



Initial Environmental Examination

Project Number: 46453
March 2014

Proposed Loan and Administration of Grant Cook Islands: Renewable Energy Sector Project

Prepared by the Ministry of Finance and Economic Management, Government of Cook Islands for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 5 September 2013)

Currency Unit = New Zealand Dollar (NZ\$)

NZ\$1.00 = US\$ 0.796

US\$1.00 = NZ\$ 1.255

ABBREVIATIONS

ADB	-	Asian Development Bank
CEFPF	-	Clean Energy Financing Partnership Facility
CFC	-	chlorofluorocarbons
CIIC	-	Cook Islands Investment Corporation
CIRECIP	-	Cook Islands Energy Chart Implementation Plan
DG	-	diesel generator
EA	-	executing agency
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EPC	-	Engineering, Procurement and Construction
GDP	-	gross domestic product
GFP	-	Grievance Focal Points
GHG	-	Green House Gases
GRC	-	Grievance Redress Committee
IA	-	implementing agency
IAC	-	Island Administration Committees
IEE	-	initial environmental examination
IUCN	-	International Union for Conservation of Nature
NEC	-	National Energy Committee
NES	-	National Environment Service
MFEM	-	Ministry of Finance and Economic Management
PCBs	-	polychlorinated biphenyl
PMU	-	Project Management Unit
PSC	-	project steering committee
PPTA	-	project preparatory technical assistance
PV	-	photovoltaic
REA	-	Rapid Environmental Assessment
REDD	-	Renewable Energy Development Division
SPS	-	Safeguard Policy Statement
TA	-	technical assistance
TAU	-	Te Aponga Uira

NOTES

- (i) The fiscal year (FY) of the Government of Cook Islands ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2013 ends on 30 June 2013.
- (ii) In this report, "\$" refers to US dollars.

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

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A. EXECUTIVE SUMMARY

1. The proposed Renewable Energy Sector Project (the project) will assist the Government of Cook Island's (the Government) efforts to reduce the country's heavy reliance on imported fossil fuels for power generation by providing a secure, sustainable and environmentally sound source of electricity for private and commercial consumers. The project will implement about 3 megawatt-peak (3 MWp) distributed photovoltaic power plant (PVP) connected to existing power distribution grids in the islands of the Southern Group.¹ The proposed project will provide operation and maintenance programs through a capacity building and knowledge transfer program after PVP commissioning. Technical designs will ensure climate and disaster resilience. The project will result in greater energy security and sustainability for the Cook Islands.

2. The scope of the project includes the following two components:

- (i) **Solar Photovoltaic Power System Development.** The project will construct up to six solar photovoltaic power plants with a total installed capacity of about 3 megawatt peak coupled with advanced secondary battery energy storage installation, and rehabilitate the existing distribution network for core and non-core subprojects. The project will feature three core subprojects on Mangaia, Mauke, and Mitiaro and up to three non-core subprojects on Aitutaki, Atiu, and Rarotonga. Due diligence for core projects will be prepared prior to approval by ADB's Board of Directors. Due diligence for non-core projects will be prepared after approval, and in parallel with the administration of the core projects.
- (ii) **Institutional Strengthening and Project Management Support.** The project will provide institutional strengthening to OEC and REDD for (i) developing the energy efficiency policy implementation plan including an energy audit and monitoring scheme to enhance demand side energy efficiency management practices for targeted major electricity consumer groups; (ii) developing capacity for renewable energy technology assessment and appropriate off-take tariff setting for power purchase agreements for private sector funded projects, and (iii) updating the CIRECIP through refining electricity load demand up to 2020, renewable technology choice, and least cost investment plan. The consultants to be engaged under this component will be the project owner's engineer (POE) who will also provide project management support for REDD and TAU to help implement core and non-core subprojects in the Southern group islands.

3. This is the environmental assessment prepared for the project. The interventions proposed are located in three outer islands of Cook Islands Southern Group. Based on the government's environmental laws and regulations and ADB's environmental safeguard policy, the proposed interventions are categorized as environmental category B project considering the most sensitive component. This assessment meets the requirements of the Cook Islands' Environment Act (2003), and as an initial environmental examination (IEE), complies with the ADB's Safeguard Policy Statement (SPS, 2009). The scope of this assessment is limited to the sites of the proposed interventions.

¹ The Southern Group comprised of the islands of Rarotonga, Aitutaki, Atiu, Mangaia, Mauke, Mitiaro, Palmerston, Manuae, and Takutea.

4. This assessment has been prepared during the project preparation work in the months of October and December 2013. The project is currently in bid preparation stage, and although there are no major changes in the project design or location of components anticipated, this assessment (including the environmental management plan [EMP]) will be updated during detailed design in line with the SPS.

5. The project will construct and operate up to six solar power generation units with lithium-ion battery storage with a total capacity up to around 3 MWp. The solar power generation units will consist as a set of solar photovoltaic (PV) modules, power inverters, switchgear, associated protection, control and monitoring equipment, and associated civil works.

6. The project will require about 70,000 m² (7.0 ha) of land in total for around 3 MW of PVP installation, of which, core subprojects on Mauke, Mangaia, Mitiaro islands will require about 40,000 square meters (m²) equivalent to 4.0 hectares (ha)² of land to install 0.78 MWp capacity over three solar PV power plants. In Mangaia, the site proposed for the solar power plants are located adjacent to the existing power plants, whereas in Mauke and Mitiaro, the proposed sites are new locations. The new plants will either be on government-owned land or private land obtained through negotiation, there will be no involuntary resettlement. The process for obtaining the land is documented separately. The topography is mostly flat and land use is mostly non-residential with vegetation cover. There are no sensitive areas on and around the proposed sites. At the sites in Mangaia and Mauke, there is vegetation cover and trees, whereas the sites proposed on the other island is generally open land without trees or vegetation cover. All selected sites are free from any encroachments. About 2.27 ha³ of vegetative cover and about 96 trees (mostly coconut and overgrown invasive trees) need clearing for installation of the three solar power plants. Coastline is between 1 and 2.5 km away from the proposed sites and there is no history of any flooding or water logging. There is no physical infrastructure, archaeological, culturally or religiously important sites in or around the proposed sites. The land proposed for power plants is privately-owned and government (Island Councils) is in the process of negotiation with landowners to acquire the land as per government norms and ADB's safeguards.

7. The solar power plants will not have any significant long-term adverse environmental impacts; in fact the project will create long-term environmental benefits by reducing CO₂ emissions in the order of 2,930 tons per year.⁴ The main environmental impacts are short-term and will be created during the construction stage. The main environmental impacts will be during site preparation, which will include the cutting of about 96 trees and clearing of vegetative cover from the proposed sites and surrounding areas to prevent shading. There will also be impacts from noise and dust emissions due to increase in traffic for transportation of equipment and construction material, as well as operation of construction machineries such as concrete mixer, bulldozer, dump trucks, cranes, etc. However, these will be short-term (approximately one week for the smaller plant and up to a month for the larger plant). Operational impact includes maintenance of the plant and management of used batteries. It is proposed, as a special condition in the technical specifications, that handling and disposal of used batteries will be taken care of by suppliers. Similarly after decommissioning of the solar plants, solar panels will be dismantled and handled by suppliers. All these impacts are manageable by implementing mitigation measures proposed in the environmental management plan.

² Land requirement is estimated based on the assumption that 1 kWp solar power requires about 10 m² area for solar PV installation and space of access and distance between rows of panels.

³ Part of Mauke site is free site and does not need clearing of vegetation.

⁴ Baseline: 33.8 GWh in 2012 and 200,000 tons of carbon dioxide in 2008.

8. Table 1 summarizes the island wise plant size and summary of existing features and proposed interventions.

Table 1: Summary of Existing Features and Proposed Interventions

Feature	Target Island		
	Mangaia	Mauke	Mitiaro
Total land area (km ²)	51.8	18.4	22.3
Population	572	307	189
Number of households	172	95	58
Geographical location	Southernmost island located at 177 km south of Rarotonga	One of smallest islands, about 270 km northeast of Rarotonga	Mitiaro is located at 230 km northeast of Rarotonga
Proposed interventions	Installation of 420 kWp solar power plant with lithium-ion storage battery connected to existing community manager mini-grid	Installation of 240 kWp solar power plant with lithium-ion storage battery connected to existing community manager mini-grid	Installation of 120 kWp solar power plant with lithium-ion storage battery connected to existing community manager mini-grid
Location of proposed sites for interventions	Near existing powerhouse in Oneroa village	North of machinery shed on Tengarua 6B block	Center part of Mitiaro Island
Ownership of proposed land	Private land	Private land	Private land
Estimated Land requirement (m ²)	20,000	10,000	10,000
Land use in and around proposed site for solar power plant site	Open unused land with Makatea (coral rock) with trees and bushes	Open unused land previously used for agricultural and fruit tree plantation	Open bush land with Makatea deposit
Approx. no. of trees to be cleared	About 56	About 40	None
Terrain of proposed site	Flat	Flat	Flat
Distance from Coastline	<1 km	1-2 km	1-2 km

9. Local communities and stakeholders were involved in the process of preparing the assessment and land access issues through on-site discussions. As the project will have minor environmental impacts, local communities and community leaders support the project. Details of community issues and project actions are incorporated in the social assessment report.

10. The assessment report will be made available at public locations and will be disclosed to a wider audience via the ADB website. The consultation process will be continued during project implementation to ensure that stakeholders are fully engaged and have the opportunity to participate in its development and implementation, and understand that there is a process in place for them to air any grievances or complaints. The EMP includes a grievance redress mechanism (GRM).

11. The interventions proposed under the project will not cause any significant or lasting adverse environmental impacts during construction, operation, and decommissioning. In terms of environmental impacts, the project will bring about benefits by reducing gaseous emissions (CO₂) through reducing dependence on existing diesel generator sets which use imported fossil fuels; reduction in noise from diesel generator sets operations; and reduction in land and ground water contamination caused by spills from diesel generator sets and diesel fuel storage areas. Only minor and transient environmental disturbances will be experienced at the project sites during construction and operation, and these can be minimized and managed through implementation of the EMP. During detailed design, the EMP will be updated and incorporated

into the bid and contract documents. The Ministry of Finance and Economic Management (MFEM), as project executing agency (EA), will ensure that necessary permits/approvals are obtained from regulatory authorities including the National Environment Service and Island Councils prior to implementation of the project.

B. INTRODUCTION

1. Project Background and Rational

12. The Cook Islands is a Pacific island country divided into the two island groups with an estimated total population of 15,000 people. The Northern Group consists of six low-lying, sparsely populated, coral atolls, while the Southern Group consists of nine fertile volcanic islands. About 74% of the population lives in Rarotonga, the capital city.

13. The Cook Islands is heavily dependent on imported fuels. The total fuel import bill of the Cook Islands in 2012 was \$58 million or about 28% of the country's gross domestic product (GDP).⁵ Diesel-powered generators constitute about 99% of the total electricity generating capacity. Electricity costs are currently among the highest in the Pacific, therefore substitution of conventional renewable power generation sources will reduce the production cost of electricity, while reducing the import bill of diesel and allowing the government to invest in social infrastructure and environmental improvements.

14. The total installed power generation capacity in the Cook Islands is 11.75 MW with a distribution network comprising 80 kilometers (km) of 11 kV underground cables and 200 km of 0.415 kV low voltage distribution lines. The whole power system generated 33.8 gigawatt-hour (GWh) of electricity in 2012. On the major islands of Rarotonga and Aitutaki, nearly 99% of all households are grid connected, 8% had additional solar photovoltaic home systems (SHS), and 3% used small diesel generators as well. In the outer islands, about 60% of households are grid connected, and 43% have SHS. The photovoltaic power plant (PVP) will save about 1.54 million liters of diesel yearly.

15. Like other Pacific island countries, Cook Islands is highly vulnerable to increasing oil prices, affecting the affordability of food, goods, electricity, and transportation. Its dependency on imported fossil fuels consequently affects the economic growth of the country.

16. The proposed Renewable Energy Sector Project (the project) will assist the government's efforts to reduce the country's heavy reliance on imported fossil fuels for power generation by providing a secure, sustainable, and environmentally sound source of electricity for private and commercial consumers. The project will implement about 3 MWp distributed PVP connected to existing power distribution grids in the islands of the Southern Group (footnote 1). The proposed project will provide operation and maintenance programs through a capacity building and knowledge transfer program to last up to three years after PVP commissioning. Technical designs will ensure climate and disaster resilience. The project will result in greater energy security and sustainability for the Cook Islands.

17. The project will have two outputs:

- (i) **Solar Photovoltaic Power System Development.** The project will construct up to six solar photovoltaic power plants with a total installed capacity of about 3

⁵ In 2012, around 12.7 million liters of diesel (7.2 million liters used for generation of electricity), 4.2 million liters of petrol, and 9.7 million liters of kerosene were imported into the country.

megawatt peak coupled with advanced secondary battery energy storage installation, and rehabilitate the existing distribution network for core and non-core subprojects. The project will feature three core subprojects on Mangaia, Mauke, and Mitiaro and up to three non-core subprojects on Aitutaki, Atiu, and Rarotonga. Due diligence for core projects will be prepared prior to approval by ADB's Board of Directors. Due diligence for non-core projects will be prepared after approval, and in parallel with the administration of the core projects.

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18. The government has requested a loan and a grant totaling NZ\$21.79 million equivalent to help finance the project. Financing will comprise (i) a loan of NZ\$13.43 million from ADB's ordinary capital resources, and (ii) a grant of EUR5.30 million (equivalent to NZ\$8.36 million) from the European Union, administered by ADB.

