Socio-political sustainability is rated **Moderately Likely**

Institutional framework and governance:

The Government of Mauritius is very serious about RE, and has set up the Utility Regulatory Authority to help achieve this goal. GoM has already heavily invested in the solar PV sector, and will continue to do so in order to achieve its ambitious plan to significantly increase the PV energy distribution, as an important means to reduce its reliance on fossil fuels; the wind farming technology has proven to be less reliable within the context of Mauritius. Institutional framework and governance sustainability is rated **Likely**

Environmental

The environmental benefits of solar PV is evident. It is a clean source of energy. The key

environmental concern affecting the sustainability of PV installations is cyclones. Solar PV systems need to be robust to resist the strong winds and rains. Regulation, certification and labeling for quality control and safety can support resilience. Further, an affordable and reliable insurance should be available to reduce risk. Environmental sustainability is rated **Likely**

Based on the review of all available information, the project Sustainability ~~was~~ is rated **Likely**.

Impact

The PV market in Mauritius has clearly taken off during the project implementation. The successful impact of the project is evident through;

- Capacity strengthened at national and local levels (CEB, private sector, UoM, MITB, PV trained workers)
- Cooperation mechanism established between CEB with other entities – Banks, inter-Ministries, vendors)
- Different Feed-in-Tariff schemes successfully piloted and implemented
- New jobs are being created
- The general public is much more conscious now of the need to reduce GHG emission
- GHG Emission Reduction estimated at 22,890 tons of CO2, far exceeding the original target of 13,298 tons during implementation period (4 yrs)
- Private sector is ready to invest in PV sector under direct, rental or leasing schemes.

4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS

4.1 CONCLUSIONS

The project's most significant achievements can be summarized as follows:

- The project has been very successful. The Project objective to install 3 MW solar energy production capacity, which was subsequently revised to 10 MW during the project inception workshop, has been fully achieved and even exceeded. The PV plants installed under the project shall realize a direct GHG emission reduction of 352,621 tons CO2eq over the lifecycle of investments and have thereby exceeded original ER targets. Further, the project has leveraged substantial co-financing in the form of government support, private sector investment and follow-up programmes.
- Financial and market uptake have been soundly established; While the GEF project is not 100% responsible for the strong market uptake, it has played a highly catalytic role. The project has succeeded in promoting both medium scale and small scale (rooftop) installations. Awareness is high, as evidenced through the large number of applicants on the waiting list anxious to partake of the SSDG and MSDG programmes. The future of PV energy generation in Mauritius is sound and sustainable.
- The management of the project within the state-owned utility was a key factor contributing to the project success. CEB took over the leadership role in the project and became the champion (rather than the opponent) for grid-connected PV in Mauritius. Even before taking over the project management in 2014, CEB was proactive in promoting PV and undertook technical studies on the feasibility and relevance of PV. Their know-how, intellectual leadership, technical expertise and enthusiasm have ensured the overall success and sustainability of the project. Further, they coordinated contributions from partners (government bodies, private sector and international organizations) and other programs creating synergies and preventing overlap of efforts.
- The project benefited greatly from a broad qualitative ownership. In addition to the proactive management of the project by CEB under MEPU and UNDP CO, other institutions and the private sector also contributed in an active and sustainable manner.
- Sound technical inputs (international best practice) and relevant experience are key contributing factors to the project design and implementation. The relevant, competent and goal-oriented contribution of international consultants contributed greatly to the project success.
- Various financial incentives such as FIT provided an impetus for the PV market take-off. Besides the FIT subsidies supported under the project, the PV market in Mauritius has benefited from VAT and income tax exemptions for PV purchases, from bank grants and low- interest loans.
- Even though the project experienced a 30-month implementation start-up delay, the project was able to complete within a period of only 32 months - as opposed to the planned four years (48 months) - most of the planned activities and even more such as the Smart Grid study, procurement of pyronometers for installations at 13 CEB sites throughout Mauritius, and in Rodrigues and Agalega islands, and achieved results far exceeding the original target of 3 MW and co-financing amounts.
- GoM and UNDP have successfully applied to the Green Climate Fund for a 2-phase, USD 28 million follow-up project 'Accelerating the transformational shift to a low-carbon economy in the Republic of Mauritius' which was approved in December 2016. The new GCF project is directly linked to and builds upon this GEF project activities and results, and is designed to include a broader spectrum of the public. This GEF project is a major

success in terms of leveraged financing and ensuring post-project sustainability.

