

Document of
The World Bank
FOR OFFICIAL USE ONLY

Report No: 137028-KI

IMPLEMENTATION COMPLETION AND RESULTS REPORT

ON A

SMALL GRANT

IN THE AMOUNT OF USD1 MILLION

AND

ON A

SMALL GRANT

IN THE AMOUNT OF USD2.9 MILLION

TO THE

REPUBLIC OF KIRIBATI

FOR

KIRIBATI GRID CONNECTED SOLAR PHOTOVOLTAIC PROJECT (P121878)

April 3, 2019

Energy and Extractives Global Practice
East Asia and Pacific Region

Regional Vice President: **Victoria Kwakwa**

Country Director: **Michel Kerf**

Senior Global Practice Director: **Riccardo Puliti**

Practice Manager: **Jie Tang**

Task Team Leader(s): **Kamleshwar Khelawan**

ICR Main Contributor: **Renee Berthome**

ABBREVIATIONS AND ACRONYMS

ADO	Automotive Diesel Oil
AUC	Australian cents
BAU	Business as Usual
CAS	County Assistance Strategy
CEO	Chief Executive Officer
CO ₂	Carbon Dioxide
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Energy Management System
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Global Greenhouse Gas
IFR	Interim Financial Report
KFSU	Kiribati Fiduciary Services Unit
KGV	King George V Secondary School
KIT	Kiribati Institute of Technology
KNEP	Kiribati National Energy Policy
kW	Kilowatt
GoK	Government of Kiribati
MELAD	Ministry of Environment, Lands and Agriculture Development
MFAT	Ministry of Foreign Affairs, New Zealand
MISE	Ministry of Infrastructure and Sustainable Energy
MFED	Ministry of Finance & Economic Development
MPWU	Ministry of Public Works & Utilities
MSP	Medium Scale Project
NZMFAT	New Zealand Ministry of Foreign Affairs and Trade
PEC	Pacific Environment Community
PDO	Project Development Objective
PE	Public Enterprise
PRIF	Pacific Region Infrastructure Facility
PST	Project Support Team
PUB	Public Utilities Board
PV	Photovoltaic
SCADA	Supervisory Control and Data Acquisition
TCH	Tungaru Central Hospital
TA	Technical Assistance
TTA	Trama Techno Ambiental

TABLE OF CONTENTS

DATA SHEET	1
I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES	4
II. OUTCOME	9
III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME	14
IV. BANK PERFORMANCE, COMPLIANCE ISSUES AND RISK TO DEVELOPMENT OUTCOME	16
V. LESSONS LEARNED AND RECOMMENDATIONS	19
ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS.....	20
ANNEX 2. ORGANIZATION OF THE ASSESSMENT OF THE PDO.....	24
ANNEX 3. TEAM COMPOSITION.....	25
ANNEX 4. CLIENT PREPARED IMPLEMENTATION COMPLETION REPORT	27
ANNEX 5. RECIPIENT, CO-FINANCIERS AND OTHER PARTNER/STAKEHOLDER COMMENTS.....	50



DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P121878	Kiribati Grid Connected Solar Photovoltaic Project
Country	
Republic of Kiribati	
Original EA Category	Revised EA Category
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
REPUBLIC OF KIRIBATI	KIRIBATI PUBLIC UTILITIES BOARD

Project Development Objective (PDO)

Original PDO

The project development objective for Kiribati Grid Connected Solar Photovoltaic (PV) is to contribute to reducing Kiribati's dependence on imported petroleum for power generation in order to improve energy security and to reduce the Global Greenhouse Gas emissions from diesel fuel use for grid electricity supply in Kiribati. The specific objectives of the proposed Medium-Sized Project is to serve as a catalyst for the substitution of the diesel based electricity generation for the South Tarawa grid by grid-connected solar PV supply of electricity.

PDO as stated in Legal Agreement (if different from Project Paper)

The project development objective for Kiribati Grid Connected Solar Photovoltaic (PV) is to reduce the Recipient's dependence on imported petroleum for power generation in order to improve energy security and to reduce the emissions from diesel fuel use for grid electricity supply in the Recipient's territory through the substitution of the diesel-based electricity generation for the South Tarawa grid by grid-connected solar photovoltaic supply of electricity.

**FINANCING**

	Original Amount (US\$)	Revised Amount (US\$)	Actual Disbursed (US\$)
Donor Financing			
TF014105	1,000,000.00	0.00	897,414.98
TF01426	2,920,000.00	0.00	2,694,578.36
Total			
Other Financing			
Borrower	0	0	0
Total	3,920,000.00	0	3,591,993.34
Total Project Cost			

KEY DATES

Approval	Effectiveness	MTR Review ¹	Original Closing	Actual Closing
25-Mar-2013	18-Jun-2013		31-Dec-2016	31-Oct-2018

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US\$M)	Key Revisions
16 May 2016	0.44	Project closing date extended by 22 months, to October 31, 2018.

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Satisfactory

¹ In accordance with the Recipient Executed Trust Fund Guidelines for Small Grants a MTR review is not mandatory. At the time the MTR review was due to take place, the Project was on track to delivering against the PDO and KPIs and it was deemed a MTR review was not necessary.



RATINGS OF PROJECT PERFORMANCE IN GRMs²

No.	Date GRM Archived	DO Rating	IP Rating	Actual Disbursements (US\$M) ³
01	11/21/2013	Satisfactory	Satisfactory	0.091
02	09/29/2014	Moderately Satisfactory	Moderately Satisfactory	0.118
03	09/04/2015	Moderately Satisfactory	Moderately Satisfactory	1.348
04	1/25/2016	Satisfactory	Satisfactory	0.878
05	08/15/2017	Satisfactory	Satisfactory	0.531
06	10/16/2018	Satisfactory	Satisfactory	0.127

ADM STAFF

Role	At Approval	At ICR
Regional Vice President:	Axel Van Trotsenburg	Victoria Kwakwa
Country Director:	Franz Drees-Gross	Michel Kerf
Senior Global Practice Director:		Riccardo Puliti
Practice Manager:	Michel Kerf	Jie Tang
Task Team Leader(s):	Kamleshwar Khelawan	Kamleshwar Khelawan
ICR Contributing Author:		Renee Berthome

² Six monthly ISRs were not required for this project. The team was advised GEF funded projects could prepare GRMs in place of the ISR.

³ The GRMs reported on only the disbursement of GEF financing. However, actual disbursements reported in the table represents the cumulative disbursements from all sources of financing (GEF and PRIF).



I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. Context at Appraisal

Country Context

1. Kiribati is one of the most remote and geographically dispersed countries in the world. The country is composed of 33 islands spread over 3.5 million square kilometers – an area larger than India. At the time of project appraisal, the estimated population of Kiribati was about 110,000 living on 20 coral atolls and a single volcanic island, with a total land area of less than 800 square kilometers.⁴ The capital, South Tarawa, is about 4,000 kilometers from Australia, Hawaii, and New Zealand. Kiribati's economic geography means that it is heavily reliant on external factors and economic performance is highly volatile. In the last ten years, Gross Domestic Product (GDP) growth has averaged around 1.1% per annum, but GDP has ranged from -5% to 6% per annum. Kiribati's growth prospects are constrained by its geographic isolation, its narrow export base, and impediments to private sector activity. The main sources of external income are investment earnings from the Revenue Equalization Reserve Fund established in the 1950s to invest royalties from now depleted phosphate reserves, workers' remittances, and the sale of fishing licenses to operate in its Exclusive Economic Zone. These external income sources are equivalent to about half of GDP or about a third of Gross National Income.

Sector Context

2. The project responded to a systemic issue in the electricity sector with significant economy-wide implications for Kiribati whose economy was marked by an overarching near-total dependency on one energy source, oil. At the time of project appraisal, about half of the imported oil (Automotive Diesel Oil or ADO) was used for electricity generation for the main electricity grid system on Tarawa atoll operated by the Public Utilities Board (PUB). Of the estimated national population of 110,000, about 42,000 live in the service area of the PUB, with over 95% of these people connected to this grid system. The remaining population is scattered and widely dispersed across the other 19 inhabited atolls.

3. The Tarawa grid system was supplied by two diesel generating stations with a combined installed capacity of 5.45MW.⁵ The maximum demand was about 4.5MW with the minimum about 2.0 MW.⁶ The demand peaked at around 5.3MW in 2006 but has since declined. The load profile examined over a week in September 2011 found that on a typical weekday the peak load was about 3.5MW, with load exceeding 3MW during a broad daytime shoulder period between 9am and 5pm. By contrast, during the secondary evening peak hours of 7pm to 9pm, load was around 3MW. On a typical weekend, the peak was around 2.7MW.

⁴ The population estimate is 114,395 people. Kiribati's atolls are divided into three island groups: Gilbert, Phoenix and Line Islands. Ninety percent of the population resides on the Gilbert Islands, of which approximately half live on the capital island of South Tarawa. Majority of the remaining population lives on Kiritimati Islands, which is part of the Line Islands.

⁵ The current installed capacity is approximately 9MW (including new high-speed generators) of which 1.6MW is solar PV.

⁶ The current peak load profile is 5.2MW and the off-peak load profile is around 3MW.



4. The electricity grid system's operational performance coupled with the high cost of diesel generation adds to the high cost of service for electricity to households and businesses, even with administered fuel prices. PUB's generation cost was estimated to be about AUc 52/kWh, at a delivered fuel cost of AUc 35/kWh (\$1.27/liter).⁷ PUB invoiced AUc 44/kWh and collected AUc 40/kWh because of increase in the total arrears. Confronted by poor financial performance of the electricity sector the Government had attempted to manage the situation through a combination of substantial direct budget subsidy transfers to the sector as well as significant amounts of indirect and non-transparent subsidies in the form of loan guarantees (contingent liabilities) implicit in intra-Public Enterprise transactions of the PUB. The result was high and unsustainable fiscal deficits.

National Priorities

5. The project was consistent with Kiribati's national priorities, policies and plans in place at the time of project approval. The Kiribati National Energy Policy (KNEP) developed in 2009 was the first energy sector framework that had been developed and adopted by the Government.⁸ The KNEP built on the theme and vision of the Kiribati Development Plan (KDP 2008-2011): "enhancing economic growth for sustainable development", with emphasis on "available, accessible, reliable, affordable, clean and sustainable energy options".⁹ The KNEP incorporated regional priorities and plans, including the Pacific Plan, Pacific Islands Energy Policy, Millennium Development Goals Declaration, the Mauritius Strategy, and the Kyoto protocol, and thus was consistent with the regional and international agenda.

6. Kiribati's Initial Communication under the United Nations Framework Convention on Climate Change¹⁰ notes that the sole source of CO₂ emissions is from the burning of fossil fuels. All fossil fuels are imported into Kiribati. The main contributions to CO₂ emissions are from the electricity and transport sectors. The Initial Communication states that the objectives of the energy sector are to supply "efficient" electricity "in urban areas for domestic and commercial consumers, and (facilitate) greater utilization of renewable energy systems which are proven to be technically and economically viable."

Rationale for Bank Assistance

7. At the time of project appraisal, the World Bank's Country Assistance Strategy (CAS) for Kiribati reflected the Government's development priorities and was consistent with the unifying themes of World Bank Group engagement in the Pacific islands. The World Bank's engagement with Kiribati focused upon: (i) building resilience against external shocks, with a focus on climate change adaptation; and (ii) mitigating economic isolation by encouraging regional and global integration. The proposed 516kW grid-connected solar PV for South Tarawa was intended to diversify electricity generation and reduce reliance on imported diesel, at a time when overall cost of diesel imports was equivalent to 15% of Kiribati's GDP.