2. Project Location

19. The project's physical components will be located in the Southern Group of Cook Islands. The southern group has nine high islands mainly of volcanic origin and several smaller atolls. Figure 1 shows the location map of the project. Detailed maps showing locations of individual plant sites are provided in Appendix 1.

Figure 1: Locations of Project Areas in Country (Cook Islands) Map



3. The Project

20. A project preparatory technical assistance (PPTA) has been provided by ADB to the government to help develop the project in the six islands of Rarotonga, Aitutaki, Atiu, Mauke, Mitiaro and Mangaia. It includes (i) solar resource assessment; (ii) screening and site selection for one solar plant on island; (iii) preparation of conceptual feasibility studies for the selected schemes including all technical, economic, financial, environmental, legal, and social considerations; and (iv) capacity strengthening program of executing and implementing agencies, including customers.

21. The executing agency (EA) for the project will be the Ministry of Finance and Economic Management (MFEM), Government of Cook Islands. The implementing agencies will be Renewable Energy Development Division (REDD), the Office of Prime Minister for Mauke, Mitiaro, Mangaia, Atiu, and Aitutaki islands component, and Te Aponga Uira (TAU) for Rarotonga island component. REDD and TAU will nominate counterpart staff conversant in engineering, power system planning, finance, environment, and social areas. REDD and TAU have hands-on expertise important to the project due to its power engineering knowledge. The project management unit (PMU) and project steering committee (PSC) will be established for implementing the project. The Cook Island Investment Corporation (CIIC) will be the owner of all assets generated by the projects.

4. Objectives and Scope of the Environmental Assessment

22. As part of the PPTA, this environmental assessment forms part of the feasibility study and has been undertaken to comply with Cook Islands' environmental law and ADB's Safeguard Policy Statement. The objectives in undertaking an environmental assessment IEE are:

- (i) To assess the environmental impacts – positive and negative associated with the proposed project;
- (ii) To identify the corresponding mitigation and/or enhancement measures for the environmental impacts; and
- (iii) To ensure that all statutory requirements for the project such as applicable rules and regulations, permits required (if any), etc., have been considered to ensure compliance.

23. The interventions proposed under the project are located in the three islands of Cook Islands Southern Group. The scope of this assessment is limited to the power plant sites, access to those sites, and associated distribution grids only while the purpose is to assess potential environmental, health, safety, and social impacts of the proposed interventions and propose suitable mitigation measures where required. This report present the findings of the environmental assessment study carried out for proposed interventions in these three islands.

(a) Methodology The assessment followed a number of steps:

- (i) Compare the environmental safeguard requirements of the Government of Cook Islands and ADB, and identify measures to bridge the gap, if any;
- (ii) Conduct field visits to collect primary or secondary data relevant to the project area to establish the baseline environmental condition;
- (iii) Assess the potential impacts on environmental attributes due to the location, design, construction, and operation of the project through field investigations and data analysis;
- (iv) Carry out consultation with affected stakeholders and island administrative authorities to identify perception of the project, introduce project components, and anticipated impacts;
- (v) Explore opportunities for environmental enhancement and identify measures;
- (vi) Prepare an EMP outlining the measures for mitigating the impacts identified including the institutional arrangements;
- (vii) Identify critical environmental parameters required to be monitored subsequent to the implementation of the project and prepare an environmental monitoring plan; and
- (viii) Disclose the draft report locally and on ADB's website and prepare a project summary, or brief in local language to be made publicly available at the offices of REDD, TAU, and Island Council Offices of the three islands.

24. This assessment is conducted based on primary data collected from site visits and field surveys (including consultations) and secondary information collected from various sources. During the site visits, the specialists had discussions with various stakeholders including island council members and local executive powers for their opinions on the project. The results of the consultations with council/village members and communities as well as an evaluation of the institutional framework have been incorporated into this assessment.

5. Structure of the Assessment

25. In line with the Environment Act (2003) and additional requirements necessary to comply with the SPS, this report has the following contents:

- *Executive Summary:* This section briefly describes the critical facts, significant findings, and recommended actions.
- *Introduction:* Describes the overview of the project, environmental requirements, objectives and scope of the study, approach, and methodology.
- *Policy, Legal, and Administrative Framework:* Discusses the national and local legal and institutional framework within which the environmental assessment is carried out.
- *Project Description:* Provides an overview of the proposed project, its objectives and major components including maps showing the project's location.
- *Description of the Existing Environment:* Describes the relevant physical, biological, and socioeconomic conditions within target islands and specific to the project sites.
- *Anticipated Environmental Impacts and Mitigation Measures:* Provides an assessment of the associated environmental impacts and corresponding mitigation measures. The environmental impacts and mitigation measures including the environmental monitoring are summarized in the environmental management plan and environmental monitoring plan.
- *Analysis of Alternatives:* Examines the alternatives to proposed project sites to ensure avoidance of significant adverse environmental impacts.
- *Consultation, Participation, and Information Disclosure:* Describes the process of engaging stakeholders and information disclosure. This section summarizes the comments and concerns of affected persons.
- *Grievance Redress Mechanism:* This section describes the grievance redress framework and setting out the timeframe and mechanisms for resolving potential complaints and/or issues from affected persons.
- *Environmental Management Plan:* Describes the set of mitigation and management measures to be taken for each identified environmental impact during project design, construction, and operation. This section also includes monitoring and reporting procedure as well as institutional implementation arrangements.
- *Conclusion and Recommendation.*

C. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

26. Environmental assessment of the proposed project has been carried out in compliance with the country safeguard systems (CSS) which include the government's environmental legislation and requirements and ADB's SPS.

1. Cook Islands' Environmental Laws and Regulations

27. Some of the important laws, regulations and developmental plans relevant to the project focusing on environmental safeguards are summarized as follows.⁶

⁶ Source: Advisory and Compliance Division of the National Environment Service of Cook Islands (www.environment.gov.ck).

(i) Environment Act (2003)

28. The Environment Act (2003) provides the legal framework for the management of any land prior to development. It establishes the roles and functions of the National Environment Service (NES), which includes the protection and management of the environment and its resources, in a sustainable manner among numerous other functions. Currently, five islands have adopted the act, as a means to safeguard their environment. These islands are Aitutaki, Atiu, Mauke, Mitiaro, and Rarotonga.

29. Section 36(1-3), Part 5 of the Environment Act states that: (a) no person shall undertake activity likely to cause significant environmental impact, unless a project permit is obtained from the permitting authority; and that (b) a project permit is obtained through a written report to the NES, setting out all activities that impact on the environment.

30. The Act provides for the application of environmental impact assessment to the planning of development in Cook Islands and to regulate major development projects and the applications of notification consistent with the Act.

(ii) The National Sustainable Development Plan

31. The National Sustainable Development Plan was developed as a pathway for sustainable development in the Cook Islands. The Cook Islands government recognizes the significance of the environment and its inter-relatedness to other areas of importance and therefore developed Strategic Outcome 5 and Strategic Goal 4 that incorporates environmental consideration into the National Goals:

- Strategic Outcome 5 - Enhanced Cultural and Environmental Values - we envisage that by 2020, we will have a firm respect for our natural environment through increased conservation efforts that are consistent with the principles of sustainable development ensuring the protection of our natural environment for future generations.
- Strategic Goal 4 - Sustainable use and management of our environment and natural resources. Strategic Goal 4, with its envisioned outcome, comprises of positive developments in the areas of marine resources, agriculture, land resources use and management, environment, water and waste for future sustainable development, and conservation in all spheres.

(iii) Environment Regulations

32. Pursuant to Section 70 of the Environment Act, the government approved two regulations in 2008. These regulations are specific regulations for conservation and management of island ecosystems for Atiu and Takutea, and Mitiaro. The objective of the regulations is to designate island as community conserved area under the management and control of the Trustees of the Islands. Under section 1 of the regulation, the Trustees of the Island shall prepare a management plan for the community conserved area designated pursuant to Regulation 4(1), for the protection, conservation, management, and control of wildlife and natural ecosystems.

33. Section II deals with protection of specific habitats within the conservation area and designation of additional protected areas. Section IV specifies the regulations for environmental health and cleanliness in the islands including water supply, sanitation, and waste management. Section V specifies the Marine Resources Management including pollution of vessels,

movement of vessels, fishing, scuba diving, and permitting system. Section VI deals in foreshore activities on the islands, whereas section VII deals in enforcement of this regulation.

34. This regulation also specifies the roles and responsibilities of Island Environment Authority and its coordination with NES.

35. Schedule 3 of the regulation listed the protected bird species on the islands, whereas Schedule 4 presents the protected areas on the islands. Schedule 6 listed the rules of the management committee.

36. Besides these laws and regulation, the government is in the process of formulating the Environment (Permits & Consents) Regulation, which is yet to be approved by the Cabinet.

2. Environmental Assessment Process in Cook Islands

37. Under the Cook Islands' regulatory framework (the Environment Act [2003] and Environment Regulations [2008] for Atiu and Mitiaro), activities likely to create significant environmental impact require a permit issued under the Act. All development activities must be referred to the NES through the Island Environment Authority. With this notification, the proponent must complete an Application Form, providing an overview of the proposed development, and a number of details in relation to the existing environment and potential environmental impacts and mitigation measures. The NES will determine whether the proposed development cause significant environmental impacts, and whether an Environmental Impact Assessment (EIA) is required. If EIA is warranted, then NES will issue the Terms of Reference (TOR) for the EIA study. The proponent then submits an EIA for review and approval to the NES. The NES makes recommendations to the environmental assessment committee. The Minister receives an assessment report and can issue approval (with or without conditions), a request for further information, or a rejection. The detailed EIA process is provided in Appendix 2.

38. Under the Environment Act and subsequent Regulations, the types of projects that need an EIA are listed. Solar power generation projects, such as the current project, are not clearly stated in the Act. Based on discussions with NES officials, it is suggested that the project proponents (REDD and TAU) submit an application to NES to determine what level of assessment is required. The project EA will approach NES and seek its guidance if additional studies are required for interventions proposed in each island, and accordingly, EA will modify the assessment report to meet NES requirements.

3. ADB's Environmental Safeguard Requirements

39. This environmental assessment is also carried out in compliance with safeguard requirement 1 of ADB's SPS so as to ensure that potential adverse environmental impacts are identified and avoided, and where impacts cannot be avoided, a suitable plan is prepared for them to be mitigated and managed. To help achieve the desired outcomes, ADB adopts eleven policy principles for guiding the assessment of projects that trigger environmental risks and impacts. ADB categorizes projects into categories A, B, C, and FI according to the significance of likely impacts.

40. Project categorization is carried out using a rapid environmental assessment checklist (Appendix 3). Based on the checklist and project and sites descriptions, the project is categorized as category B (based on the most sensitive component). Category B projects are judged to have some adverse impacts, but of lesser degree and/or significance than category A,

the impacts are site-specific and can be managed or mitigated to satisfactory levels. Category B projects require an initial environmental examination (IEE), the assessment concludes whether or not there will likely be significant environmental impacts warranting an EIA. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. Accordingly this assessment also constitutes an IEE and meets the requirements of the SPS.

4. Institutional Roles and Responsibilities

41. The main institutions that will be involved in the project are the National Environment Service as regulatory agency, the Ministry of Finance and Economic Management (MFEM) as the executing agency (EA), TAU and REDD as implementing agencies (IAs), and ADB as project financing agency.

42. **NES and IEA.** The principal national agency charged with environmental protection is the NES or Tu'anga Taporoporo. The role of NES is to protect the environment (including people, communities, land, water, and native species), promote sustainable development, and prevent and control pollution. The issue of permits for activities that will create environmental impacts and review of EIA for the same is through the Director of the NES. The Act (and NES) applies to the islands of Rarotonga, Atiu, and Aitutaki but does not apply to any outer islands unless otherwise specified by an Order in the Executive Council. Except in Mangaia, all other islands' IEA will also be involved in the approval process at island level. These are the agencies also required to respond to any complaints from the public about environmental issues. In Mangaia, the Island Council would be responsible to give the approval.

43. **Executing and implementing agencies.** MFEM as the EA of the project will be overall responsible for environmental management, implementation of mitigation measures, and environmental reporting. MFEM will also be responsible to update the environmental assessment report and to obtain necessary permits/approval for the project. It will submit environmental monitoring reports to ADB. The TAU and REDD as implementing agencies (IAs) will be responsible for day-to-day monitoring of EMP implementation.

44. **ADB.** As project financing agency, ADB will be responsible for approval of project documents. In respect of safeguards, this includes clearing the IEE, and making sure that there are sufficient loan agreements and requirements in the Project Administration Manual covering updating of the IEE, integration of the EMP into bid and contract documents, monitoring undertaken and reported, and disclosure of environmental monitoring reports.

D. DESCRIPTION OF THE PROJECT

1. Project Components

45. The project will implement about 3 MWp distributed PVP connected to existing power distribution grids in the islands of the Southern Group. The project includes the following two components:

- (i) **Solar Photovoltaic Power System Development.** The project will construct up to six solar photovoltaic power plants with a total installed capacity of about 3 megawatt peak coupled with advanced secondary battery energy storage installation, and rehabilitate the existing distribution network for core and non-core subprojects. The project will feature three core subprojects on Mangaia, Mauke, and Mitiaro and up to three non-core subprojects on Aitutaki, Atiu, and Rarotonga. Due diligence for core projects will be prepared prior to approval by ADB's Board of Directors. Due

diligence for non-core projects will be prepared after approval, and in parallel with the administration of the core projects.