4.2 Corrective actions for the design, implementation, monitoring and evaluation of the project

The project design was relevant to the national development priorities and the Long-Term Energy Strategy 2009-2025, and continues to be of relevance to the current national development strategy. Adaptive management measures were effectively taken during project implementation to avoid further delays or disruptions in project implementation, to cancel obsolete activity, and to enhance project effectiveness by incorporating additional essential activities such as the Smart Grid Roadmap. With CEB personnel taking over the responsibilities for day-to-day project management, this provided benefits for a more direct and effective monitoring and management of the project activities, in addition to building capacity building of CEB/MEPU in effective project management. Some recommendations below have been put forward for the timely implementation of the remaining activities presently underway.

4.3 Actions to follow up or reinforce initial benefits from the project

Recommendation 1: It is recommended that the few remaining project activities be completed as soon as possible, including the booklet for awareness campaign, SSDG and PV market review by Deloitte, early implementation of the Smart Grid Roadmap, and the operationalization of the solar mapping system. For the latter, it is recommended to complete the installations of the pyranometers in Mauritius first, latest by the second quarter of 20127, then test and fine-tune the system if need be. This will help reduce any technical or operational problems that could arise for the pyranometers in Rodrigues and Agalega.

Recommendation 2: There should be increased quality control on PV panels at the point of import. CEB/MEPU to request Ministry of Trade, Commerce and Consumer Protection (MTCCP) to declare importation of PV panels as controlled product and to establish acceptable certification standards.

Recommendation 3: Grid absorption capacity presently has limitations to meet the increased solar energy to be produced by future PV installations. CEB should fast-track the upgrading of its grid absorption capacity in order not to block the huge momentum in the PV market created under the project.

Recommendation 4: During the TE Workshop with project stakeholders, the need for norms and standards for solar PV installation works, including mechanical mounting and electrical wiring, was strongly voiced. While the electrical specifications are prescribed in the grid codes, the mechanical and electrical works and installations should be regulated and monitored, for quality controls, safety and ensuring that the installations can withstand cyclonic exposures. It is therefore recommended that MTCCP consider introducing a system of licensing of trained and certified PV installers, and their performance be tracked; this necessarily requires putting in place a system of performance feedback from end-users on PV installers contracted. The performance record should be taken into consideration at the time of their license renewals. It may be envisaged to register independent PV Inspectors much in the way of the Machinery and Boiler Inspectors scheme.

Recommendation 5: To maintain the uptake momentum of solar PV installations, it is recommended that all present fiscal incentives be maintained at least for the next 8 years to 2025, including but not limited to zero customs duty (including on partial shipments) and VAT on all solar PV components including their spare parts, and green energy investment tax relief.

Recommendation 6: MITD offers courses on solar PV installation and students benefit from on-site demonstration and hands-on practice. It is recommendation that a 5 kW PV system be installed in Rodrigues for training and demonstration purposes so that students can have actual hands-on,

practical experience in installing solar PV panels.

Recommendation 7: Presently, local insurers are sharing and re-insuring their risks with international insurers at high premium rates. It is recommended that CEB/MEPU, MTCCP and the Association of Commercial Banks in Mauritius negotiate for a group insurance policy for all the solar PV owners - and even for all renewable energy installations – in order to benefit from economies of scale.

Recommendation 8: The performance data from solar PV installations and the grid would be of great value for analyzing and planning future market development. It is recommended that data on actual PV generation and electricity use be cross-validated with the solar maps to be generated, to guide plans for future solar PV programmes.

Recommendation 9: PV generation remains more expensive than conventional electricity generation, even with the drop in price of PV installations, at about 15% worldwide over the past years. With the added removal of the 15% VAT by the government of Mauritius in 2016, in the Mauritian context, this comes to about 30% overall cost reduction for PV investors. While the price differential between conventional generation and RE is decreasing, the price gap needs to be tracked. Tracking the differential will help determine the future of PV sector in Mauritius and to plan the extent of future funding necessary to close the gap between conventional generation and solar PV and other renewable energy technologies.

4.4 Proposals for future directions underlining main objectives

The implementation of the recently approved GCF project will further stimulate the rapid growth of solar PV sector in Mauritius, Rodrigues and the outer islands.

4.5 Best and worst practices in addressing issues relating to relevance, performance and success

The project demonstrated several best practices which resulted in the successful implementation of the project that may be adopted for the formulation of other projects. Some of the best practices are: (a) a very effective public-private partnership in project development and implementation is a contributing factor to successful achievement of the project objectives. (b) Timely adaptive management measures undertaken during project implementation have avoided further implementation delays, and have taken advantage of opportunities arising that led to improved cost-efficiency, and/or offers solutions to a problem. On the other hand, when planning future RE projects, selecting the most appropriate entity with the required level of expertise, know-how, experience and institutional authority is paramount for ensuring smooth and successful project implementation to achieve the planned outcomes. This GEF project has effectively demonstrated the importance of this point.