⁷ Note that the wholesale price of diesel in Kiribati was AU\$1.33/liter and retail price was AU\$1.47/liter in 2010-2011. PUB may therefore benefit from some subsidy from KOIL.

⁸ Kiribati National Energy Policy (KNEP), Ministry of Public Works and Utilities, April 2009.

⁹ Kiribati Development Plan was revised and approved by Cabinet, 25 April 2012. Kiribati Development Plan ((2012 – 2015) reconfirmed the theme and vision of the original plan.

¹⁰ September 1999 – refer to sections 3.4 and 3.6, currently being revised.



B. Project Development Objectives (PDOs)

8. The Project Development Objective (PDO) as stated in the grant agreement: The project development objective for Kiribati Grid Connected Solar Photovoltaic (PV) is to reduce the Recipient’s dependence on imported petroleum for power generation in order to improve energy security and to reduce the emissions from diesel fuel use for grid electricity supply in the Recipient’s territory through the substitution of the diesel-based electricity generation for the South Tarawa grid by grid-connected solar photovoltaic supply of electricity.

9. The PDO formulation in the project paper is not identical to the PDO in the grant agreement, but the differences are deemed non-substantial.¹¹

10. The PDO was not modified over the life of the project.

C. Key Expected Outcomes and Outcome Indicators

11. The objectives of the project were to:

- a. Reduce Kiribati’s dependence on imported petroleum for power generation to improve energy security.
- b. Reduce the emissions from diesel fuel use for grid electricity supply in Kiribati.

12. Two outcome indicators were defined to measure the achievement of the objectives as shown in Table 1:

Table 1. Key Project Outcome Indicators and Targets

Key Project Outcome Indicator	Unit of Measure	Baseline Value (2014)	End Project Target (2018)
Energy from Renewables (PDO1)	Percentage	0	7%
Medium term renewable energy plan and PUB capacity to increase renewable generation. (PDO2)	Text	0	Feasibility study on the amount of renewable energy on grid and 30 (over 3 years) trained staff to integrate RE into the grid.

¹¹ The PDO in the project paper included ‘Global Greenhouse Gas (GHG) emissions from diesel fuel use’ while the PDO in the grant agreement referred to ‘emissions from diesel fuel use...’. In addition, the PDO in the project paper included a second sentence: “The specific objective of the Medium Sized Project (MSP) is to serve as a catalyst for the substitution of diesel-based electricity generation for the South Tarawa grid by grid-connected solar PV supply of electricity” while this sentence was included as part of the PDO and read: “the substitution of the diesel-based electricity generation for the South Tarawa grid by grid-connected solar photovoltaic supply of electricity”.



13. The purpose of the medium-term energy plan was to establish how much on-grid renewable energy could be installed without requiring storage. Based on the installed capacity and the load profile at the time of project preparation, it was established that 900kW of renewable energy could be installed on the grid without storage. The indicator was developed to measure the completion and submission of the feasibility study.

14. At the time of project preparation, it was estimated that the project would reduce diesel fuel use by 230,000 liters per annum and reduce GHG emissions by 765 tons per annum. The savings from the reduction in diesel fuel use was expected to reduce the level of direct and indirect subsidies transfers from the GoK to PUB. An: (i) overall reduction in fuel costs; (ii) reduction in diesel fuel use through the installation of solar PV through the project; (iii) improvement in collections; and (iv) improvement in operational efficiency also contributed to reducing the direct and indirect subsidies transfers. The Government subsidy/Community Service Obligation to PUB totaled AUD1.135 million (~US\$821 059) in 2017, according to PUB's report 'Financial Performance for the Year Ended 31 December 2017'.

D. Project Components

15. The three components of the project are outlined below.

- i. **Component 1: Investment in Grid Connected Solar Photovoltaic Equipment.** This component was designed to support the PUB to invest in 516-Kilowatt peak capacity of grid connected solar PV without storage, installed and managed at technically suitable locations as approved by the GoK that were identified with associated inverters to enable grid in-feed at each location.
- ii. **Component 2: Maintenance Program and Capacity Building.** This component was designed to support the PUB to implement the investment through a "design, supply and install" contract for the solar PV installation with operations and maintenance provisions to cover the entire project implementation. The component also supported PUB to gain experience in operations and maintenance and build capacity to initiate and manage future investments.
- iii. **Component 3: Project Management.** This component was to: (a) support the GoK to effectively manage the fiduciary aspects of the project (including procurement and financial management) through the Central Fiduciary Unit; and (b) support the PUB to effectively manage the technical aspects of the project through its Project Support Team (PST).

16. The project was financed by the Pacific Region Infrastructure Facility (PRIF) and the Global Environment Facility (GEF).¹² The estimated and actual funds allocated to each component are presented in table 2. There were cost savings achieved under Component 1 but actual costs at closing for Component 2 and Component 3 exceeded cost estimates at appraisal.

¹² PRIF is a Multi-Donor Trust Fund funded by Australia and New Zealand



Table 2. Actual and Estimated Cost Per Component

Project components	Estimated at Appraisal (US\$)	Actual at Closing (US\$)	Expenditure as per Actual Value (%)
1. Investment in Grid Connected Solar Photovoltaic Equipment.	3,400,000	2,872,993	84%
2. Maintenance Program and Capacity Building.	155,000	184,000	118%
3. Project Management.	365,000	535,000	146%
Total project cost	3,920,000	3,591,993	91%
Undisbursed	328,007 ¹³		8%

E. Significant Changes during Implementation

Revised PDOs and Outcome Targets

17. The PDOs were not revised.

Revised PDO Indicators

18. The PDO indicators were not revised.

Revised Components

19. The components were not revised.

Other Changes

20. **Changes in Closing Date.** In May 2016, two years after project approval, a restructuring was approved to extend the closing date of the original grant from December 31, 2016 to October 31, 2018. The reason for this change was to facilitate the completion of a two-year operations and maintenance period under the solar PV contract. The project closing date was not extended to include the full three-year operations and maintenance period because it became evident during implementation that the operations and maintenance requirements for the solar installation beyond the 2-year period was not necessary. The PDO indicator 'medium term renewable energy plan and PUB capacity to increase renewable generation' end target was not amended to reflect the revised two-year operations and maintenance period. At the time the restructuring took place, the progress towards the achievement of the PDO was rated 'Satisfactory', the installation of the solar PV was nearing completion, and actual disbursements were US\$2.44 million.

¹³ Rounded to the nearest dollar



II. OUTCOME

21. **The project met and exceeded the performance indicators within budget.** The project established a medium-term renewable energy plan and achieved donor coordination for its implementation leading to a total of 1.6MW (30% of peak demand) renewable energy investment on the South Tarawa electricity grid.¹⁴ Cost savings enabled the project to be scaled up by installing additional grid connected solar PV and an energy management system to optimize input into the grid from all generation facilities. The project was implemented with a local project management team with support from international technical experts and a local central fiduciary unit suitable for a small operation and in an environment of limited local capacity. This local involvement in project management and in the installation of facilities, and the training provided through the project has contributed to the development of local capacity. In related (but not directly funded) activities, the World Bank leveraged its involvement with the project and together with other development partners assisted the GoK on a program for improving the financial and operational performance of the PUB and on a Scaling-Up Renewable Energy in Low Income Countries Program (SREP) Investment Plan (IP) for Kiribati. The IP identifies US\$76 million in renewable energy investments that will be required to meet 2025 Kiribati Integrated Energy Roadmap and Nationally Determined Contributions (NDC) targets.

22. The solar PV installations were commissioned in mid-2016 however, the project closing date was extended by 22 months to October 2018 to allow for an adequate operations and maintenance and training period by the supplier. There were three main reasons for the delays that led to the extension:

1. Delays in procuring a Project Manager to be based in Kiribati for an extended period;
2. The GoK's recommendation not to accept the "lowest technically compliant" bid for the solar PV installations due to irregularities in the bid and prior unfavorable experience with the bidder; and
3. Unanticipated shipping delays and the impact of devastation caused by a category 5 cyclone in Fiji which required suspension of work for three weeks to allow the contractor's Fiji-based crew to return to Fiji to attend to the cyclone devastation.

23. The following sections detail the outcomes and performance, key issues during implementation and the lessons learned.

G. Relevance of PDOs

24. **The relevance of the objectives is rated high.** The objectives directly contribute to focus area – "building resilience against external shocks, with a focus in Kiribati on climate change adaptation" – of the World Bank's CAS and support the promotion of low carbon energy generation, including renewables, and the reduction in GHG emissions. The objectives are also consistent with the World Bank's ambition to help diversify electricity generation and reduce reliance on imported fuel products. The objectives are relevant to Kiribati's development plan for 2016-2019, which seeks to scale-up renewable energy in all sectors of the economy as part of its goal to increase the population's access to high-quality and climate-resilient infrastructure. The objectives also remain relevant to the Kiribati Integrate Energy Roadmap 2016-2025,

¹⁴ A total of over 1.6MW of renewable energy was installed through three donor funded projects. Refer paragraph 34 for further details.



which is Kiribati's medium-term strategy document, and sets out targets for renewable energy. The Government has committed to reducing the country's GHG emissions by 48.8 percent and fossil fuel consumption by 45 percent in South Tarawa.

H. Achievement of PDOs (Efficacy)

25. **The overall efficacy rating of the project is high.** The PDO indicators are considered to inform the achievement of the PDO objectives, be adequate to capture the contribution of the project through Components 1 and 2, and be specific, measurable, achievable, and time-bound. The intermediate indicators are considered to succeed in informing on progress toward achieving the PDO objectives.

26. The project objective was to contribute to reducing Kiribati's dependence on imported petroleum for power generation in order to improve energy security and to reduce the GHG emissions from diesel fuel use for grid electricity supply in Kiribati. The specific objective of the project was to serve as a catalyst for the substitution of the diesel-based electricity generation for the South Tarawa grid by grid connected solar PV supply of electricity. This was to be achieved through a least-cost approach in the context of renewable energy options available to Kiribati, which was identified at appraisal as being solar PV and revalidated as part of the preparation of the SREP IP in 2018.

27. Compared to estimates at appraisal (in brackets) the project has delivered the following results: (i) reduction in diesel fuel use in liters 290,000 (230,000); (ii) reduction in GHG emissions in tons 1,048,000 (765,000) and catalyzing substitution of diesel generation as a percentage of total generation 17.9% (7%). At time of appraisal the levelized cost of energy from solar PV was estimated at around US\$0.32 c/kWh compared to US\$ 0.45 c/kWh for diesel generation. The project achieved a levelized cost of energy from solar PV of US\$0.28 c/kWh.

Assessment of Achievement of Each Objective/Outcome

28. **Efficacy is rated high for the first PDO objective** (to reduce Kiribati's dependence on imported petroleum for power generation to improve energy security). The first PDO indicator – energy from renewables – was overachieved through the installation of 729 kW solar PV across the four sites on the South Tarawa grid network, equivalent to 8.1 percent energy from renewables in the current energy generation mix against an end target of 7 percent. The second PDO indicator - medium term renewable energy plan - was achieved through the delivery of a feasibility study recommending a maximum of 900kW of solar could be installed on the grid without storage and a follow up study titled 'Upscaling Solar PV' established the framework for future expansion of renewable energy installation to achieve energy independence for Kiribati.