- (ii) **Institutional Strengthening and Project Management Support.** The project will provide institutional strengthening to OEC and REDD for (i) developing the energy efficiency policy implementation plan including an energy audit and monitoring scheme to enhance demand side energy efficiency management practices for targeted major electricity consumer groups; (ii) developing capacity for renewable energy technology assessment and appropriate off-take tariff setting for power purchase agreements for private sector funded projects, and (iii) updating the CIRECIP through refining electricity load demand up to 2020, renewable technology choice, and least cost investment plan. The consultants to be engaged under this component will be the project owner's engineer (POE) who will also provide project management support for REDD and TAU to help implement core and non-core subprojects in the Southern group islands.

2. Location and Scope of the Project

46. The project will be located in the Southern Group, made up of nine high islands mainly of volcanic origin and several smaller atolls. The majority of the population lives in the Southern Group. Rarotonga, located on southern part of Cook Islands, is the capital and largest island in terms of population (13,095 people) as well as geographic area (67.1 km²).

47. The project will construct and operate three solar photovoltaic power generation units with a total capacity of 0.78 MWp. The solar power generation units will consist in a set of solar photovoltaic modules, power inverters, switchgear, associated protection, control and monitoring equipment, and associated civil works. The electricity output will be directly fed into existing distribution grids in target islands for further distribution.

48. Located about 177 km south of Rarotonga, Mangaia is the southernmost island of the Cook Islands. With an estimated land area of 51.8 km², it is also the second largest island. It has population of 572 comprised of 172 households. It has the distinction of being the oldest island in the Pacific. Roughly circular in shape, it rises 4,750 m above the ocean floor. It has a central volcanic plateau and, like many of the southern islands in the Cook Islands, it is surrounded by 60 m high ring of cliffs of fossilized coral makatea (old coral limestone rock). Interventions proposed for Mangaia include installation of 420 kWp solar PV power plant with lithium-ion battery storage system. The proposed site is located on Aremauku road in Oneroa village. Site is approximately 200 m away from existing powerhouse. The terrain is mostly flat, with some minor rocks and makatea. The site is open land with overgrown invasive trees and bushes. About 56 trees (21 coconut) and bushes will have to be cleared from this site.

49. Mauke is one of the smallest islands lying at southeastern corner of Cook Islands about 270 km northeast of Rarotonga. It is a raised atoll encircled by the characteristic fossilized cliffs of makatea. Mauke is virtually flat with its center about 30 m above sea level. The island has a circumference of 18 km. The soil is fertile and supports agriculture. The total land area of Mauke is 18.4 km² with a population of 307 persons and 95 households. Interventions proposed for Mauke include installation of 240 kWp solar PV power plant with lithium-ion battery storage system. The proposed site is located on center part of the Island north of machinery shed (Tengaru 6B block). The terrain is flat with part of the site already cleared near the machinery shed, with area covered with invasive tree to the north side and mango trees on the east. There

is an existing road running through the site. About 40 trees (Mango, nuts and invasive trees) will have to be cleared from this site.

50. Located at 230 km northeast of Rarotonga, Mitiaro is the largest island which is of volcanic origin. Standing in water 4,500 m deep, it is 6.4 km across at its widest point. It is surrounded by 6 to 9 m high belt of fossilized coral makatea. As per census 2011, it has a population of 189 people with 58 households, spread over a land area of 22.3 km². Interventions proposed for Mitiaro include installation of 120 kWp solar PV power plant with lithium-ion battery storage system. The proposed site is located on center part of the Island on Mitiaro Community Access Road. The terrain is flat covered with makatea and invasive bushes.

51. The project will require about 40,000 m² (4.0 ha) of land area to install 0.78 MWp capacity over three solar power plant sites. The sites proposed for the solar power plants are open areas of flat topography and land use being mostly rural (non-residential) and invasive vegetative cover. In Mangaia and Mitiaro, the site has makatea. Tree cutting will be required in Mangaia and Mauke. The land proposed for power plants is privately owned customary land which will be acquired/leased by the government.

52. Table 2 below summarizes the island wise plant size and summary of existing features and proposed interventions.

Table 2: Summary of Existing Features and Proposed Interventions

Feature	Target Island		
	Mangaia	Mauke	Mitiaro
Number of HH	172	95	58
Location	Southern-most island, 177 km south of Rarotonga	One of smallest islands, located 270 km northeast of Rarotonga	Located 230 km northeast of Rarotonga
Proposed interventions	Installation of 420 kWp solar power plant with LISB connected to existing community manager mini-grid	Installation of 240 kWp solar power plant with LISB connected to existing community manager mini-grid	Installation of 120 kWp solar power plant with LISB connected to existing community manager mini-grid
Ownership of land	Private land	Private land	Private land
Estimated Land area required (m ²)	20,000	10,000	10,000

53. The main activities under the project include installation and commissioning of grid-connected solar PV power plants ranging from 120 kWp to 420 MWp capacity with lithium-ion battery storage and refurbishment of grid assets. The project would also include capacity building of executing and implementing agencies, solar electricity committees in planning and customers in managing the electricity services, and efficient project management services.

3. Local Infrastructure Required

54. The local infrastructures required at each site include roads, wharf, and the pre-existing energy grid. The solar power plant will be connected to the existing grid and will feed it energy. Access by road and wharf will be needed to transport necessary materials and equipment during construction. In all the project islands, the proposed sites are accessible and well connected with existing roads and wharfs/ports. Therefore there is no need to construct additional access roads as part of this project.

55. It is estimated that maximum 2-3 trucks mostly carrying construction materials will be moving daily for a maximum 3-4 days during peak construction time.

4. Implementation Schedule

56. The core subprojects will be implemented between June 2014 and December 2016. The tendering process will begin in January 2015 and expected to be completed in August 2015. Bid evaluation and contract will be awarded in September 2015. The detailed design and updating of safeguards documents shall take place before start of installation work. Installation work is expected to start in October 2015 and trial operation is scheduled on third quarter of 2016.

5. Project Benefits and Justification

57. The successful implementation of the 0.78 MWp solar power generation capacity in three core subprojects will result in reduction of annual diesel import for power generation equivalent to about 0.26 million liters/year.⁷ Additional 1.12 GWh of solar power electricity is supplied to customers in three islands every year by 2017, avoiding at least 720 tons of carbon dioxide per year.⁸

58. In addition, a key element of the project will be capacity building including strengthening of staff from island electricity committees in the areas of O&M of solar-diesel hybrid energy systems. The project will also bring positive impacts by reducing gaseous emissions (CO₂) from running of existing diesel generator sets; reduction in noise from diesel generator sets operations, and reduction in land and ground water contaminations caused by spill of oil from diesel generator sets. Overall, at a local level, the project will improve socio-economic conditions of the local communities in the targeted areas, and at a national level will help improve the national gross domestic product (GDP).

E. DESCRIPTION OF THE ENVIRONMENT (BASELINE)

1. Physical Conditions

1.1 Physiography and Land Use

59. The Cooks Islands is a Pacific island country comprising 15 islands scattered between Tonga to the west and New Zealand to the northeast. The islands are located between 8° and 23° south latitude and 156° and 167° west longitude and are geographically divided into two groups, commonly referred to as the Northern and Southern Group islands. The Northern Group consists of six low-lying, sparsely populated, coral atolls, while the Southern Group consists of nine raised atolls and volcanic islands.

60. The description of physiographical and demographical features of each site is presented in the following paragraphs. A brief introduction on each island is presented first followed by a description on environmental features of each site.

61. **Mangaia.** Located about 177 km south of Rarotonga, Mangaia is the southern-most island of the Cook Islands. With an estimated land area of 51.8 km², it is also the second largest island. Analysis of its geology shows it dates from 18 million years ago. Roughly circular in

⁷ Diesel consumption for power generation is 12.7 million liters (2012 baseline).

⁸ Baseline: 33.8 GWh in 2012 and 200,000 tons of carbon dioxide in 2008.

shape, it rises 4,750 m above the ocean floor. It has a central volcanic plateau and, like many of the southern islands, it is surrounded by a 60 m high ring of cliffs of fossilized coral makatea.

62. Interventions proposed for Mangaia include installation of 420 kWp solar PV power plant with lithium-ion battery storage system. The proposed site is located on Aremauku road in Oneroa village. Site is approximately 200 m away from existing powerhouse and residential building line is about 300 m away from the proposed site. The terrain is mostly flat, with some minor rocks and makatea

63. The site is open land and it is reportedly used for the agricultural purpose in the past but it is now overgrown with invasive trees (pine) and bushes. About 56 trees (21 coconut) and bushes will have to be cleared from this site. It is a customary land owned by three families. The site is free from any environmentally sensitive or protected areas.

64. **Mauke.** Mauke is one of the smallest islands lying at southeastern corner of Cook Islands about 270 km northeast of Rarotonga. It is a raised atoll encircled by the characteristic fossilized cliffs of makatea. Mauke is virtually flat with its center about 30 m above sea level. The island has a circumference of 18 km. The soil is fertile and supports agriculture. The total land area of Mauke is 18.4 km². Interventions proposed for Mauke include installation of 240 kWp solar PV power plant with lithium-ion battery storage system. The proposed site is located on center part of the Island north of machinery shed (Tengaru 6B block). Land use is mixed (industrial and agricultural). Agriculture activities are being practiced on west side of the proposed site. Soil of the site is soft reddish-brown fertile soil rather than the coral aggregate and limestone found around the outer ring of the island. About 41 trees (mango, nuts and invasive trees) will have to be cleared from this site. There are no residential buildings in close vicinity of the site. Building line is about 500 m away from the proposed site. It is a customary land owned by six families. The site is free from any environmentally sensitive or protected areas.

65. **Mitiaro.** Located at 230 km northeast of Rarotonga, Mitiaro is the largest island of volcanic origin. Standing in water 4500 m, deep it is 6.4 km across at its widest point. It is surrounded by 6 to 9 m high belt of fossilized coral makatea. The center is almost flat, quite swampy and contains two freshwater lakes teeming with eels (itiki) and the imported tilapia from Africa where it is known as bream. The land area of the island is 22.3 km². Interventions proposed for Mitiaro include installation of 120 kWp solar PV power plant with lithium-ion battery storage system. The proposed site is located on center part of the island on Mitiaro Community Access Road. The terrain is flat covered with makatea and bushes. There are no big trees and site is free from any encroachments and it is about 700 m away from residential buildings. It is a customary land owned by ten families. The site is free from any environmentally sensitive or protected areas.

66. Table 3 presents the physiographical features of the islands that form the project area.

Table 3: Physiographical Features of the Proposed Sites

Feature	Target Island		
	Mangaia	Mauke	Mitiaro
Location of proposed sites for interventions	Near existing powerhouse in Oneroa village	North of machinery shed (Tengaru 6B block)	Center part of Mitiaro Island
Land use in and around proposed site for solar power plant site	Makatea (coral rock) with invasive trees and bushes	Open unused land previously agricultural and fruit tree plantation	Open bush land with makatea deposit

Feature	Target Island		
	Mangaia	Mauke	Mitiaro
Terrain of proposed site	Flat	Flat	Flat
Distance from the coastline	<1 km	1-2 km	1-2 km

Source: Statistics Office, Ministry of Finance and Economic Management, Government of Cook Islands. 2011. Census 2011. Rarotonga, and field surveys carried out in the months of November to December 2013.

1.2 Meteorology and Climate

67. The climate of the Cook Islands is sub-tropical and tropical oceanic, moderated by trade winds. It has two distinct seasons, hot and humid. The average rainfall is between 2,000 and 3,000 mm per year. The mean annual temperature is 24°C with little seasonal variation. Temperatures ranges between 18°C and 28°C in the southern winter, which is May to October, and between 21°C and 29°C in the summer, which spans from November to April. The wet season is normally January to early May. Average annual rainfall is about 2400 mm with the wettest months from January to May.

68. Seasonal temperatures differ between the northern and southern Cook Islands. The Northern Cook Islands' position so close to the equator results in fairly constant temperatures throughout the year, while in the Southern Cook Islands, temperatures cool off during the dry season. Changes in temperatures are strongly tied to changes in the surrounding ocean temperature. The annual average temperature at Penrhyn in the Northern Group is 28°C and at Rarotonga in the Southern Group is 24.5°C.

69. Rainfall in the Cook Islands is strongly affected by the South Pacific Convergence Zone. This band of heavy rainfall is caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. It extends across the South Pacific Ocean from the Solomon Islands to east of the Cook Islands. It is centered close to or over the Southern Group from November to May. This is when the South Pacific Convergence Zone is most active and furthest south. From November to March, the South Pacific Convergence Zone is wide and strong enough for the Northern Group to also receive significant rainfall. The driest months of the year in the Cook Islands are from June to October.

70. The Cook Islands' climate varies considerably from year to year due to the El Niño-Southern Oscillation. This is a natural climate pattern that occurs across the tropical Pacific Ocean and affects weather around the world. There are two extreme phases of the El Niño-Southern Oscillation: El Niño and La Niña. There is also a neutral phase. The El Niño-Southern Oscillation has opposite effects on the Northern and Southern Groups. In Rarotonga, El Niño events tend to bring drier and cooler conditions than normal, while in the north, El Niño usually brings wetter conditions. Ocean temperatures warm in the north during an El Niño event so air temperatures also warm.

71. Tropical cyclones affect the Cook Islands between November and April. In the 41-year period between 1969 and 2010, 47 tropical cyclones passed within 400 km of Rarotonga, an average of just over one cyclone per season. The number of cyclones varies widely from year to year, with none in some seasons but up to six in others. Over the period 1969 to 2010, cyclones occurred more frequently in El Niño years.