29. While not explicitly captured by the PDO indicators, clear land ownership, on-site security and the distributed geographic location of the selected sites contributed to the safety of the installed solar PV and to improved energy security. During project preparation, four sites were selected by the Government to house the solar PV based on the following criteria: (i) technical compliance; (ii) clear land ownership; and (iii) satisfactory on-site security (i.e., gated facilities with regular security patrols). The solar PV installations were to be installed on land owned by the Government or on land with long term leases with the Government with facilities owned by the Government. In addition, sites meeting the criteria were also selected based on their physical distribution of solar across South Tarawa to reduce the risk of significant dips in total solar output due to site-specific occurrences, such as site wide cloud coverage. The sites selected were: a) Tungaru Central Hospital (TCH); b) King George V Secondary School (KGV); c) Betio Sports Complex; and d) Kiribati Institute of Technology (KIT). A Co-operation Agreement between the Ministry of Public Works and Utilities and the PUB to allow PUB to fulfill its obligations as a Project Implementing Agency under the financing agreements was signed on 31 July 2013 and was witnessed by the authorized representatives of the four sites.

30. **Efficacy is also rated high for the second PDO objective** (to reduce the emissions from diesel fuel use for grid electricity supply in Kiribati). The installation of 729 kW solar PV has resulted in an estimated annual reduction in fuel of 298,000 liters. The avoided fuel used for electricity generation from diesel plants will save approximately 1,048 tons of CO₂ emissions per annum. This objective is implicitly reflected in the PDO-level indicators; however, in retrospect, it is considered that some intermediate indicators could have been PDO-level indicators ('reduction in diesel use per year' and 'Carbon Dioxide reductions per year') to better measure the achievement of the expected objective.

Table 3. Summary of PDO Indicators and Achievement

Key Project Outcome Indicators	Baseline Value (2013)	End Project Target (2018)	Actual Value at Closing (2018)	Achievement Rate as per Actual Value (%)
Energy from Renewables (percentage) (PDO1)	0	7%	8.1%	115%
Medium term renewable energy plan (text) (PDO2A)	0	Feasibility study on the amount of renewable energy on grid.	Feasibility study on the amount of renewable energy on grid has been completed.	100%
PUB capacity to increase renewable energy generation (text) (PDO2B)	0	30 trained staff to integrate RE into the grid (over 3 years).	Thirty one (31) people over 2 years have been trained to integrate RE into the grid.	103.3%



31. **Attribution of outcomes to the project's activities.** The achievement of outcomes arises from the activities and outputs of the project. The outputs are measured through intermediate indicators that measure progress of project activities toward achieving the PDO. The intermediate indicators include: (i) Solar energy Kilowatt hours (kWh) per year; (ii) Reduction in diesel use per year; (iii) Savings per year (liters avoided multiplied by cost/liter); (iv) Carbon dioxide (CO₂) reductions per year; (v) Maintenance program developed and implemented; and (vi) training plan to build local capacity for maintenance and expansion. Based on these intermediate indicators, the achievement of outcomes is attributable to the project's activities as follows:

- i. **Component 1: Investment in Grid Connected Solar Photovoltaic Equipment.** A total of 1,165 kWh of energy per year will be realized with an annual reduction in fuel of 290,172 liters saving the PUB AU\$368,519 on annual fuel cost. The avoided fuel used for electricity generation from diesel plants will save approximately 1,048 tons of CO₂ emissions per annum.
- ii. **Component 2: Maintenance Program and Capacity Building.** At least two programmed maintenance are being undertaken each year. A total of thirty-one (31) people were trained over the project period on solar PV systems of which 8 were PUB staff and 21 were staff from other institutions including the Energy Planning Unit and KIT. Five KIT students were trained on how to install solar panels, and one student went on to get a job at PUB. In 2018, the solar PV contractor delivered additional training to PUB staff: four (4) electricity meter readers and two (2) electricians benefited from the training, and the additional onsite training was delivered at the four sites. Finally, during construction the contractor, under their own initiative, hired eight electrical students and the students worked part time during the construction period while studying part time.
- iii. **Component 3: Project Management.** No intermediate indicators were defined to track progress towards this activity. The PUB was supported by a project financed local Project Manager who was responsible for overall project implementation, coordination with the project financed Project Support Officer. The Project Support Officer was retained up until the commissioning of the solar systems in September 2016. The PUB project staff also benefited from the technical assistance provided through an international firm.

F. Overall Outcome Rating

32. **Based on the assessment of objectives' achievement discussed in the previous paragraphs, the ICR concludes that the overall outcome efficacy rating of the project is satisfactory.** After some initial delays in implementation, the PDO-level and intermediate indicators achieved or exceeded the respective target values by the revised project closing date. It can be concluded that there were only minor shortcomings in the operation's achievement of its objectives.



33. The ICR also concludes that the restructuring approved during project implementation does not trigger a split rating as it did not have an impact on the project objective or the outcome targets and the scope of the project remained the same.

I. Other Outcomes and Impacts

Donor Coordination

34. **Donor coordination contributed to standardization of Solar PV equipment to help mitigate grid instability.** During project preparation in 2011, the Bank-funded feasibility study recommended that a maximum of 900kW of solar could be installed on the grid without storage. After the completion of the feasibility study, the Government, through the Ministry of Public Works and Utilities (MPWU), considered two other donor funded grid connected Solar PV projects on the South Tarawa electricity grid: (a) 400kW of grid connected ground mounted solar PV through the Pacific Environment Community (PEC) fund, installed by a Japanese Supplier; and (b) 500kW of grid connected solar funded by the United Arab Emirates (UAE), installed by Masdar. The Government chose to pursue all three donor funded projects (World Bank, PEC and UAE) which was estimated to reach total over 1.4 MW (total achieved through the three projects is just over 1.629MW) of grid connected solar during project appraisal. This raised issues around overall grid stability and the need for standardization of solar PV equipment across the three projects to avoid stranded assets. The specifications were streamlined to ensure technical consistency and ease of ongoing maintenance and availability of spare parts. Importantly, it was agreed that the UAE funded solar PV would form the “balancing unit” on the grid network and would be controlled automatically to turn on and off the power supply when necessary to ensure grid stability on the network was maintained. In addition to the specific physical placement of the solar installations, these measures have contributed to mitigating high levels of grid instability and improved energy security. The outcomes of the three donor funded projects on the South Tarawa grid are set out in table 3. The results attributable to this project are set out under ‘World Bank’ (column 4) of the table.

Table 3. Outcomes of The Various Donor Funded Projects in Kiribati¹⁵

Solar PV	PEC	UAE	World Bank	Total
Location	Bikenibeu	Bonriki	Bikenibeu, Betio	
Solar (kW installed)	400	500	729	1,629 (1.6MW)
Contribution to total installed RE generation (%)	4%	5.5%	8.1%	17.9%
Solar (kWh)	601,637	846,170	1,165,000	2,612,807
Total diesel offset (liters)	149,852.90	210,760.02	290,172.69	650,785.61
Total Savings (AU\$)	\$ 190,313.18	\$ 267,665.23	\$ 368,519.32	\$ 826,497.73

35. A Solar PV Steering Committee, chaired by the Secretary of Ministry of Public Works and Utilities (now known as MISE), was established as part of the PEC funded project implementation but later evolved as a coordination body for the three donor funded projects. One role of the Steering Committee was to ensure proper coordination between the three projects, including the standardization of Solar PV

¹⁵ Source: Renewable Energy Development Project Implementation and Completion Evaluation Report, Mr. Tiaon Aukitino, 31 October 2018.



equipment. During implementation of the Bank funded project, the PUB organized four Steering Committee meetings and the PUB found the committee useful for project coordination purposes.

Improved Grid Stability and Grid Management

36. **Cost savings contributed to improved grid stability and grid management.** The procurement process for the design, supply and install contract for the solar PV installation commenced in December 2014. Due to unforeseen circumstances, the procurement process was delayed by almost 12 months and the contract was not signed with the selected contractor until December 2015.¹⁶ During this time, a significant decrease in the capital cost of solar PV and associated equipment occurred globally, and as a result, the project benefited from an overall reduction in the budgeted cost estimate and final contract price of the solar PV. In 2016, at the completion of the construction of the solar PV installations, the PUB commissioned their technical consultants to conduct a feasibility study on 'Upscaling Solar PV' to integrate the existing assets from the three donor funded projects into the grid and to allow for future expansion of renewable energy installation to achieve energy independence for Kiribati. The report recommended the installation of an Energy Management System (EMS) with forecast capabilities and Supervisory Control and Data Acquisition (SCADA) and the installation of batteries for primary control and long-term storage.¹⁷

37. In accordance with the recommendations of the feasibility study, the PUB proceeded with procuring an EMS and SCADA system. In parallel, the PUB commenced the procurement of battery storage; however, the supplier confirmed it would not be able to deliver the storage units prior to the project closing, and thus, the PUB cancelled the procurement. In order to utilize some of the cost savings remaining after the cancellation of the battery storage procurement process, the PUB decided to proceed with procuring and installing an additional 180kW of solar at TCH, KGV and KIT.¹⁸ PUB opted to install additional solar based on good initial operational experience with the EMS and SCADA to manage the combined donor funded installed solar, and following the New Zealand Foreign Affairs and Trade (NZMFAT) funded installation of high-speed generators at Betio power station (780 kVa) and a high-speed generator at Bikenibeu power station (1,020 kVa) to provide additional spinning reserve on the South Tarawa Grid and optimize the installed solar and manage intermittency without battery storage to achieve increased operational efficiencies. The additional solar was commissioned in October 2018, prior to project closing.

38. PUB staff also received training and technical support on how to use the SCADA and EMS system and can generate useful data reports for ongoing grid maintenance and operation. The EMS and SCADA contractor will continue to provide technical and troubleshooting support beyond the current contractual relationship. Overall, the training has been successfully delivered and has contributed to building local capacity and technical skills of KIT students and PUB staff.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

¹⁶ Further details are included at Paragraph 40 and 41.

¹⁷ The battery system size was estimated at 800kWh which considered the diesel start-up and ramping rates to ensure stability in the system.

¹⁸ The PUB, with financing from NZMFAT, installed 2 high-speed generators. The installation of the new generators also allowed the PUB to undertake maintenance of its other generation assets.



Key Factors During Preparation

39. **Readiness for Implementation.** Due to capacity constraints within the PUB, the project was designed for the PUB to obtain support from technical consultants, namely a Project Manager and Project Support Officer, to oversee and manage project implementation and contract management of design, supply and install contract.¹⁹ The Project Manager and Project Support Officer were to be funded through the project. The PUB lacked familiarity with the World Bank fiduciary processes; to support the PUB it was agreed that fiduciary support arrangements would be provided through Kiribati Fiduciary Support Unit (KFSU), which was established in 2012 as a central fiduciary unit within the Ministry of Finance and Economic Development.²⁰ The KFSU would support the Financial Management processes on behalf of PUB and would provide procurement support for the Solar PV design, supply and install contract. Addressing the gaps related to implementation capacity resulted in some initial delays, but the issue was approached in flexible manner and an alternative suitable practical solution was adopted for the benefit of the project.

Key Factors during Implementation

40. **Human Resources and organizational capacity.** Implementation was initially slow due to capacity constraints within the PUB. The procurement of the Project Manager was delayed. The PUB originally intended to appoint an international Project Manager, however given difficulty in finding a suitable candidate, a suitably qualified local Project Manager was appointed. The Project Manager was appointed in June 2014 (12 months after project effectiveness) and was supported by an Owner's Engineer. The progress of implementation began to improve and the procurement process for the design, supply and install contract, including operations and maintenance of the solar installation, was launched in December 2014 (18 months after project effectiveness). Overall, the Project Manager performed well and was responsible for the overall successfully implementation of the project. In addition, the appointment of a local Project Manager contributed to building strong local capacity.

41. **Procurement challenges.** The progress of implementation was further delayed due to unforeseen circumstances during the procurement process for the design, supply and install contract for the solar PV installation. A total of 32 firms expressed interest of which 5 firms submitted bids and three firms qualified. During the evaluation process, concerns were raised regarding the past performance of the first ranked firm. It was also identified that the same firm had miscommunicated and misrepresented the team composition, which in accordance with the Bank's procurement guidelines resulted in the firm ultimately being disqualified. The firm requested a debriefing and the Bank undertook an internal investigation and further due diligence. The debriefing processes delayed the contract award by almost 6 months. In parallel, the second ranked firm was disqualified on technical grounds. The third ranked firm met the technical requirements and was awarded the contract in October 2015, more than 10 months after the procurement process was launched. The PUB and the Bank worked proactively in capacity and policy constrained circumstances to resolve the procurement issues. Overall despite the delays the process achieved a positive outcome. The contractor performed satisfactorily and successfully completed the solar

¹⁹ Since 2013, the placement of an international CEO, funded by NZMFAT, has contributed to increased human resource and organizational capacity, including providing strategic direction of the PUB.

²⁰ In 2012 the KFSU was established with MFED as a centralized fiduciary unit. In addition to providing fiduciary support to this project, the KFSU provided centralized fiduciary support to the World Bank funded Kiribati Roads Project and the Kiribati Aviation Project.



installation with minimal delays despite the logistical challenges of the remote location. Throughout the remainder of project implementation, the operation and maintenance and training components of the contract were ongoing and successfully completed by project close.

42. **Logistics.** PUB considers that the SCADA and EMS system has been a critical and beneficial investment, which contributes to the overall improvement in grid stability and reliability for the South Tarawa network. However, the functioning and performance of the SCADA and EMS system has been impacted by poor communications links between the solar arrays and the SCADA system at the PUB powerhouse. The PUB, the contractor and the communications provider (which is the only communications provided in Kiribati and has a monopoly over the sector) faced initial difficulties to establish the communication links between the solar installations and the SCADA and EMS system. Once the links were established, the reliability of the communication link has been an ongoing problem – the communication link between the solar installation and the SCADA system regularly fails, resulting in the loss of real time data on the output of solar from each array, which can pose risks for system reliability if there is a sudden spike or drop in the output of solar. PUB was exploring cellular options, and initial results were positive, problems with the stability of the link developed. The PUB is exploring the possibility of a private fiber optic network for PUB’s exclusive use as a future option. Notwithstanding the difficulty with the communication links, PUB consider the SCADA and EMS system to be a critical and beneficial investment, which contribute to the improvement in grid stability and reliability. Improvements in the existing communications links are ongoing and stability and reliability are improving.

43. **Natural Disasters.** Tropical Cyclone Winston struck Fiji in February 2016. The contractor, based out of Fiji, had to bring back all their workers because they were all affected by the cyclone. In agreement with PUB and the contractor, all construction works were suspended for three weeks. Around the same time, KIT was experiencing frequent flooding and requested backfilling of the site of the ground mounted solar installation as the flooding would have prevented students and PUB personnel from accessing the site for training and ongoing maintenance and monitoring. This work was supported by the MWPU, and the MWPU assisted with levelling and compacting the site for the ground mounted solar. The backfilling works were completed by the contractor in a timely manner. The frequent rain during this time delayed the progress of the roof replacements and the solar system installation; however, the delays were minor, and the contract implementation timeline was not negatively impacted.

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

G. Monitoring and Evaluation (M&E)

44. The M&E strategy for implementation included the following elements: (i) a detailed work plan for the project to program and manage project implementation; (ii) Periodic reports to monitor and evaluate the progress of project implementation; (iii) quarterly reports against the project results framework; (iv) interim financial reports prepared quarterly by the PMU for the WB; (v) annually audited financial statements provided to the WB by the Auditor General’s Office; (vi) WB team supervision visits to sites and corresponding aide memoires; and (vii) Grant Monitoring and Results Report (GRM).

45. Throughout the implementation, these M&E activities were fulfilled in a timely manner by the



responsible parties, except for quarterly reports on the results framework which was ultimately included in the semesterly reports provided by PUB. The PUB was responsible for overall coordination and implementation of the M&E activities during the project. The WB team annually updated the progress in achieving results and reporting on the monitored indicators in the GRM. Overall, it is considered that data were collected in a methodologically sound manner.

46. M&E findings were regularly communicated to the recipient. The implementing agency and the WB team used the indicators to monitor physical progress.

47. **The overall rating of quality of M&E is satisfactory.**

H. Environmental and Social Compliance

48. The project triggered OP4.01 Environment Assessment and was categorized as 'C' given that the potential environmental impacts were mostly temporary and minor during the installation of the PV solar on the roof tops at the four sites and the ground mounted solar PV at KIT. An Environmental Management Plan (EMP) was prepared and the PUB applied and obtained an environmental license from the Ministry of Environment, Lands and Agricultural Development prior to installation of the Solar PV.

49. **Environmental Safeguards Compliance:** The EMP along with the Environmental Impact Assessment (EIA) was prepared by the consultants on behalf of the PUB and GoK for the project. An Environmental License dated 3 November 2012, was issued to the PUB by MELAD. The contractors along with the PUB worked together to ensure full compliance of the Environmental License and EMP. The Environmental Officer from MELAD reported a few minor issues with respect to the waste management during the installation phase. Wastes such as packaging material including cardboard, plastic and metal wastes were reported to be scattered across the sites. MELAD reported the issues to the contractors and the contractors ensured the waste disposal was carried out in accordance to local (Kiribati) requirements. Notwithstanding this, no major issues were reported during the project implementation and the compliance with safeguards has been reported to be satisfactory in general.

50. **Social Safeguards Compliance:** Compliance with the social safeguards was carried out as per the project requirements. A social officer for the project from MISE was appointed for recording grievances related to the project. No grievances or issues were reported during the project implementation and the compliance to social safeguards has been reported to be satisfactory.

I. Fiduciary Compliance

51. **Procurement:** Procurement activities were generally carried out in accordance with agreed procedures. The KFSU was mandated to provide procurement and financial management support to the project. A Senior Procurement Specialist was engaged as a consultant in December 2014 to support the KFSU and PUB with the preparation and evaluation of bids for the design, supply and install contract for the Solar PV installation. The Procurement Specialist provided key advice and support to PUB and KFSU during the procurement process and assisted the PUB to respond to the issues identified with the qualifying bidders described in paragraph 41. Although the delay in awarding the contract led to implementation delays, the project duly complied with procurement requirements and the works were



carried out satisfactorily.

52. The KFSU procurement staff were trained under the Senior Procurement Specialist and continued to support the project on the consultant's departure.

53. **Financial Management:** The KFSU was mandated to provide financial management support to the project. Arrangements in the KFSU, including accounting, reporting, budgeting and funds flow, internal controls, and financial management staffing were generally adequate. The final financial management implementation review report recorded the IFRs were up to date and the minor issues identified in the previous reviews had been rectified. Annual project account(s) were audited each financial year. The Project Audits were carried out by the Kiribati National Audit Office and submitted to the Bank; the first financial audit dated 31 December 2014 was received on 30 June 2015. The audits were submitted on time.

54. There remained at the end disbursement date, AU\$328,006 undisbursed due to: cost savings on the design, supply and install contract that were unable to be utilized by project closing; and minor currency fluctuations against contracts held in a foreign currency. The underutilization of these funds did not impact on the achievement of the project objectives.

J. Bank Performance

55. **Quality at entry was satisfactory.** The Bank identified, prepared and appraised the operation in such a manner that it was likely to achieve the planned development objective. The project objective was relevant for Kiribati's long-term goals, and the project approach proposed by the Bank was realistic for the country context. The indicators identified were appropriate to inform on the project objectives' achievements. The technical design of the project was sound. Safeguards and fiduciary policy compliance and policy institutional arrangements were strong. Overall, implementation and M&E arrangements were sound.

56. **Quality of Supervision was satisfactory.** Technical matters were supervised satisfactorily by experienced team members and the task team leader on a regular basis. The project benefited from the continuity of the task team leader throughout implementation. Supervision input included periodical missions conducted at least twice per year, as well as concise and regular reporting of any issues raised during missions. The Aide Memoires and GRMs offer pertinent information to inform on project progress. Fiduciary matters were supervised satisfactorily on a regular basis. There was some turnover in procurement team members which did have some impact on resolving the procurement process for the design, supply and install contract for the solar PV installation in a timely manner. Safeguards supervision was less intense as only minor safeguards issues arose throughout the implementation periods.

K. Risk to Development Outcome

57. The risk is considered negligible, given the institutional strengthening and increased technical capacity of the PUB. The PUB has taken over the responsibility of the continued operations and maintenance of the solar PV installations.



V. LESSONS LEARNED AND RECOMMENDATIONS

58. The following lessons were learned from the project:

59. **In a highly constrained environment it is important that project design deliberately consider the existing implementation capacity and implement realistic, incremental steps to improve capacity during implementation.** The project was designed to streamline the technical, fiduciary and administrative requirements to respond to the capacity constrained environment. Through the project and the provision of technical assistance, the capacity of the PUB has been improved, aided by the operation and maintenance training received under the project. Technical skills have also been developed through learning to manage a hybrid system (diesel and solar).

60. **Project supported technical assistance can be instrumental for coordinating broader involvement of donor partners beyond just the immediate activities of the Project.** The initial Bank funded feasibility study on the solar PV demand of the South Tarawa grid network enabled the PUB to plan in other donor funded projects, which ultimately resulted in a total of 1.6 MW solar on grid. The PUB has indicated that there is scope for further solar PV installations at the four sites and this would be welcomed by the site operators. The PUB is investigating the option of installing storage on the South Tarawa grid to mitigate solar intermittency.

61. **When multiple donors are involved in investing in the same type of infrastructure on a small grid network with different equipment, it is critical to ensure standardization of equipment and spare parts for optimal infrastructure operation and maintenance.** The Solar Steering Committee, PUB and the World Bank played a key role in the coordination of PEC and UAE/MASDA to help achieve the standardization of equipment in a remote and low capacity environment. The standardization of equipment and spare parts helped to ensure: it would not result in stranded assets the PUB would not be able to sufficiently integrate within the grid; and guaranteed an optimal number of spare parts are available to ensure proper operation and maintenance. The availability of spare parts is especially important in a remote location where the cost to bring in required spare parts or equipment is high.



ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objectives	Indicator Name	Baseline	Target Value	Means of Verification	Actual Achieved at Completion
Reduced reliance on diesel generation.	Energy from Renewables (PDO1)	-	7%	Metered supply from solar PVs.	8.1%
		March 2013	March 2013		31 October 2018
	Medium term renewable energy plan and PUB capacity to increase renewable generation. (PDO2)	Limited	Feasibility study on the amount of renewable energy on grid and 30 (over 3 years) trained staff to integrate RE into the grid.	Report (kWh and sites) and a number of staff trained in renewable energy systems	Feasibility study on the amount of renewable (solar) integration to the grid has been provided. 31 staff from PUB and other institutions have been trained through the project in a 2 year period.
		March 2013	March 2013		31 October 2018
Comment:	<p>PDO1: This indicator has been overachieved. The project financed 729 kW exceeding the expected target of 516kW.</p> <p>PDO2: This indicator has been achieved. A total of 31 people have been trained over a 2 year period as opposed to the initially planned 3 year training period.</p>				



A.2 Intermediate Results Indicators

Component: Component 1: Solar PVs

Objectives	Indicator Name	Baseline	Target Value	Means of Verification	Actual Achieved at Completion
516 KW grid-connected Solar PV	Solar energy kWh per year	-	850,000	Metered supply from solar PVs	729 kW of PV installed and connected to the grid with an estimated energy contribution of 1,165,000 kWh per year.
		March 2013	March 2013		31 October 2018
	Comment:	This target has been overachieved. The installation of 549kW was completed in 2016 with an estimated energy contribution of 878,000kWh per year (a cumulative total of 1,756,000 kWh at project close). The installation of the additional 180kW was completed in October 2018 and it is too soon to calculate the attribution to energy contribution from the additional solar.			
	Reduction in diesel use l/yr.	-	230,000	Fuel use for equivalent generation	According to estimated energy contribution and current diesel generator efficiency, the estimated fuel savings is 290,172 liters over the year.
March 2013		March 2013		31 October 2018	
Comment:	This target has been overachieved. The installation of 549kW was completed in 2016 and according to estimate energy contribution and diesel generator efficiency at the time, the estimated fuel savings was 225,000 liters over the year per year (a cumulative total of 450,000 liters at project close). The installation of the additional 180kW was completed in October 2018 and the high speed generators came online in mid-2018, thus it is too soon to calculate the				



		attribution to fuel saving from the additional solar.			
	Savings \$/yr	-	290,000	Liters avoided x cost/liter.	Based on the estimated fuel saved as highlighted above, the avoided fuel cost will be \$368,000 over the year.
		March 2013	March 2013		31 October 2018
	Comment:	This target has been overachieved.			
Objectives	Indicator Name	Baseline	Target Value	Means of Verification	Actual Achieved at Completion
CO ₂ reductions	Tons per annum	-	765	Generation from solar PVs x 0.9 kg/kWh	Based on the system performance. Based on the estimated energy contribution about 1048.5 tons saved over the year.
		March 2013	March 2013		31 October 2018
	Comments	This target has been overachieved.			

Component: Component 2: Maintenance and Capacity Building

Objectives	Indicator Name	Baseline	Target Value	Means of Verification	Actual Achieved at Completion
Maintenance Program	Maintenance program developed and implemented	-	At least two programmed maintenance undertaken per annum.	Report by PUB.	Completed. 3 visits along with ongoing remote support provided from the contractor.



Objectives	Indicator Name	Baseline	Target Value	Means of Verification	Actual Achieved at Completion
Capacity Building	A training plan to 'build' local capacity for maintenance and expansion	Limited	At least 30 PUB, KESC and KIT staff trained. At least 10 per annum.	Number of staff "accredited" for solar systems.	A total of 31 staff have been trained. In addition, a total of 15 locals were involved with the installation works.
		March 2013	March 2013		31 October 2018



ANNEX 2. ORGANIZATION OF THE ASSESSMENT OF THE PDO

Objective/Outcome 1: Reducing Kiribati’s dependence on imported diesel for power generation to improve energy security & to reduce GHG emission from diesel use for grid electricity supply in Kiribati.

Outcome Indicators	<ol style="list-style-type: none"> 1. Energy from Renewables 2. Medium term renewable energy plan and PUB capacity to increase renewable energy generation.
Intermediate Results Indicators	<ol style="list-style-type: none"> 1. Solar energy kWh per year. 2. Reduction in diesel use in liters per year. 3. Savings in fuel cost in \$ per year 4. CO₂ reductions in tons per annum 4. Maintenance program 5. Capacity Building – a training plan to “build” local capacity for maintenance and expansion.
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	<ol style="list-style-type: none"> 1. 729 kW of PV installed and connected to the grid with an estimated energy contribution of 1,165,000 kWh per year 2. Approximately 298,000 liters of diesel use reduced per year 3. Approximately \$378,460.00 savings from fuel cost per year. 4. Approximately 1048.5 tons of CO₂ reductions per year. 5. 3 visits completed, and ongoing remote support is being provided by the contractor. 6. A total of 31 staff have been trained. In addition, over 15 locals were provided with training and recruited as interns during the installation phase.



ANNEX 3. TEAM COMPOSITION

Team Composition at Project Approval

Name	Role	Title	Unit	Location
Mr. Kamleshwar Prasad Khelawan	Task Team Lead	Senior Energy Specialist	GE0009	Sydney, Australia
Nicole Forrester	Team Assistant	Team Assistant	EACNF	Sydney, Australia
Miriam Witana	Procurement Specialist	Procurement Specialist	-	Sydney, Australia
Stephen Paul Hartung	Financial Management Specialist	Financial Management Specialist	GGOEP	Sydney, Australia
Penelope Ruth Ferguson	Environmental Safeguards Specialist	Consultant	GENDR	Auckland, New Zealand
Anne McLean	Social Safeguards Specialist	Consultant	GENDR	Sydney, Australia
Isabella Micali Drossos	Legal Counsel	Senior Counsel	LEGLE	Brasilia, Brazil

Team Composition at Project Closing

Name	Role	Title	Unit	Location
Mr. Kamleshwar Prasad Khelawan	Task Team Lead	Senior Energy Specialist	GE0009	Sydney, Australia
Kim Baverstock	Program Assistant	Program Assistant	EACNF	Sydney, Australia
Eric Leonard Blackburn	Procurement Specialist	Procurement Specialist	GGOPG	Sydney, Australia
Zhentu Liu	Senior Procurement Specialist	Senior Procurement Specialist	GGOPG	Sydney, Australia
Stephen Paul Hartung	Financial Management Specialist	Financial Management Specialist	GGOEP	Sydney, Australia
Nicolas John Valentine	Environmental Safeguards Specialist	Consultant	GEN2A	Sydney, Australia
Ross James Butler	Social Safeguards Specialist	Senior Safeguards Specialist	GSU02	Sydney, Australia
Duangrat Laohapakakul	Legal Counsel	Senior Counsel	LEGES	Sydney, Australia



Recipient Organization(s) at Project Approval

Organization Name	Role	Contact	Title	Phone	Email
Public Utilities Board	Implementing Agency	Mr. Kevin Rouatu	CEO	-	-

Recipient Organization(s) at Project Closing

Organization Name	Role	Contact	Title	Phone	Email
Public Utilities Board	Implementing Agency	Mr. Wayne Brearley	CEO	-	ceo@pub.com.ki
Public Utilities Board	Implementing Agency	Mr. Tiaon Aukitino	Project Manager (Consultant)	-	aukitino@gmail.com



The World Bank

Kiribati Grid Connected Solar PV Project (P121878)

ANNEX 4. CLEINT PREPARED IMPLEMENTATION COMPLETION REPORT

Grid Connected Solar PV Project

Title of Consulting Service:
Renewable Energy Development Project implementation and completion
evaluation

Prepared by
Mr. Tiaon Aukitino

Tarawa, 31 October 2018

Table of Contents

1.	DATASHEET	30
	A. Basic Information	30
	B. Key Dates	30
	C. Ratings Summary	30
	D. Sector and Theme Codes	31
	E. Admin Staff	31
	F. Results Framework Analysis	31
	G. Ratings of Project Performance in GRMs	33
	H. Restructuring (if any)	33
	I. Disbursement Profile	33
1.	OVERVIEW	35
	1.1. Project context and objectives	35
	1.2. Project components	35
	1.3. Project stakeholders	36
	1.4. Project costs	37
	1.5. Key project development objectives indicators	38
	1.6. Significant changes during implementation	39
2.	KEY FACTORS AFFECTING IMPLEMENTATION AND OUTCOMES	39
	2.1. Key factors during preparation	39
	2.2. Key factors during implementation	40
3.	ASSESSMENT OF OUTCOMES	41
	3.1. Relevance of objectives, design and implementation	41
	3.2. Achievement of objectives	42
	3.3. Other outcomes and impacts (positive and negative)	45
4.	SAFEGUARD AND FIDUCIARY COMPLIANCE AND RISKS TO OUTCOMES	46
	4.1. Environment	46
	4.2. Social	46
	4.3. Procurement	47
	4.4. Risks to outcomes	47
	5. LESSONS LEARNED AND RECOMMENDATIONS	48

Index of Figures

<i>Figure 1: Schematic Presentation of Project institutional arrangement</i>	10
--	----

Index of Tables

<i>Table 1: GCSPVP project cost</i>	10
<i>Table 2: GCSPVP key project indicators</i>	11
<i>Table 3: Project outcome from additional activities</i>	13
<i>Table 4: Solar PV Project outcomes</i>	14
<i>Table 5: GCSPV project indicators in planned design and actual implementation</i>	17
<i>Table 6: The safeguard and fiduciary compliance of the project</i>	19
<i>Table 7: Latest fund disbursement</i>	20

1. Datasheet

A. Basic Information			
Country:	Kiribati	Project Name:	Kiribati Grid Connected Solar Photovoltaic Project
Project ID:	P121878	L/C/TF Number(s)	TF-014105 TF-014126
Original Category:	EA Partial Assessment (B)	Revised Category:	EA Partial Assessment (B)
Borrower	Ministry of Finance and Economic Development	Disbursement Amount:	TF 14105: US\$ 784,165 TF 14126: US\$ 2307,730 (19 September 2018)
Implementing Entity: Public Utilities Board			
Financiers and Other External Partners:			

B. Key Dates				
Approval	Effectiveness	MTR Review	Original Closing Date	Revised/ Actual Date(s)
25-Mar-2013	18-June-2013		31-Dec-2016	31-Oct-2018

C. Ratings Summary	
C.1 Performance rating by ICR	
Outcomes	58. Satisfactory
Project Management	60. Satisfactory
Financial Management	62. Satisfactory
Counterpart funding	64. N/A
Procurement	66. Satisfactory
Monitoring and Evaluation	68. Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	Ratings	Borrower	Ratings
Quality at Entry	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Satisfactory
Overall Bank Performance	Satisfactory	Overall Borrower Performance	Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	Indicators	QAG Assessments (if any)	Rating:
Potential Problem Project at any time	No	Quality at Entry (QEA)	None

(Yes/No):			
1. Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA)	None
0. DO rating before	2. Satisfactory	3.	4.
1. Closing/Inactive status			

D. Sector and Theme Codes		
	Original	Actual
5.		
6. Sector Code (as % of total Bank financing)		
7. Renewable Energy	100%	100%
8.		
9. Theme Code (as % of total Bank financing)		
0. Climate change	S	S

E. Admin Staff		
	At approval	At ICR
1. Positions		
2. Regional Vice President:	Axel Van Trotsenburg	Victoria Kwakwa
3. Country Director:	Franz Drees-Gross	Michel Kerf
4. Senior Global Practice Director		Riccardo Puliti
5. Practice Manager	Michel Kerf	Jie Tang
6. Task Team Leader:	Kamleshwar Khelawan	Kamleshwar Khelawan
7. ICR Contributing Author		Renee Berthome

F. Results Framework Analysis

Project Development Objective (from Project Appraisal Document)

The Project Development Objective is to contribute to reducing Kiribati's dependence on imported petroleum for power generation in order to improve energy security and to reduce the GHG emissions from diesel fuel use for grid electricity supply in Kiribati. The specific objective of the proposed MSP is to serve as a catalyst for the substitution of the diesel based electricity generation for the South Tarawa grid by grid-connected solar PV supply of electricity.