72. A climate risk profile for Cook Islands⁹ indicates that the main impacts of climate change are expected to be high sea levels, extreme winds, and extreme high air and water temperatures. Best estimates of long-term, systematic changes in the average climate for Cook Islands indicate that sea level is likely to have increased by 4-15 cm and the frequency of severe short sea level rise resulting from storm surge (2.2 m above mean sea level) will increase from a one in 580-year event to a one in 5-year event by 2050. The project will provide solar PV plants with resilience to climate change through compact and preassembled systems resistant to extreme weather events.

1.3 Geology, Soils and Mineral Resources

73. The islands of the Southern Group (where project components will be implemented) differ widely in form, structure and relief, such that it is difficult to deduce a geological history consistent for the whole group. They include a high mountainous island, Rarotonga; four raised coral islands with volcanic cores, Mangaia, Mauke, Mitiaro and Atiu; one atoll, Manuae; one “near-atoll” with a volcanic core, Aitutaki; and a sand-cay on a coral foundation, Takutea. The geology of Southern Group comprised of three soil forming deposits. These are the volcanic rocks, the raised coral limestone, and the swamp deposits. The volcanic rocks are mainly olivine basalts including tuffs, breccias, and dikes. The coral limestone forming the makatea comprises mainly calcite and aragonite but is magnesium enriched in some inland areas. The swamp deposits in the depression comprise fine textured basaltic alluvium derived from erosion of interior upland rocks.

74. Mangaia consists of a low central plateau top, which is separated from the completely encircling platform of coralline limestone by a series of irregular swampy depressions. The volcanic rocks of Mangaia are deeply weathered and the scarcity of outcrops on the volcanic hills precludes any detailed inferences as to the island’s volcanic history. The volcanic core is mainly basalt, commonly ankaramite. Coral sand forms a coastal belt, 90-180 m wide surrounding the island, which supports coastal species such as much of the casuarina, pandanus, hibiscus, and other shrubs and trees.

75. The makatea averages about 1,100 m in width and on the seaward side ends in a small cliff up to 6 m high, broken in places by gaps occupied by small sandy beaches. From the cliff edge, the highly irregular surface of the makatea rises for about 300 m inland, gradually to about 20 m above sea level in the south and to about 30 m in the north, and then descends gradually to the small cliffs and steep slopes of its inner margin, against the taro swamp depression. Analyses show that the outer 46 m consists of calcite and aragonite of both primary and secondary origin, and the inner parts more than 370 m from the shore consist of irregularly dolomitized limestone.

76. The soils in the Southern Group generally consist of six types (Grange and Fox, 1952), i.e., Tamarua Clay Loam, Makatea Sand, Keia Clay Loam, Oneroa Clay Loam, Ivirua Clay Loam, Tupapa Clay Loam. The foundation of the PV arrays should be designed keeping in view the characteristics of the soil on project sites.

1.4 Water Resources

77. The freshwater resources of Cook Islands consist of surface water, ground water and rainwater. In the Southern Group of islands which includes the main island of Rarotonga,

⁹ 2011. Pacific Climate Change Science Program for Cook Islands (International Climate Change Adaptation Initiative).

surface water is sourced from springs and streams within catchments valleys, while in the Northern Group of islands, water is sourced from rainwater and groundwater as the islands are coral atolls.

78. Freshwater lens are present, however, the past practice of manually extracting water from wells have been abandoned. In terms of consumption, per capita figures of about 260 liters per capita per day are high for a developing country, and water losses throughout the system are thought to be around 50%.

79. The water resources of volcanic islands such as Mauke and Mitiaro consist of rainwater (collected from roofs and stored in tanks), groundwater (fresh and brackish), surface water lakes (brackish) and swamps (fresh and brackish). Many of the community buildings have rainwater collection systems and there are also some at private houses.

80. In Mauke, fresh groundwater is present in the central volcanic part of the islands. Fresh groundwater is found, except perhaps in droughts, in caves in the surrounding makatea. Brackish groundwater is found in other caves, which are closer to the margin of the island.

81. Surface water occurs in the forms of (i) small streams and springs that discharge from the central volcanic area of the island, (ii) some swamps in low-lying areas near the junction between the inner volcanic area and the surrounding makatea, and (iii) a constructed reservoir (dam) in the central volcanic part of the island at the head of one of the main streams (Vaitaruke Stream).

2. Ecological Resources

2.1 Flora and Fauna

82. Cook Islands' flora and fauna is limited in diversity. The estimated plant and animal biodiversity is about 7,000 species, divided almost equally between marine and terrestrial. There is a wide variety of vegetation types throughout the islands of Cooks. On islands in the Southern Group, the rocky makatea is covered with tropical growth and a considerable variety of plants.

83. The vegetation of the high islands includes creepers, ferns, and tall trees in the interior, while coconuts, bananas, and grapefruit grow on the coast. Avocados and papayas are so abundant that the locals feed them to their pigs. On the elevated atolls, the vegetation in the fertile volcanic center contrasts brusquely with that of the infertile limestone makatea. Taro and yams are subsistence crops.

84. In volcanic islands such as Mauke and Mitiaro, very little evidence remains of the original vegetation of the volcanic area. The 'Au Hibiscus tiliaceus and Toa Casuarina equisetifolia are the only native tree species which remain common, the remainder are all introduced, invasive species. Native tree species includes *Toa*, *Ironwood*, *Casuarina equisetifolia*, 'Au', *Hibiscus tiliaceus*. Introduced tree species are *Pistati*, *Jambolan*, *Syzygium cumini*, *Paina Papa'ā*, *Caribbean Pine Pinus caribaea* *Ākasia*, *Crassicarpa*, *Acacia crassicarpa*, *Mango*, *Mangifera indica*, 'Arapitia, *Albizia Albizia falcataria*, *Tūava*, *Guava Psidium guajava*

85. The only native mammal is the Pacific Fruit-Bat, which is found on Mangaia. Eight species of gecko and six species of skinks are found in the Cook Islands. Conservation programs are being implemented on islands including that of the Rarotonga flycatcher or kakerori and the reintroduction of the Rimatara lorikeet to Atiu. The ubiquitous myna bird, a native of India, was introduced in 1906 to control the coconut stick insect. Its role here was so

successful that these insects are rarely found now but the myna bird has in turn become a nuisance if not a pest.

86. The forest birds of the Cook Islands include the Atiu swiftlet (*kopeka*), blue lorikeet (*kuramo'o*), chattering kingfisher (*ngotare*), common mynah (*manu kavamani*), Cook Islands fruit dove (*kukupu*), Cook Islands reed warbler (*kerearako*), long-tailed cuckoo (*karavia*), Mangaia kingfisher (*tanga'eo*), Pacific pigeon (*rupe*), Rarotonga flycatcher (*kakerori*), and Rarotonga starling (*'i'oi*).

87. Shorebirds include the bristle-thighed curlew (*teue*), grey duck (*mokoro rauvai*), Pacific golden plover (*torea*), spotless crane (*mo'omo'o*), and wandering tattler (*kuriri*).

88. Among the seabirds are the black noddy (*rakia*), blue-grey noddy (*kara'ura'u*), brown booby (*kona*), brown noddy (*ngoio*), great crested tern (*kakavai mau*), great frigatebird (*kota'a nui*), masked booby (*lulu*), red-footed booby (*toroa*), red-tailed tropic bird (*tavake*), sooty tern (*tara*), white-tailed tropic bird (*rokoa*), and white tern (*kakaia*).

89. National Environment Service in Rarotonga and Island Environment Authorities in each project islands were consulted to obtain information about presence of flora and fauna in each island. However, there are no specific studies/documents available detailing island wise species of flora and fauna.

2.2 Forests and Protected Areas

90. The Cook Islands' protected area network consists of one national park, one wildlife sanctuary, and six islands specific conservation areas/reserves. The reserves in Cook Islands range from whole island reserves to specific locations on various islands.

91. *Whole Island Reserves.* Whole Island reserves encapsulate that entire island or ocean that is named as a Sanctuary or National Park.

92. *The Cook Islands.* In 2001, the Government declared the Cook Islands with its ocean EEZ of 2 million km² as a whale sanctuary. The waters of the Cook Islands are now a safe haven for migrating humpback whales that consistently migrate through the Cook Islands every year from about August to October.

93. *Suvarrow National Park.* Suvarrow Atoll was the first island to be formally established as a National Park in the Cook Islands in 1978 for the protection of the wildlife and the marine resources that it possesses. Suvarrow is an important sea-bird breeding site not only for the Cook Islands but also for the region and the world. Eleven species of seabirds breed are found on the island. It supports regionally significant colonies of Lesser Frigatebirds (9% of world population), Red-tailed tropicbirds (3% of world population), and the Cook Islands only large colony of Sooty Terns. The atoll also supports locally significant colonies of Red-footed Boobies, Great Frigate birds, Masked boobies and Brown Boobies. In addition, it is an important wintering site for Alaskan migrant, the vulnerable Bristle-thigh Curlew.

94. *Takutea Wildlife Sanctuary.* The Island of Takutea, a breeding ground for birds has been a Wildlife Sanctuary since 1903. The traditional leaders of Atiu who are the trustee of Takutea still manage the island as a conservation area for wildlife.

95. Besides these two nationally protected areas, there exist six island specific reserves, which are declared by island council based on conservation significance. These are Rarotonga

Island Reserves, Aitutaki Island Reserves, Pukapuka Island Reserves, Mitiaro Island Reserves, Rakahanga Island Reserves, and Manihaki Island Reserves.

96. None of the sites proposed for the installation of solar power plants under the proposed project are located near these protected areas. Also, the presence of any endangered specific is not reported in the locality of the proposed sites.

97. No endemic, rare or threatened terrestrial vertebrates or plants are known from the proposed project sites on the three islands of the Southern Group. One plant, the 'Ara pepe, Ngaputoru Pandanus Pandanus arapepe is restricted to Atiu and Mauke and is considered globally endangered. On Mauke, it is confined to makatea habitats and is not found on the volcanic soils, i.e., around the proposed site of the power plant.

98. There is no endemic fauna or flora known from proposed sites on the three islands. Also there is no vegetation of conservation significance at, or immediately around, the proposed sites. The original native vegetation of volcanic areas has long since been completely removed and replaced by either grassland or scrub-woodland supporting exotic and largely invasive species.¹⁰ This is of no conservation significance.

3. Socio-economic Conditions

3.1 Demography

99. As of 2011, the Cook Islands population is 17,794 spread over a land area of 236.7 km². Approximately 70% (13,095) of the population is domiciled on the largest island, Rarotonga. Around 20% of the population lives in the nine islands of the Southern Group. Rarotonga is the capital and main commercial and government center.

100. The total population of the Cook Islands is 17,794 people (Census 2011, as enumerated on 1 December 2011) consisting of 8,815 men and 8,979 women. This population count reflects a decrease of 1,315 people compared to the 2006 Census (19,342). The population growth trend reversed in the early 70's, with the population declining quite dramatically, especially between 1971 and 1976, as a result of the opening of the Rarotonga International Airport in 1974, when many people took the opportunity to migrate to New Zealand.

101. The distribution of the total population varied considerably by region. About 74% (13,095) lived in Rarotonga, 20% (3,586) lived in the Southern Group islands, and 6% (1,113) in the Northern Group islands. The population density varied widely by island as well. While there were about 347 people per km² in Pukapuka, in Mitiaro Island, there are only eight people per km². The population density of Rarotonga was 195 people per km². The average household size is 4 persons per household. Table 4 presents the demographic features of each targeted island.

Table 4: Island-wise Demographic Features

Feature	Target Island			
	Cook Islands	Mangaia	Mauke	Mitiaro
Area (km ²)	236.7	51.8	18.4	22.3
Population	17794	572	307	189
Male	8815	287	162	101

¹⁰ Invasive trees are either introduced trees/vegetation for a specific purpose but they became overgrown in abundance and have now become a problem for the islands. Invasive tree/vegetation species include Acacia and Mango (in Mauke, Mitiaro) and Pine trees (in Mangaia) and other secondary growth coastal vegetation/trees.

Feature	Target Island			
	Cook Islands	Mangaia	Mauke	Mitiaro
Female	8979	285	145	88
Pop. density (person/km ²)	75.18	11.04	16.68	8.48
Sex ratio	1.02	0.99	0.90	0.87
Number of HH		172	95	58

102. Cook Island Maori made up the bulk of the resident population with 12,930 persons (84%), 1,045 persons (7%) were part Cook Island Maori, and 1,349 persons (9%) were of foreign descent. The largest single group of foreigners were New Zealand European (458 people) and Australian (311).

103. The Cook Islands Christian Church (CICC) continues to be the dominant religious denomination of the resident population; however, affiliation with this church has declined from 55% in 2001 to 53%. The next largest group is the Roman Catholic Church with 2,599 members (17%), followed by the Seventh Day Adventist Church (SDA) with 1,154 members (8%). All other religious denominations account for 6% of the resident population and people with no religion comprised of 4% of the resident population.

3.2 Economic Development

104. Population and economic activities of the Cook Islands concentrated in coastal zones and on low-lying islands are vulnerable to the impacts of sea level rise and cyclones. On Rarotonga and Aitutaki, tourism is a major contributor to the economy of the Cook Islands.

105. However, islands such as Atiu and Mauke also have smaller tourist operations. Other economic activities including pearl farming, agriculture (taro, pineapples, noni), and fisheries play a major role in supplying local markets within the Cook Islands. In many instances, particularly in the Northern Group, local communities are simply living a subsistence existence.