G. Revised Project Development Objective (as approved by original approving authority) The DPO was not revised.

(a) PDO indicators

Objectives/outcomes	Indicators	Baseline	Target Value	Means of verification	Achievement against Indicator for current reporting period
Project objective					
Reduced reliance on diesel generation.	Energy from renewables	-	7%	Metered supply from solar PVs.	11% of energy from solar is realized.
	Medium term renewable energy plan and PUB capacity to increase renewable generation.	Limited.	Feasibility study on the amount of renewable energy on grid and 30 (over 3 years) trained staff to integrate RE into the grid.	Report (kWh and sites) and a number of staff trained in renewable energy systems.	Feasibility study on the amount of renewable (solar) integration to the grid has been provided and 8 PUB staff has been trained so far plus 21 from other institution.
Component 1 – Solar PVs					
516 KW grid-connected solar PV.	Solar energy kWh per year.	-	850,000	Metered supply from solar PVs.	729 kW of PV installed and connected to the grid with an estimated energy contribution of 1,165,000 kWh over the year.
	Reduction in diesel use l/yr.	-	230,000	Fuel use for equivalent generation.	TBC based on the system performance but according to estimated energy contribution and current diesel generator efficiency, the estimated fuel savings is 298,000.00 liters over the year.
	Savings \$/yr.	-	290,000	Liters avoided x cost/liter.	Based on the estimated fuel saved as highlighted above, the avoided fuel cost will be \$378,460.00 over the year.
CO2 reductions	Tons per annum	-	765	Generation from solar PVs x 0.9 kg/kWh	TBC based on the system performance but based on the estimated energy contribution, about 1048.5 tons will be saved over the year.
Component 2 – Maintenance and capacity building					

Maintenance program.	Maintenance program developed and implemented.	-	At least two programmed maintenance undertaken per annum.	Report by PUB.	Completed. 3 visit plus ongoing remote support provided from the supplier
Capacity building*.	A training plan to “build” local capacity for maintenance and expansion.	Limited.	At least 30 PUB, KSEC, and KIT staff trained. At least 10 per annum.	No. of staff “accredited” for solar systems.	A total of 31 have been trained. In addition a total of over 15 locals were involved with the installation.

H. Ratings of Project Performance in GRMs

No	Date GRMs Achieved	PDO ratings	Overall Implementation Progress (IP) rating	Disbursement (US\$ million)
1	11/21/2013	S	S	0.091
2	09/29/2014	MS	MS	0.118
3	09/04/2015	MS	MS	1.348
4	1/25/2017	S	S	0.878
5	08/15/2017	S	S	0.531
6				0.127

Note: NA: Not Available, S: Satisfactory, MS: Moderately Satisfactory, MUS: Moderately Unsatisfactory, M: Moderate

I. Restructuring (if any)

Dates	Amount Disbursed (US\$M)	Key Revision
16-May-3016	0.41	Project closing date extended by 22 months, to October 31, 2018.

J. Disbursement Profile

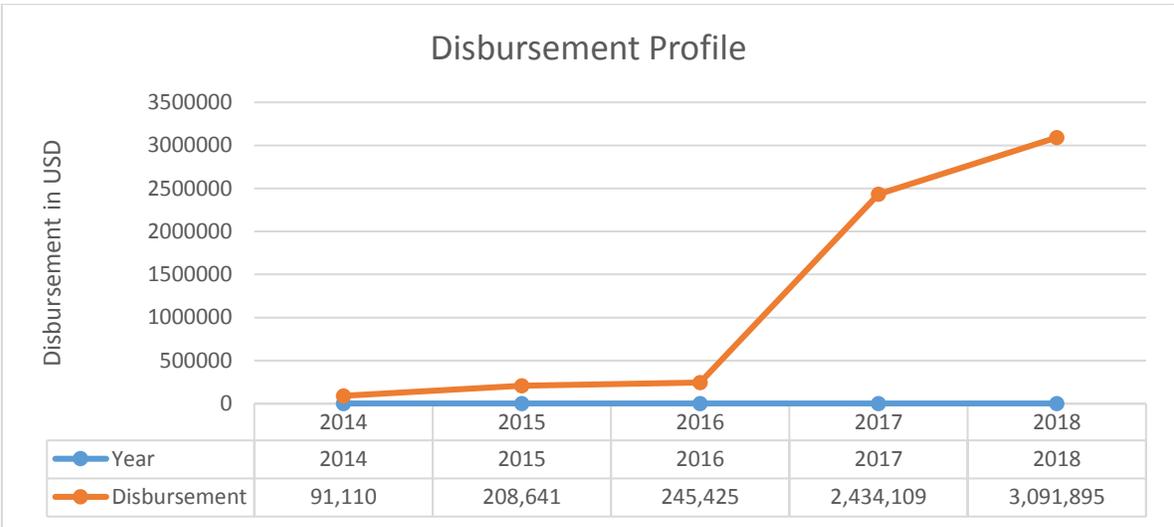


Figure 1: Project funds disbursement profile

1. Overview

1.1. Project context and objectives

1. The Kiribati economy has near-total dependency on oil as an energy source and about half of imported automotive diesel oil (ADO) is used for electricity generation for the main grid on Tarawa, operated by Public Utilities Board (PUB). Over 95% of the Tarawa population of 42,000 is connected to the main grid. The Tarawa grid is supplied by two diesel generating stations with combined installed capacity of 5.45 MW. The demand has a maximum of 4.5 MW, minimum of 2.0 MW and typical weekday peak load of 3.5 MW. PUB's generation cost is about AU 52 cents/kWh compared with collection about AU 40 cents/kWh, resulting in high unsustainable fiscal deficits. Improving the performance of PUB, reducing direct and indirect subsidies, and lowering the ADO dependence of the electricity grid system are policy priorities which will help restore fiscal sustainability to the national budget.

2. The project design aims for simple implementation; early positive impact in the electricity sector; and a shift from the current ad hoc approach to a strategic operational roadmap approach for Government and partner engagement to strengthen capacity and enhance financial sustainability in the sector. The project strategy is to strengthen PUB over the long-term as the central operator of the electricity grid system. Attracting a good quality IPP/BOT investor is unlikely and the Kiribati Solar Electricity Corporation (KSEC) lacks the capacity and experience to be an owner/operator of a grid-connected plant. A 2012 feasibility study shows that 900 kW peak of solar PVs could be installed on the Tarawa grid system without the need for enhancements, constituting 27% of average peak demand and 7% of energy demand.

1.2. Project components

3. The Grid Connected Solar PV Project includes three components which are; Construction of Solar PVs, Maintenance and Capacity Building and Project Management.

Component 1- Investment in Grid Connected Solar PV Equipment: Provided support to the Project Implementing Entity to invest in 516 kilowatt peak capacity of grid connected solar photovoltaic without storage, to kick-start a staged implementation strategy over the medium-term, installed and managed at technically suitable locations (the four Project Sites) as approved by the Recipient that have been identified with associated inverters to enable grid in-feed at each location.

Component 2 – Maintenance Program and Capacity Building: provided support to the Project Implementing Entity to implement the investment through a “design, supply and install” contract for the solar photovoltaic installation with operations and maintenance provisions to cover the entire Project implementation, and to gain experience in operations and maintenance and build capacity to initiate and manage future investments.

Component 3 – Project Management: provided support to the Recipient to effectively manage the fiduciary aspects of the Project (including procurement and financial management) through the Central Fiduciary Unit and support the Project Implementing Entity to effectively manage the technical aspects of the Project through its Project support team.

1.3. Project stakeholders

4. The Government of Kiribati carried out the Project's activities through the PUB (Project Implementing Entity), with administrative, procurement, accounting and reporting support from the Kiribati Fiduciary Services Unit (KFSU) within the Ministry of Finance and Economic Development (MFED), all with due diligence and efficiency and in accordance with the provisions of approved project documents.

5. The Project Support Team (PST) established within the PUB was responsible for the coordination of the technical area of the Project, and overall project progress reporting. It makes all necessary decisions and provide guidance for the implementation of project activities, including approval of overall work plan, providing technical inputs for the procurement activities (including bid documents and evaluation of bids and contractors' proposals), and technical and safeguards supervision. The PST led by the CEO of the PUB with the support of the Project Manager/Engineer and a Project Support Officer who provides day-to-day project implementation support, reporting directly to the Project Manager/Engineer and the Power Engineer, PUB. The PST received administrative support from the PUB. The Project Manager/Engineer Ministry of Environment, Lands and Agricultural Development (MELAD) oversees the compliance with the Environmental Management Plan by the Contractor.

6. The PST was accountable to the GoK for ensuring (a) the substantive quality of the project, (b) the effective use of both GoK and World Bank resources allocated to it, (c) and proper coordination and supervision of the project. The terms of reference of the key PST staff are attached at Annex E.

7. The KFSU was responsible for the fiduciary activities for the project, namely, procurement and financial management (budgeting, accounting, disbursements, reporting and auditing). During the implementation, an international procurement specialist was engaged to assist with the project procurement for the main contract and also assist with KFSU procurement needs.

8. The Solar PV Project Working Committee was formally in charge of cross sectoral coordination and monitoring during project implementation. The committee was chaired by the Secretary of Ministry of Infrastructure and Sustainable Energy (MISE) and in its members include the CEO and the Power Manager of the PUB and staff from the line ministries involved to project's implementation such as the Ministry of Finance and Economic Development, Ministry of Environment Lands and Development, Attorney General's Office.