106. The per capita Gross Domestic Product (GDP) of Cook Islands at current price is NZ\$ 17,799 (Cook Islands Statistics Office, 2011/2012). GDP per capita is high compared to other economies in the region. Tourism is vital to the Cook Islands economy and is estimated to account for around 60% of GDP, with tourist arrivals ranging from 100,000-120,000 each year. Tourism is the major driver in the Cook Islands' economy. The Cook Island's economic prospects are largely reliant on its capacity to grow and continually improve its tourism product.

107. The Cook Islands' marine sector continues to be made up predominantly of albacore and tuna fisheries, with a smaller contribution being made from black pearl cultivation. The Cook Islands' fisheries are a major resource and attention is being paid to striking a balance between maintaining the fishery and extracting the best value possible for the country, using the precautionary principle to ensure the sustainability of the fisheries. The pearl industry is also important to the economic development of the remote northern islands and improvements in farming techniques should result to an increase in export earnings from pearl farming. Population loss remains a concern to the Cook Islands and is an economic risk.

108. Island-wise economic and labor data are presented in Table 5.

Table 5: Island-wise Economic Activities

Feature	Target Island
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	Cook Islands	Mangaia	Mauke	Mitiaro
Average annual HH income (NZ\$)	15,028	8,070	8,070	8,070
Employed population	6,938	132	102	63
Economically active pop.	7,554	179	122	74

3.3 Historical and Cultural Values

109. The proposed project sites and the surrounding areas are for mainly agricultural and non-residential land use, and have no important historical or cultural sites. There are no records of archeological findings around the project areas. Also during consultation process, presence of historical and cultural values was discussed and local people have not raised any issues related to historical or cultural significance.

F. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

1. Impacts and Mitigation Measures Due to Pre-construction Activities

1.1 Physical Environment

110. The proposed sites of the power plants are unused open land except in Mangaia and Mauke where the proposed sites are covered by trees and invasive vegetation. The project facilities do not encroach any of the physical infrastructure (roads, buildings, transmission lines, etc.). Also there are no sites of any archaeological importance in and around the project facilities. All the selected sites are accessible by existing roads, therefore there is no need for construction of new roads or wharfs. Therefore, impacts associated with project siting on physical environment are negligible.

111. Minor impacts on topography and visual impacts are expected due to installation of the solar power plants. However, these impacts are permanent and these impacts were minimized by careful site selection to avoid inhabited areas.

112. The equipment to be procured and installed by the project will comply with international standards for noise as well as escape of polluting materials. The project will use compact and preassembled systems to minimize the impacts. Therefore, no adverse impacts due to the project design are anticipated. To ensure that all the environmental mitigation measures are implemented, the EMP will be updated during detailed design and incorporated in the bidding documents.

113. Climate risk profile for Cook Islands indicates that the main impacts of climate change are expected to be high sea levels, extreme winds, and extreme high air and water temperatures. Best estimates of long-term, systematic changes in the average climate for Cook Islands indicate that sea level is likely to have increased by 36 cm and the frequency of severe short sea level rise resulting from storm surge (2.2 m above mean sea level) will increase from a one in 580-year event to a one in five-year event by 2050.

114. The project will provide solar PV plants with resilience to climate change through compact and preassembled systems resistant to extreme weather events.

1.2 Ecological Environment

115. The project would need clearing of approximately 0.72 ha of bush land/vegetative cover and cutting of about 96 trees for the installation of solar PV plants. Besides this, trimming of trees from the periphery of solar power plant would also be required to avoid restriction of sunlight on the PV arrays. Table 6 presents the trees and vegetation likely to be affected at proposed sites on the three islands.

Table 6: Summary of vegetative cover and trees to be cleared from proposed sites

Feature	Target Island		
	Mangaia	Mauke	Mitiaro
Vegetative area to be cleared (m ²)	4,500	1,500	1,200
No of trees to be cleared	56	40	0

116. The loss of trees will be compensated by planting additional trees as per the requirements of the Island Councils. Although Cook Islands has a large protected area network, none of these areas is located in the impact area of sites proposed for the interventions (solar power plants and electricity grid) under the project. Therefore there will not be any impacts on the fauna.

117. The sites proposed for interventions in the three islands are accessible by existing wharfs and roads. The existing wharfs and roads are in good conditions and there is no need for upgrading or constructing new wharfs and roads for the project. Therefore there are no impacts on flora and fauna associated with new associated facilities.

1.3 Social Environment

118. The project will require about 4.0 ha of land.¹¹ The proposed land is mostly privately owned. Island councils are in the process of negotiation with land owners to acquire land for the project as per national regulations. Affected people will be compensated as per entitlement matrix proposed in the project Resettlement Plan. Since the proposed sites are free from any agricultural/commercial activities, livelihood of affected people will not be affected. Also there are no relocation issues as proposed sites are free from buildings/structures.

2. Impacts and Mitigation Measures Due to Construction Activities

2.1 Physical Environment

119. Impacts on topography due to installation of the solar power plants will be insignificant. Small changes in land-use and visual impacts are anticipated because the installation of PV panel which will be visible on the ground for solar plant is over an area of 1,200m² in Mitiaro. This change will be permanent. No topographical changes are envisaged due to access to the sites.

120. The proposed sites are accessible by existing access roads and wharfs and these existing facilities will be used to transport materials and equipment.

121. Small change in topography is anticipated due to construction activities such as excavation and cutting of trees. Temporary negative impacts on the appearance of the project area and its vicinity are anticipated due to supply, storage, and haulage of construction

¹¹ The core subprojects require a total land area of 4 ha. Of this about, 0.72 ha is covered with generation/trees and need clearing.

materials and movement of equipment and machineries. However, the proposed project is modest in its material requirements, thus impact will only be moderate. The impacts will be minimized by the selection of suitable storage areas for materials with minimum visibility from residents and roads with screening where necessary. In installation phase, there will be no impact on soil quality of the area.

122. Impacts on water resources are not anticipated as there are no water bodies around the project sites. Wastewater generated during construction will be managed by constructing temporary collection tanks.

123. The project will involve only minor civil works such as clearing of site, earth work, and foundation for panels. Mechanical and electrical works will take place at various locations within a large project site. The site preparation will involve only minor levelling, and thus will not significantly change the drainage pattern.

124. The transportation of construction materials and project equipment will require about ten truck trips per day during the working period of eight hours. It will mean there is more traffic, particularly heavy traffic, on the road than usual. The distance from the port/wharf to the proposed sites are generally short so few roads will be affected. Traffic level will return to normal after the construction of the solar plant is completed. Considering the nature and scope of the construction works and the ecological insensitivity of the project sites, it is certain that only minor and manageable environmental disturbances will be created during construction, with minimum impact on nearby communities and the natural environment.

125. A number of temporary impacts could also arise during construction. However, these will be controlled and can be minimized.

126. *Dust, Noise and Vibration.* During the construction phase, the activity would involve excavation for the PV array footing, and movement of vehicles carrying the construction materials along the haul roads. Although all the sites are accessible, the movement of vehicles and excavation work would give rise to emission of dust particles thereby affecting air quality marginally at the sites. The impact will be transitory in nature and therefore is assessed as of low significance. Covering of stockpiles, minimising double handling and drop loads as well as sprinkling of water during excavation will reduce the dust emission to a great extent.

127. During the construction phase, the major sources of noise pollution are movement of vehicles carrying the construction material and equipment to the sites. Most of the access roads to the sites are motorable and project traffic would be negligible. The major work of the construction is expected to be carried out during the daytime. Apart from vehicles bringing in materials to the sites, construction works for the PV plant will not require powered equipment. As such, noise emissions will be minor. As the predominant land use at most of the sites is open/unused, there will be few residential areas exposed to noise generated during the construction phase and the noise produced during the construction period will have negligible impact on residents.

128. While the impact of noise and vibration cannot be avoided altogether, impacts will be minimized by prohibiting all work between 22:00 and 06:00 hours. Vehicles and machineries will undergo periodic checks and maintenance to ensure they are in good running condition and comply with air quality and emission regulations.

129. The nature of the construction works indicates that no toxic or hazardous materials will be used, apart from fuel oils for vehicles, which will be properly stored. Construction waste will

be sorted out by the contractors for recycling. The residual waste will be properly handled by the relevant Island Council units for waste disposal.

130. As stated, the environmental disturbances during construction will be small and transient, such as dust, noise, incremental traffic loads on the roads, and gaseous emissions created by trucks and heavy construction equipment.

131. The impacts associated with civil works activities will be controlled by adapting suitable mitigation measures such as:

- Selection of construction techniques and machinery seeking to minimize ground disturbance and noise vibrations.
- At PV plant sites, contractor shall equip their construction equipment with exhaust silencers to limit the engine noise so as not to exceed 75 dB (loaders and cranes) and regularly maintain all construction vehicles and machinery that should meet the permissible standards.
- Proper maintenance and operation of construction equipment.
- All the proposed sites are accessible by existing roads. These existing roads and tracks will be used for construction and maintenance access to the site wherever possible to minimize increase in airborne dust particles.
- Soil excavated from foundation footings will be disposed of at designated places.
- Fuel and other hazardous materials will be securely stored at least 100 m away from the high tide line.
- Noise and vibration impacts will be minimized by prohibiting all work between 22:00 and 06:00 hours. Residential houses are generally away from the proposed project sites. Construction activities only undertaken during the day and local communities informed of the construction schedule.
- Protect/preserve topsoil and reinstate after construction is completed.
- Contractor to arrange for health and safety training sessions..
- Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements.

2.2 Ecological Environment

132. Clearing of 0.72 ha of land and cutting of about 96 trees and trimming of some more trees on surrounding areas will have some adverse impacts on the environment. Except coconut, the trees to be cut are mostly invasive tree species (which are in abundance on the islands and have no economic values). Invasive tree species includes Acacia, Mango, Pine, and secondary growth of coastal vegetation. Cutting of coconut trees will be compensated by planting additional trees as necessary. Necessary budget will be provided for planting trees. Cutting and planting of trees will be done in coordination with local offices of the Island Councils and Island Environment Authority. No impacts on fauna are anticipated due to contraction activities. Following mitigation measures will be implemented by the contractor:

- Marking of trees to be removed prior to cutting, and strict control on clearing activities to ensure minimal clearance.
- Trees that can survive pruning to comply should be pruned instead of cutting.
- Contractor to ensure that there is no illegal felling of trees by the construction workers.
- Planting of trees in coordination with the Island Environment Authorities of target islands.

2.3 Social Environment

133. The construction will require not more than 30 workers, who will reside outside the project sites for a period of about three months. Technical staff will be from outside whereas labor and support staff would be hired locally. No groundwater will be tapped at the project sites as these sites have low groundwater potential. The water required for construction (concrete mixing) and consumption will be brought in from outside sources.

134. Domestic wastewater generated by the construction workers would not be more than 10 m³ per day per site and will be treated either in a small centralized package treatment plant or by individual septic tanks, one for each toilet.

135. Following additional mitigation measures will be implemented to ensure health and safety of local communities and construction workers:

- Construction activities only undertaken during the day and local communities informed of the construction schedule.
- Construction workforce facilities to include proper sanitation, water supply, and waste disposal facilities.
- Protect/preserve topsoil and reinstate after construction is completed.
- Contract provisions specifying minimum requirements for workers camps.
- Provide protection gears.
- Contractor to prepare and implement a health and safety plan including safety manual.
- Contractor to arrange for health and safety training sessions.

136. Since there are no cultural resources near the project sites, there will be no impacts on physical cultural resources through the implementation of various project components. However, the EMP contains a 'chance find' provision in cases such are encountered during excavation of the sites and installation of the plant.

3. Impacts and Mitigation Measures from Operation

137. Unlike thermal power plants, the operation of the solar power plant will have negligible environmental impact at, and adjacent to, the sites during operation. There will be no waste products, no requirements for cooling, no moving parts, no noise, and no impact on flora and fauna.

3.1 Physical Environment

138. After construction, the project impacts will diminish. The existing access routes will be utilised during the operation and maintenance of the power plants. After construction, traffic to and from the existing diesel generation unit sites will reduce to present levels. The solar facilities contribution to noise in the vicinity will be undetectable and definitely insignificant compared to that of the adjacent diesel generators.

139. The possible impact could be visual with the addition of the solar panel arrays on the sites, including the possibility of some glare from the panels, even though they are designed to absorb the incident solar radiation.

140. The arrays will be less than 3 m high at their peak, and will be on a fixed 20° angle facing due north. The proposed sites for the arrays are kept away from the residential areas,

therefore impacts from glare and the visual impact from the proposed power solar power plants will be insignificant.

141. The water to be used for washing of the solar panels will be taken from outside sources. Provision of adequate drainage facilities will control impacts due to wastewater generated by washing of solar panels.

142. Southern Group islands are vulnerable to the tropical cyclones and hurricanes. To mitigate these impacts, the foundations and racking system will be designed to withstand powerful cyclones and hurricanes, which will limit the probability of generation unavailability as well as reducing any potential hazard of panels being lifted up and blown onto adjacent properties.

143. During the operation phase, the battery of Solar Power Plant will have to be replaced after 5 to 7 years. Although the batteries to be used for power plants are lithium-ion batteries, it may contain some heavy metal and sulphuric acid. If the batteries are discarded in the surroundings, then there will be soil contamination with lead and sulphuric acid in the area. To mitigate these impacts, the replaced batteries will be stored in leak proof battery collection system and will be sent to manufacturers for recycling and further management.

3.2 Ecological Environment

144. No significant impacts anticipated on biological environment due to operation of solar power plants. Minor impacts on fauna species such as birds, bats, etc. due to the reflection and glare from solar panels are possible, but the presence of birds in the targeted areas is very rare therefore no impacts on fauna. Wastewater generated from cleaning of solar panels will be collected for sediment removal before discharging to the water bodies, therefore impact on aquatic life is not expected.

3.3 Social Environment

145. Only about 10-15 staff will operate the project facilities. Domestic waste generated by this small number of people could be readily handled by conventional practices.

146. Contractors' emergency response plan including occupational health and safety plan approved by owners engineer will be adopted to handle emergency situation during the operation period. Workers will be trained to deal with the emergency situations.

4. Impacts and Mitigation due to Decommissioning

147. The project's solar PV panels are expected to have an economic life of 25 years. The suppliers will accept the decommissioned solar PV panels for recycling based on the thin-film technology and their update. Dismantling of the PV panels will be handled by the suppliers that offered the best price for used PV panels in the future. Similarly, the project will require the use of batteries which will need proper disposal and recycling of the lithium-Ion that is contained in the batteries after 20 to 25 years of operation. To control these possible impacts, it is proposed that the responsibility of the handling and disposal of the used batteries will be contracted to the suppliers.

5. Cumulative Impacts

148. The solar power plants proposed under the project will be mostly located adjacent to the existing diesel generation power stations, which consist of diesel generators and diesel storage

tanks. While the facilities will result in a number of new solar array structures, these will be no higher than 3 m and visual impact on neighboring properties will be limited by providing adequate fencing along the plant boundaries.

149. Presently, there is no future development or expansion plan either of existing diesel power plants or any other infrastructure by government. Therefore, there will be no cumulative environmental effects of constructing an additional solar plant in each of three targeted islands of the Southern Group.

G. ANALYSIS OF ALTERNATIVES

150. With and without the proposed project, alternatives were analyzed and it is found that the outer islands would continue to pay heavy price for diesel import which will affect the overall economic development of the country. Implementation of the project will bring positive economic, social, and environmental benefits. Economic benefits will be from the reduction in import of diesel for power generation. Social benefits will be from sustainable electricity supply to the consumers and environmental benefits will be from reduction in emission from diesel generator sets by reducing diesel transport, storage, spills and emissions; and reduction in noise levels from diesel generator sets being currently operated by power stations.

151. Also as part of capacity building of local technicians in the implementation and operation of solar and other renewable energy projects, future projects will be benefit from the learning from the construction and operation of the sites.

152. Alternative sites were considered, but the proposed selected sites in each island were considered the best locations for the solar power plants as these are adjacent to the existing generation diesel power generation plants, easy access to distribution network, providing existing facilities (network, access roads), security, and operational workforce that will reduce capital and operating costs. The land at selected sites has low environmental or residential values, given the current land use and existing power generation operations. The project's technical team is reviewing the technical aspects and conceptual designs of potential PV panels and battery suppliers and the best configurations that would meet desired locational requirements would be selected.

H. CONSULTATIONS AND INFORMATION DISCLOSURE

1. Stakeholders and Community Consultations

153. As part of environmental assessment, consultations were carried out during field visits in the month of December 2013. Stakeholder consultations were carried out by holding meetings at offices of the respective agencies in Rarotonga, as well as at island council offices. Whereas personal discussion, focus group discussions and questionnaire surveys were used for community/public consultations.

154. In total eight stakeholder meetings involving 31 officials from various agencies, i.e., the Renewable Energy Development Division (REDD), Te Aponga Uira, National Environment Service, Island Environment Authorities, Statistics and Economics, Utilities from targeted islands, women groups, etc., were consulted during the fact-finding visits. The list of officials/stakeholders consulted and summary of the issues raised are presented in Appendix 4a.

155. The consultations included both discussions with stakeholders and discussions with community/island level authorities including project affected people, landowners and women groups from the islands. Affected people and landowners (64 in total involving 26 women participants) and women groups (one group from each Island) were consulted during the field visits. Consultation will continue at next stages, i.e., after finalization of detailed design and before start of the civil works construction, as well as at implementation stage. The details of such consultation carried out during reconnaissance field visits are presented in Appendix 4b.

156. Local communities and community leaders from target islands are well aware of and fully support the proposed project, as the installation of solar power plants will bring benefits to the islands in terms of improved and sustainable electricity supply, improve the overall economy situation by saving in cost of imported diesel and some employment opportunities. Recommendations and suggestions from stakeholders/public are incorporated in the project IEE and EMP. Appendix 5 shows the photographic record of the consultations undertaken during preparation of the IEE.

2. Information Disclosure

157. All environmental documents are subject to public disclosure, and therefore will be made available to the public. The IEE will be disclosed on ADB's website upon receipt as per ADB's Public Communications Policy (PCP) 2011. EA through IAs will ensure that meaningful public consultations, particularly with project affected persons, if any, are undertaken. Consultation plan will be prepared and agreed by EA during the detailed design stage.

158. The EMP includes a grievance redress mechanism (GRM) so that any concerns raised during construction or operation can be addressed.

I. GRIEVANCE REDRESS MECHANISM

1. Grievance Redress Mechanism

159. In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental and social safeguards performance, a GRM is proposed for the project. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the construction and operation of the project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism is not impeding access to the Cook Islands' judicial or administrative remedies. EA through IAs will appropriately inform the affected people about the mechanism before commencement of any civil works.

2. Proposed GRM Mechanism

160. The following seven-step mechanism is proposed for grievance redress of environmental and social matters in construction and operation of various project components uses existing island/village administrative structures (affected persons/organizations/village groups), any of which can be complainants.

161. The IA's project management unit (PMU) will have a designated staff member to address all potential complaints from the public for both construction and operation phases of

the project. Any complaint will be recorded and investigated by the PMU working with the construction and operations managers (as appropriate) of the individual project components. A complaints register will be maintained which will show the details and nature of the complaint, the complainant, the date and actions taken as a result of the investigation. It will also cross-reference any noncompliance report and/or corrective action report or other relevant documentation.

162. When construction starts, a sign will be erected at all sites providing the public with updated project information and summarizing the grievance redress mechanism process including contact person details at the PMU. All corrective actions and complaints responses carried out on site will be reported back to the PMU. The PMU will include the complaints register and corrective actions/responses in its progress reports to the ADB.

163. In the whole progress, the Cook Islands national agencies (NES for environment related grievances and NICC/Ministry of Justice for Social/Resettlement related grievances) will be always available to public complaints and advice on the PMU's performance for grievance redress.

164. On receipt of a complaint in any form (in person, telephone, written), the PMU complaints officer will log the details in a complaints register. The PMU will forward the complaint to the contractor/construction manager/operations manager (as appropriate) within 48 hours. The contractor or managers will respond to the PMU within 1 week with advice on corrective actions taken or put in train. PMU will review and find solution to the problem in consultation with village or traditional chief and relevant local agencies. Then PMU will report back to the village/traditional chief and affected persons within a week's time. If the complainant is dissatisfied with the outcome, or have received no advice in the allotted time period, he or she can take grievance to the Island Council. Island Council will refer the matter to the relevant national agencies (NES, CICC, MOJ). National agency refers to an internal committee and reports back to AP/village or traditional chief about outcome. If unresolved or at any time if complainants is not satisfied, he or she can take the matter to appropriate court. Both successfully addressed complaints and non-responsive issues will be reported to the ADB by the PMU.

165. Table 7 presents the steps and corresponding time frame for proposed grievance redress mechanism.

Table 7: Grievance Redress Process

Stage	Process	Duration
1	Affected Person (AP)/village elected or traditional chief takes grievance to PMU	Any time
2	PMU review and find solution to the problem in consultation with village or traditional chief and relevant agencies	2 weeks
3	PMU reports back to village/traditional chief/AP	1 week
If unresolved		
4	AP/village or traditional chief take grievance to Island Council	Within 2 weeks of receipt of decision in step 3
5	Island Council refers matter to relevant agency (NES/CICC/Ministry of Justice)	2 weeks
6	National agency refers to an internal committee	4 weeks
7	National agency reports back to AP/village or traditional chief	1 week
If unresolved or at any stage if AP is not satisfied		
	AP/village or traditional chief can take the matter to appropriate court	As per judicial system

J. ENVIRONMENTAL MANAGEMENT PLAN

1. Mitigation Measures

166. The major adverse effects of construction stage are change in topography, visual impacts, increased traffic, ground disturbance, and health and safety of workers. The environmental effects during operation are minor. If the increased traffic causes an issue with local residents, a scheduled time for shipments to and from the wharf can be created. The preferred foundation design of floating concrete pads is being proposed because it uses local materials and limits the ground disturbance. Provisions of adequate health and safety measures will control adverse health impacts and will ensure safety of the workers and communities. To minimize climate change impacts, the project will provide solar PV plants with resilience to climate change through compact and preassembled systems resistant to marine environments.

167. The cutting of trees and clearing of the topsoil will have a definite impact on the vegetative site in appearance. The project will attempt to limit the amount of organic material removed from the site, limiting the construction environmental impact. Any organic material removed from the surface will remain on site and be placed in the corner of the property. Used batteries will be sent to authorized dealers for disposal.

168. An environmental management plan showing the stage-wise potential impacts and proposed mitigation measures and responsible agency has been prepared in a matrix form and presented at Table 8. The EMP will be updated following detailed design.

2. Monitoring and Reporting

169. Throughout implementation of the project, the government and ADB will monitor the implementation progress and impacts of the project. Overall, the EMP will be implemented by the executing agency through project implementing agencies. In consultation with executing agency and ADB, the implementing agencies will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans.

170. An EMP will be part of the overall project monitoring and supervision, and will be implemented by the Project Owners' Engineer (POE) with oversight from the implementing agencies. POE will be responsible to update EMP followed by the design phase.

171. The updated EMP will be approved by the executing agency and compliance with it will be monitored by the implementing agencies. Progress on the preparation and implementation of an EMP will be included in the periodic project progress reports. Specific monitoring activities defined in the IEE and EMP will be carried out by engineering, procurement and construction (EPC) contractor, and supervised by POE and monitored by implementing agencies. The executing agency will submit semi-annual environmental monitoring reports on EMP implementation for ADB's review. In general, the overall extent of monitoring activities, including their scope and periodicity, should be commensurate with the project's risks and impacts. The implementing agencies, with the support from POE, will be required to implement safeguard measures and relevant safeguard plans, as provided in the project agreement. Complaints and problems from affected people/communities will be monitored and resolved in accordance with grievance redress mechanism proposed for this project.

172. Table 9 provides the environmental monitoring plan outlining parameters and frequency of monitoring.

Table 8: Environmental Management Plan

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
A. Pre-construction					
Location	Encroachment into precious ecological and protected areas	Careful site selection avoided encroachment of ecological sensitive areas including protected areas and areas of historical and cultural importance.	Project Cost	EA, IAs through POE	Detailed design
	Topography and visual impacts	Careful selection of site away from inhabited areas.	Project Cost	EA, IAs through POE	Detailed design
Access	Impacts due to construction of new access roads and wharfs	Proposed sites are accessible by existing wharf and road network. Therefore no need to construct new access roads or wharfs. <i>(In case requirement arises for new roads/wharfs, this EMP will be updated to address associated impacts.)</i>	Project Cost	EA, IAs through POE	Detailed design
Project design	Negligence of environmental mitigation measures	Ensure that EMP is included in the bidding documents.	Project cost	EA, IAs through POE	Tendering process
	Updating EMP	Mitigation measures defined in this EMP will be updated and incorporated into the detailed design to minimize adverse impacts.	Project cost	EA, IAs through POE	Detailed design
	Updated EMP incorporated into bid and contract documents	Prepare environmental contract clauses for contractors, namely the special conditions (e.g. reference EMP and monitoring table).	Project cost	EA, IAs through POE	Tendering process
Climate Change	Risk of climate change	Provided solar PV plants with resilience to climate change through compact and preassembled systems resistant to marine/coastal environments.	Project cost	EA, IAs through POE	Detailed design

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
Equipment design and selection	Release of toxic chemicals and gases in receptors (air, water, land) Noise from equipment/machineries	PCBs should not be used in transformers and other project facilities or equipment. The equipment to be procured and installed by the project will comply with international standards for noise as well as escape of polluting materials.	Project Cost	EA, IAs through POE	Tendering process
Statutory clearances/ permits	Delay in the project process	Ensure that all necessary permits and clearances, i.e., environmental clearances from NES, Island Environment Authority are obtained prior to commencement of civil work.	Project Cost	EA, IAs through POE	Prior to commencement of civil work
Resettlement (land acquisition)	Social inequities	Compensation paid for temporary/permanent loss of productive land as per resettlement plan	Project Cost	EA, IAs through POE	Prior to start of civil work
Site clearing	Cutting of trees about 96 trees and removal of vegetative cover on over 0.72 hectare land area	Compensatory afforestation as per government policies.	To be included in Contractor cost.	EA, IAs through POE	Preparation of site prior to civil work
B. Construction					
Construction of access road	Increase in airborne dust particles increased land requirements for temporary accessibility	All proposed sites are accessible with existing road. These roads will be used for construction and maintenance access to the sites wherever possible to avoid dust emission. In case new access roads are required, it will be limit to the minimum width required to avoid land acquisition.	To be included in Contractor cost.	EA, IAs through POE	During civil work construction
Installation of solar panels and Storage of construction material and	Topography and visual impacts	Selection of suitable storage areas for materials or plant with minimum visibility from	To be included in Contractor cost.	Contractor & POE	During civil work construction