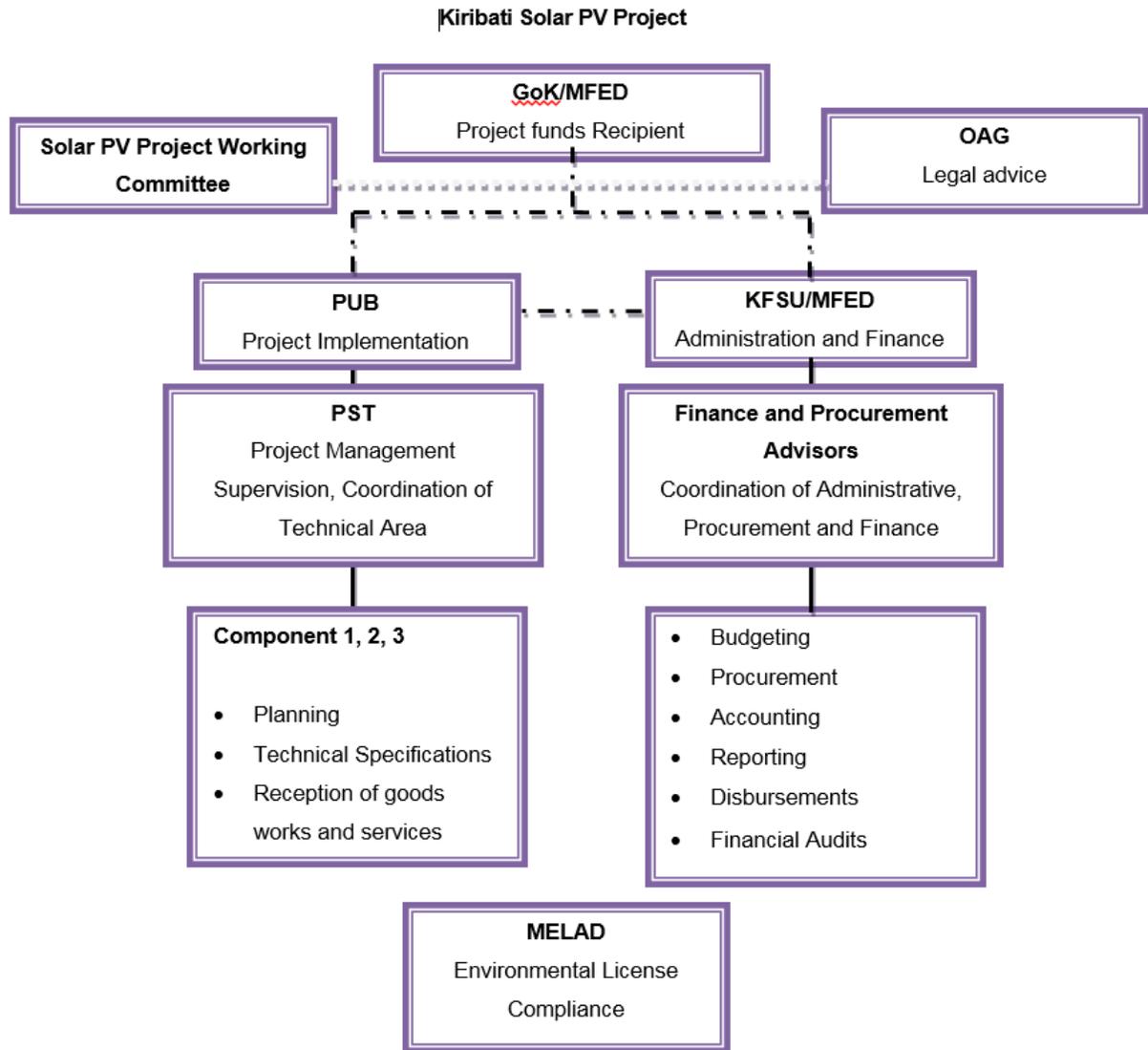


Figure 2: Schematic Presentation Project institutional arrangement

1.4. Project costs

9. The project costs for all three components within the original plan in 2013 is illustrated below.

Table 1: GCSPVP project cost

Components	GEF (US\$)	AusAID/PRIF (US\$)	GOK (US\$)	Total (US\$)
Component 1: Investment in Grid Connected Solar Photovoltaic Equipment: 500 KW grid connected solar PV (including civil works, structures and spares)	860,000	2,540,000		3,400,000

Component 2: Maintenance Program and Capacity Building: 3 -year operations and maintenance (TA) and capacity building	50,000	105,000		155,000
Component 3: Project Management	90,000	275,000		365,000
Total	1,000,000	2,920,000		3,920,000

1.5. Key project development objectives indicators

10. The project progress are measured against the following results indicators.

Table 3: GCSPVP key project indicators

Objectives/outcomes	Indicators	Baseline	Target Value	Means of verification	Assumption/risks
Project objective					
Reduced reliance on diesel generation.	Energy from renewables	-	7%	Metered supply from solar PVs.	Local capacity and donor support to catalyze and maintain investment.
	Medium term renewable energy plan and PUB capacity to increase renewable generation.	Limited.	Feasibility study on amount of renewable energy on grid and 30 (over 3 years) trained staff to integrate RE into grid.	Report (kWh and sites) and number of staff trained in renewable energy systems.	Lack of ongoing local capacity and commitment to diversification.
Component 1 – Solar PVs					
500 KW grid connected solar PV.	Solar energy kWh per year.	-	850,000	Metered supply from solar PVs.	Solar radiation and capacity factor realized.
	Reduction in diesel use l/yr.	-	230,000	Fuel use for equivalent generation.	As above.
	Savings \$/yr.	-	290,000	Liters avoided x cost/liter.	As above
CO2 reductions	Tons per annum	-	765	Generation from solar PVs x 0.9 kg/kWh	As above
Component 2 – Maintenance and capacity building					
Maintenance program.	Maintenance program developed and implemented.	-	At least two programmed maintenance undertaken per annum.	Report by PUB.	Installations serviceable. Maintenance program adequate.
Capacity building.	Training plan to “build” local capacity for maintenance and	Limited.	At least 30 PUB, KESC, and KIT staff trained. At least 10 per annum.	No. of staff “accredited” for solar systems.	Trained staff remain on the island and in the industry. Contract non-compliance. Lack of

	expansion.				ongoing interest.
--	------------	--	--	--	-------------------

1.6. Significant changes during implementation

11. The project was effective on 18 June 2013 and to be closed on 31 December 2016. After some delays, the project was extended to 31st of October 2018 to allow for two years O&M after installation. The implementation was delayed initially due to: (a) Resourcing a Project Support Team for the PUB with appropriate project management, procurement and technical expertise; and (b) Resolution of complex procurement issues related to certain bidders which resulted in the PUB not recommending the lowest technical responsive bid and which required the World Bank to undertake further due diligence in order to provide a no objection to the PUB's Bid Evaluation Report. These matters were resolved.

12. With the delay in project implementation, a level 2 restructuring of the grant was approved on May 16, 2016. The closing date of the grant is extended by 22 months to October 31, 2018.

13. A delay in the project benefited from the falling solar PV prices which has enabled PUB to implement energy management and control systems utilizing the remaining funds, to optimize the input from the three solar facilities that currently contribute 10% of the energy demand. This, combined with the purchase of high speed generators by the PUB provides an opportunity for the remaining project funds to be deployed to further scale up solar PV.

14. PUB in consultation with the TTL, an additional 180kW was installed and a SCADA and EMS utilizing the remaining funds. This has resulted in a significant change in the outcome of the project.

15. The World Bank is currently supporting the Government of Kiribati with the preparation of the a Scaling Up Renewable Energy Investment Plan under the Climate Investment Funds which will identify options for further scaling up of renewable energy and potentially provide additional funds to support investment.

2. Key factors affecting implementation and outcomes

2.1. Key factors during preparation

16. In the project preparation period, even now, the GoK paid attention to promote RE for not only additional electricity generation to the grid but also sustainable economic development & climate change protection. The designed project was in line with the GoK national energy policy.

17. The project responds to a systemic issue in the electricity sector with significant economy-wide implications for Kiribati; whose economy is marked by an overarching near-total dependency on one energy source, oil. About half of the imported oil (Automotive Diesel Oil or ADO), is used for electricity generation for the main electricity grid system on Tarawa atoll, and operated by the Public Utilities Board (PUB).

18. The project objective and key performance indicators, were appropriately designed. The indicators are typical representatives for the project objective with clear quantity assessment methodology. They were workable in the project implementation phase. Overall, the social and environmental safeguard requirement were addressed adequately in the Environment Management Plan (EMP) developed during the project design to minimize social and environmental impacts and ensure compliance with the relevant World Bank safeguard policies.

2.2. Key factors during implementation

19. After some delay in the project implementation, the project team successfully commissioned 546kW of solar PV grid connected at 4 different sites on South Tarawa. Two sites, namely King George the Fifth school and Tungaru Central Hospital benefited from roof replacement construction works before the installation which significantly improved the integrity of the roof structure of their building.

20. A remaining project funds was utilized by adding additional solar pv installation and installation of a SCADA and EMS system. The additional solar pv significantly exceed the target set out in the project development objective indicators. The table below shows the total installed capacity of the WB project and related outcome. The SCADA and EMS is also included.

Table 3: Project outcome from additional activities

Objectives/Outcomes	Target value	Outcome after project completion
Component 1		
Installed capacity (kW)	516	729 ²¹
Energy production (kWh/yr)	850	1,165
Fuel saved (Ltrs/yr)	230,000	298,000
Co ₂ reduction (tons/yr)	765	1048
New activity		
SCADA and EMS ²²	None	1

21. Prior to the commissioning of the solar pv grid connected project in September 2016, two other similar project financed by the Japanese government under the Pacific Environment Facility and United Arab Emirates with a capacity of 400kW and 500kW respectively have been online. The additional 729kW capacity from the WB project makes up a total combined installation of 1.629MW. The contribution of each installation including the annualized savings based on the current diesel generation efficiency is presented in the table below;

²¹ Additional 180kW of solar pv utilizing the remaining funds including extra 33kW capacity already installed as part of the original contract.

²² Additional activity utilizing the remaining funds.

Table 4: Project outcomes

Solar PV	Bikenibeu (PEC)	Bonriki (UAE)	WB	Total
Solar KWh	601,637	846,170	1,165,000	1,253,649
Contribution	2.5%	3.6%	4.89%	11.0%
Total liter offset	149,852.90	210,760.02	290,172.69	650,785.61
Total Savings	\$ 190,313.18	\$ 267,665.23	\$ 368,519.32	\$ 826,497.73
Annualized Saving	\$ 190,313.18	\$ 267,665.23	\$ 368,519.32	\$ 826,497.73

22. The GoK strongly commits to support RE development by recently approving a Kiribati Integrated Energy Roadmap with official renewable and energy efficiency targets. The targets details are illustrated below;

1. The goal for Tarawa is a 45% reduction in energy coming from fossil fuels for electricity generation by 2025 compared to Business As Usual (BAU). This goal will be met through a 23% reduction of fuel use for power generation and a 22% reduction from improvements to energy efficiency on both the supply and demand side.
2. The goal for Kiritimati is a 60% reduction in energy coming from fossil fuels for electricity generation by 2025 compared to BAU. It is anticipated that 40% of this reduction will come from solar energy and biofuels while the remaining 20% will come from improvement to energy efficiency on both the supply and demand side.
3. For the outer islands, it is proposed that any expansions in electricity generation be met through renewable energy and that existing diesel generation used by Island Councils (IC), government and schools must be converted to renewable energy by 2025. The goal is to have at least 60% renewable energy by 2025 in rural public infrastructures (e.g. the Tabiteuea North Hospital and ice plants) and 100% RE for rural public and private institutions.

3. Assessment of outcomes

3.1. Relevance of objectives, design and implementation

Rating: High

23. Relevant of objective - High: The main objectives of the project has been evaluated to be high relevance with priorities given to GoK, Kiribati National Energy Policy (KNEP), KIER and with the Bank’s Country Partnership Strategy (CPS).

(i) Alignment with Government Strategy: The project is fully consistent with Kiribati’s national priorities, policies and plans. The Kiribati National Energy Plan (KNEP, May 2009, is the very first time that such a framework has been developed and adopted by the Government. The KNEP builds on the theme and vision of the Kiribati Development Plan (KDP 2008-2011) : “enhancing economic growth for sustainable development”, with emphasis on “available, accessible, reliable, affordable, clean and sustainable energy options”. The Policy incorporates and is consistent with regional priorities and plans, including the Pacific Plan, Pacific Islands Energy Policy, Millennium Development Goals Declaration, the Mauritius Strategy, and the Kyoto protocol, and therefore this policy is also consistent with the regional and international

agenda. The GoK recently adopted the KIER which sets the target for achieving the policy goals on renewable energy and energy efficiency.

Alignment with Bank Strategy: The project objective is still relevant with the Bank CPS for the fiscal year 2012-2016 in pillar 1.2 on Improved Quality and Efficiency of Infrastructure Services, pillar 2.2 on Climate change mitigation: CO2 emissions reductions associated with investments supported, and pillar 2.3 on Climate change adaptation: Coherent framework for prioritization of climate change adaptation action in key sectors is available.