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
movement of vehicles		residences and roads with screening where necessary.			
Construction activities	Generation of dust by construction activities	Vehicles carrying soil, sand, or other fine materials to and from the sites must be covered. Water will be spread on construction sites and access roads each day.	To be included in Contractor cost.	Contractor & POE	During civil work construction
Construction debris and wastewater	Adverse impacts on surrounding environment due to construction waste. Pollution of water bodies due to disposal of waste material into water bodies.	Construction waste that cannot be reused will be regularly transported offsite for disposal and not allowed to accumulate on site over long periods. Provision of adequate drainage system including controlled collection and preliminary treatment of wastewater.	To be included in Contractor cost.	Contractor & POE	During civil work construction
Movement and operation of construction equipment	Noise and vibrations generated from operation and movement of trucks and cranes	Construction techniques and machinery selection seeking to minimize ground disturbance. Noise level not to exceed 85 dB(A) (over 8 hr period). Operation of machinery generating high levels of noise during solar panel installations will be to between 6:00 am and 10:00 pm in areas where there are nearby residences. No noisy activities undertaken on Sundays and holy days.	To be included in Contractor cost.	Contractor (preparation and implementation) POE (approval)	During land clearing and civil work construction
Transportation of equipment and construction material.	Dust and particulate emission from movement of construction vehicles transporting equipment and construction material.	Truck wheels cleaning Road cleaning and watering Selection of suitable	To be included in Contractor cost.	Contractor (preparation and implementation) POE (approval)	During land clearing and civil work construction

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
	Visual impacts from storage and haulage of construction material	storage areas for materials or plant with minimum visibility from residences and roads with screening where necessary.			
Cutting of trees and clearing/trimming of trees and vegetative cover	Loss of 96 trees and about 0.72 ha vegetative covers	Removal of only those trees, which are necessary. Transplanting of trees if this is possible. Prohibiting illegal felling of trees by construction workers for domestic uses. Planting of trees in coordination with the Island Environment Authorities of target island.	To be included in Contractor cost.	Contractor	During land clearing and civil work construction
Public access	Hindrance to public access due to project construction activities	Consultation with residents to reach agreements. Adequate safety measures like traffic controller, erect and maintain barricades, signs, markings, flags, lights, etc.	To be included in Contractor cost.	Contractor, POE, Island Council	During land clearing and civil work construction
Occupational health and safety	Impacts on workers' health due to working with trucks and piling cranes, building construction, high voltage work	Contractor to prepare and implement H&S Plan Contractor to arrange for H&S training sessions Undertake and report supervision and inspection Provide PPE gear to workers Fuel and other hazardous materials securely stored at least 100 m away from the high tide line. Construction activities only undertaken during the day and local communities informed of the construction schedule	To be included in Contractor cost.	Contractor (preparation and implementation) POE (approval)	During land clearing and civil work construction

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
		Construction workforce facilities to include proper first aid kits, sanitation, water supply and waste disposal facilities Work vehicles to include first aid kits Contract provisions specifying minimum requirements for workers camps			
Construction activities	Unexpected environmental impacts	If unexpected environmental impacts occur during construction phase, the POE will update the EMP, and the environmental protection measures will be designed to address the impacts.	Project cost	EA, POE	During construction
C. Operation and Maintenance					
Reflection and glare from solar arrays	Visual impacts and glare	Design of solar arrays to absorb incident solar radiation. Proper orientation of arrays.	To be included in Contractor O&M cost.	Contractor	During operation and maintenance
	Disturbance on movement of birds and bats due to reflection and glare	Presence of birds/bats is very rare on the proposed sites. Impacts will be minimized by close monitoring of movement of birds/bats in the proposed areas.	To be included in Contractor O&M cost.	Contractor	During operation and maintenance
Cleaning of solar panels	Wastewater generated from cleaning of solar panels	Provision and cleaning of adequate drainage system.	To be included in Contractor O&M cost.	Contractor	During operation and maintenance
Natural disasters	Damage from hurricanes and cyclones.	Design of foundations and racking system to withstand powerful cyclones and hurricanes, which will reduce any potential hazard of panels being lifted up and blown onto adjacent properties.	To be included in Contractor O&M cost.	Contractor	During operation and maintenance
Health and safety	Health hazards in the event of accidents	Emergency Response Plan	O&M Cost	Contractor	Emergency during operation

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
	(cyclones, hurricanes) and emergency	Health and Safety Plan			and maintenance
Disposal and management of used batteries	Impacts from used batteries and panels	Adequate storage and handling system. Used batteries to be transported to manufacturer.	O&M Cost	Contractor / Manufactures	During operation and maintenance
Operation of project facilities	Unexpected environmental impacts	If unexpected environmental impacts occur during project operation phase, the IA will update the EMP, and the environmental protection measures will be designed and resources will be utilized to cope with these impacts.	O&M Cost	IAs	During operation
D. Decommissioning					
Dismantling of PV panels	Impacts from disposal of PV panels and batteries.	Contract agreements with PV panel suppliers for dismantling and disposal of panels and batteries.	Maintenance cost	EA	Post operation

Table 9: Environmental Monitoring Plan

Environmental Features	Aspect to be Monitored	Time and Frequency of Monitoring	Location	Monitoring Cost	Responsible party (Implementation/ Supervision)
Construction stage					
Noise	Noise levels in dB(A)	At the start of concerned activities. At least 3 times during construction period.	Project site Front main road	3000*3 =9000	Contractor & POE
Air	Emission of dust and particulate matter	At the start of concerned activities. At least 3 times during construction period.	Project site Front main road	4000*3=12000	Contractor & POE
Physical Works Progress	As specified in contractors' plan	Project site Monthly	Project Site	Project Cost	Contractor & POE
Occupational Health and Safety	As specified in project OHS plan prepared by Contractor	Project site Weekly	Project Site	Project Cost	Contractor & POE
Operation Stage					
Occupational Health and Safety	As specified in project OHS plan prepared by Contractor	Project site Weekly	Project Site	Project Cost	Contractor & POE

Note: This monitoring plan is prepared for one site. Same monitoring plan will be implemented on other solar power plant sites.

3. Implementation Arrangements and Responsibilities

173. The main institutions that will be involved in environmental management activities are the MFEM as the EA of the project, TAU and REDD as IAs, project owners' engineer (POE), Contractor, and line agencies including the National Environment Service. The project management unit (PMU) and project steering committee (PSC) will be established for implementing the project. The EA will submit the environmental assessment report to NES or Island Environment Authority, as applicable for review and approval as per the Environment Act 2003. During implementation, the EA with support from POE environmental expert will update this IEE and EMP based on the detailed designs. The EMP from the updated assessment will be integrated into the bid and contract documents.

174. Efficient project implementation related to the turnkey contract will be provided by the POE and will include safeguards aspects as related to preparation of bidding documents; assistance during the bidding process; and supervision of the project design, supply, construction including monitoring of compliance with the approved EMP, and commissioning. The POE will have expertise on implementation and supervision of PVP projects.

175. EA has overall responsibility for all aspects of the project. IAs through support of POE will be responsible for day-to-day management of technical aspects of the project. POE will be responsible to update EMP followed by design phase and he will also be responsible to approving contractors' management plan, emergency plan, and occupational health and safety plan, as well as to ensure on-ground implementation of the environmental management plan. EA will ensure the environmental management and monitoring budgets are available and utilized as necessary for timely implementation of EMP. Cost of capacity building is included in the capacity building component of the project.

176. TAU and REDD will nominate counterpart staff conversant in engineering, power system, planning, finance, environment, and social areas. TAU and REDD have hands-on expertise important to the project due to its power engineering knowledge. However, there is need to enhance capacity of TAU and REDD staff in safeguards implementation and monitoring. POE will provide training to IA and contractor staff on managing the environmental issues associated with project. The contractor will be required to have one staff with experience in environmental management. This staff will be responsible for preparing plans such as emergency preparedness plan; occupational health and safety plan, and energy day-to-day implementation of EMP.

177. **Monitoring and reporting.** Contractors will report on construction progress on a monthly basis. The monthly reports will include a section on implementation of the EMP and other H&S provisions as required. Quarterly progress reports to be prepared by IAs and POE will summarize the contractor's monthly reports and also include the monitoring of contractor compliance with EMP undertaken through spot checks and sites visits by POE. Safeguards monitoring reports will be prepared on a semi-annual basis (every six months) by the POE and submitted to EA, PSC, NES, and ADB. All safeguards monitoring reports will be disclosed as per ADB policies.

4. Environmental Management Budget and Resources

178. The cost of all compensation and rehabilitations works will be an integrated part of the overall project cost, which will be borne by the project. The preliminary estimated cost of the

environmental management including implementation and monitoring is US\$126,000 as detailed in Table 8 and Table 9.

K. CONCLUSION AND RECOMMENDATION

179. The environmental impacts associated with proposed installation of 0.78 MWp solar power plants have been assessed and described in the previous sections of this document. The findings establish that the project sites are not located in a sensitive ecosystem, and have no historical and cultural value. This nature of the project coupled with the clean nature of solar power generation ensures that the project will not cause any significant, lasting environmental impacts during construction, operation, and decommissioning. Only minor and transient environmental disturbances would be experienced at the project sites during construction and operation, and they will be minimized through implementation of the EMP. The EMP will be updated in case of any change in location or project design followed by detailed design stage. It is then recommended that the project be considered environmentally feasible, and that this environmental assessment is adequate to justify environmental feasibility of the project. There is no need for further analysis and this environmental assessment of the project is considered complete.

180. It is concluded that the project has no further environmental issues to follow up, and the adequate measures listed in this environmental assessment and EMP, when implemented, will fully comply with government CSS requirements as set out in the Environment Act and will also comply with ADB's SPS.

APPENDIX 1: LOCATION MAP OF PROJECT SITES

Figure 1: Location of Mitiaro Solar Power Plant on the Island Map



Figure 3a: Map of Mitiaro Island



Figure 3b: Photograph of the Proposed Site



Figure 3c: Location map of the proposed sites on Island Map of Mitiaro Island

Figure 2: Location of Mauke Solar Power Plant on the Island Map



Figure 4a: Map of Mauke Island



Figure 4b: Photograph of Proposed Sites



Figure 4c: Location map of the proposed site on Island Map of Mauuke Island

Figure 3: Location of Mangaia Solar Power Plant on the Island Map



Figure 5a: Map of Mangaia Island



Figure 5b: Photograph of the Proposed Site



Figure 5c: Location map of the proposed site on Island Map of Mangaia Island

APPENDIX 2: EIA PROCESS IN COOK ISLANDS

The EIA process in Cook Islands is administered by the National Environment Service (NES) and it involves three stages. These are (1) Application stage, (2) Consultation stage, and (3) Approval stage. These stages as they relate to this project are described below.

(1) Application Stage

The Application Stage has two parts - the preparation of Terms of Reference (TOR) and the acceptance of the application by the NES in the form of an EIA report.

The preparation of TOR involves presentation of the proposal by the applicant to the NES. The applicant outlines the need for the project and any alternatives; how works are proposed to be carried out; and the potential environmental effects of the proposal. The NES then determines whether or not the proposal has the potential to significantly affect the environment, and if so, a TOR is provided to the applicant for the preparation of an application under Section 36 of the Environment Act 2003.

The second part of this stage involves the preparation of the EIA report and ongoing dialogue between the applicant and the NES.

(2) Consultation Stage

Prior to consideration of the EIA report by the Island Environment Authority (IEA), Section 36(5) of the Environment Act 2003 requires the EIA Report be made publicly available for comment in the form of written submissions (oral submissions are not accepted). This public submission period lasts for 30 days from when the NES accepts the submitted EIA report. The public will be notified by way of a notice in the local newspapers about the proposal and where the EIA report is available for reading, or if required a copy of the report can be obtained from the NES. The EIA report will be publicly notified in Rarotonga and Islands.

Throughout the 30-day consultation period, the NES will give the applicant all written submissions relevant to the proposed work. These will be addressed by the applicant (if necessary, by way of an amended EIA report) and incorporated by the NES in their recommendation to the MEA.

(3) Approval Stage

Once all the issues raised during consultation are incorporated into the EIA report (if necessary), it is submitted to the NES. The NES will provide the EIA report and their recommendation to the MEA secretariat for consideration at their next meeting. This process has two possible outcomes:

- The application is approved and the NES informs the applicant by letter and outlines the conditions of the approval; or
- If there are any issues, the proposal is referred back to the applicant to review and address any aspects that may have been insufficiently covered. The applicant can then re-submit the application to the MEA for further consideration.

In the event of public feedback, applications can be declined or deferred until the issues raised have been properly addressed by the applicant.

APPENDIX 3: REA CHECKLLIST

SOLAR ENERGY

Rapid Environmental Assessment (REA) Checklist

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to Environment and Safeguards Division (RSES) for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: Cook Islands / Renewable Energy Sector Project
(Installation of 0.78 MWpeak Solar PV Generation on Three Outer Islands of Southern Group)

Sector Division: PARD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			The proposed sites are located adjacent to the existing diesel power generation units at Mangai, Mauke, and Mitiaro. The project will be implemented on a combined land area of about 0.72 hectares which in non-residential land. There are no environmental sensitive areas reported in and around the proposed project sites.
▪ Physical cultural heritage site		X	No heritage sites.
▪ Located in or near to legally protected area		X	No legally protected areas.
▪ Located in or near to special habitats for biodiversity (modified or natural habitats)		X	No biodiversity sites.