24. Relevant of design and implementation - High: The project has made an important contribution in renewable energy capacity interconnected to the national grid. The system design and components selection target the climate condition of Kiribati and remoteness in terms of sourcing spare parts. The components are modular and can be easily sourced and replace by PUB when required. The overall project implementation arrangements were sound. Key government entities were involved in these arrangements: The PUB is the implementing entity on behalf of GoK. Ministry of Finance and Economic Development through the Kiribati Fiduciary Services Unit is the local financial and procurement point that oversee the finance and procurement aspect of the project. The MISE assist with identifying the sites and handling of complaints if any from the site operators. The MELAD assist with the environment safeguards throughout the project implementation.

3.2. Achievement of objectives

25. The objective of this project is to contribute to reducing Kiribati's dependence on imported petroleum for power generation in order to improve energy security and to reduce the GHG emissions from diesel fuel use for grid electricity supply in the country. The specific project's objective is to serve as catalyst for the substitution of the diesel based electricity generation for the South Tarawa grid by grid-connected solar PV supply of electricity. The project is structured around two components in order to achieve the project objective. The three components are:

- Component 1: Construction of Solar PVs;
- Component 2: Maintenance and Capacity Building;
- Component 3: Project Management.

3.2.1. Grant Outcome Indicators

3.2.1.1. Energy from Renewables;

26. The project has financed 729kW of grid connected solar PV, and installed a SCADA and Energy Management System to optimize the input of solar PV into the grid. The energy from renewable is contributing about 11% of the total generation.

Target value; 7%

3.2.1.2. Medium term renewable energy plan and PUB capacity to increase renewable generation.

26. The project has contributed to building local capacity for project design, bidding, selection and contract management and for operations and maintenance of solar PV installations. Feasibility study on the amount of renewable (solar) integration to the grid has been provided and 8 PUB staff has been trained so far plus 21 from other institutions.

Target Value; Feasibility study on the amount of renewable energy on grid and 30 (over 3 years) trained staff to integrate RE into the grid.

119.

3.2.2. Component 1: Construction of Solar PVs;

Rating: Satisfactory

27. The satisfactory rating proposed for achievement of the target under component 1 is justified by substantial meeting of the milestone indicated in the project development objectives indicators under component 1. The contract for the supply, installation, operations and maintenance support was signed on 28 October 2015 with the works commencing from January 2016 on the replacement of roofs at the Tungaru Central Hospital (TCH) and the King George V Secondary School (KGV). Installation, commissioning and handover of the solar PV plants was completed in the first week of July 2016. With the savings incurred from the falling solar prices, PUB was able to utilize the remaining funds by installation additional 40kW followed by another 140kW. Both systems were commissioned on the 29th of June 2018 and 8th of October 2018 respectively. A total solar pv installation of 729kW grid connected is realized including civil works structures and spare parts.

28. The target values under component 1 were exceeded following the commissioning of the combined 729kW of solar pv installation. A total of 1,165kWh of energy per year will be realized with an estimated reduction in fuel of 298,000 liters saving PUB, \$378,460.00 on fuel cost. The avoided fuel use for electricity generation from diesel plant will save 1048 tons of CO₂ per annum.

29. In addition to the extra solar pv installation, PUB was able to implement an energy management and control system (SCADA and EMS) utilizing the remaining funds. This new activity enables PUB to optimize inputs all solar pv plants and diesel gensets on the network.

3.2.3. Component 2: Maintenance and Capacity Building.

Rating: Satisfactory

30. The satisfactory rating of proposed for achievement of project objective under this component is justified by completing the activities and achieving the target. Programmed maintenance completed, local staff and consultants trained on operations and maintenance and on design, bidding, and supervision. A total of 31 staff were trained (10 PUB and 21 other staff from KSEC, EPU and KIT) attended the training over the project period.

3.2.4. Component 2: Project Management.

Rating: Satisfactory

31. The satisfactory rating proposed for achievement of the project objective under component 3 is justified by delivering the project and residual matters being finalized. The PUB and the Kiribati Fiduciary Services Unit (KFSU) have adequate resources and a Procurement Advisor and a Technical Support Consultant (TSC) are in place to support project implementation.

Table 5: GCSPV project indicators in planned design and actual implementation

Objectives/outcomes	Indicators	Baseline	Target Value	Means of verification	Achievement against Indicator for current reporting period
Project objective					
Reduced reliance on diesel generation.	Energy from renewables	-	7%	Metered supply from solar PVs.	11% of energy from solar is realized.
	Medium term renewable energy plan and PUB capacity to increase renewable generation.	Limited.	Feasibility study on the amount of renewable energy on grid and 30 (over 3 years) trained staff to integrate RE into the grid.	Report (kWh and sites) and a number of staff trained in renewable energy systems.	Feasibility study on the amount of renewable (solar) integration to the grid has been provided and 8 PUB staff has been trained so far plus 21 from other institution.
Component 1 – Solar PVs					
516 KW grid-connected solar PV.	Solar energy kWh per year.	-	850,000	Metered supply from solar PVs.	729 kW of PV installed and connected to the grid with an estimated energy contribution of 1,165,000 kWh over the year.

	Reduction in diesel use l/yr.	-	230,000	Fuel use for equivalent generation.	TBC based on the system performance but according to estimated energy contribution and current diesel generator efficiency, the estimated fuel savings is 298,000.00 liters over the year.
	Savings \$/yr.	-	290,000	Liters avoided x cost/liter.	Based on the estimated fuel saved as highlighted above, the avoided fuel cost will be \$378,460.00 over the year.
CO2 reductions	Tons per annum	-	765	Generation from solar PVs x 0.9 kg/kWh	TBC based on the system performance but based on the estimated energy contribution, about 1048.5 tons will be saved over the year.
Component 2 – Maintenance and capacity building					
Maintenance program.	Maintenance program developed and implemented.	-	At least two programmed maintenance undertaken per annum.	Report by PUB.	Completed. 3 visit plus ongoing remote support provided from the supplier
Capacity building*.	A training plan to “build” local capacity for maintenance and expansion.	Limited.	At least 30 PUB, KSEC, and KIT staff trained. At least 10 per annum.	No. of staff “accredited” for solar systems.	A total of 31 have been trained. In addition a total of over 15 locals were involved with the installation.

3.3. Other outcomes and impacts (positive and negative)

32. There are no other noticeable positive or negative impacts of the project.

4. Safeguard and fiduciary compliance and risks to outcomes

Rating: Moderately Satisfactory

33. Evaluation by the Bank of the safeguard and fiduciary compliance of the project is as follow for reference.

Table 6: The safeguard and fiduciary compliance of the project

Items	Year	
	June-2017	June-2018
Project Management	S	S
Financial management	S	S
Procurement	S	S
Monitoring and Evaluation	S	S
Social safeguard	S	S
Environment safeguard	S	S

Source: WB

4.1. Environment

Rating: Satisfactory

35. The environment compliance was satisfied. The project has an Environment Management Plan (EMP) in place that manages social and environment compliance of the project. The contractor and Project Manager worked together to ensure full compliance of the environment licence and EMP throughout the project implementation. Proper disposal of construction waste was done by the contractor in accordance with the advice given by the Environment office.

4.2. Social

Rating: Satisfactory

36. The social compliance was highly paid during the project implementation. A social officer for the project from MISE was appointed to records complaints related with the project. No complaints about the project were recorded.

4.3 Financial management

Rating: Satisfactory

37. The June 30, 2018 semester IFR report was received and accepted by the Bank. There were no material issues identified although there were commitment issues that were corrected during the review by the finance consultant. As of September, 2018, the status of the disbursement of funds is provided in the table below.

Table 8: Latest fund disbursement

Source of funds	Currency	Grant amount	Amount disbursed	% of funds disbursed
TF 14105	USD	1,000,000	784,165	78.4%
TF 14126	USD	2,920,000	2,307,730	79%

4.3. Procurement

Rating: Satisfactory

38. The procurement implementation was satisfactory done in accordance to the World Bank guideline and regulation 2011. The Kiribati Fiduciary Service Unit was mandated to provide procurement management support to the Project. The procurement expert was directly involved with the actual preparation of bidding documents and bid evaluation for the supply and installation of 516 KW solar PV station and the recruitment of the Technical Support Consultant. KFSU procurement staff were well trained by the Procurement Expert so they continued to provide procurement support to the project on shopping packages as well as consultancy services. During the project period, no cases of fraud and corruption were detected. The post review was deferred at later date since it was noted that most contracts were reviewed by the Bank, then no post review were carried on the Project in 2017.

4.4. Risks to outcomes

Rating: Moderate

39. A key risk was the volatility of solar PV module prices and, to a lesser extent, some volatility in the costs of related services (engineering, installation, commissioning). These risks were mitigated by the fact that the grant has leveraged other co-financing, together with the PRIF. In fact the falling solar PV prices benefited the PUB. There are no conflicts of interest for the Bank. The delay in implementation benefited from further fall in solar PV prices, saving PUB around \$1.3 million which has now being used to scale up the facility.

4.6 Monitoring and Evaluation

Rating: Satisfactory

40. Project reports required under the Grant Agreement have been submitted and accepted. A six monthly report outlining the progress against the project plan and project development indicators prepared and submitted to the Bank for continuous monitoring. The finance and

procurement components were also closely monitored. The Aide Memoire has also been shared with Government and key development partners.

5. Lessons learned and recommendations

Lessons learned: The lessons learned are drawn from GCSPV project implementation as follows:

41. The Bank procedure in managing projects and safeguard policies are new things with the implementing entity (PUB) and has strengthened local capacity in project implementation. The training was very useful in building local capacity on solar pv installation and grid integration. It is suggested that standard procurement procedure, report and project implementation standard are employed locally to raise the standard of project implementation.

42. Putting together a team of expert from different aspects of the project is very important for a successful project implementation. Other resources required for project execution are also important. The inputs required for the project was timely and adequate, however, the project experienced delay in the implementation due to complex procurement issues related with the bidders. In this case, there is a need to review the national procurement procedure which can assist project procurement needs related with contractors past and current project performance and compliances with national and international standards, etc.

43. The components selected for the project are modular and can be easily sources from nearby countries and can also be installed by PUB without requiring additional technical support from outside Kiribati. It is recommended that future similar project will select project components that are easy to install, operate and maintained.

44. The SCADA and EMS is completely new system for PUB and has proven to be very useful to PUB operation. Despite the ongoing support that will be provided from the contractor in case of system fault, it is highly recommended that additional training on the system is carried out to strengthen PUB capacity to operate and maintain the system. In addition, one critical components of the SCADA and EMS is the link which enables communication from all point of interest to the central station where all the monitoring and control is done. The link currently used for the system is not stable. It is recommended that a reliable link is used to ensure full functionality of the system.

Annex 1 – List of reference document

- Project Operations Manual (POM) by the PUB
- Aide Memoire of the review mission prepared by the Bank
- IFR reports
- EIA and EMP
- Solar PV grid connected completion report.
- SCADA and EMS project closure report.
- Feasibility Study reports by TTA



ANNEX 5. RECIPIENT, CO-FINANCIERS AND OTHER PARTNER/STAKEHOLDER COMMENTS

The following comments were received from the PUB and the Australian High Commission on March 12th and March 25th, 2019 respectively and were incorporated in the final version of the ICR.

- Other Outcomes and Impacts: Clarify the highspeed generators were funded by NZMFAT and are 780kVa and 1020kVa respectively (PUB).
- Factors that affected implementation and outcome: Clarify the positive impact of EMS and SCADA installation (PUB).
- Lessons Learned: Clarify the positive impact donor coordination on standardization of Solar PV equipment (PUB).
- Other: recognition of donor contribution to the Project and the positive impact of additional technical assistance on PUB's increased human resource and organizational capacity through the placement of an international CEO since 2013 to date (Australia High Commission).