Screening Questions	Yes	No	Remarks
▪ Wetland		X	No wetlands. Proposed sites are mostly on the flat terrain.
▪ Mangrove		X	No mangroves. Coastline is about 1-2 km away from the proposed sites.
▪ Estuarine		X	
▪ Offshore (marine)		X	Project sites in all the target islands are 1-2 km away from coastline.
B. Potential Environmental Impacts Will the Project cause...			
▪ large scale land disturbance and land use impacts specially due to diversion of productive lands?	X		Possible. The project will change land use because of installation of solar panels on 0.72 ha of land that currently has vegetation covers and trees.
▪ involuntary resettlement of people? (physical displacement and/or economic displacement)		X	No physical displacement involved.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ noise, vibration and dust from construction activities?	X		Minor short-term impact due to noise generated from construction activities is expected. Suitable mitigation measures are included in the EMP.
▪ an increase in local traffic during construction?	X		Likely. Transportation of construction equipment and construction material will increase the local traffic during construction. Mitigation measures are included in the EMP.
▪ environmental disturbances such as soil erosion, land contamination, water quality deterioration, air pollution, noise and vibrations during construction phase?	X		Possible. Short-term disturbance due to noise from construction activities.
• aesthetic degradation and property value loss due to establishment of plant and ancillary facilities?		X	
▪ changes in flow regimes of the water intake from surface water or underground wells due to abstraction for cooling purposes?		X	
▪ pollution of water bodies and aquatic ecosystem from wastewater treatment plant, from cooling towers, and wash-water during operation?		X	Not expected. Wastewater generated will be collected and disposed off after preliminary treatment.
▪ a threat to bird or bat life from colliding with the project facilities and/or being burned by concentrated solar rays?		X	

Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none"> industrial liquid (dielectric fluids, cleaning agents, and solvents) and solid wastes (lubricating oils, compressor oils, and hydraulic fluids) generated during construction and operations likely to pollute land and water resources? 		X	
<ul style="list-style-type: none"> Soil/water contamination due to use of hazardous materials or disposal of broken or damaged solar cells (photovoltaic technologies contain small amounts of cadmium, selenium and arsenic) during installation, operation and decommissioning? 		X	<p>Possible. Waste generated during construction will be handled carefully.</p> <p>Used batteries will be sent back to manufacturers for recycling and disposal.</p>
<ul style="list-style-type: none"> noise disturbance during operation due to the proximity of settlements or other features? 		X	
<ul style="list-style-type: none"> visual impacts due to reflection from solar collector arrays resulting in glint or glare? 		X	Not expected. Solar panels will be installed with a tilt angle to avoid glare and reflection.
<ul style="list-style-type: none"> large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? 		X	Small scale construction.
<ul style="list-style-type: none"> social conflicts between local laborers and those from outside the area? 		X	Small scale construction. Local labor employment.
<ul style="list-style-type: none"> risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during construction, installation, operation, and decommissioning? 		X	Likely: Mitigation measures for occupational health and safety are included in the EMP.
<ul style="list-style-type: none"> risks to community health and safety due to the transport, storage, and use and/or disposal of materials and wastes such as explosives, fuel and other chemicals during construction, and operation? 		X	
<ul style="list-style-type: none"> community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning? 		X	Controlled access will be provided.

Climate Change and Disaster Risk Questions	Yes	No	Remarks
<p>The following questions are not for environmental categorization purposes. However, the questions are included in this checklist to help the project team identify the potential climate and disaster risks of the project.</p>			

<ul style="list-style-type: none"> ▪ Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)? 	X		Islands are vulnerable to tsunami and cyclones.
<ul style="list-style-type: none"> ▪ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost? 	X		Change in solar radiation will affect the operation of the solar power plant.
<ul style="list-style-type: none"> ▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)? 		X	
<ul style="list-style-type: none"> ▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)? 	X		

APPENDIX 4A - LIST OF STAKEHOLDERS / COMMUNITIES CONSULTED

No.	Name	Designation and Organization
RAROTONGA		
1.	Roger de Bray	Energy Commissioner, Office of the Prime Minister, Rarotonga, Cook Islands
2.	Tangi Tereapii	Director, Renewable Energy Development Division, Office of the Prime Minister, Rarotonga, Cook Islands
3.	Apii Timoti	Chief Executive Officer, Te Aponga Uira (TAU), Rarotonga, Cook Islands
4.	Ngateina Rani	PEC Fund Coordinator, Renewable Energy Development Division, Office of the Prime Minister, Rarotonga, Cook Islands
5.	Vanessa Jenner	ADB Liaison Officer, Development Coordination Division, MFEM, Rarotonga, Cook Islands
6.	Vavia Tangatataia	Manager, Advisory and Compliance Division, National Environment Service, Rarotonga, Cook Islands
7.	Celine Dyer	Climate Change Coordinator, Climate Change Division, NEW, Rarotonga, Cook Islands
8.	Tamari'i Tutangata	Chief Executing Officer, CIIC, Rarotonga, Cook Islands
9.	Morgan Hanks	Statistics Officer, Statistics and Economic Department, Rarotonga, Cook Islands
10.	Kevin Hosking	Sr. Statistician, Statistics and Economic Department, Rarotonga, Cook Islands
11.	Otherniel Tangianau	Director, Pa Enea Division (Outer Islands), Office of the Prime Minister, Rarotonga, Cook Islands
MANGAIA		
12.	Anthony Whyte	Energy Manager, Mangaia Power House, Mangaia Island, Cook Islands
13.	Teremoana Atariki	Mayor, Mangaia Island Council, Mangaia Island, Cook Islands
14.	Nena Ngametua	Executive Officer, Mangaia Island Council, Mangaia Island, Cook Islands
15.	Allan Tuara	President, Mangaia Environment Society, Mangaia Island, Cook Islands
16.	Thaine Tuara	Member, Mangaia Environment Society, Mangaia Island, Cook Islands
		Island council member and community leaders, Mangaia Island, Cook Islands
		Women groups and affected landowners, Mangaia Island, Cook Islands
MAUKE		

17.	George Samuela	Mayor, Mauke Island Council, Mauke Island, Cook Islands
18.	Taukea Raui	Executive Officer, Mauke Island Council, Mauke Island, Cook Islands
19.	Basilio Kaokao	Environment Officer, Island Environment Authority, Mauke Island, Cook Islands
20.	Maara Kimiora	Manager, Mauke Power Plant, Mauke Island, Cook Islands
		Island council member and community leaders, Mauke Island, Cook Islands
		Women groups and affected landowners, Mauke Island, Cook Islands
MITIARO		
21.	Vaine Putiare	Dy. Mayor, Mitiaro Island Council, Mitiaro Island, Cook Islands
22.	Nga Tama	Executive Officer, Mitiaro Island Council, Mitiaro Island, Cook Islands
23.	Maara Kimiora	Manager, Mitiaro Power House, Mitiaro Island, Cook Islands
24.	Nooroa Pouao	Environment Officer, Island Environment Authority, Mitiaro Island, Cook Islands
		Island council member and community leaders, Mitiaro Island, Cook Islands
		Women groups and affected landowners, Mitiaro Island, Cook Islands

**APPENDIX 4B –
SUMMARY OF VIEWS OF STAKEHOLDERS AND COMMUNITY CONSULTATIONS**

Date / Venue / No. of participants	Issues discussed / remarks ¹²
05.12.13 (6 pax) TAU Boardroom	<p>Discussions were held with Officials from the Office of the Energy Commissioner, REDD and TAU on following aspects.</p> <p>Objectives and scope of project in each island, technical details of interventions being proposed, clarifications of status and land ownership of land being proposed for solar power plants, environmental issues associated with implementation of solar power plants such as management of used batteries, current institutional and capacity building need, implementation arrangements, applicability and requirements of EIA for proposed interventions under Environment Act 2003.</p> <p>Current capacity and capacity building needs are incorporated in the IEE. Also mechanisms to handle discarded batteries and used oil from existing diesel generator sets are discussed in the IEE and appropriate mitigation measures were recommended in the project EMP.</p>
05.12.13 (5 pax) MFAI Boardroom Officials from National Environment Service (NES)	<p>Scope of proposed project, roles and responsibilities of NES, national environmental policies and regulatory framework, as well as requirements for preparing EIA and permits, applicability of the Cook Islands' Environment Act 2003 to this project, EIA approval process and time frame. Officials from NES informed that NES is responsible to issue environmental permit for developmental projects in the Cook Islands. For this project, project proponent (REDD here) should submit application to NES with project details to determine whether project needs an EIA or not.</p> <p>National policy and regulatory framework and requirements of NES for project implementation are incorporated in the IEE.</p>
05.12.13 (4 pax) MFEM Boardroom	<p>Discussions were held with Officials from Statistics and Economics Division on following aspects.</p> <p>Socioeconomic and demographic data for target islands, major economic activities and development projects in the target islands, social/poverty issues, etc.</p>
05.12.13 (3 pax) CIIC Boardroom /03	<p>Together with social expert, discussions were held with CEO of CIIC on following aspects.</p> <p>Scope of proposed project, roles and responsibilities of CIIC, ownership status of the land proposed for power plants, policies and regulatory framework for land acquisition, timeframe and process for land acquisition as per government laws. It is informed by CEO that CIIC will be responsible for acquiring the land on behalf of the government as per Cook Islands laws.</p>
06 .12.13 (21 pax) Mangaia Island Council Chamber, Island council members, community leaders, landowners, women groups	<p>Information about existing power generation system, status of land proposed for power plant, presence of environmental sensitive areas on and around the proposed site, existing capacity of Island Electricity Committee in managing environmental issues were assessed. It is informed by Island Council representative that the land proposed for solar power plant belongs to 3 landowners (private). He informed that landowners agreed to give their land for solar PV plant and necessary discussion was held with landowners by Island Council. Local community leaders informed that there are no environmental sensitive areas in and around the proposed site and land use is makatea (volcanic deposit with invasive trees and bushes). Mayor of Mangaia informed that there is a need of capacity building in managing the solar plant plants. Necessary capacity building and training requirements are proposed in the IEE.</p> <p>Mayor informed that local communities support the project.</p> <p>Landowner's greed to let their land for the solar PV plant.</p>

¹² Queries raised by people were answered to their satisfaction and it was assured that their concerns would be addressed in the process of project design.

Date / Venue / No. of participants	Issues discussed / remarks ¹²
<p>10.12.13 (14 pax) Island Council Court Room, Mauke/ Island Council Members, Comm. Leader, women groups, land owners</p>	<p>Discussions were held together with social team to inform communities about the proposed project and understand their concerns, if any. Communities were informed about the benefits both socio-economic as well as environmental benefits of the project. All the participants consulted fully support the project. Women groups recommended need for the support for women groups and other community facilities. Present of environmental sensitive areas were discussed with the Island Mayor and Environment Officer and they informed that there are no such area on the island.</p>
<p>12.12.13 (18 pax) Mtiaro Representatives from Island Council Utility, Island Environment Authority, landowners and community leaders</p>	<p>Discussions were held together with representative from REDD. Island council members were informed about project and its objectives. Land use and ownership status were discussed with Dy. Mayor and he informed that proposed land is private land belonging to six families.</p> <p>Local communities and landowners were consulted to inform them about the proposed project and to understand their concerns, if any. Communities were informed about the benefits both socio-economic as well as environmental benefits of the project. All the participants consulted fully support the project. Women groups recommended need for the support for women groups and other community facilities. When asked about participation of women in the project, President of CICC informed that women are willing to participate at admin level. She also suggestion training and awareness program for local women groups on energy conservation and efficient use of appliances. Training and awareness programs for women groups are recommended in the social report. Present of environmental sensitive areas were discussed with the Island Mayor and Environment Officer and they informed that there are no such area on the island.</p> <p>Landowners also support the project and they are willing to give land for the project.</p>
<p>17.12.13 (11 pax) Island Council Secretariat Rep. from Island Council, Utility, Island Environment Authority</p>	<p>Discussions were held together with representative from REDD. Island council members were informed about project and its objectives. Land use and ownership status were discussed with Mayor and he informed that proposed is Crown Land but need to check status with CIIC as they do not have documents with them about ownership of the land.</p> <p>Proposed land is open land adjacent to the existing power plant. Local communities were consulted to inform them about the proposed project and to understand their concerns, if any. Communities were informed about the benefits both socio-economic as well as environmental benefits of the project. All the participants consulted fully support the project.</p> <p>Present of environmental sensitive areas were discussed with the Mayor and Environment Officer and they informed that there are no such area on the Island. When asked about the issue of battery disposal, environment officer informed that used batteries should be sent back to the manufacturers for treatment and disposal. Measures to handle and disposal of used batteries are included in the project EMP.</p> <p>APS Officer informed that their existing capacity to manage solar technology and environmental issues is inadequate and they need training and capacity building on these issues. Training on technical aspects to IA staff is included in the scope of the POE as part of the project management support.</p>

APPENDIX 5: PHOTOGRAPHS (FIELD AND CONSULTATIONS)

A. Photographs (site and consultations)



Consultation with Mayor and Environmental Officer of Aitutaki Island Council at Aitutaki Island



Consultation with Women Group and Community Leaders from Mangaia Island



Vegetation (bushes) on proposed site in Rarotonga Island



Discussion with Head of Women Group in Mangaia Island



Consultation with Land Owners in Mitiaro Island



Consultation with local Communities Leaders in Mitiaro Island



Photo 1: Meeting with Island Council Members and Stakeholders from Mangaia Island



Makatea (typical coral limestone deposit) on proposed site in Mangaia Island



Invasive plants /vegetation on proposed site in Mangaia Island



Fruit trees in proposed site in Mauke Island



Existing power house in Mauke Island to be relocated to proposed solar power plant



Existing practices for used oil and battery management in Mauke powerhouse need immediate attention